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Environmental Assessment

Woods Creek Stewardship Thin

Cowlitz Valley Ranger District, Gifford Pinchot National Forest
Lewis County, Washington

T 11 N, R 7 E, Sections 3, 4, 5, 7, 8, 9, 12, 14, 15, 16, 17, 19, 20, 21, 22, 23, and 26; T 12 N, R 7 E Sections 28, 29, 32, and 33; and T 12 N, R 8 E, Sections 7, 8, 17, 18, 19, and 20; Willamette Meridian

For Information Contact: Ken Wieman
Project Team Leader
Cowlitz Valley Ranger District
PO Box 670, Randle, WA 98377
Phone: 360-497-1100
www.fs.fed.us/gpnf

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1.0 SUMMARY

The Cowlitz Valley Ranger District of the Gifford Pinchot National Forest is proposing to thin and restore forested stands within the Woods Creek project area. The Woods Creek Stewardship Thin project area is located approximately 10 miles south of Randle, Washington in the Woods Late Successional Reserve (T 11 N, R 7 E, Sections 3, 4, 5, 7, 8, 9, 12, 14, 15, 16, 17, 19, 20, 21, 22, 23, and 26; T 12 N, R 7 E Sections 28, 29, 32, and 33; and T 12 N, R 8 E, Sections 7, 8, 17, 18, 19, and 20; Willamette Meridian). The project proposal is scheduled for implementation in 2008 and beyond, and will commercially thin young, densely stocked timber stands and implement watershed restoration projects.

The Woods Late Successional Reserve (LSR) is 28,260 acres and is located in the Lower Cispus River and the Middle Cowlitz River watersheds. It is a highly productive, low-elevation area with large tree habitat that is currently interspersed with young forest stands that originated from clearcut timber harvest. The primary goal of the Woods Creek LSR Stewardship Thinning project is to accelerate the development of late-successional forest characteristics. The project is designed to meet the goal by restoring late-successional forest form and function, predominantly through thinning young stands to hasten tree growth, stimulating understory development by increasing the quantity of snags and down woody debris, and by developing forest conditions in riparian areas. This project would help to restore large blocks of contiguous late-succesional forest, which will improve the habitat of old-growth-related wildlife species including the northern spotted owl, pileated woodpecker, salmon, and steelhead.

Approximately 11,300 acres within the planning area are designated as Riparian Reserves. Restoration projects in these areas will be designed to accomplish one or more of the following objectives:

- Increase the amount of snags and down wood in riparian areas;
- Reduce motorized vehicle-related resource damage;
- Decrease the roaded areas which pose risks to the aquatic ecosystem;
- Reduce sediment production from the road system to improve water quality;
- Reduce overland flow of water on road surfaces and in roadside ditches to restore hillslope hydrologic functions and processes, and to reduce road effects on peak and low stream flows; and
- Restore channel processes at road crossings to provide for free passage of water, sediment, woody debris, fish, and other aquatic organisms.

The action is needed to (a) treat densely stocked managed stands to enhance vigor and growth, and (b) enhance late-successional structural elements of those stands. All stands are located within the Woods Late Successional Reserve, and this project would accelerate the development of late-successional characteristics in managed stands. All actions are consistent with the Gifford Pinchot National Forest Forestwide Late Successional Reserve Assessment (1997) which details existing and desired conditions and provides recommendations for all LSRs within the Gifford Pinchot National Forest.

Restoration projects include the following:

a) Snag and down wood creation
b) Road closures, stabilization and decommissioning
c) Salmon rearing habitat restoration
d) Riparian conifer release
e) Western redcedar underplanting
f) Cispus River riparian and floodplain restoration

The restoration projects could be made possible through the Forest Service's Stewardship Contracting Authority. This means that timber receipts (the revenue generated from harvesting timber) could be retained and used for restoration projects within the Woods Creek Stewardship Thin planning area. The restoration projects have been prioritized and would be implemented in that order as receipts become available.

The Forest Service evaluated a no-action alternative and two action alternatives. The action alternatives were responsive to two key issues including: 1) impacts of temporary road construction and 2) impact to recreation opportunities. Consequently, the two alternatives vary by acreage treated, miles of temporary road construction or reconstruction, number of streams crossed with temporary roads, and the degree of impact to recreationists. The action alternatives would harvest thinned trees using ground-based and skyline yarding methods. Thinning the stands would attempt to retain and restore structural elements that characterize late-successional and riparian forests, in addition to retaining features and structures that are representative of habitat important to northern spotted owls. The amount of soil disturbance that would result from logging systems varies by alternative based on temporary road and skyline corridor construction. Both action alternatives minimize soil disturbance by utilizing existing skid trails and roads created during previous logging entries, and by limiting the amount of ground-based logging that would occur near sensitive areas (e.g. close proximity to streams and/or steep terrain). The placement of numerous skips and gaps and the retention of existing legacy features are key components of all alternatives. The types of proposed restoration projects are common to both action alternatives, but vary between alternatives by size and scope (see Table 3.3.3).

2.0 INTRODUCTION

2.1 Document Structure

The Forest Service has prepared this Environmental Assessment in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This Environmental Assessment discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives. The document is organized into five parts:

- *Introduction:* This section includes information on the history of the project proposal, the purpose of and need for the project, and the agency's proposal for achieving that purpose and need. This section also details how the Forest Service informed the public of the proposal and how the public responded.
- *Comparison of Alternatives, including the Proposed Action:* This section provides a more detailed description of the agency's proposed action as well as alternative methods for achieving the stated purpose. These alternatives were developed based on significant issues raised by the public and other agencies. This discussion also includes possible mitigation measures. Finally, this section provides a summary table of the environmental consequences associated with each alternative.
- *Environmental Consequences:* This section describes the environmental effects of implementing the proposed action and other alternatives. This analysis is organized by resource area, significant issues, and environmental impacts. Additional detailed analysis is provided in specialist reports in the analysis file. Within each section, the affected environment is described first, followed by the effects of the No Action Alternative that provides a baseline for evaluation and comparison of the other alternatives that follow.
- *Agencies and Persons Consulted:* This section provides a list of preparers and agencies consulted during the development of the environmental assessment.
- *Appendices:* The appendices provide more detailed information to support the analyses presented in the environmental assessment.

Additional documentation, including more detailed analyses of project-area resources, may be found in the project planning record located at the Cowlitz Valley Ranger District Office in Randle, Washington.

2.2 Background

The Woods Creek Stewardship Thinning project was derived from a planning effort undertaken in 2006 which initiated the collaborative process to develop a proposal that would improve conditions with in the Woods Late Successional Reserve (LSR). Pinchot Partners, a local collaborative group consisting of environmental groups, community stability organizations, and interested local citizens collaborated with the Forest Service to develop a proposal to commercially thin previously harvested stands in order to promote the development of late- and old-structured conditions within the LSR. The group suggested additional restoration projects to enhance watershed conditions within the Lower Cispus subwatershed,

including road stabilization and decommissioning, snag and down wood enhancement, riparian vegetation treatments, invasive plant treatments and salmon habitat restoration.

The Woods Creek Stewardship Thinning planning area is located within the Lower Cispus River and the Middle Cowlitz River watersheds, and all project work would occur entirely within the Lower Cispus subwatershed. The entire planning area lies within National Forest, but borders private lands within the project boundary. The planning area is located approximately 10 miles south of Randle, Washington and is located in T 11 N, R 7 E, Sections 3, 4, 5, 7, 8, 9, 12, 14, 15, 16, 17, 19, 20, 21, 22, 23, and 26; T 12 N, R 7 E Sections 28, 29, 32, and 33; and T 12 N, R 8 E, Sections 7, 8, 17, 18, 19, and 20; Willamette Meridian. Elevations range from 1,090 feet (Unit 12) near Woods Creek to 3,120 feet (Unit 9).

Extensive harvest activity in the watershed resulted in the loss of structural elements, including snags, coarse woody debris, and reduced thickness of duff layers. Young, previously managed stands are considered overstocked (the trees are growing in an overly dense manner), and could potentially benefit from stand treatments that not only enhance growth, but are designed to increase stand diversity and to promote the development of late-successional characteristics.

2.3 Purpose and Need for Action

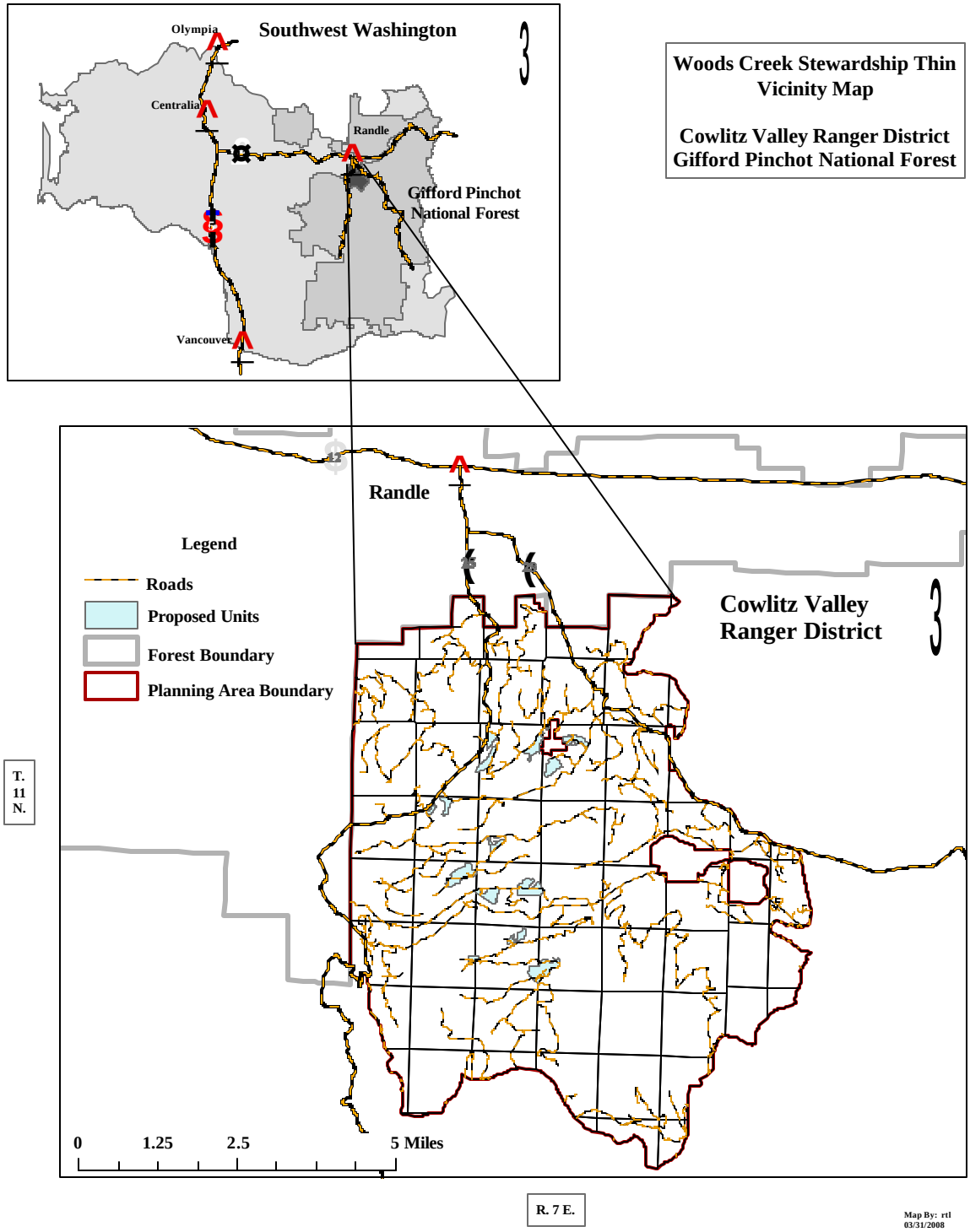
The 28,260-acre Woods Late Successional Reserve is a highly productive, low-elevation area with large tree habitat that is currently interspersed with young, dense forest stands that have originated from clearcut timber harvest. The primary goal of the Woods Creek Stewardship Project is to advance the development of late-successional forest characteristics. The project is designed to meet that goal by restoring late-successional forest form and function, primarily through thinning young stands to hasten tree growth, stimulating understory development, increasing the amount of snags and down woody debris, and developing forest conditions in riparian areas. This proposal will help to restore large blocks of contiguous mature forest to improve the habitat of old growth-related species, including the northern spotted owl, pileated woodpecker, salmon, and steelhead trout.

Approximately 11,300 acres within the planning area are designated as Riparian Reserves. Restoration projects in these areas will be designed to accomplish one or more of the following objectives:

- Increase the amount of snags and down wood in riparian areas;
- Reduce motorized vehicle-related resource damage;
- Decrease the roaded areas which pose risks to the aquatic ecosystem;
- Reduce sediment production from the road system to improve water quality;
- Reduce overland flow of water on road surfaces and in roadside ditches to restore hillslope hydrologic functions and processes, and to reduce road effects on peak and low stream flows; and
- Restore channel processes at road crossings to provide for free passage of water, sediment, woody debris, fish, and other aquatic organisms.

A vicinity map showing the proposed project area is on the following page.

Figure 2.3.1. Woods Creek Stewardship Thinning Project Area and Vicinity Map



The purpose of this project is to:

- Speed the development of and protect existing features representative of late-successional and old-growth forest characteristics of stands within the Woods Late Successional Reserve (LSR).

This action is proposed because young, managed stands within the LSR lack the desired characteristics of late-successional and old-growth forests. The stands tend to have a high density of trees, have reduced stand diversity, and lack late-successional elements such as snags and downed woody debris. While stands may develop these late-successional characteristics over time, the process of thinning is expected to accelerate this process. Existing late-successional features would be protected to the fullest extent possible.

- Enhance watershed conditions

Actions undertaken to enhance watershed conditions include riparian conifer release, snag and down wood creation, road decommissioning, dispersed campsite closure, road closure and stabilization, Cispus River riparian and floodplain restoration, and salmon rearing habitat restoration. The purpose of identifying these additional projects is to create conditions in the watershed that improves the function of components of wildlife and fisheries habitat. The environmental analysis compares existing conditions with desired conditions and makes recommendations on activities that move conditions towards what is desired on the landscape.

- Provide forest products

This action is proposed because there is a need to supply forest products consistent with the Northwest Forest Plan goal of maintaining the stability of local and regional economies. While the primary goal of Late Successional Reserves is to provide habitat for species associated with late and old structured habitat, the use of silvicultural prescriptions in young stands within the LSR to promote the development of late and old structured habitat is permitted under current standards and guidelines. The purpose of this project is to supply products and increase employment opportunities for the local timber industry and independent local contractors, especially through the use of stewardship contracting authorities that allow the use of value generated by the timber sale to be utilized to improve conditions within the watershed. If stewardship contracting is not successful, receipts from the timber sale can also be used to improve conditions.

Management Direction

The proposed action has been designed to meet the goals and objectives documented in the *Gifford Pinchot National Forest Land and Resource Management Plan (LRMP, USDA 1990), as amended by the Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl (Northwest Forest Plan, USDA and USDI 1994, as amended).* The LRMP was amended in response to the Northwest Forest Plan (NFP) in a document referred to as *Amendment 11* (USDA 1995), which

applies the Northwest Forest Plan Record of Decision to the local conditions of the Gifford Pinchot National Forest.

This assessment is tiered to the following Environmental Impact Statements and plans, which are incorporated by reference:

- The Gifford Pinchot National Forest Land and Resource Management Plan and Environmental Impact Statement, as amended (USDA 1990).
- The Northwest Forest Plan and Record of Decision and Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species within the Range of the Northern Spotted Owl (USDA, USDI 1994) (hereafter referred to as the Northwest Forest Plan or NFP).
- The Gifford Pinchot National Forest Land and Resource Management Plan Amendment 11 (USDA 1995).
- The Forest Plan as amended by the 2001 Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines (USDA and USDI, 2001).
- The Environmental Impact Statement and Record of Decision for Preventing and Managing Invasive Plants (USDA 2005).
- Memorandum declaring the protection of known sites for 57 former survey and manage species. (USDA and USDI 2005).

The Gifford Pinchot National Forest LRMP and Amendment 11 provide management direction through the designation of specific management areas, and standards and guidelines specific to these designations. The following management areas and allocations have been applied to the portions of the Lower Cispus Watershed within which the Woods Creek Stewardship Thinning project is located:

Late Successional Reserve (Management Area Category LS). All proposed timber sale units lie within the Woods Late Successional Reserve (LSR) (see Amendment 11, pp. 5-1 to 5.4). The objective of Late-Successional Reserves is to protect and enhance conditions of late-successional and old-growth forest ecosystems, which serve as habitat for late-successional and old-growth related species including the northern spotted owl. In the future, LSRs are intended to be large, contiguous blocks of late-successional habitat that can sustain populations or sub-populations of those species associated with late-successional forests" (Amendment 11 to the GPNF Land and Resource Management Plan, p. 3-3). The Woods Creek Stewardship Thin project was designed to meet the goals and objectives of the LSR by addressing issues and concepts like fragmentation, connectivity, and the availability of forest structural elements (such as snags and coarse woody debris) and prescribing treatments and projects to accelerate the development of late-successional forest habitat and conditions.

Riparian Reserves. Portions of Woods Creek LSR Stewardship Thinning units are within Riparian Reserves, where riparian-dependent resources receive primary emphasis and special standards and guidelines apply (see Amendment 11, pp. 2-4 to 2-10). Riparian Reserves are applied along all streams, wetlands, ponds, lakes and unstable and potentially unstable areas, and are a key component of the Aquatic Conservation Strategy provided in the NFP. The

proposed action treats up to 224 acres of Riparian Reserves to promote the development of conditions that would enhance the features of the riparian reserve such as promoting large conifer growth to increase shading in the future, especially along listed 303(d) streams that have higher temperatures than desired.

Wild and Scenic Rivers (Management Area Category NA). The Cispus River is a candidate for inclusion into the National Wild and Scenic Rivers System, including the portion of the river that passes through the Woods Creek Stewardship Thin planning area. Two of the proposed thinning units and three of the restoration projects fall within the Scenic River management prescription (NA). The Visual Quality Objective (VQO) assigned to Scenic Rivers is retention, (see Amendment 11, pp. 4-28 though 4-30). The proposed thinning will not alter the visual qualities of the Cispus, as neither of the commercial thinning units is visible from the river. Once complete, the restoration projects will have maintain or improve the visual qualities of the river corridor.

Visual Emphasis (Management Area Category VL). Three proposed commercial thinning units and one non-commercial thinning (conifer release- a restoration project) are within the management prescription of Visual Emphasis (VL). The desired condition for these areas is to meet the VQO of Retention. Timber harvest is allowed under this management prescription, and thinning activities would be conducted in compliance with VQO standards and guidelines (see Amendment 11, pp. 2-42 and 2-43; pp. 5-49-5-50).

Other Natural Resource Management Guidance Documents

The ***Lower Cispus River Watershed Analysis (2003)*** is incorporated by reference. Watershed analyses represent one of the key components of the Aquatic Conservation Strategy as described in the Northwest Forest Plan. The proposed action is consistent with recommendations in the Lower Cispus River Watershed Analysis, and the analysis provides a detailed reference to historical and existing conditions within the watershed.

The Gifford Pinchot National Forest Roads Analysis (2002) provides recommendations regarding Forest road maintenance objectives, and identifies long-term objectives in order to manage forest transportation system facilities that provide user safety, convenience, and efficiency of operations in an environmentally responsible manner and to achieve road related ecosystem restoration with the limits of current and likely funding levels. The actions proposed in this project are consistent with the Roads Analysis, which recommends a variety of possible treatments including decommissioning, closing and stabilizing roads, improving road drainage systems, and reconstructing crossings to protect aquatic and riparian resources.

2.4 Proposed Action

The action proposed by the Forest Service to meet the purpose and need is a timber sale and/or stewardship contract that would commercially thin and harvest trees from 412 acres. Approximately 1.8 miles of temporary road would be constructed or reconstructed, and removed following logging operations. Existing spurs and skid trails still evident from the last

harvest entry would be used to the greatest extent possible, and then obliterated after project work is complete. Treatments for stands would be designed to improve health, vigor, and species diversity while retaining late-successional characteristics that are lacking in previously managed stands less than 50 years old. These treatment objectives are intended to improve the ability of stands to provide for habitat needs and future harvest. The proposed action distinguishes the interim riparian reserve area (USDA USDI 1994) into two portions, an outer and inner. The width of these riparian reserve areas is dependent on the type of aquatic feature. Streams and wetlands greater than one acre received an inner buffer equal to 1/3 the interim reserve width, and wetlands less than one acre received an inner buffer measuring 2/3 the interim reserve width.

The preferred method of harvest is to utilize ground-based and skyline harvest systems. Thinning would be designed to enhance or restore diversity (see the *Alternatives* section for additional detail). Associated projects to be implemented under the Stewardship Contracting Authority would include snag and down wood creation, road closures, stabilization and decommissioning, Cispus River riparian and floodplain restoration, riparian conifer release, western redcedar underplanting, and salmon rearing habitat restoration. The proposed action is expected to be advertised in summer 2008, and implemented as early as Fall 2008 or Summer 2009.

2.5 Decision Framework

Given the purpose and need, objectives for enhancing late- and old-structure conditions within the Late Successional Reserve and the watershed through the use of a timber sale and/or stewardship contract, and issues raised by the interdisciplinary team and the public, agencies and tribes, the deciding official will review the proposed action and the other two alternatives in order to make the following decisions:

- Select one of the alternatives for implementation, or
- Defer action at this time, or
- Identify the mix of restoration activities associated with selected alternative that would be implemented, and
- Select the mix of mitigation measures to be implemented.

2.6 Public Involvement

After considering the project objectives and potential issues, a project proposal was developed in collaboration with the Pinchot Partners. Scoping letters describing the proposed action and preliminary issues identified were sent to the public on October 25, 2007 to solicit comments. Public comment on the proposed action was also solicited through the Gifford Pinchot's quarterly Schedule of Proposed Action (SOPA) website.

Representatives of the Gifford Pinchot Task Force, Conservation Northwest, the Pinchot Partners collaborative working group, and other interested citizens have provided recommendations related to proposed silvicultural treatments and potential restoration activities, and expressed concerns about components of the proposed action.

Responses were received during the scoping period for the proposed Woods Creek Stewardship Thin, and throughout the period of time preceding and following the public scoping period. Comments within the scope of the Project and not covered by previous environmental review or existing regulations were reviewed for substantive content related to the Project. The public and the interdisciplinary team identified issues, which led to the design and development of alternatives. The proposed action was modified and a second action alternative was created to address issues and concerns raised by the public and the interdisciplinary team.

2.7 Issues

Issues are separated into two groups: issues that drive the development of alternatives and issues that indicate the need to develop mitigation measures. Issues that drive alternatives were defined as those directly or indirectly caused by implementing the proposed action. The following issues raised during the scoping process were considered significant because all are affected by implementation of the proposed action, and potential effects may vary between alternatives.

Issues that Drive the Development of Alternatives

Temporary road construction, especially those roads that would be constructed where temporary roads had not been built before, would result in increased runoff and sedimentation to streams, in particular where roads are proposed to cross streams. In addition, temporary road construction would act as physical barriers to movement of forest flora and fauna. Ground disturbance and tree removal associated with temporary road construction may result in fragmentation to wildlife habitat.

There is a concern that new temporary road construction would result in impacts to soils, increased sedimentation and wildlife habitat fragmentation. In the design of the project, temporary road locations were identified to minimize impacts to soils and sedimentation. Previously used skid trails or temporary roads that were still visible within the units were identified for reuse. The existing skid trails and roads selected for reuse also did not require the removal of trees in order to reuse the trail. In some cases, the areas had recovered ecologically so that the previously used skid trails and temporary road prisms were no longer visible and were forested with young trees. To address this issue, an alternative was developed that dropped those portions of units associated with new temporary road construction or extensive temporary reconstruction. The previously used skid trails and temporary roads that had recovered ecologically were also considered new construction and those portions of units that were accessed by these roads were dropped from the alternative. Three units (6, 8 and 10) contained proposed temporary road stream crossings and these portions of units accessed by the roads were also dropped from the new alternative. One temporary stream crossing was kept under the proposed action, and it is an intermittent stream with no surface connectivity to other streams (because it becomes subterranean downstream of the proposed crossing). In some cases, skidding distances were increased and temporary road construction mileage

decreased in units. The public felt that skid trails were less impactive than temporary road construction.

Harvest could negatively impact recreation opportunities within the Woods Creek Watchable Wildlife area.

Harvest was proposed in the western portion of the Woods Creek Watchable Wildlife area and would overlap with a portion of the Old Growth Loop Trail (#247A). There was a public concern that logging this area would impact the recreational value of the trail by decreasing the feelings of solitude. This would be affected by increasing the existing spacing of the leave trees and resulting in people being able to see other people on the loop trail. Respondents were also concerned that logging would damage the trail. To address this issue, the portion of Unit 11 that included the trail was dropped from harvest activities in the proposed action. This is the skyline portion of the unit. This portion of the unit was left in the other alternative considered so that a comparison of impacts could be shown. Buffers along the trail were also added in both action alternatives—a 100-foot buffer would be in place on one side of the trail in Alternative 2 (the other side would not be logged), and a 50-foot buffer would be in place on either side of the trail in Alternative 3.

The proposed action does not decommission or close enough existing roads in the watershed.

The mileage for road decommissioning was reduced in the proposed action from initial estimates that were made prior to the scoping period. The respondents felt that the proposed action did not fully address the watershed restoration needs and reduce road-related impacts; therefore, they wanted to see additional miles of road decommissioning considered.

To address this issue, several more miles of road for decommissioning were added to both action alternatives. It is important to note that significantly more miles of road are expected to be decommissioned within the next several years through a separate planning process, tentatively entitled the Lower Cispus Road Decommissioning project.

Dispersed camping opportunities would be reduced in the proposed action.

Restricting motorized access to these sites would displace campers to other sites or may result in new sites being developed in the future, potentially in areas where the impact would be greater. Because of this issue, Alternative 2 was modified to include restricting motorized access and restoring vegetation at one campsite, the partial closure of another site (the site would remain compacted and unvegetated, but the access road to it would be restored and closed to vehicular traffic), and to leave one campsite and its access road open. Alternative 3 would restrict motorized traffic on the three unmanaged roads that lead to dispersed campsites, as well as restore vegetation and decompact the soil at the campsites themselves.

Other Issues

The following issues were not considered to drive the formulation of alternatives because they are either mitigated through project standards and guidelines, project design criteria, or mitigation measures, or they were analysis issues where the emphasis was to display how the proposed action affected a specific resource.

Fisheries

1. Water yield and timing of flow

Woods Creek Stewardship project proposed timber harvest and associated restoration activities have the potential to impact water quantity and peak flows. Road development and soil compaction may increase the surface drainage area network, decrease infiltration rates and consequently increase the rate by which water reaches the stream channel. Physical alterations may modify the hydrograph timing and yield by increasing instantaneous peak flows and decrease the summer base flows to streams. These physical changes may disrupt the biological life history of fish including run and spawn timing and smolt out migration.

Measurement Method
Risk to timing and rate of *water yield* due to timber harvest will be measured as a function of forest openings as calculated by percent of watershed with canopy closure < 40 percent.

2. Water quality

Proposed timber harvest activities including skyline and ground based yarding and log transportation may instigate surface soil displacement, mobilize fine particles and generate stream sediment. Potential increases in bedload fine material (channel substrate < 0.84 mm.) may have deleterious impacts on salmonid egg to fry survival. Stream sediment can impact other aquatic organisms of which salmonids depend on for food (e.g. aquatic algae and insects) and compromise the health of fishes.

Measurement Method
Risk to increased stream sediment as a function of ground disturbance from log transportation will be measured by 1) predicted disturbances from skid trails, temporary road and landings 2) Riparian acres with high and risk of instability 3) Change in surface coefficient associate with down wood cover.

3. Loss of channel habitat (Large Wood)

Timber management in the Woods Creek LSR may result in a reduction of large wood available for instream habitat. The loss of large wood may have a direct impact on available fish hiding and holding habitat. Reduction in large wood may indirectly impact recruitment of instream substrate and channel stability.

Measurement Method
Risk of decreased large wood recruitment potential and associated instream habitat as a function of riparian harvest will be measured as acres of harvest in Riparian Reserve.

4. Loss of riparian habitat

The Cispus River and major subwatersheds in the planning area including but not limited to Woods Creek, Ames Creek, Greenhorn Creek, riparian reserve boarding the Cispus River has been heavily impacted by past timber management (e.g. road construction and harvest) and natural catastrophes (e.g. the 2006 and 1996 floods). Proposed riparian management may impact channel stability the composition and distribution of mature trees within the riparian reserve

Measurement Method
The extent and distribution of detrimental soil impacts such as compaction, displacement, and severe burning, measured in percent of each activity area, are used to analyze the effects of management activities on long-term soil productivity.

Soils Issues

5. Soil productivity

The potential effects of the proposed activities on soil productivity are compaction, puddling, displacement, and erosion. Timber harvest, fuels treatment and site preparation can result in soil damage and loss of site productivity.

Soil compaction inhibits root elongation, reduces the infiltration and storage of water and decreases the gaseous exchange between roots and the atmosphere. This can inhibit seedling establishment and can reduce the growth of trees. Reductions in future timber volume are proportional to the degree and extent of compacted soil.

Puddling affects soil productivity in much the same way as compaction. Displacement of topsoil can remove soil nutrients from the root zone of desired vegetation and expose the soil to the forces of erosion. Soil erosion can result in nutrient-rich topsoil moving down slope, away from the root zone of desired vegetation. If eroded soil reaches a stream, it can impair water quality. Exposed mineral soil may promote the invasion of a site by undesirable vegetation.

Logging and site preparation can affect the numbers of species and abundance of soil organisms. Some of these organisms, called mycorrhizae, have been shown to significantly affect forest growth and productivity. Mycorrhizal fungi assist trees in absorbing water, nutrients and provide protection from pathogen attack. Soil compaction, loss of soil organic matter, and changes in vegetation can affect soil organisms.

Efforts to minimize soil disturbance, maintain organic matter, and encourage rapid growth of native vegetation would help to conserve soil organisms, facilitate re-colonization, and maintain forest productivity.

Measurement Method

Based on the best information available, the Standards and Guidelines are believed to be adequate to protect the soil resource. The extent and distribution of detrimental soil impacts such as compaction, displacement, and severe burning, measured in percent of each activity area, are used to analyze the effects of management activities on long-term soil productivity.

5. Slope stability

Road construction and timber harvest can increase the rate of mass failures, and the size and number of these events. Changes in hydrologic processes and root deterioration can contribute to these effects (Sidle, R. C. 1985). Soil compaction, soil displacement, and vegetation removal can cause changes in hydrologic process. There is a potential for increased frequency of landslides if groundwater conditions change and root strength is diminished. Factors in soil stability not related to management activities include soil type, geology (rock composition and slope shape), and earthquakes.

Measurement Method

The extent and distribution of vegetation removed (greater than 50% thinning) on potentially unstable soils, measured in percent of each activity area, will be used to analyze the potential effects of management activities on slope stability.

Hydrology Issues

7. Water quantity – Increased peak flows

Roads can increase the total volume of water available for rapid transport to stream channels in two ways. Roads intercept precipitation, which results in overland flow over compacted surfaces – reducing infiltration rates. Secondly, shallow subsurface flow may be intercepted at road cut-banks and converted to rapid surface runoff. This process effectively increases drainage density in a watershed, which can indicate increased peak flows (Wemple et al., 1996; WFPB 1997).

Drainage density is widely accepted as an index of drainage efficiency. Wemple et al. proposed that roads modify drainage density by extending the total length of effective surface flow; in other words, extending the stream channel network. This stream channel network extension can be estimated by adding the length of road segments discharging runoff directly to stream channels, and by adding the length of newly eroded gullies located on hillslopes where channels did not previously exist. Stream channel network extension estimates can be estimated based on a modification of methods described by Wemple et al. (1996).

Measurement Method

Risk to changes in timing and rate of water yield due to roads will be measured as a function of increase in watershed Drainage Density & Network.

8. Water Quantity – Increased peak flows due to log harvest

Vegetation manipulation can affect hydrologic processes at the stand scale, including changes in the interception of precipitation, changes in evapotranspiration, changes in snow accumulation, and changes in rates and timing of snowmelt. These hydrologic changes brought about by vegetation modification can affect the amount and timing of water that is available for runoff from a site, and thus can cumulatively affect stream flows. The degree to which these stand scale changes are manifested at the subwatershed scale in terms of changes in stream flow is dependent upon a number of factors related to both the extent and intensity of the forest manipulation, and characteristics of the site and subwatershed. Additionally, streamflow conditions are readily impacted by precipitation patterns across the contributing area. Four precipitation zones occur throughout the analysis area. The Rain-on-snow zone has the greatest potential to affect peakflows, thus the percentage of a subwatershed within this elevation band is used as an indicator of potential peakflow sensitivity concern.

Measurement Method
Risk to changes in timing and rate of water yield due to log harvest will be measured as a percent of watershed with canopy closure < 40%.

9. Water Quality – Stream Sedimentation

Ground disturbances have the potential to increase stream sedimentation, particularly when located close to streams. More specifically, road networks are the most important source of accelerated delivery of sediment to anadromous fish habitats in forested watersheds of the Pacific Northwest (Ice 1985; Swanson et al. 1987). Sediment from the road system can be delivered to streams by direct erosion of cut-and-fill slopes associated with stream crossings, or by surface runoff from roads and ditches that carries sediment-laden water directly or indirectly to streams. In general, roads lacking surface rock, those with steep grades and steep sideslopes, and those that cross streams or are in proximity to streams are the greatest contributors of sediment from surface erosion. Newly constructed stream crossings have the greatest potential to increase stream sedimentation due to hydraulic connectivity and a likely lack of vegetation along disturbed stream banks. Not all sediment production from roadways reaches the aquatic system though, because surface runoff from road surfaces and ditches is often directed to unchanneled slopes below the road where runoff has the potential to infiltrate the ground surface or to be filtered by forest debris before entering streams.

Nonetheless, roads have the potential to increase sediment delivery and the total volume of water available for rapid transport to stream channels. Roads intercept precipitation, which results in overland flow over compacted surfaces – reducing infiltration rates. Additionally, shallow subsurface flow may be intercepted at road cut-banks and converted to rapid surface runoff. This process effectively increases drainage density in a watershed (Wemple et al., 1996; WFPB 1997), which can indicate the risk to increased sediment delivery to streams.

Drainage density is widely accepted as an index of drainage efficiency. Wemple et al. proposed that roads modify drainage density by extending the total length of effective surface flow; in other words, extending the stream channel network. This stream channel network

extension can be estimated by adding the length of road segments discharging runoff directly to stream channels, and by adding the length of newly eroded gullies located on hillslopes where channels did not previously exist. Stream channel network extension estimates can be estimated based on a modification of methods described by Wemple et al. (1996).

Measurement Method
This issue will be measured as a function of disturbance from temporary road & landing construction along with aquatic crossing construction (new or reconstruction). Additionally, the increase in watershed drainage density and network will indicate relative risk to change in stream temperature.

10. Water quality – Stream Temperature

Fish habitat can become limited due to increasing stream temperatures. High temperatures can be attributed to increased solar radiation, which can be directly impacted by logging activities along stream corridors. Increases in temperature can also attributed to stream widening resulting from past removal of large instream wood and excessive sediment from roads and landslides, particularly in flat, low elevation streams.

Measurement Method
Change in Stand Density (Trees per acre) in Riparian Reserve.

Wildlife Issues

11. Effects to TES Wildlife Species

What are the effects of the project on federally-listed threatened and endangered species, as well as Forest Service-listed Sensitive and "Survey and Manage" species?

Although the Woods Creek Stewardship commercial thinning units presently provide poor, or non-suitable, habitat for federally-listed species like the northern spotted owl, the thinning treatment will directly affect future habitat conditions for several listed species. The thinning units do provide suitable habitat for at least one Sensitive/"Survey and Manage" mollusk species (the Puget Oregonian snail, *Cryptomastix devia*). Stand treatment has the potential to impact suitable habitat for this species, as well as improve long-term habitat capability for this species through the "release" of bigleaf maple trees which are currently being over-topped and out-competed by conifers.

Measurement Method
Acres of suitable, or potentially suitable, habitat treated by alternative for selected species.

12. Effects to wildlife management indicator species

What are the effects of the project on Gifford Pinchot National Forest Plan "Management Indicator Species," including Roosevelt elk and black-tailed deer?

Management Indicator Species (MIS) are those which represent other species with similar habitat requirements, or that are in high public demand for consumptive or non-consumptive uses. These include the pileated woodpecker, "cavity excavators" (mostly woodpeckers), the pine marten, wood duck, and Roosevelt elk and black-tailed deer. Most of these species are permanent, year-round residents of the Woods LSR, with deer and elk most numerous during the winter months. The treatment of the Woods Creek Stewardship stands has the potential to both adversely and beneficially affect MIS over the short- and long-terms, depending on treatment type and intensity, as well as site-specific habitat conditions. The project may potentially have short-term, adverse effects on some species due to noise disturbance from project activities.

Measurement Method
Total acres treated; acres of biological deer and elk winter range treated.

Botany Issues

13. Effects of invasive plants

Invasive plant species can dominate sites or ecosystems, altering ecosystem balance. The results may include changes in biodiversity, fire frequency, soil erosion and hydrology of a site. Other effects include poisoning of livestock, reducing forage for domestic and native grazing animals, and reducing the quality of recreational experiences. These effects may occur at a given site, or the site may serve as a stepping stone or corridor for the further spread of invasive plants to locations where these effects can occur.

Measurement Method
These issues will be evaluated by measuring the area of disturbance from yarding system (skid roads and skylines) and from temp roads and landing along with reduction in canopy cover (shading), particularly along roads. Additionally, reduction in canopy covers (shading), particularly along roads will be used to predict risk of invasive plant dissemination.

14. Effects to Regional Forester's sensitive plant species

Regional Forester's Sensitive plants may be impacted by harvest disturbance including direct trampling, loss of shade, reduction of humidity, loss of substrate, competition from weeds, or loss of population connectivity.

Measurement Method
Disturbance of known Sensitive plant sites as measured by number of sites.

Forest Structural Development

15. Windthrow risk

A number of units proposed for thinning in the lower, flatter portions of the Woods Creek Project Area (units 1, 2, 11, & 12) have low to moderate levels of windthrow. Uprooted trees are mostly in small clumps or isolated individuals, but several larger patches exist in units 1 and 12. The windthrow is likely caused by the following factors:

- Saturated soils during winter storms in these low lying areas
- Deep and loose pumice and ash based soils. While these soils are deep, soil strength appears low in the B & C horizons
- Laminated root rot: most uprooted trees show at least some signs of infection. In most stands, trees remaining standing in the initial stages of infection and often die standing.
- High height-to-diameter ratios. Even the dominant trees in these stands are just past the HD ration threshold where windthrow is more likely (75).

Reducing the stand density through thinning will increase risk of further windthrow. Some future windthrow will be beneficial in terms of adding CWD, ongoing density reduction, creating horizontal complexity, and uprooting laminated root rot infected trees (which accelerates root decomposition and kills the fungus). However, too much windthrow will reduce canopy cover beyond the desired levels and set back structural development of late seral conditions.

Measurement Method

A windthrow risk model will be used to analyze increase in windthrow risk under different thinning intensities. The model is laid out in: *Scott RE, Mitchell SJ. 2005. Empirical modeling of windthrow risk in partially harvested stands using tree, neighborhood, and stand attributes. For. Ecol. Manage. 218: 193-209.* Analysis will include a comparison of stand characteristics in the proposed harvest units and similar stands in the area that have been thinned in the past. This exercise will evaluate the amount of post-thinning windthrow and determine the like causes that potentially exacerbated it.

16. Simplification of fine-scale spatial patterning

Spacing-based thinning, either through Designation by Description (DxD) or traditional spacing-based marking guidelines, generally eliminates all closely-spaced pairs and clusters of overstory trees. Recent analysis from the Galena sale demonstrated this. Observation and quantitative analysis of inter-tree distances in old growth stands in the project area show that tree distribution in old growth is very clumpy, with well over 30% of overstory Douglas-fir having nearest neighbors closer than 14' (a typical DxD spacing guideline). Thinning has the potential to eliminate the future development of closely-spaced pairs and clusters of overstory Douglas-fir. Gaps, dense thickets, and midstory layers will all develop through time in these stands. Once closely-spaced Douglas-fir are removed, they will never come back until a major stand-replacing disturbance occurs. While the ecological effects of this are not known, precluding the development of spatial patterns that clearly exist in current old growth is not in line with the management goals of LSRs. Prescriptions will be modified to reduce this risk.

Measurement Method
Percent of nearest neighbor distances less than 14' in current old growth as compared to projected nearest neighbor distances in stands post-thinning. This will be measured by running the prescription through numerous plots in stands and measuring post thinning nearest neighbor distances.

Public Services

17. Recreation opportunities at Wood Creek Watchable Wildlife Area

The proposed timber management associated with Unit # 11 may impact recreational opportunities on the Old Growth Trail (#247a). Activities associated with timber felling and transport may create visual and noise disturbance, which could adversely impact the Forest visitor's experience. There is an increased risk to public safety during timber harvest activities.

Measurement Method
This issue will be evaluated as a measure of area, duration and magnitude of recreation site disturbed by proposed timber management activity. Evaluation may include change of visual quality objective (VQO) and/or Recreational Opportunity Spectrum (ROS). Implementing a closure/mitigation measure should limit the risk to public safety.

18. Recreation opportunities at dispersed campsites

Proposed access management activities will eliminate vehicle access to dispersed camp sites and/or other Forest remote locations primarily along the Cispus River corridor (FR 7600 and 2508). The proposed decommissioning of system and non-system roads could displace the existing recreation to other locations on the Forest.

Measurement Method
This issue will be evaluated as a function of lost motorized recreation access opportunity as a measure of miles of road decommissioned and number of sites displaced.

19. Impact to private inholdings

Proposed forest management may impact the access and create disturbance around private lands adjacent to the National Forest. Access to private lands via FR 2305025 may be limited by timber management in Unit 2. Noise and visual distraction associated with Units 1 and 2 may impact private lands. Floodplain restoration sites in the lower Yellowjacket Creek abut private land and Tower Rock Campground, which may cause public disturbance.

Measurement Method
This issue will be evaluated as a measure of area, duration and magnitude of private land disturbed by proposed management activity. If applicable this issue may be evaluated as a function of lost motorized access measure of miles of road decommissioned and number of sites displaced.

3.0 ALTERNATIVES, INCLUDING THE PROPOSED ACTION

This chapter describes and compares the three alternatives considered for the Woods Creek Stewardship Thin. It includes a description and map of each alternative considered. This section also presents the alternatives in comparative form, defining the differences between each alternative and providing a clear basis for choice among options by the decision maker and the public.

The two action alternatives have many design features in common. Snags and down wood would be created, and minor species such as western redcedar, red alder, black cottonwood, and bigleaf maple would be favored and retained to promote and increase species diversity. Unit prescriptions are consistent between alternatives, and slash treatments are common to all action alternatives. Both action alternatives would treat riparian reserves.

All temporary roads and landings would be rehabilitated. Many remnant skid trails (from the first logging entry) are apparent on the landscape, and would be utilized as much as possible unless it is determined that such use is more detrimental to the environment than creating new skid trails. Skid trails would be rehabilitated following the completion of work in each unit. See Section 3.2 for a detailed listing of project design criteria and mitigation measures common to all alternatives.

Unconnected actions are restoration project proposals that would occur within the project action area. These projects would be similar under all alternatives, and would be implemented as funding becomes available.

An additional 281 acres of thinning units were originally considered for inclusion in the proposed action alternatives. However, those units were dropped for one or more of the following reasons: the stands were too high in elevation to benefit from this *type* of restoration project, the stands were in a wet area, extensive road reconstruction would be required to access the unit(s), road construction on steep or unstable slopes would be required to access the unit(s), and/or the tree size was too small to make thinning economical at this time. One stand was dropped because it was in a wet area and was adjacent to Tower Rock Campground. Portions of units were excluded from one or both action alternatives based on skidding distance, presence of riparian areas, or based on alternative-driving issues such as stream crossings or temporary road construction (see Section 2.7).

3.1 Alternatives

Alternative 1 – No Action

Under the No-Action alternative, current management plans would continue to guide

management of the area. No timber harvest or other associated actions would be implemented to accomplish project goals at this time. If allowed to proceed without further management, self-thinning would occur over time, resulting competition-induced mortality. Tree mortality would not be captured and utilized as wood products. Natural mortality and stand differentiation would result in the natural accumulation of snags, down wood and the creation of openings in the stand, or gaps. In some stands, species diversity would decrease over time as deciduous trees, particularly bigleaf maples, are overtopped and outcompeted by conifers.

Restoration and road-related treatments would not occur in association with this analysis; however, they may be pursued under a separate analysis. Harvest-related transportation activities or ground disturbance would not occur at this time, such as the creation and subsequent rehabilitation of skid trails and landings, or hauling along Forest roads.

Alternative 2 – The Proposed Action

The primary goal of the Woods Creek Stewardship project is to advance the development of late-successional forest characteristics. The project is designed to meet the goal by restoring late-successional forest form and function, primarily through thinning young stands to hasten tree growth, stimulating understory development, increasing the amount of snags and down woody debris, and by developing forest conditions in riparian areas. This proposal will help to restore large blocks of contiguous late-successional forest to improve the habitat of old-growth-related species, including northern spotted owl, pileated woodpecker, salmon, and steelhead. Please see page 26 for a map of the proposed thinning units and restoration treatments under Alternative 2.

Project goals include:

1. Reduce tree density by approximately 40% on 412 acres of mid-seral forest stands in the 30-50 year age category in order to stimulate tree growth, promote development of forest understory, and increase levels of snags and coarse woody down material.
2. Release bigleaf maple trees and other hardwoods that provide significant intra-stand diversity for numerous species of amphibians, mollusks, arthropods, songbirds, and other species.
3. Reduce the road density within heavily roaded areas within the project area to restore hydrologic function and prevent illegal activities such as firewood theft and garbage dumping.
4. Restore instream habitat in the Lower Cispus River, which is a vital component to the salmon recovery goals in the Lower Columbia River. Habitat restoration will promote channel connectivity, and renew channel form and function.
5. Water quality will be restored where timber management (logging and associated road building) and natural disturbance (the 2006 flood) have had a negative influence on riparian areas. Proposed riparian treatment will increase the available stream shade, thereby reducing solar radiation and stream temperature.
6. Reduce the disturbance to fish and wildlife species where dispersed and developed recreational activities are concentrated near sensitive habitat. Public education and control of recreation access will reduce disturbance factors.

Commercial thinning is proposed for 412 acres (376 acres when one excludes skips, buffers and areas where logging is infeasible) of 30-50 year old managed stands of Douglas-fir and western hemlock. The treatment would primarily use ground-based yarding systems, but in one area a skyline system will be used. The proposed action would thin twelve units that were identified to promote late-successional development and provide benefits to water quality. Site-specific surveys of timber, wildlife, heritage, botany, soils, and aquatic resources were completed in 2007.

The silvicultural prescription of these units is a variable density thinning approach, which promotes the development of a range of vegetation types over time. The prescription calls for no-cut islands ("skips"), gaps in the forest canopy, and retaining features important to wildlife (for example: retaining large down trees/logs). The prescription includes commercial treatment of riparian reserves designed to promote the growth of large trees, accelerate the development of late-successional characteristics, promote intra-stand diversity, promote stream shade, and recruit future downed large wood.

The silvicultural prescription under Alternative 2 is to employ a "Designation by Prescription" approach to achieve variable density spacing. Such spacing mimics that of old-growth stands, and provides more flexibility and implementation options. Post-harvest units will have and average of 150 trees per acre, and spacing between individual Douglas-fir trees will vary from 10 to 28 feet. Diameter limits for cut trees are between 16 and 22 inches, depending on the unit. This alternative would produce approximately 3,845 mbf of harvested timber.

No permanent road development is proposed, as the area is currently accessible. Approximately 0.9 miles of new temporary roads will be constructed, 0.3 miles of temporary roads will be extensively reconstructed, and 0.6 miles of existing temporary roads will be minimally reconstructed (brushing, etc.) to provide logging equipment access. Those roads would remain "temporary" and would be obliterated after treatment. Ground-based systems would utilize existing skid trail remnants to the greatest extent possible. Road access management will include monitoring and treatment of invasive species both before and after harvest activities using approved mechanical removal methods.

Skips, or no-cut areas, would be located in all units. Ten to forty percent of each unit would be left as no-entry skips, depending on the number of biologically responsive areas that should be left intact, such as riparian areas, bigleaf maple patches, legacy downed logs, or other features. Skips would include a mix of large patches of 1 to 5 acres in Riparian Reserves and other portions of units (avoided due to steep slopes, high moisture content, etc.) and smaller patches of one-third of an acre to protect specific habitat features (snags, down wood, bigleaf maples, decadent trees, etc.). In managed stands, no-cut riparian reserve buffers, survey and manage sites, etc. are included in skips where possible, and where the skip is beneficial to habitat. Skips would be placed evenly across units as practical, considering habitat protection and effectiveness.

Gaps, which are small openings designed to increase light or "release" understory species and add structure to a stand, would be present in all managed stand units. Approximately 4-14% of unit acres would occur in gaps. Some units already have natural gaps, such as those left by

root rot mortality and blowdown, and more gaps would be created through clearing around dominant Douglas-fir and western redcedar as well as the creation of landings, temporary roads, and skid trails. Gap size is one-half acre or less, but would also include "daylighting" or individual tree culturing of individual leave trees or clumps, where the leave tree or clump would be retained in the center of a gap, and "released" or "daylighted" by harvesting trees within 25 to 30'. This "wide-thinning" would have the effect of enhancing the growth of a single tree or clump. The largest, healthiest Douglas-fir or western redcedar, or sometimes a clump of conifers or hardwoods, would be selected as the leave tree in wide-thin gaps.

Streams, wet swales, and wetlands will have no-harvest buffers, placed depending on stream class, fish presence, geomorphologic indicators, and site potential tree height. No-harvest buffers would around all sides of a riparian feature, with minimum widths as follows: wet swales, 70 feet; non-fish-bearing streams (Class III & IV), 140 feet; and fish-bearing streams (Class I & II), 280 feet.

Approximately 347 acres would be yarded with ground-based logging systems, and 28.5 acres would be yarded through skyline systems.

Slash would be left on skid trails and lopped-and-scattered throughout the unit. In two of the units, slash would be piled and burned. Upon completion of project work, slash will be evenly scattered on landings to serve as mulch. In order to increase and promote species diversity, minor species such as western redcedar, red alder, black cottonwood, bigleaf maple and other minor species would be retained.

Restoration Projects

The Woods Creek Stewardship Thin includes a number of stewardship restoration projects which would be implemented to meet the project objectives. The projects are prioritized in the order listed below.

1) *Snag and down wood creation* - The forest stands included for commercial thinning in the Woods Creek Stewardship Thin currently have very low levels of both snags and coarse woody material (whole trees and logs) as a result of the clearcut logging that created these stands. Snags are uncommon in these units, and are usually created by small patches of laminated root rot. Down logs are also rare, and most often found as Class III "cull logs" that were left on site during previous timber harvest. During commercial thinning, an unknown number of these habitat features will be either felled (i.e. snags) for logging safety reasons, or broken or damaged (down wood) during yarding. The objective of this project is both to compensate for direct losses of snags and down wood from logging, and to enhance current habitat conditions by creating additional structures.

   Two snags per acre will be created in units by girdling or topping. Assuming that one snag per acre will be created naturally within five years of harvest (from factors like logging-induced mortality and root rot), Late-Successional Reserve Assessment Guidelines will be met. Down wood will be created in the units with the goal of

achieving 5% cover by down wood in the unharvested riparian buffers, and 3 down logs per acre in the harvested section of the units. Snags and down wood will be created throughout commercially harvested portions of the units (including the outer riparian reserves), as well as the inner riparian reserves.

2) *Access/Travel management*: Roads proposed for treatment were identified during the Roads Analysis process. The access/travel management project proposes to decommission 3.74 miles of system road and 1.3 miles of non-system road that are non-essential to administrative operations and that negatively impact fish, plant, and wildlife habitat. The expected outcome of the proposed decommissioning is reduced sedimentation, restored aquatic connectivity, reduced soil compaction, reduced garbage and noxious weed introduction, and reduced harassment to fish and wildlife. Decommissioning roads involves: restricting vehicle traffic by installing closure berms and water bars, removing culverts, de-compacting road surface where necessary, and reestablishing ground cover (e.g. woody debris, seeding/mulching) to control erosion where necessary.

   Part of the road decommissioning project would involve non-system roads that also function as dispersed campsites. In this alternative, one site and its access road would be and revegetated, and the road to another site would have access restricted but the campsite would remain compacted and unvegetated to facilitate walk-in camping. Please see Section 4.7 for tables showing the roads proposed for management and the types of treatment they would receive.

   Roads treatment will be prioritized based on Roads Analysis ranking system. All roads with a "high" Aquatic Risk Rating and half of the roads with a "medium" Aquatic Risk Rating will be the second priority for the implementation of restoration projects after snag and down wood creation. The rest of the roads—those with a "low" rating and the other half of the "medium"-rated roads, would be treated after redcedar underplanting but before salmon rearing habitat restoration. Table 4.7.8 displays the Aquatic Risk Ratings of those roads.

3) *Salmon rearing habitat restoration:* The goals of this project are to restore hydrologic connectivity of off-channel habitat to the main stem of Yellowjacket Creek (T 11 N, R 7 E, Sec. 17). The project will restore rearing and holding habitat for threatened Coho and Chinook salmon, and improve wildlife conditions at these two locations.

   Numerous side channels once covered the floodplain of the lower Cispus River. This valuable Coho rearing habitat has been lost due to dike and road construction. Past storm events have also prompted channel migration and subsequent filling of side-channel habitat. This project will reconnect Yellowjacket Creek by deepening an off channel alcove over a length of approximately 1500 feet. The expected results will restore perennial water flow increase available rearing habitat and reduce the risk of stranding juvenile Coho from the mainstem stream.

4) *Riparian Conifer Release*: Past timber management action has left portions of the Woods Creek LSR river corridor dominated by hardwood species. As a result, these managed stands lack stream shade and contribute to elevated water temperatures. This project proposes to treat hardwood-dominated stands to promote stand diversity and structural development. This project includes select areas which have been slow to recover from past timber management. Non-commercial silvicultural treatment will release select conifers by opening the canopy and removing competing vegetation approximately 38 feet from select trees (0.3 acre opening/site) to increase the growth rate of under-story conifers. Trees cut will remain on site to meet coarse woody down debris needs. Two sites (totaling 13 acres) will be treated. Priority release sites will be dispersed along stream with abnormally high water temperature that are within State listed 303(d) water quality limited watersheds. This project will increased stream shade as prescribed in the Iron Creek and Yellowjacket Creek subwatersheds (USDA 2003).

5) *Western redcedar underplanting:* Western redcedar is underrepresented in the units due to past harvest and replanting practices. Planting western redcedar will augment natural regeneration and ensure that a laminated root rot-resistant species is present in pockets where the fungus is infecting Douglas-fir. Seedlings would be planted in natural openings and created gaps within the commercially harvested portion of the units, as well as in natural openings and beneath hardwood trees in the inner riparian reserves.

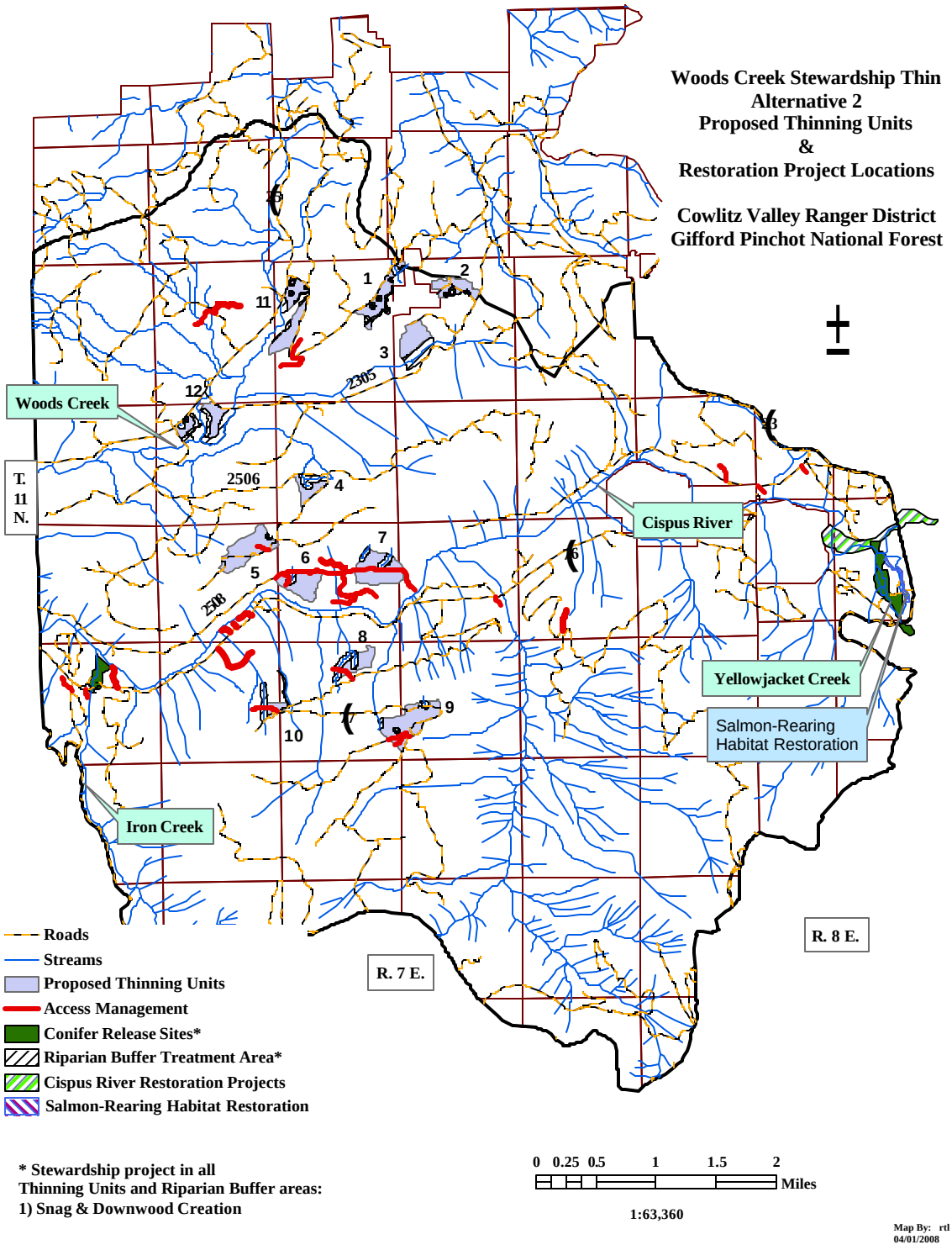
6) *Cispus River floodplain and riparian restoration*: This stewardship project proposes to restore approximately 60 acres of Cispus River floodplain where the 1996 and 2006 floods washed away segments of FR 28 and caused severe impacts to riparian areas and streams including uprooted mature trees, cleared vegetation and deposited heavy loads of sediment, which resulted in severe impacts to over 1.0 mile of lower bank within the planning area and near the confluence of Yellowjacket Creek and the Cispus River (T11N, R8E, Sec. 17 and 18). Large swaths of bare, unprotected streamside have left the channel open to excessive solar heating, susceptible to erosion, and vulnerable to an active encroachment of invasive plants. The flood resulted in sustained impacts to water quality including high stream temperatures, unstable stream banks, and diminished fish habitat (such as loss of hiding cover and spawning gravel).

   This project would treat approximately 2,000 feet of eroding stream and maintain four existing engineered log jams along Cispus River. A log structure would be installed upstream of the FR 2800 road crossing site to reduce stream velocity and decrease near bank pressure. A bar retaining structure would be constructed to maintain channel stability, capture large wood and promote riparian vegetation development. Lastly, non-native vegetation would be manually removed and native hardwoods and conifers would be re-established.

Please see Tables 4.10.2 and 4.10.4 for a breakdown of timber harvested and value by unit, as well as a breakdown of restoration projects and costs.

This alternative was driven primarily by the objective for the sale of timber while maintaining and enhancing stand diversity and late-successional characteristics through the implementation of skips and gaps, and other conservation measures. The sale of timber will provide opportunities to maintain receipts or provide "goods for services" contracts to conduct restoration activities within the project area.

Figure 3.1.1. Woods Creek Thin Alternative 2, the Proposed Action.



Alternative 3

The silvicultural prescription and harvest-related treatments would be the same as Alternative 2. As with Alternative 2, post-harvest units will have between 40 and 160 trees per acre, and spacing between individual Douglas-fir trees will vary from 10 to 28 feet. Diameter limits for cut trees are between 16 and 22 inches, depending on the unit. This alternative would produce approximately 3,291 mbf of harvested timber.

Commercial thinning is proposed for 353 acres under Alternative 3 (339 acres when one excludes skips, buffers, and areas where logging is infeasible). Approximately 310 acres would be treated with ground-based logging systems, and 28.3 acres would be harvested through skyline systems. No new temporary roads would be constructed, no temporary roads would be extensively reconstructed, and 0.6 miles of existing temporary road would be minimally reconstructed in order to be usable. The minimally reconstructed roads would remain "temporary" and would be obliterated after treatment. Ground-based systems would utilize existing skid trail remnants to the greatest extent possible. In some cases, extending ground-based skidding distances would be utilized where economically feasible (up to 1000 feet long) to reduce the need for of temporary roads (Unit 11).

Streams, wet swales, and wetlands will have no-harvest buffers, placed depending on stream class, fish presence, geomorphologic indicators, and site potential tree height. No-harvest variable buffers are prescribed around riparian features with minimum widths as follows: wet swales, 70 feet; non-fish-bearing streams (Class III & IV), 140 feet; and fish-bearing streams (Class I & II), 280 feet.

Slash would be left on skid trails and lopped-and-scattered throughout the unit. In two of the units, slash would be piled and burned. Upon completion of project work, slash will be evenly scattered on landings to serve as mulch.

Alternative 3 was designed to respond to the issue regarding potential effects of sedimentation to streams from the construction of temporary roads, especially in those areas where previously existing roads are not readily evident. For those portions of units where temporary road construction would be in areas that had ecologically recovered since the previous entry or where new construction was necessary, the portion of the units were removed from consideration and treatment in this alternative. Please see page 31 for a map of the proposed thinning units and restoration treatments under Alternative 3.

Restoration Projects

Alternative 3 of the Woods Creek Stewardship Thin includes a number of stewardship restoration projects which would be implemented to meet the project objectives including the following:

1) *Snag and down wood creation* - The forest stands included for commercial thinning in the Woods Creek Stewardship Thin currently have very low levels of both snags and

coarse woody material (whole trees and logs) as a result of the clearcut logging that created these stands. Snags are uncommon in these units, and are usually created by small patches of laminated root rot. Down logs are also rare, and most often found as Class III "cull logs" that were left on site during previous timber harvest. During commercial thinning, an unknown number of these habitat features will be either felled (i.e. snags) for logging safety reasons, or broken or damaged (down wood) during yarding. The objective of this project is both to compensate for direct losses of snags and down wood from logging, and to enhance current habitat conditions by creating additional structures.

Two snags per acre will be created in units by girdling or topping. Assuming that one snag per acre will be created naturally within five years of harvest (from factors like logging-induced mortality and root rot), Late-Successional Reserve Assessment Guidelines will be met. Down wood will be created in the units with the goal of achieving 5% cover by down wood in the unharvested riparian buffers, and 3 down logs per acre in the harvested section of the units. Snags and down wood will be created throughout commercially harvested portions of the units (including the outer riparian reserves), as well as the inner riparian reserves.

2) *Access/Travel management*: Roads proposed for treatment were identified during the Roads Analysis process. The access/travel management project proposes to decommission 3.74 miles of system road and 1.5 miles of non-system road that are non-essential to administrative operations and that negatively impact fish, plant, and wildlife habitat. The expected outcome of the proposed decommissioning is reduced sedimentation, restored aquatic connectivity, reduced soil compaction, reduced garbage and noxious weed introduction, and reduced harassment to fish and wildlife. Decommissioning roads involves: restricting vehicle traffic by installing closure berms and water bars, removing culverts, de-compacting road surface where necessary, and reestablishing ground cover (e.g. woody debris, seeding/mulching) to control erosion where necessary.

Part of the road decommissioning project would involve non-system roads that also function as dispersed campsites. In this alternative, one site and its access road would be and revegetated, and the road to another site would have access restricted but the campsite would remain compacted and unvegetated to facilitate walk-in camping. Please see Section 4.7 for tables showing the roads proposed for management and the types of treatment they would receive.

All roads with a "high" Aquatic Risk Rating and half of the roads with a "medium" Aquatic Risk Rating will be the second priority for the implementation of restoration projects. The rest of the roads—those with a "low" rating and the other half of the "medium"-rated roads, would be treated after redcedar underplanting but before salmon rearing habitat restoration. Table 4.7.8 displays the Aquatic Risk Ratings of those roads.

3) *Salmon rearing habitat restoration:* The goals of this project are to restore hydrologic connectivity of off-channel habitat to the main stem of Yellowjacket Creek (T 11 N, R 7 E, Sec. 17). The project will restore rearing and holding habitat for threatened Coho and Chinook salmon, and improve wildlife conditions at these two locations.

   Numerous side channels once covered the floodplain of the lower Cispus River. This valuable Coho rearing habitat has been lost due to dike and road construction. Past storm events have also prompted channel migration and subsequent filling of side-channel habitat. This project will reconnect Yellowjacket Creek by deepening an off-channel alcove over a length of approximately 1500 feet. The expected results will restore perennial water flow increase available rearing habitat and reduce the risk of stranding juvenile Coho from the mainstem stream.

4) *Riparian Conifer Release*: Past timber management action has left portions of the Woods Creek LSR river corridor dominated by hardwood species. As a result, these managed stands lack stream shade and contribute to elevated water temperatures. This project proposes to treat hardwood-dominated stands to promote stand diversity and structural development. This project includes select areas which have been slow to recover from past timber management. Non-commercial silvicultural treatment will release select conifers by opening the canopy and removing competing vegetation approximately 38 feet from select trees (0.3 acre opening/site) to increase the growth rate of under-story conifers. Trees cut will remain on site to meet coarse woody down debris needs. Three sites (totaling 35 acres) will be treated. Priority release sites will be dispersed along stream with abnormally high water temperature that are within State listed 303(d) water quality limited watersheds. This project will increased stream shade as prescribed in the Iron Creek and Yellowjacket Creek subwatersheds (USDA 2003).

5) *Western redcedar underplanting:* Western redcedar is underrepresented in the units due to past harvest and replanting practices. Planting western redcedar will augment natural regeneration and ensure that a laminated root rot-resistant species is present in pockets where the fungus is infecting Douglas-fir. Seedlings would be planted in natural openings and created gaps within the commercially harvested portion of the units, as well as in natural openings and beneath hardwood trees in the inner riparian reserves.

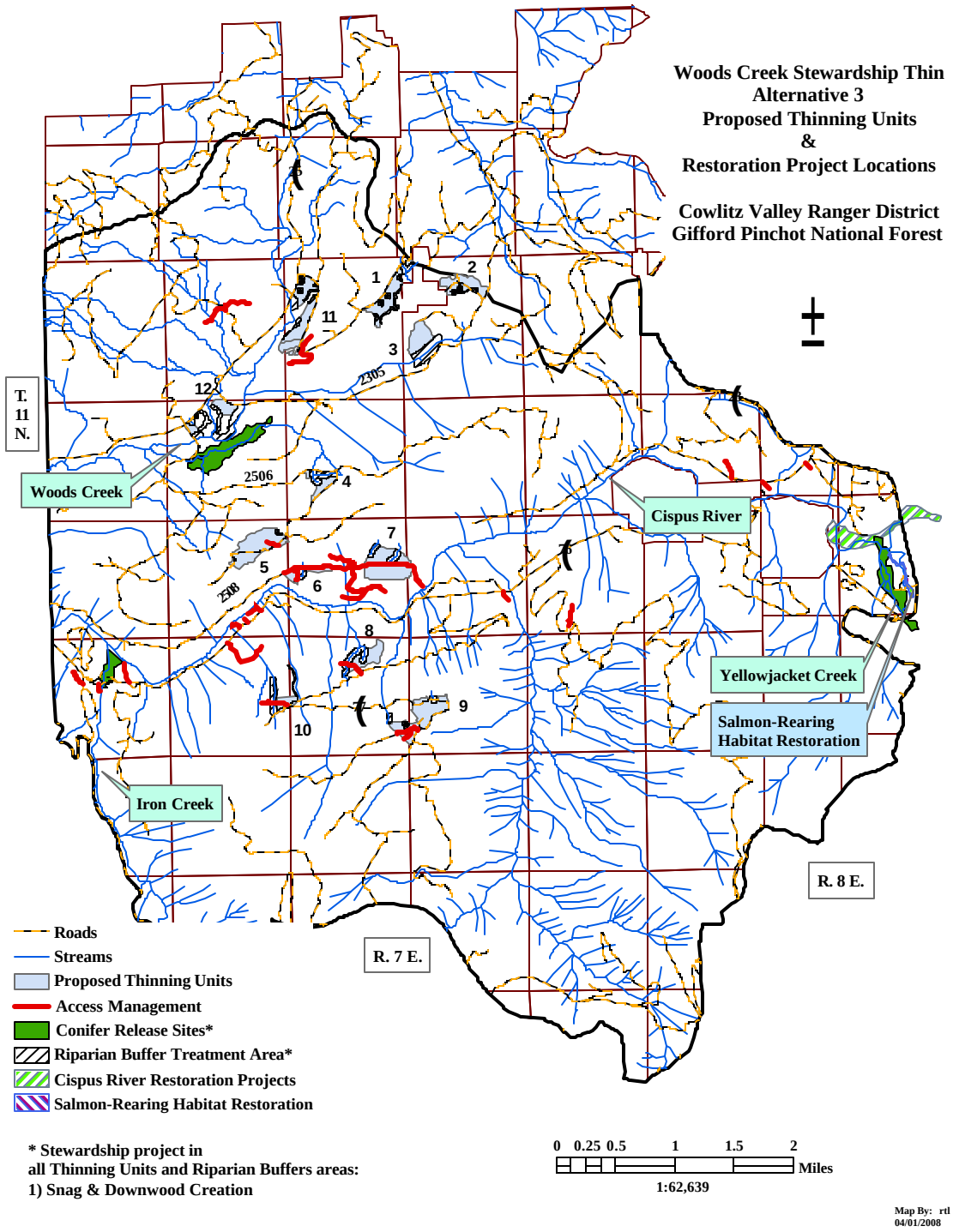
6) *Cispus River floodplain and riparian restoration*: This stewardship project proposes to restore approximately 60 acres of Cispus River floodplain where the 1996 and 2006 floods washed away segments of FR 28 and caused severe impacts to riparian areas and streams including uprooted mature trees, cleared vegetation and deposited heavy loads of sediment resulting in severe impacts to over 1.0 mile of lower bank within the planning area and near the confluence of Yellowjacket Creek and the Cispus River (T11N, R8E, Sec. 17 and 18). Large swaths of bare, unprotected streamside have left the channel open to excessive solar heating, susceptible to erosion, and vulnerable to an active encroachment of invasive plants. The flood resulted in sustained impacts to

water quality including high stream temperatures, unstable stream banks, and diminished fish habitat (such as loss of hiding cover and spawning gravel).

This project would treat approximately 2,000 feet of eroding stream and maintain four existing engineered log jams along Cispus River. A log structure would be installed upstream of the FR 2800 road crossing site to reduce stream velocity and decrease near bank pressure. A bar retaining structure would be constructed to maintain channel stability, capture large wood and promote riparian vegetation development. Lastly, we propose to manually remove non-native vegetation and re-establish native hardwoods and conifers.

Please see Tables 4.10.3 and 4.10.4 for a breakdown of timber harvested and value by unit, as well as a breakdown of restoration projects and costs.

Figure 3.1.2. Woods Creek Stewardship Thin Alternative 3



3.2 Mitigation Measures and Project Design Criteria

In response to public comments on the proposal, mitigation measures, project design criteria and best management practices were developed to ease some of the potential impacts the various alternatives may cause. The mitigation measures may be applied to either action alternative.

Timber Harvest Mitigation Measures & Project Design Criteria

1. In all harvest units, the following actions should be considered to minimize damage and wounding of residual trees (trees left after harvest): a) pre-designate skid trails/skyline corridors and use existing skid trails whenever possible and practical; b) fell and yard skid trails/skyline corridors first; c) in the skid trails, cut stumps as low as possible so they will not shunt the skidding vehicle or logs sideways into residual trees; d) keep the skid trails/skyline corridors as narrow as possible; e) require felling to the lead with trees being felled 30-45 degrees toward or away from the skid trails/skyline corridors; f) do not allow whole-tree yarding (cut trees into logs, limbing and topping them prior to yarding; and h) consider requiring tree guards or designating rub trees, to be cut and yarded last, along the edges of skid trails/skyline corridors.

   Alternatives 2 and 3: All harvest units

2. No timber sale activities that generate noise above ambient levels will occur within biological deer and elk winter range from December 1 to April 1. Waivers to the above restriction may be given to work on one unit at a time (i.e. complete work at one unit before starting at another) based on winter weather conditions, as determined by the District wildlife biologist. Due to the existing winter range gate closure at Forest Road 2506.037, no waivers or alterations of this restriction will be given for activities at unit 5, which occurs behind this gate. Written concurrence from the District wildlife biologist will occur before this restriction is lifted or altered.

   Alternatives 2 and 3: All harvest units except Unit 9

3. No timber sale activities that produce noise above ambient levels will occur between March 1 to June 30 in units adjacent to suitable spotted owl nesting habitat, to limit disturbance to owls that may be nesting nearby. The above restriction may only be waived if surveys to protocol standards are conducted, and it is determined that no nesting spotted owls are present. Any waivers will be documented in writing by the District wildlife biologist prior to the commencement of harvest activities.

   Alternatives 2 and 3: All harvest units

4. No timber sale activities that generate noise above ambient levels will occur between May 15 to July 1 to limit disturbance to potential elk calving areas located adjacent to these

units. This restriction may be waived based on field surveys that indicate that elk are not using these areas for calving during this time. Any waivers will be documented in writing by the District wildlife biologist prior to the commencement of harvest activities.

Alternatives 2 and 3: Units 1, 2, 9, 11, 12

5. Minimize disturbance to standing snags and existing coarse woody debris (particularly large-diameter, legacy trees and logs) to the extent practical by yarding away from these features, including them in no-thin "skips" or wider riparian reserves, or protecting them with individual, adjacent leave trees. Existing, merchantable down trees or logs (or merchantable snags felled for logging safety reasons) will not be removed during the sale.

   Alternatives 2 and 3: All harvest units

6. Retain all bigleaf maple trees over 8 inches in diameter to provide suitable habitat for Sensitive-listed mollusks, as well as amphibians, arthropods and many other species. Minimize ground disturbance by establishing a 40 foot radius no-disturbance buffer area around larger, more vigorous bigleaf maples per the silvicultural prescription trees, including the identified *C. devia* sites in unit 7, or eliminating clumps of bigleaf maples from units. It is recognized that an occasional maple tree may need to be cut for skyline logging corridors or other reasons, but these should be kept to a minimum, and bigleaf maples should only be felled when no other reasonable alternative exists. Use snags and down wood to release maples in the 40 foot "skips" post-harvest.

   Alternatives 2 and 3: All harvest units

7. Ensure impacts from harvest activities to the Woods Creek Watchable Wildlife Trail System in Unit 11 are minimized. The trail and unit overlap in the southern portion of unit 11. Trees will be felled directionally felling away from trail, and there will be a 50' no-cut buffer on either side of the trail except for skyline corridors. Skyline corridors will be minimized to the greatest extent possible. One-end log suspension will be achieved on all trees crossing the trail. Slash within 100' of the trail corridor will be hand-piled and burned. The unit boundary will be marked in such a way that it is not visible from the trail. Skyline corridors will be rehabilitated to block access in such a manner that they will not be mistaken for a trail. If trail is damaged by logging and yarding operations, trail repair will be required. Motorized access will be prohibited on trail.

   Alternative 3: Unit 11

8. Ground-based machinery will not operate where soil water content is high enough to cause rutting that exceeds 6 inches in depth for a length of ten feet or more in accordance with Region 6 Standards and Guidelines (Forest Service 1998). Deviation from this measure should involve consultation with the appropriate resource specialist. This measure will limit the degree of detrimental soil rutting and puddling as well as reduce the potential for offsite stream sedimentation. Applicable BMP: T-13. Erosion Prevention and Control Measures During Timber Sale Operations.

Alternatives 2 and 3: All harvest units

9. Harvested trees will be felled away from streams, wetlands or other riparian reserve features. Exceptions would be trees which are leaning towards the creek, or when conditions would not allow safe felling. Any portion of a felled tree that lands in the no cut buffer will be left on the ground. The objective of this measure is to prevent damage to riparian vegetation and soils within Riparian Reserves. Applicable BMPs: T-6 - Protection of unstable lands; T-13 - Erosion prevention and control measures during timber sale operations T-17 - Meadow protection during timber harvesting.

   Alternatives 2 and 3: All harvest units

10. One-end log suspension will be required for ground-based and cable yarding systems (except during winching or lateral yarding). Full suspension will be required where possible over class IV streams. No yarding is permitted over class I, II, III, or IV streams. This will reduce the risk of soil compaction and displacement from dragging entire logs along the ground. The objective of this measure is to minimize erosion and potential sedimentation. Applicable BMP: T-13 - Erosion prevention and control measures during timber sale operations.

    Alternatives 2 and 3: All harvest units

11. All ground based equipment will be confined to approved temporary roads, skid trails and landings during yarding and brush disposal operations. Loaders or feller-bunchers may not operate off designated skid trails. Exceptions may be made in consultation with soil and aquatic resource specialist. Exceptions will include equipment operation over slash beds that are as thick and continuous as practicable. Landings, temporary roads, skid trails and skyline corridors will be approved by the sale administrator prior to timber felling. Skid trails must be located at least 100 feet from any stream channel. Skid trails will be spaced a minimum of 150 feet apart for tractors and 400 feet apart for loaders. When possible, temporary roads and skid trails will be re-established at previous skid trail locations rather than constructing new ones. These trails and roads will be treated to restore hydrologic function as needed. Temporary roads will not be constructed within Riparian Reserves, unless pre-approved in collaboration with the aquatics or soils resource specialist. The objective of this measure is to minimize the extent and the degree of soil damage, displacement, and disturbance, and to allow sediment filtration. Applicable BMP: T-11. Tractor Skid Trail Location and Design.

    Alternatives 2 and 3: All harvest units

12. Ensure Forest Plan Standards and Guidelines (USDA 1990 and Wade 1992) for equipment slope restrictions are met. Designated temporary roads and skid trails will not be permitted on slopes greater than 30 percent (20% in Unit 9). This measure will limit the amount of erosion, soil compaction and displacement associated with use of equipment on steep slopes.

Alternatives 2 and 3: All harvest units

13. Temporary roads and landings will be subsoiled to a depth of 18 inches (minimum). Subsoiling must be done immediately following logging activities. Any proposed alternative methods to subsoiling must be approved by the sale administrator in consultation with the Zone aquatic specialist or soil scientist. To prevent re-compacting of the treated roadways and landings, no ground-based equipment will be operated on subsoiled portions of roads and landings after subsoiling is completed. Cross-drains or water bars will be installed every 150 feet or more frequently where slopes exceed 5%. Available logging slash will be placed across the subsoiled road landing surface. (Acceptable grass seed mix; type of weed free mulch; and application rates will be specified by a qualified specialist). Post harvest motorized access to temporary roads will be prevented by construction of an approved closure device (e.g., construction of a 4-foot high earth berm at the entrance to the road or landing). Closure to vehicles is required to prevent these areas from being re-compacted and to allow vegetation to develop. The objective of this measure is to rehabilitate areas compacted during management activities, accelerate recovery of compacted soils, and facilitate water infiltration and revegetation on those disturbed areas. Applicable BMP: T-13. Erosion Prevention and control measures during timber sale operations; T-14 - Revegetation of area disturbed by harvesting activities; T-16. Erosion control on skid trails.

    Alternatives 2 and 3: All harvest units

14. Rock will be used only when necessary to reduce erosion, puddling and compaction on landings and temporary roads, and applied only where needed ("spot rocking"). Rock will be incorporated into the roadbed by ripping or scarification following harvest activities (see mitigation measure which requires subsoiling). The objective is to provide better substrate for vegetative growth and water infiltration following logging and harvest activities.

    Alternatives 2 and 3: All harvest units

15. All road drainage structures (e.g. culverts) will be designed to accommodate bankfull flow flood events if left in place into the wet season (October 1-June 15), consistent with Gifford Pinchot Land Resource Management Plan Standards and Guidelines (USDA 1995). Temporary drainage structures will be designed to meet the base flow condition (approximately 36 inches) if utilized only during the dry season (June 16-Sept 29) and removed prior to the fall wet season. If new structures are to weather through fall and winter, they must comply with standards and guidelines as if a permanent structure. The objective of this measure is to ensure channel transport function and channel longitudinal connectivity. Applicable BMP: T-13. Erosion prevention and control measures during timber sale operations.

    Alternatives 2 and 3: Unit 6

16. All currently closed system roads used by the sale will be reclosed after sale activities have been completed. The roads will be left in a self-maintaining condition by placing a barrier at the junction with the existing road system adequate to prevent off-road vehicle use, constructing cross-ditching on steep-gradient sections and at culverts or other drainage locations. Applicable forest road systems include: Forest Roads 2305026, 2305027, 2506608, 2508039, 2508049, 7700036, 7700660, and 7700663. This measure will prevent chronic ground disturbance, compaction and help promote hydrologic and biological process. Applicable BMPs: T-13 - Erosion prevention and control measures during timber sale operations; T-14 - Revegetation of area disturbed by harvesting activities.

    Alternative 2: Units 2, 3, 5, 6, 7, 8, 9, and 10
    Alternative 3: Units 3, 5, 8 and 10

17. Prior to the wet season (October 1-June 15) or any expected seasonal period of precipitation and runoff, cross drains and grade breaks will be installed on all temporary roads, skid trails, landings, and skyline corridors. The objective of this measure is to reduce risk of soil displacement through rill, gully and splash erosion processes. Applicable BMP: T-13 - Erosion prevention and control measures during timber sale operations.

    Alternatives 2 and 3: All harvest units

18. Subsequent to burning piled slash, burned areas greater than 100 square feet (not on permanent roads or landings) will be seeded. This measure will mitigate the effects of severe burning on the soil.

    Alternatives 2 and 3: All harvest units

19. A spill plan will be developed and pre-approved prior to project implementation. The plan will include appropriate operational measures for handling hazardous materials. A Hazardous Material kit will be on site, and would contain materials to control/contain a spill of fuel, oils, and/or hydraulic fluid. Fueling equipment will be located outside of riparian reserves. All service work on heavy machinery and refueling will be done on an established system road at a site approved by the Forest Service. The objective of this measure is to reduce the potential for damage to the stream and flood plain as a result of a hazardous material spill. Applicable BMPs: T-4 - Use of sale area maps for designating water quality protection needs; T-7 - Streamside management unit designation; T-17. Meadow protection during timber harvesting; T-22 - Modification of the TSC (Timber Sale Contract); R-12 - Control of construction in streamside management units.

    Alternatives 2 and 3: All harvest units

20. The silvicultural treatment in the riparian reserve will follow a prescription to optimize structural development and plant species diversity to benefit water quality and old growth dependent fauna including native salmonids. The riparian treatment will prescribe down wood level and riparian reserve buffer widths based on topographic relief and other

inherent channel stability indicators. For more information see Woods Creek Stewardship Thin Riparian Reserve Silvicultural Prescription (project record). The objective is to optimize plant structural development species diversity to benefit water quality and old growth dependent fauna including native salmonids. Applicable BMPs: T-4 - Use of sale area maps for designating water quality protection needs; T-7. Streamside Management Unit Designation; T-17. Meadow Protection during Timber Harvesting; T-22. Modification of the TSC (Timber Sale Contract); R-12. Control of Construction in Streamside Management Units; W-3 - Protection of wetlands.

Alternatives 2 and 3: All harvest units

21. Areas of gouging or soil displacement resulting from suspended cable yarding systems and/or mobile yarding systems will be treated to prevent rill and gully erosion and possible sediment delivery to stream courses. Erosion control treatment may include but not limited to repositioning displaced soil to recontour disturbed site, creating small ditches or diversions to redirect surface water movement, scattering slash material to create flow disruption and surface soil stability. Erosion control measures implemented by the purchaser will be complete prior to the onset of wet season (October 1) and approved by an aquatic resource specialist prior to the close of the timber sale. The objective of this measure is to prevent surface soil erosion resulting from timber related ground disturbance. Applicable BMPs: T-6 - Protection of unstable lands; T-13. Erosion Prevention and Control Measures During Timber Sale Operations.

    Alternatives 2 and 3: All harvest units

22. For instream projects: to minimize the amount of sediment entering the stream and possible damage to stream banks and channel bottoms, stream crossings and activities in the stream are prohibited except as prescribed for Forest Service instream projects.

23. All yarding and haul activities will be restricted to a Normal Operating Season (NOS), defined as June 15 to October 1. The objective of this measure is limit ground disturbing activities to the dry season thereby minimizing soil rutting, compaction, surface erosion and sediment delivery.

    Exceptions to this timing restriction may be made during periods of anomalous weather conditions. Extraordinary wet weather during NOS may limit yarding and haul operations. During extended periods of dry weather outside the NOS, yarding and haul operations my proceed only with the written approval of an aquatic resource specialist and providing there is daily monitoring to evaluate if exceptional wet weather logging operations are meeting project design criteria. Applicable BMPs: T-4. Use of Sale Area Maps for Designating Water Quality Protection Needs; T-6. Protection of Unstable Lands; T-7. Streamside Management Unit Designation; T-13. Erosion Prevention and Control Measures During Timber Sale Operations; T-17. Meadow Protection during Timber Harvesting ; T-22. Modification of the TSC (Timber Sale Contract); R-12. Control of Construction in Streamside Management Units

Any pre-approved hauling activities occurring outside of the Normal Operating Season defined as June 15 to October 1, will monitor conditions daily as follows:

- Implementation and effectiveness monitoring of BMPs will be documented in daily diaries and made available to the aquatic resource specialist to assess conditions of haul routes, landings, and skid trails.

- Project activities will be curtailed and corrective action taken when ponding, rutting, rilling, culvert blockages, stream channel instability, and the occurrence of scour or sediment transport and deposition downstream of cross drains are encountered on adjacent system roads, temporary roads, skid trails, landings, stream crossings, riparian reserves or within harvest units where ground disturbance has occurred. See Fisheries Biological Evaluation for indicators of damage due to significant rainfall events.

  Alternatives 2 and 3: All harvest units

24. The project will comply with Washington State law (WAC 220-110-070) and provisions of the USDA Forest Service Memorandum of Understanding with the Washington State Department of Fish and Wildlife (2005) to minimize effects to fish and other aquatic organisms.

    Alternatives 2, 3 and 4: Units 3,

25. For instream work related to stream crossings: to minimize the amount of sediment entering the stream channel, the operation period would be limited to low flow period. This measure will help minimize disturbance to aquatic organisms and their habitat.

    Alternatives 2, 3 and 4: Units 3,

26. For stream crossings and work adjacent to streams: to minimize the amount of sediment reaching the stream and to accelerate the re-vegetation process, rehabilitate areas compacted during management activities, and accelerate recovery of compacted soils, subsoil the compacted areas and plant native vegetation to restore any areas used as access points by equipment. Alternatives to subsoiling should involve consultation with the appropriate resource specialist and documentation in project files to track for monitoring purposes. *See subsoiling and revegetation standards.*

    Alternatives 2, 3 and 4: Units 3,

27. To protect *Usnea longissima* (beard lichen) create 50 foot radius buffers centered around populations to be flagged by the District Botanist. During thinning operations, timber should be felled away from the reserve. The purpose of the buffer is to protect the host trees from impacts during harvest, to preserve nearby trees as possible future sites for lichen dispersal, and to avoid large changes in local microclimate. The sites in both units are along a boundary road, so the buffers will be a half-circle.

Alternatives 2 and 3: Units 6 (three sites) and 11 (one site).

28. For actions conducted outside the road prism, all heavy equipment (bulldozers, skidders, graders, backhoes, dump trucks, etc.) will be cleaned prior to entering National Forest System lands to prevent the introduction of noxious weeds into the project area. An inspection will be required to ensure that equipment is clean before work can begin (Equipment cleaning clause Wo-C6.35) (**Standard 2**, USDA 2005).

    Alternatives 2 and 3: All harvest units

29. 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 is not available, individual Forests should require sources certified to be weed free using the North American Weed Fee Forage Program standards or a similar certification process. Mulch species shall preferably be from annual rye or cereal grain fields. District Botanist will identify local contacts. (**Standard 3,** USDA 2005)

    Alternatives 2 and 3: All harvest units

30. Inspect active gravel, fill, sand stockpiles, quarry sites, and borrow material for invasive plants before use and transport. Treat or require treatment of infested sources before any use of pit material. Use only gravel, fill, sand, and rock that is judged to be weed free by District or Forest weed specialists (**Standard 7,** USDA 2005).

    Alternatives 2 and 3: All harvest units

31. 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. (**Standard 13,** USDA 2005).

    Alternatives 2 and 3: All harvest units

32. Temporary roads, landings and other areas of heavy disturbance would be revegetated with a native seed mix and application prescription developed by the Forest. Guidelines for site preparation would also be followed (see Gifford Pinchot Native Species Policy, 2000). The following prescription is recommended, or consult North Zone botanist: a locally native seed mix such as 65% *Elymus glaucus* with 35% *Deschampsia elongata* (by weight) applied at a rate of 100 lbs/acre, with fertilizer (spring only) at 200 lbs/acre and enough weed-free mulch to cover the seed 2-3 inches. When seed is used it should be either

certified noxious weed free or from Forest Service native seed supplies. Purpose of mitigation: to minimize soil erosion and weed establishment at disturbance sites.

Alternatives 2 and 3: All harvest units

33. Minimize road maintenance clearing zones, as much as safety regulations will allow. Purpose of mitigation is to maintain shady conditions that help minimize invasive plant population expansion.

    Alternatives 2 and 3: All harvest units

34. During years of project implementation, conduct any road brushing activities during spring-early summer, before seed heads mature. Purpose of mitigation is to prevent formation and release of viable seeds that could be dispersed along hauling corridors by vehicles, and/or when wind-borne seeds could disperse into newly harvested units.

    Alternatives 2 and 3: All harvest units

35. Clean heavy equipment used for project activities when equipment moves from or between project sites or areas known to be infested into other areas, infested or otherwise. If wash facilities are not readily available, all visible dirt and plant parts on equipment will be removed by brushing or scraping at the infested site before moving. All of the proposed Woods Creek units have populations of at least one invasive plant. Purpose of mitigation is to avoid spreading invasive weed populations.

    Alternatives 2 and 3: All harvest units

36. During the season of the beginning of the ground disturbing phase of project implementation, and during seasons in which the project is being implemented, hand treat Canada thistle sites. The plants shall be hand pulled or weed whipped (unless NEPA analysis allows for alternative treatment) at the time when flower buds are forming and root reserves are at their lowest. If this timing is not achieved and seed heads have already formed, they shall be bagged and disposed of outside of Gifford Pinchot National Forest boundaries. Return to sites for one subsequent years following completion of project for follow up treatment, as necessary.

    Alternatives 2 and 3: Unit 4, 6 (located on road 25080 on upper unit boundary), 7, and 10.

37. Scotch broom shall be pulled or cut (unless additional NEPA analysis allows for alternative treatment) prior to beginning work on the unit, and in subsequent years of work if necessary to prevent bloom and seed set.

    Alternatives 2 and 3: edge of Unit 9 and in adjacent rock pit.

38. Control specified invasive plants at landings, culvert replacement sites, ground-disturbing road closure actions, and along access roads for 1/4 mile preceding areas of ground disturbance (i.e. staging areas, and harvest units adjacent to roads), to 1/4 mile following area of ground disturbance, and within timber harvest units, as specified below:

    a. **During the season** the ground disturbing phase of project implementation begins, and **before ground disturbing action**, weeds shall be hand pulled, bagged and disposed of outside of Gifford Pinchot National Forest boundaries (unless Forest NEPA analysis allows for alternative treatment). Hand control efforts should occur before invasive species have set seed for the year (May or June). The Gifford Pinchot National Forest (contact the North Zone Botanist) shall provide a list of weeds to be controlled previous to project implementation. The project lead shall inform the Gifford Pinchot North Zone botanist when the weed control work will be performed, and when it is complete.
    b. **During** seasons of project implementation weed re-occurrences along access roads shall be controlled as specified above.
    c. **For two field seasons following** project completion, weed re-occurrences at landings, and along access roads, shall be controlled as specified above. In addition, harvest units shall be surveyed for invasive plant establishment and/or encroachment. If new invasive plant populations are located within harvested units, population data shall be collected for entry into the Natural Resource Inventory System (NRIS) invasives database, and invasive plants shall be controlled, as specified above.
    d. **After two years**, the North Zone Botanist shall re-evaluate the weed control needs within the project area and determine whether further treatment is needed. It is likely that, at some sites, weed control beyond two years will be necessary.

    Alternatives 2 and 3: All harvest units

Stewardship Restoration Project Mitigation Measures & Project Design Criteria

1. Ground-based machinery will not operate where soil water content is high enough to cause rutting that exceeds 6 inches in depth for a length of ten feet or more. Deviation from this measure should involve consultation with the appropriate resource specialist. This measure will limit the degree of detrimental soil rutting and puddling as well as reduce the potential for offsite stream sedimentation.

    Alternatives 2 and 3: All restoration projects

2. *Snag creation*: create two snags per acre following the completion of harvest activities by topping or girdling live trees at the crown level. This will meet LSR Assessment goals for snags in young forest stands, based on the assumption that one snag/acre will occur in these stands within 5 years after harvest from logging induced mortality, root rot, and other factors. Trees chosen for snag creation should be a minimum of 12 inches in diameter.

Snag creation will occur both within and outside riparian reserves, where snags will be used to "release" bigleaf maple trees to ensure the long-term persistence of these maples. A higher concentration of snags may be placed within unharvested riparian reserves if there is a greater need in these locations for maple release. Snags may also be used to stimulate the growth of the dominant trees within a stand, particularly where bigleaf maples are absent or scarce. If possible, create some snags by "high stumping" trees, at least 20 feet in height with feller/bunchers or other equipment.

Alternatives 2 and 3: All harvest units

3. *Down wood creation*: Create down wood by falling live, green trees following the completion of harvest activities. The goal will be to achieve 5% ground cover of down wood within unharvested riparian reserve buffers, and 3 down trees per acre outside of the riparian reserve buffers. Some of the 5% of down trees felled within the unharvested riparian buffers may be directionally felled outside the buffer to increase the amount of down wood in these areas. Ideally, a post-sale down wood survey will be conducted not sooner than 2 years following harvest to evaluate the actual number of trees to be felled to meet the guidelines above; however, this may not be possible due to the timing of stewardship project implementation. Probable future mortality over the next decade will be considered when prescribing the exact numbers of trees for down wood creation, based on recent monitoring results from nearby commercial thinning sales,. Trees to be fallen for down wood should represent the average-sized trees in a particular stand, and the largest diameter trees should not be preferentially selected for down wood. Trees fallen for down wood should not be less than 10 inches in diameter, however. Per snag creation, use down wood to "release" bigleaf maple trees, or to stimulate the growth of selected conifers in the harvest units or adjacent sites.

   In units 6 and 7, which are scheduled for only one thinning entry, increase the number of trees fallen for down wood to twelve per acre (outside of RRs) and use these down trees to accomplish the above stated objectives.

   Alternatives 2 and 3: All harvest units

4. No stewardship project activities that generate noise above ambient levels will occur within biological deer and elk winter range from December 1 to April 1.

   Alternatives 2 and 3: All restoration projects except for snag and down wood creation in Unit 9.

5. No stewardship project activities that produce noise above ambient levels will occur between March 1 to June 30 at sites adjacent to suitable spotted owl nesting habitat to limit disturbance to spotted owls that may be nesting nearby. These restrictions assume that no blasting will occur in connection with these projects; if blasting is proposed, the list of projects below may change based on input from the District wildlife biologist. The above restrictions may only be waived if surveys to protocol standards are conducted, and it is

determined that no nesting spotted owls are present. Any waivers will be documented in writing by the District wildlife biologist prior to the commencement of harvest activities.

Alternatives 2 and 3: a) snag and down wood creation (all units), b) access/travel management (sites adjacent to old-growth forest), c) Cispus River riparian and floodplain restoration, d) riparian conifer release.

6. No stewardship project activities that generate noise above ambient levels will occur between May 15 to July 1 to limit disturbance to potential elk calving areas located adjacent to these sites. This restriction may be waived based on field surveys that indicate that elk are not using these areas for calving during this time. Any waivers will be documented in writing by the District wildlife biologist prior to the commencement of harvest activities.

   Alternatives 2 and 3: a) snag and down wood creation (units 1, 2, 9, 11, 12 only), c) Cispus River riparian and floodplain restoration, d) riparian conifer release, e) salmon rearing habitat restoration.

7. *Riparian conifer release project*: Do not fall bigleaf maple trees at the Woods Creek site for conifer release, and do not fall any alders or cottonwood trees within 40 feet of bigleaf maples over 12 inches in diameter. A total of 25% of the trees scheduled to be felled for conifer release should be designated for snag creation by girdling trees at their base, to provide foraging habitat for cavity nesters and other species.

   Alternative 3: Woods Creek conifer release project site only

8. Control scotch broom, Canada thistle, and tansy ragwort where present in project area. The plants shall be hand pulled or weed whipped (unless additional NEPA analysis allows for alternative treatment) at the time when flower buds are forming and root reserves are at their lowest. If this timing is not achieved and seed heads have already formed, they shall be bagged and disposed of outside of Gifford Pinchot National Forest boundaries. Return to sites for two subsequent years following completion of project for follow up treatment, as necessary.

   Alternatives 2 and 3: All restoration projects

9. For actions conducted outside the road prism, all heavy equipment (bulldozers, skidders, graders, backhoes, dump trucks, etc.) will be cleaned prior to entering National Forest System lands to prevent the introduction of noxious weeds into the project area. An inspection will be required to ensure that equipment is clean before work can begin (Equipment cleaning clause Wo-C6.35) (**Standard 2**, USDA 2005).

   Alternatives 2 and 3: b) access/travel management, c) Cispus River riparian and floodplain restoration, e) salmon rearing habitat restoration.

10. 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 is not available, individual Forests should require sources certified to be weed free using the North American Weed Fee Forage Program standards or a similar certification process. Mulch species shall preferably be from annual rye or cereal grain fields. District Botanist will identify local contacts. (**Standard 3,** USDA 2005)

    Alternatives 2 and 3: b) access/travel management, c) Cispus River riparian and floodplain restoration, e) salmon rearing habitat restoration.

11. Inspect active gravel, fill, sand stockpiles, quarry sites, and borrow material for invasive plants before use and transport. Treat or require treatment of infested sources before any use of pit material. Use only gravel, fill, sand, and rock that is judged to be weed free by District or Forest weed specialists (**Standard 7,** USDA 2005).

    Alternatives 2 and 3: b) access/travel management, c) Cispus River riparian and floodplain restoration, e) salmon rearing habitat restoration.

12. 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. (**Standard 13,** USDA 2005).

    Alternatives 2 and 3: b) access/travel management, c) Cispus River riparian and floodplain restoration, e) salmon rearing habitat restoration.

13. Areas of heavy disturbance would be revegetated with a native seed mix and application prescription developed by the Forest. Guidelines for site preparation would also be followed (see Gifford Pinchot Native Species Policy, 2000). The following prescription is recommended, or consult North Zone botanist: a locally native seed mix such as 65% *Elymus glaucus* with 35% *Deschampsia elongata* (by weight) applied at a rate of 100 lbs/acre, with fertilizer (spring only) at 200 lbs/acre and enough weed-free mulch to cover the seed 2-3 inches. When seed is used it should be either certified noxious weed free or from Forest Service native seed supplies. Purpose of mitigation: to minimize soil erosion and weed establishment at disturbance sites.

    Alternatives 2 and 3: b) access/travel management, c) Cispus River riparian and floodplain restoration, e) salmon rearing habitat restoration.

14. Clean heavy equipment used for project activities when equipment moves from or between project sites or areas known to be infested into other areas, infested or otherwise. If wash

facilities are not readily available, all visible dirt and plant parts on equipment will be removed by brushing or scraping at the infested site before moving. Purpose of mitigation is to avoid spreading invasive weed populations.

Alternatives 2 and 3: b) access/travel management, c) Cispus River riparian and floodplain restoration, e) salmon rearing habitat restoration.

3.3 Comparison of Alternatives

This section provides a summary of the effects of implementing each alternative. Table 3.3.1 displays the differences between alternatives in terms of acres treated, type of harvest, and revenue generated from timber management. Table 3.3.2 provides a comparison of the analysis indicators for the significant issues (Section 2.7). Table 3.3.3 displays the comparison of restoration activities by alternative.

Table 3.3.1. Comparison of alternatives including a quantitative summary of activities or project elements.

Activities	Alternative 1 (No Action)	Alternative 2	Alternative 3
Total stand acres	0	541	475
Total acres within commercial thinning unit boundaries	0	412	352
Net acres treated with commercial thinning	0	349	295
Acres of outer riparian reserves treated	0	94	75
Acres of inner riparian reserves treated	0	130	123
Skyline harvest	0	28.5	28.3
Ground-based harvest	0	347	310
Landing area (in acres)	0	4.06	1.69
Volume harvested	0	3,845 mbf	3,291 mbf
Net revenue	0	$203,325	$185,219
Benefit/Cost Ratio	0	1.18	1.19

Table 3.3.2. Comparison of analysis indicators for significant issues by alternative.

Activities	Alternative 1 (No Action)	Alternative 2	Alternative 3
Total length (in miles) of temporary roads associated with timber harvest	0	1.8	0.6
Miles of new temporary roads constructed or requiring extensive reconstruction	0	1.2	0
New temporary stream crossings	0	1	0
Impacts to Woods Creek Watchable Wildlife Area Trail 247A	0	Logging occurs no closer than 100' on one side of the trail	Logging occurs no closer than 50' on both sides of the trail
Miles of road decommissioned	0	5.0	5.2
Motorized access to dispersed campsites closed	0	1 closed	3 closed

Table 3.3.3. Comparison of restoration activities by alternative

Activities	Alternative 1 (No Action)	Alternative 2	Alternative 3
Snag and down wood creation (acres)	0	534	468
Road closures, stabilization, and decommissioning	0	5.0	5.2
Cispus River riparian and floodplain restoration (acres)	0	60	60
Riparian conifer release	0	13 acres (2 sites)	35 acres (3 sites)
Western redcedar underplanting (trees)	0	9400	9000
Salmon rearing habitat restoration (linear feet)	0	1500	1500
Cost of all restoration projects	0	$345,990	$338,012

4.0 ENVIRONMENTAL CONSEQUENCES

This section summarizes the physical, biological, social and economic environments of the affected project area and the potential changes to those environments due to implementation of the alternatives. It also presents the scientific and analytical basis for comparison of alternatives presented in the tables in Section 3.3. This analysis is organized by resource area.

4.1 Disturbance History

The Woods Creek Stewardship Thin planning area is located in the Lower Cispus Watershed in the Woods Late Successional Reserve. Large-scale natural disturbance has historically included fire, floods, and volcanic eruptions. An intermediate disturbance agent in the planning area is laminated root rot. Human disturbance historically included Native American burning (such as to improve huckleberry production), but is now characterized by timber harvest and associated road building, and at a smaller scale unmanaged recreation and forest product extraction.

The disturbance regime in the Lower Cispus Watershed is characterized by large, high intensity fires every 100-400 years, such as the Cispus Burns that occurred in the Lower Cispus Watershed in 1902 and 1918. Scattered islands of large Douglas-fir old-growth amidst a wide distribution of mid-seral stands are one indication that a very large fire may have also occurred in the early 1800's in the mountains of Lewis, Cowlitz, and Skamania Counties.

The extent and role of low-moderate intensity fire is not fully known because the large, high-intensity fires typically destroy evidence of these less intense fires. Historically and prehistorically, American Indians managed huckleberry patches through burning. Also, effective fire suppression since the 1930s and the termination of Native American burning around the turn of the century have reduced both the number and extent of low-moderate intensity fires in this century compared to previous centuries (USFS 1997).

Geologic processes such as seismic conditions and volcanic eruptions are also natural disturbances within the planning area. The volcanic eruptions of Mount St. Helens deposited ash and tephra across the Lower Cispus watershed. These deposits have contributed to increased fine sediment delivery to streams for a period of years to decades after each eruption. Volcanic eruptions have inundated the floodplain of the Cispus River with mudflows. Earthquakes pose the hazard of causing landslides that either directly affect human habitations or block stream drainages that form dam-break floods along stream channels.

Other disturbance is caused by intermediate, chronic, low-moderate intensity disturbances caused by wind, laminated root rot, and Douglas-fir beetle. Laminated root rot appears to be a notable disturbance agent in the Woods LSR and interacts with wind and Douglas-fir bark beetles to create complex stand structures (USFS 1997). It is a major determinant of forest structure and driver of development processes, as it shifts species composition away from Douglas-fir towards western hemlock and redcedar and creates openings that range in size from a few trees to 10 acres (USFS 1997). It also creates significant numbers of snags and

downed logs. Although no landscape-scale analysis has been done, it is estimated that 10-15% of the total area within the Woods LSR is affected, and laminated root rot is present in all stands under the proposed action. By weakening the structural roots of trees and reducing overall tree vigor, laminated root rot increases windthrow risk and likelihood of mortality from Douglas-fir beetles. Additionally, heavy rain and windstorms can saturate soils and lead to significant patches of windthrow in the valley bottoms of Woods and Ames Creeks.

The landscape is highly fragmented from past clearcutting and road building which has resulted in a decline in habitat value for many old-growth dependent species. Forty-two percent of the stands in the Woods LSR are less than 80 years old. Road densities in the planning area range from 2.2 to 3.9 miles per square mile, which is of concern due to the high levels of sediment delivery from road surfaces, the relative instability of the hill slopes, and the impacts to wildlife.

Additional information regarding the planning area can be found in the *Lower Cispus Watershed Analysis* (USFS 2003) and the *Middle Cowlitz Watershed Analysis* (USFS 1997b).

4.2 Affected Environment

As stated above, the planning area has been highly fragmented by past clearcutting and road building. Nonetheless, patches of late-successional forest are still relatively abundant in the Woods LSR and occupy 37% of the analysis area. Most of the units selected for treatment are bordered by a mix of late-successional forest and managed stands of varying age classes. Most units proposed for harvest are bounded by Forest Service land, but Units 1 and 2 are bordered, in part, by private property (Black Ranch).

The 12 units proposed for treatment range in elevation from 1090' to 3120' (Table 4.2.1). The topography is generally rolling and gentle with steep slopes in a few units. Units 1, 2, 11, and 12 are located in the rolling, hummocky valley bottoms of the Woods and Ames Creek drainages. Numerous wetlands are scattered throughout this area and wet saturated soils are common during periods of heavy rains. Units 6 and 7 are located on flat Holocene terraces of the Cispus River, while the rest of the units are located on sideslopes or tops of various ridge systems. Precipitation is generally between 60-80 inches per year and temperatures typically range from the low 30's to the low 40's in winter and 50-80 degrees in summer. Site productivity is generally high and site class ranges from class 2 to 3 (Table 1). Soils are volcanic in origin with high pumice and ash content. They are typically coarse-textured and well-drained with depth to bedrock greater than 40 inches.

All of the proposed units are in previously managed stands. After clearcutting, most stands were broadcast burned, planted, and pre-commercially thinned at age 15-20. Many stands were also given conifer release treatments from competing shrubs and hardwoods. Overstory tree species composition is dominated by Douglas-fir in all the stands, with significant components of western hemlock in a few stands (Table 4.2.1). Bigleaf maple, red alder, black cottonwood and western redcedar are present in varying amounts, but generally make up less than 5% of the overstory. Pacific silver fir, grand fir, and noble fir are moderately abundant in

Unit 9 and rare or non-existent in the rest of the units. Understory plant communities are relatively lush and well-developed for young, plantation stands, and are dominated by sword fern, Oregon grape, vanilla leaf, and vine maple. Salal, oxalis, bracken fern, red huckleberry, and devil's club are also present in significant amounts. Understory western hemlock is scarce to moderately abundant in different units, while western redcedar is non-existent to scarce.

Table 4.2.1. Physical and biological conditions for Woods Creek Stewardship Thin stands

Unit	Stand Tag	Age	Stand Size (Ac)[1]	Slope %	Elevation (ft)	Site Index [2]	Site Class	Soil Mngt Unit	Plant Association[3]
1	528229	46	43	0-25	1380-1420	180	II	27	TSHE/POMU
2	528240	39	29	0-40	1320-1410	170	II	27, 28	TSHE/BENE/ POMU
3	528242	42	50	0-60	1330-1610	180	II	27,37	TSHE/BENE/ POMU
4	528288	41	27	0-40	1520-1780	180	II	27,36	TSHE/BENE/ POMU
5	528285	41	55	10-40	1840-2240	160	II	36, 51	TSHE/POMU
6	528287	43	40	0-20	1130-1220	180	II	13	TSHE/POMU
7	528299	43	59	0-25	1200-1260	160	II	13	TSHE/POMU
8	528318	40	33	5-35	1980-2200	170	II	27	TSHE/POMU
9	528322	40	67	5-30	2780-3120	140	III	25	TSHE/POMU
10	528315	40	23	15-40	2060-2440	160	II	27	TSHE/POMU
11	528246	46	58	0-20	1130-1200	170	II	28, 27	TSHE/POMU
12	528266	50	57	0-10	1090-1120	180	II	28	TSHE/POMU

[1] Stand size includes acres within official sale-unit boundaries where commercial thinning will occur (412 total acres) as well as areas outside of official unit boundaries where non-commercial thinning will occur (130 total acres).
[2] Based on Stabler (1944) 100 yr base site index
[3]Plant association as per Guide for Western Hemlock Zone ecoclass (USDA 1986) codes *where;* TSHE/POMU= western hemlock/ swordfern, TSHE/BENE/ POMU = western hemlock/ dwarf Oregon grape/swordfern

4.3 Stand Growth and Productivity

The 12 stands proposed for thinning are all in the competitive exclusion, biomass accumulation stage of stand development (Franklin et. al. 2002) and are likely to remain in it for another 30-50 years. This is the most structurally simple stage of stand development (Franklin et al. 2002, Oliver and Larson 1996). The stands are primarily single story and the canopy tends to be relatively uniform in terms of crown class differentiation. Although pre-commercial thinning maintained the understory plant community to varying degrees in most stands, canopy closure and competition are suppressing development of the understory and development of a mid-story tree layer (Table 4.2.2). The dominant processes of stand development that are occurring in these stands can be broken down into three categories:

1. Competition from high density: Exclusion of understory plants, vertical crown recession, increasing height to diameter ratios, crown class differentiation in the overstory, canopy stratification into overstory and mid-story cohorts, mortality of suppressed overstory and mid-story trees, and horizontal packing (spacing out of overstory trees in a more even fashion).
2. Tree growth: Height growth and biomass accumulation are near their maximum. Height growth will not begin to significantly slow for another few decades.
3. Competition independent mortality from Laminated Root Rot (LRR) and wind: Small and large gap creation and moderate snag and downed wood accumulation.

Table 4.2.2. Species composition and stand conditions of Woods Creek Stewardship Thin stands

Unit	DF %	Minor Overstory Species	Understory Tree Abundance[1]	Bigleaf Maple Abund. [1]	Shrub Cover %	Major Shrub Species	Forest Health Notes [2]
1	90	RA, BC, WH, BM	High (20+ tpa)	Mod (2-5 tpa)	40-90	SWF, OG, VM	Significant LRR & blowdown patches
2	80	WH (15%), BM, RC, RA, BC	Mod (5-20 tpa)	High (5+ tpa)	50-80	OG, VM, SWF, VL	Lots of small LRR pockets. Armillaria found 1 location
3	95	RA, BM, RC, WH	Low (<5tpa)	Low (<2 tpa)	10-50	SWF, OG, SL, VM	Moderate LRR openings
4	90	RA (8%), WH, BM	Mod	Mod	30-60	SWF, OG, VL	Moderate LRR openings, lots of RA
5	95	BM, WH, RA, RC	Low	High	20-50	OG, SWF, VL	Low LRR openings, significant patch bear damage on main knoll
6	95	BM, RA	Low	High	20-80	SWF, VM	Moderate LRR openings
7	90	WH, BC, RA, BM	Mod	Low	20-90	SWF, OG, BF	High LRR, large pocket in SE
8	95	WH,BM,RA, BC	Low-Mod	Mod	30-70	SWF, OG, VL	Moderate LRR, large openings in NW and NE of stand, bear damage
9	70	WH(20%), SF(10%), RA, RC, NF	Low-Mod	Low	0-20	SWF	Very low LRR, some blowdown pockets & snow break
10	90	WH,BM,RA	Low	High	10-40	SWF, OG, VL	Low LRR, Dw Mistletoe, snow break, & bear damage
11	85	BC, RA, BM, RC, WH	Mod-High	High	80-100	SWF, VM, OG	Moderate LRR openings
12	80	WH, BC, RA, BM, RC	Mod-High	High	30-80	SWF, VM	Moderate LRR openings

[1] These quantities are rough estimates based on impressions during walk throughs. They are not from inventory plots.

[2] Definitions for level of Laminated Root Rot (LRR) are:

- Low: Small pockets of 1-3 infected trees scattered throughout stand, 1 per every 5-10 acres. Less than 5% of stand area infected.
- Moderate: Small pockets of 1-3 infected trees, 1 per every 2-5 acres, plus larger openings (1/20 – 1/5th acre) every 15-30 acres. 5-15% of stand area infected.
- High: Small pockets of 1-3 infected trees, 1 per every 2-3 acres, plus larger openings (1/20th – 5 acres) every 15-30 acres. Greater than 15% of stand area infected.

Densities are at or above the threshold for self-thinning in almost all stands. Competition from high density is causing crown recession and high height-to-diameter ratios (HDR) in the overstory trees. Average live crown ratios (LCR) are below 40%, and HDRs are above 85 in almost all stands. Dominant trees, however, are growing at moderate to high rates (averaging between 2.4" and 4.0" in diameter increment the last 10 years) with moderate live crown ratios (between 35-44%). Height to diameter ratios of dominant trees are higher than desired (over 70) for post-thinning stability (Emmingham et al. 2000, Mustard and Harper 1998, Wonn and O'Hara 2001), but not dramatically so. When all trees are considered, low live crown ratios and high height to diameter ratios show that overall stand vigor is declining. However, the majority of dominant and co-dominant trees have sufficient crown and stability to respond well to release from thinning. Table 4.2.3 displays the tree vigor metrics for stands within the proposed thinning area.

Table 4.2.3. Tree vigor metrics for Woods Creek Stewardship Thin stands.

	Live Crown Ratio (%)		**Height:Diameter Ratio**		**Height (ft)**		**Crown Radius (ft)**	**10 Yr DBH Increment (")**
Unit #	**Dominant Trees**	**All trees GT 6"**	**Dominant Trees**	**All trees GT 6"**	**Dominant Trees.**	**All trees GT 6"**	**Dominant Trees**	**Dominant Trees**
1	35	30	88	104	129	114	18.7	2.7
2	43	38	81	90	115	102	18.2	2.8
3	41	36	87	102	125	109	19.0	2.4
4	40	35	79	98	122	100	20.0	4.0
5	44	38	68	89	109	99	19.4	3.4
6	38	37	88	95	124	103	19.2	2.4
7	42	42	74	88	115	104	19.3	2.6
8	44	38	79	86	114	94	NA	3.3
9	40	40	77	92	94	88	NA	2.7
10	37	36	87	86	109	102	18.3	2.7
11	41	42	81	100	120	100	20.0	2.6
12	37	33	75	94	136	113	18.9	3.3

Almost no legacy snags exist, and a low to moderate amount of small diameter (8-15") snags are present. Abundance of green wildlife trees (trees with broken tops, bole decay, branch platforms, cavities, etc) is low in most units, except for Units 5, 8 and 10 where significant bear damage and snow breakage is present. Coarse woody debris levels are low with percent cover generally below 1%, although some units contain a low to moderate amount (estimated 1-3% cover) of large, legacy downed logs in decay classes 3-4. Laminated root rot (LRR) is present in all stands in varying amounts and, together with wind, is the principle disturbance agent creating gaps, snags, and course woody debris. In addition to windthrow and root rot pockets, most stands contain one or more of the following features in or adjacent to the stand that break up the relatively uniform, canopy of Douglas-fir: wetlands, streams, hardwood pockets, or natural openings. These features, along with gaps and dense thickets, create

significant horizontal patchiness in the majority of the units, considering their young age and management history.

Summary of Stand Diagnosis and Treatment Recommendations

These units are presently in the "golden years" of height and diameter growth. The opportunity to influence the development of large trees with long full crowns is greatest at this stage. In riparian areas, these large conifers will provide increased shading, bank stability, and large woody debris in the future. As the process of competitive exclusion is well underway, however, opportunities to shape species composition, build stem stability, slow crown recession, maintain diameter growth, and maintain the vigor of shade tolerant mid-story trees and hardwoods will decrease exponentially with time. In contrast, the relatively small size of the trees and large proportion of sapwood vs. heartwood make creating large and long lasting dead wood challenging at this time. Also, the stands already have relatively well-developed shrub layers, and natural processes will continue to expand and create gaps and horizontal patchiness through time. Thus, the primary objectives for the proposed thinning are to:

1) Maintain and increase growth rates of dominant and co-dominant conifers in upland and riparian forests and accelerate crown class differentiation.
2) Maintain and enhance riparian forest functions: shade to maintain cold water temperatures and moist, cool terrestrial microclimates; deposition of organic litter and nutrients, maintenance of bank integrity, filtering and reduction of sediment delivery, and recruitment of large woody debris.
3) Accelerate the growth and establishment of shade tolerant understory and mid-story tree layers.
4) Prevent shading-out and decline of hardwoods, especially bigleaf maple.
5) Decrease relative dominance of Douglas-fir versus other species and increase amount of western redcedar to increase resilience to laminated root rot and increase conifer presence in riparian forests.
6) Prevent simplification of horizontal patchiness and fine-scale spatial patterning.

Based on field reviews, stand inventories, and analysis of vegetation, the areas proposed for harvest are suitable for silvicultural treatments that remove timber volume while providing benefits to selected stands that are consistent with the purpose and need described in Chapter 1. Detailed silvicultural prescriptions are available in the project record.

4.3 Silviculture

The proposed action consists of twelve units that would receive an intermediate, even-aged harvest method (thinning) on stands created by even-aged methods (clearcutting). In all of the proposed units, even-aged management is appropriate based on the management allocation/direction involved and the existing vegetation/stand conditions. Existing natural and managed stands within the planning area are even-aged, which lend themselves to a continued even-aged management regime. To best meet the management/resource objectives for the planning area and to address the soil, water quality and wildlife (resource) issues for the project, commercial thinning was chosen as the preferred treatment method. However, some components of uneven-aged management would be added to this even-aged thinning approach to promote the development of understory and mid-story cohorts, release selected hardwoods and minor species, and maintain and enhance horizontal patchiness.

Single vs. Multiple Entries

Prescriptions were designed under the assumption that a second commercial thinning entry may be needed in 15-30 years to achieve the desired future condition in 10 of the 12 units. A third entry close to age 80 is also possible, but is unlikely to be needed. If additional entries are necessary, they will be analyzed under a new Environmental Analysis (or similar document). From a vegetation standpoint, the multiple-entry approach is preferable as not all management objectives have to be accomplished in one entry. A higher leave-tree retention prescription ("lighter touch") can be used and the response of the stand, as well as subsequent natural disturbances, can be evaluated to determine if further treatment is necessary. Quick re-closure of the canopy after thinning and the need for variable spacing are not as great a concern. However, impacts from roads and yarding can outweigh the benefits of multiple entries. In some cases, a one-entry treatment combined with road obliteration is preferable. Units 6 and 7 have been selected for this approach as they are at the end of a dead-end road. These two stands will be thinned more heavily and greater variability added. A greater portion of these stands will be planted to ensure establishment of a new understory cohort and increased species diversity. If a second entry is necessary to achieve the desired future condition in the future, a cut and leave approach can be used.

Effects of Thinning on Stand Development

Direct and Indirect Effects

To compare the effects of No-Action Alternative and the two action alternatives, three treatment scenarios were modeled and "grown out" 50 years using the Landscape Management System (LMS). The prescriptions used in LMS closely mimic the actual thinning, downed wood, and planting prescriptions. The three scenarios that were modeled were the No-Thin (NT), the general thinning prescription (TH), and the heavy thinning in the wide thin gaps (HT) (Tables 4.3.1 and 4.3.2). This same heavy thinning (thinning to 50 TPA of trees =>6"

dbh) will also be used to release selected trees in the non-commercial drop-and-leave treatments in the riparian buffers. The model used to show the stands in 2057 did not assume a second entry has taken place.

Overstory Development

The modeling shows a clear increase in diameter growth from thinning compared to the no-thin scenario. The quadratic mean diameter (QMD) of Douglas-fir averaged across all stands is 19% and 38% higher in the TH and HT treatments respectively, versus the NT treatment. Part of the increase in QMD from thinning is due to removing the lower diameter classes which increases the average, and the rest is due to increased diameter growth from thinning. Thinning also increased the number of trees over 30" by an average of 5 and 12 trees per acre in the TH and HT treatments, respectively, showing that thinning will lead to significantly more large trees versus not thinning. Trees over 40" dbh are also higher in thinning treatments. Forest Vegetation Simulator (or FVS, the growth modeling program used within LMS) underestimates the effects on diameter growth from thinning compared to results from the Levels of Growing Stock Study (Curtis 2006) that had a field site in the Gifford Pinchot National Forest not far from the planning area. Results from this site show an approximate 10-15% greater increase in the growth of the 40 largest trees from thinning compared to this modeling exercise (Curtis and Clendenen 1994).

The proposed variable density thinning treatments in the two action alternatives will create patches of different densities that range from the high densities of no-thin all the way to the low densities of the heavy-thin treatment. Patch size will range from $1/15^{th}$ of an acre to 5 acres. The result will be different levels of release across each stand. Crown class differentiation will accelerate and both diameter growth and crown development will vary considerably among residual trees, which will lead to a more complex overstory canopy over time. Under the no-action alternative, live crown ratios will fall well below 40% on most of the Douglas-fir and diameter growth is likely to continue to slow. Overstory canopies will remain largely closed and vertically uniform with crown class differentiation proceeding slowly in most areas. Based on 80-year-old, dense natural stands in the Woods LSR, competitive exclusion may continue for another 5-8 decades.

Figure 4.3.1, below, shows that average canopy cover across all stands is approximately 70% within 30 years for the TH treatment scenario. At the end of 50 years, canopy cover is within 2-10% of the NT treatment. After 50 years in the TH scenario, Curtis relative densities are well above levels where competition related mortality sets in, suggesting that thinned areas will be fully stocked and canopy cover will be high. As FVS underestimates growth response post-thinning, both canopy cover and relative density will be higher and the stands will re-close in less time. In stands thinned to a similar density in western Oregon, canopies re-closed in 10-15 years post-thinning on sites with similar productivity levels (Chan et al. 2006, Davis et al. 2007).

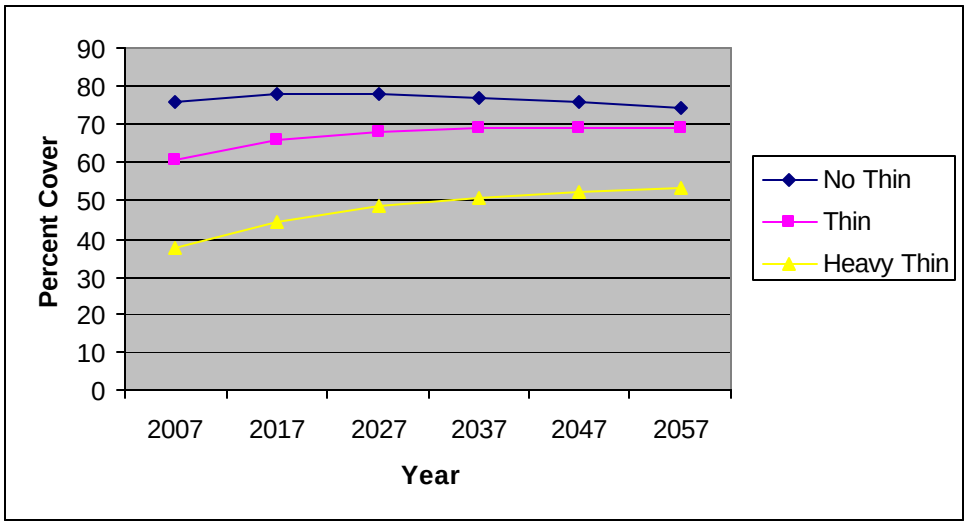


Figure 4.3.1: Canopy cover changes over time under different treatment scenarios. Values are an average of all stands.

The two action alternatives would result in a mosaic of the three treatment types across each stand. Table 4.3.3 shows an estimated breakdown for each alternative and the corresponding canopy cover. Both alternatives have a rough 60% Thin, 20% Heavy Thin, 20% No-Thin breakdown. In reality, the spread of laminated root rot will likely create more openings and reduce canopy cover in all 3 treatments. On the other hand, actual response to thinning, especially understory tree growth, will likely be higher than what is projected by FVS and may increase canopy cover. Overall, the two action alternatives may lead to a slight decrease in canopy cover compared to the no-action alternative.

Table 4.3.3. Canopy cover, acres, and percent of treatment type for both action alternatives

Treatment Type	2007 Canopy Cover[1]	2057 Canopy Cover	Alternative 2		Alternative 3	
			Acres	%	Acres	%
Thin	61%	69%	332	61%	295	62%
Heavy Thin[2]	41%	59%	90	17%	84	18%
No-Thin[3]	76%	75%	119	22%	97	20%

1: Average of canopy cover % across all 12 stands. 2007 is the year the treatments were modeled, not when the thinning will actually occur.
2: Heavy thin areas are made up of all openings, wide thin gaps in the commercial thinning area, and 2/3rds of Bigleaf maple skips and 20% of the inner riparian reserve buffers that will be treated with non-commercial heavy release treatments
3: No-thin areas are made up of 1/3rd of bigleaf maple skips and 80% of the inner riparian reserves. See explanation in #6 below.

Vertical Canopy Development

The action alternatives would increase growth rates of planted and existing understory shade-tolerant trees. Thinning will also likely stimulate the establishment of a new understory cohort. As all stands are bordered by old-growth on at least one side, seed sources for regeneration exist. In most stands, establishment is likely to be higher close to old-growth stands and

quickly taper off after 500' or so, as hemlock and especially western redcedar seed dispersal drops significantly after several hundred meters. In stands that have overstory western hemlock and redcedar, establishment will be more uniformly distributed. However, the well-developed understories in all the stands will suppress seedling establishment, and should prevent excessive hemlock regeneration. Planting of western redcedar will augment natural regeneration and ensure that a resistant species is present in laminated root rot pockets. As the existing understory cohort is relatively patchy in all stands and understory light levels will be fairly variable post-thinning, a patchy midstory with two cohorts should develop over 50 years in both action alternatives. In the no-action alternative, the development of the midstory will be slower. Some existing understory trees will be killed or heavily damaged from the thinning operation, however, and so a short-term reduction in the understory tree layer is likely.

The vigor, longevity, and relative abundance of hardwood tree species will be increased by the heavy release of many bigleaf maples, as well as the lighter release of red alder, black cottonwood, and vine maple from the TH treatment. Most existing bigleaf maples in the stands are being overtopped by Douglas-fir and will continue to decline in relative size and vigor under the no-action alternative. As hardwoods have distinct height growth, crown development, and life expectancy patterns, they exert significant influence over the crown development of surrounding conifers and thus add vertical and horizontal complexity to the canopy (Oliver and Larson 1996). Also, a new cohort of hardwoods will very likely establish in disturbed sites such as landings, skids trails, and decommissioned roads.

Horizontal Patchiness

The thinning prescriptions in Alternatives 2 and 3 were designed to maintain and increase heterogeneity at both the fine scale (clumps of individual trees), and the patch scale ($1/15^{th}$ – 5 acres). The treatments would create a more complex understory light environment at the patch scale that should be variable enough to foster markedly different understory responses across each stand. This will promote the development of a patchy midstory tree layer, which will ultimately be what controls the understory light environment and creates a patchy understory structure over time. Based on rough estimates in several stands, treatments should not preclude the future development of pairs or clusters of old-growth trees because prescriptions will retain clusters of dominant and co-dominant Douglas-fir as well as all shade-tolerant species in most stands. Dense, closely spaced patches will also remain in no-thin areas. Overall, the two thinning alternatives will increase horizontal complexity compared with the no-thin alternative.

Dead Wood

Dead wood includes snags, downed logs, and live trees with decadence (e.g. broken or forked tops, large branch platforms, or areas with significant bole cavities and bole decay). By creating larger trees in an accelerated time frame, thinning theoretically leads to faster recruitment of large snags and downed logs (20+" dbh). By reducing competition-related mortality and removing significant levels of wood volume, thinning reduces recruitment of small diameter snags and overall downed wood levels at least in the short term. Density management can also increase stability and resistance to wind. This may lead to stands with large, stable trees that are less susceptible to the intermediate disturbance agents that drive large dead wood recruitment in natural stand development (Franklin et al. 2002).

The short-term impact of downed wood and snag creation was analyzed. The downed wood and snag treatments in the action alternatives should meet or exceed the target levels laid out in the GPNF LSR assessment for stands less than 15" average diameter: 3% cover over 50% of the unit within 5 years. For snags, the target is 3 snags per acre. These created inputs will combine with existing dead wood and expected recruitment in the five years post-thinning, which is 5 downed trees per acre based on recent measurement in similar stands. Table 4.3.4 demonstrates how the numbers add up and the total projected number of downed logs per acre across entire stands (far right column of Table 4.3.4). Downed wood levels in all stands will exceed 3% and many stands will have over 5% in 50% of the stand area.

Table 4.3.4. Levels for snags and downed wood creation for Woods Creek Stewardship Thin.

	Acres		Snags[1]		Downed Trees					
Unit	Com. Thin Unit	Exterior Inner Riparian Reserve Buffers	Post thin	High Stump	Created in Comm Thin Unit /acre [2]	Created in Exterior Inner Riparian Buffers /acre [3]	Total # Created in Comm Thin Unit	Total # Created in Exterior Inner Riparian Buffers	Existing + Post Thin Natural Recruit/ acre[4]	Total/Ac Avg Across Entire Stand
1	32	11	54	32	2	15	63	165	8.0	13.3
2	26	3	32	26	3	25	77	76	6.0	11.3
3	30	19	100	0	3	25	91	484	5.5	17.1
4	16	11	38	16	3	25	48	272	5.5	17.4
5	54	1	56	54	3	25	162	20	5.5	8.8
6	36	4	45	36	12	25	433	105	6.0	19.4
7	51	8	68	51	12	25	615	206	7.0	20.8
8	19	14	47	19	2	25	38	353	7.0	18.8
9	62	5	72	62	3	25	186	124	5.5	10.1
10	10	13	37	10	1	25	10	327	6.0	20.4
11	47	11	70	47	3	25	142	279	7.0	14.2
12	27	29	86	27	3	25	82	728	7.0	21.3
Tot	**412**	**130**	**702**	**381**			**1949**	**3137**		

[1] A total of 2 snags per acre will be created throughout all portions of each stand.

[2] Includes all general thinning acres, riparian buffers and bigleaf maple skips within commercial thin unit.

[3] Inner riparian buffers outside of commercial thin unit boundary

[4] Five downed trees per acre are projected to recruit naturally within 5 years post thinning. The existing number is based on a rough estimate during walk throughs.

The effects of the commercial thinning treatments versus not thinning over a 50 year period was also analyzed in regard to dead wood. Modeling results show that thinning reduces overall snag recruitment over time. By reducing competition-related mortality, thinning reduces snag recruitment. By removing trees, thinning reduces the overall number of trees available for recruitment; hence the low number of snags per acre in the HT treatment. In the NT scenario, snag recruitment increases until 2037 and then only slowly begins to decline, suggesting that

the competitive exclusion phase will continue for at least the next 50 years absent any disturbances. The average diameter of the snags suggests that thinning does indeed lead to larger snag recruitment.

Total downed wood volume is higher in the thinning scenarios. The increasingly large difference in downed wood over time between the thinning treatments and the NT is due to the faster decay rates of the smaller diameter logs that are recruited in the NT treatment. In addition to taking longer to decay, larger logs also have exponentially more cubic volume for the same DBH. The NT treatment produces higher numbers of snags and downed logs, but they move through the system much faster. However, the decay rates used in this modeling exercise do not take into account the wide growth rings and larger proportion of sapwood in the fast-grown large logs. It is likely that these logs will decompose faster than old growth logs of a similar size that have much tighter grain and higher heartwood content. The decay rates used in the model are based on old growth logs.

As laminated root rot will continue to be the primary cause of mortality and dead wood recruitment, its extent and spread will likely have more impact on downed wood levels that the treatment effects. However, live standing volume is lower in the thinning scenarios even after 50 years, and so less wood will be available for recruitment overall. A decrease in dead wood recruitment in the thinning scenarios is thus possible.

Plant Community Development

Thinning has been shown to initially reduce shrub cover from mechanical damage, but then generally leads to increases in abundance and species richness over time. Thinning increases the number of early seral and exotic species, but can also reduce the abundance of species that require deep shade or are susceptible to competition from competing shrubs. Herb cover generally responds either neutrally or slightly negatively to thinning across a wide range of residual densities and spatial patterns. Overall, understory vegetation in thinned stands has been shown to be more similar to old-growth than unthinned young stands (Bailey and Tappeiner 1998). Similar to excessive understory tree regeneration, however, high uniform shrub cover by a few understory species can develop after thinning and out-compete the herb layer, tree regeneration, and other understory shrubs, thereby lowering diversity and homogenizing the understory (Tappeiner and Zasada 1993). Sites with sparse understories and few species tend to be more susceptible to homogenous expansion by aggressive colonizers, while sites with diverse and well developed understories tend to maintain diversity post-thinning (Beggs 2004).

In contrast, thinning tends to adversely affect macro fungi species richness and biomass, at least in the short-term, and thinned stands tend to have less even species diversity (Colgan et al. 1999, Fogarty et al. 2001). Thinning appears to have little or no effect on lichen diversity (Peterson and McCune 2001). Lichen diversity and abundance are positively related to stand age, however, suggesting that development of the lichen communities in forests is thought to be a dispersal limited process (Sillett et al. 2000). Hardwood patches have been identified as "hot spots" for epiphytic lichen diversity in young, previously harvested western coniferous forests (Neitlich and McCune 1997), suggesting thinning entries should conserve hardwood

tree species if maintaining lichen diversity is an objective. The thinning prescriptions will accomplish this objective as well.

The two action alternatives will decrease shrub cover in the short-term from mechanical damage, especially where ground-based yarding occurs. Observations from recently thinned stands in the Woods Creek LSR suggest that cover, average height, and species diversity of the understory plant layer should recover within 2-5 years and then significantly increase after that, compared to the no-thin alternative. The diverse and well-developed understory layers in these stands reduce the risk of excessive, homogenous expansion of sword fern or salal. As these stands are generally on productive soils, however, understory cover may be too high for optimal Northern Spotted Owl foraging habitat in the short- to medium-term. Un-thinned patches should maintain 5-10% of stand area in bare ground or with light shrub cover. Over time, the growth of planted and existing shade-tolerant conifers will shade out shrubs in additional areas and create a more patchy understory and better foraging habitat. Large skips (=>1 acre) will provide refugia for plant and fungal species negatively impacted by thinning.

Inner Riparian Reserve Treatments

The proposed non-commercial, drop-and-leave treatments in the inner riparian reserves in both alternatives will heavily release bigleaf maples, western redcedar, and selected conifers with a 25' radius circle and leave the rest of the area untreated. Individual trees, as well as pairs or clusters of trees, will be chosen for release.

This ratio of treatment types will result in higher canopy cover than the commercially thinned area. Based on the same weighted average method described above, the action alternatives will result in a projected average of 69% canopy cover in the first year post treatment and 72% in 2057 in the inner riparian reserves. These values are very close to the NT treatment and thus the no-action alternative. In terms of development of large trees and canopies for stream shade and large woody debris recruitment (Roni et al. 2002), modeling suggests that the HT treatments will indeed produce 4-6 large trees per acre in the center of the release circles, plus additional larger trees on the outer edges of the release circles. Development of midstory tree and understory shrub layers will also be accelerated within the circles. As all wood will be left on the ground and 80% of the area will not be thinned, the potential reduction in small and medium diameter dead wood recruitment in the commercial thinning areas will not be an issue. Overall, the action alternatives will result in more complex riparian forest with larger trees, faster establishment of western redcedar, and more developed understories compared with the no-action alternative.

Cumulative Effects

There are a number of completed, active, and pending thinning sales in stands less than 80 years old in the Woods Creek LSR. These include Ames-Woods Thin, Heli-Tower Thin, Tower Thin, and Tower Rock Thin. In the Iron Creek watershed, just outside of the LSR, recent and current thinning sales include Lower Iron, Iron Summit, Iron Horse, and Upper Iron. There has also been extensive, recent clearcutting on private timber lands near the Cispus River, including along FR 2508 which accesses proposed Units 6 and 7. Finally, permitted and un-permitted firewood salvage in areas near open roads has reduced downed wood levels, especially in old-growth stands.

The cumulative effects of the two action alternatives on forest structure, combined with these other activities, must be analyzed at the landscape scale. Within the Woods Creek LSR, forests greater than 120 years old occupy approximately 42% of the forested area, and forests younger than 80 years old occupy 43% of the LSR (Table 4.3.5). The great majority of these older forests contain all the key elements of late-seral structure and meet the management goals of the Forestwide LSR assessment (USFS 1997). The LSR assessment calls for thinning a significant portion of the younger age classes to accelerate the development of desired structures, particularly large trees which form the backbone of live and dead old-forest structure. It is uncertain whether these dense, managed stands will develop into old-growth structure without intervention.

Table 4.3.5. Age class acreages in the Woods Creek LSR

Age Class	Acres	Percent
0-24	3300	10%
25-49	5089	16%
50-79	5673	17%
80-119	5032	15%
120-200	1722	5%
200+	12,133	37%
Total	32,949	100%

The overall effects of thinning on the development of old-growth will not be known for many decades and thus there is an inherent degree of risk in thinning (Spies et al. 2002). Winter (2002b) reconstructed the development of a 500–year-old old-growth stand in the nearby Yellowjacket drainage, and found that the stand was fully stocked with 360 trees per acre 20 years after the initiating disturbance. The stand then developed along a "high density" pathway with only a few small disturbances that initiated western hemlock establishment (Winter et al. 2002a). Many of the stands that originated after the Cispus Burns in 1902 and 1918 are developing along this pathway; as are the managed stands under consideration in this project. However, planting, pre-commercial thinning, and removal of most legacy dead wood likely created important differences in canopy differentiation, horizontal complexity, and dead wood levels in these managed stands versus stands originating after a natural disturbance. In addition, fire scars and distinct age classes of Douglas-fir in other old-growth stands in the area suggest that some stands develop through partial disturbances. This pattern of multiple development pathways across the landscape likely created significant landscape scale heterogeneity. By thinning a portion of young stands within the Woods Creek LSR and leaving the rest un-thinned, similar landscape scale heterogeneity may result and the risks of thinning and not thinning will be spread out. Under both action alternatives, approximately 20% of the project area will remain un-thinned. Road decommissioning will eliminate access to many areas and thus reduce illegal firewood salvage. In addition, portions of 12 stands and additional stands were dropped entirely from consideration in this project and will likely never be thinned. With the current treatment cap of 80 years in LSRs and lack of road access to some areas, it's likely that well over 30% of the forested area currently less than 80 years of age will remain un-thinned.

Laminated Root Rot and Windthrow Risk

Laminated root rot (LRR) is present in all of the stands. Combined with windthrow, it is causing varying levels of gap formation, ranging from very low in unit 9 to high in units 1 and 7 (see Table 4.3.2 for a breakdown). LRR pockets occupy less than 15% of total area in all units, except for unit 7. Units 1, 11 and 12 have a number of 0.25-0.5 acre patches of windthrow, mostly of trees with root systems weakened by LRR. The pumice-based soil in these units, as well as Unit 2, appears to be prone to saturation during heavy rain events and thus pre-dispose trees to windthrow. Also, evidence of Douglas-fir beetle is often associated with the LRR pockets and is likely contributing to mortality in most stands. Units 7 and 8 have several large (1-5 acre) patches of LRR and Douglas-fir beetle mortality. *Armillaria* was also observed in Units 2 and 7. In the larger Woods Creek LSR, windthrow appears to be a common disturbance event throughout the low, flat areas of the Woods Creek drainage during wet, winter storms. LRR is also common in old-growth stands and large pockets (>2 acres) exist in many stands.

Direct and Indirect Effects

Laminated Root Rot

The proposed treatment alternatives will not employ any specific LRR treatments. Units will be "thinned through" and root rot pockets ignored in the thinning. The slow expansion of root rot pockets, approximately 1' per year, will be an important source of snags and downed wood over time and serve as a natural form of gap creation. Openings within stands will be planted with western redcedar (a species resistant to laminated root rot infection) post-thinning to increase this under-represented species and overall diversity. By planting resistant species, favoring them in thinning leave tree selection, and natural colonization resulting from soil disturbance and increased light levels associated with the thinning entry, the proportion of susceptible species will decrease and the stands will be more resilient to laminated root rot. Also, shrubs and hardwoods will establish in root rot gaps and provide structural complexity and important early seral habitat over time. Under the no-action alternative, LRR will continue to spread at similar rates, but the stands will be less resilient to it over time due to the lower amounts of western redcedar and loss of bigleaf maple from suppression.

Given current infection levels and estimated spread rates, mortality from LRR is not likely to be extensive enough to threaten the attainment of the desired future conditions under all alternatives. Instead, it should remain an intermediate disturbance agent that enhances structural complexity over time. However, there remains considerable uncertainty regarding the effects of thinning on *Phellinus weirii* in Douglas-fir dominated stands (Thies and Westlind 2005). In terms of spread rates and resistance to laminated root rot, thinning does not appear to accelerate or slow spread (Thies and Sturrock 1995). Spacing is generally not wide enough to prevent root-to-root contact of residual trees and the fungus remains alive in infected stumps for several decades. By increasing tree vigor, thinning can increase the amount of time that trees can remain alive once infected, and thus decrease the overall rate of mortality in a stand. Spread rates through the root system are thought to remain the same and thus overall mortality

over time is not affected. Yet, thinning may increase spread rates in stumps by killing trees and removing possible resistance mechanism of live trees. Due to this uncertainty, stands should be evaluated in 15-30 years to determine if infection levels are higher and if additional actions are needed. By this time, ongoing research may provide greater understanding of the extent, spread, and ecosystem function of LRR, as well as how to manage it.

Wind

Risk of windthrow will be increased by thinning. Combined with weakened root systems from LRR and seasonally saturated soils in Units 1, 2, 11, and 12, there is a risk of blowdown. The high height-to- diameter ratios (HDR) in these stands makes them even more susceptible. The probabilities for windthrow in the 3 different treatment types, averaged across all stands, are shown in Figure 4.3.2. The probabilities for the high-risk units (1, 2, 11, and 12) are very close to these averages. It should be noted that the model does not account for LRR, thus the actual probabilities will likely be significantly higher. However, the relative difference between the treatments should remain the same.

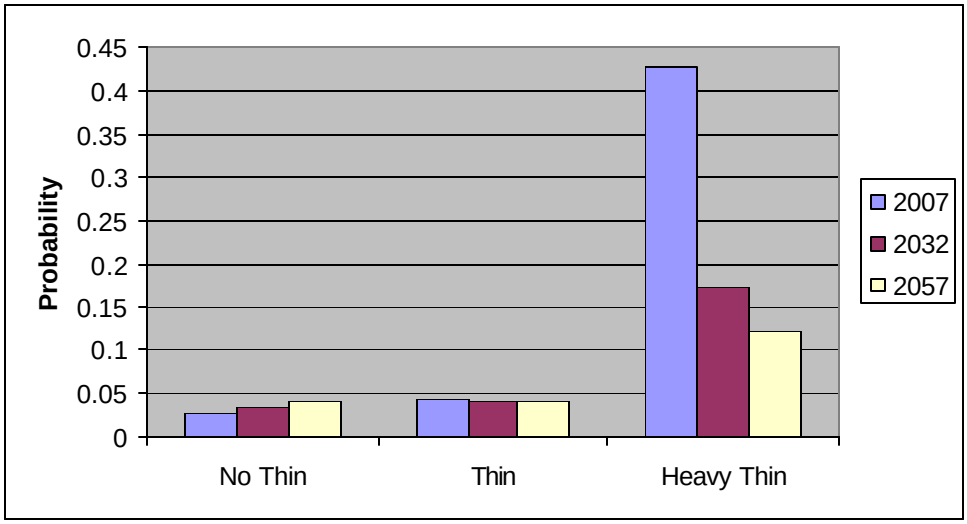


Figure 4.3.2. Windthrow risk probability averaged across all twelve units for different treatment scenarios and time periods.

Results from the model show that the TH treatments will very slightly increase windthrow risk in the short–term compared to the NT treatment. As trees respond to release and lower their HDR, windthrow probability will decrease over time. In the NR scenario, increasing HDRs will raise probabilities over time. The increase in windthrow probability of the HT treatment suggests that some of the targeted released trees may blow down and that the wide-thin gaps will expand through time. No HT treatments will be done in the commercial portions of the four high risk units. In the rest of the stands, HT treatments will occupy less than 6% of the entire treatment areas and will be spread out through stands. Slow expansion of these gaps is desirable as it is will add dead wood and complexity to stands over time. This is especially desirable in the riparian reserves where 80% of the area will not be treated.

Cumulative Effects

Past management has likely increased the extent and severity of laminated root rot compared to pre-settlement levels. Under natural stand development and disturbance regimes in Douglas-fir forests, the extent of the fungus is constrained by a number of factors. Large, old growth trees that are infected at older ages take a long time to die and often are overcome by other mortality agents before the root systems are fully infected. They are spaced father apart, sometimes with resistant species in-between. When trees blow over, the up-ending of root balls accelerates decomposition of the infected roots and reduces the amount of residual inoculum in the soil. Re-colonization by Douglas-fir on or near these root balls is rare and establishment of resistant or immune trees or shrubs typically occurs instead. Fires also often burn out the partially decomposed root balls and underground root systems to some extent. After a stand-replacing fire, 20-50 year periods of cohort establishment and slow initial growth of seedlings allow sufficient time for infected roots from the previous stand to decompose and inoculum levels to decrease before the roots from the new cohort become fully established.

On the other hand, clearcutting has left infected stumps and root systems in the ground, which has persisted as inoculum for many decades. Replanting efforts created stands with high densities of Douglas-fir that quickly occupied the site and thus had a high probability of coming into contact with infected roots before they decomposed. Pre-commercial thinning removed most resistant species and likely left infected Douglas-fir as it was too early to see signs of infection. The result was a perfect setup for the spread of the fungus. It is likely to become a high severity, stand replacing disturbance in some areas.

As no landscape-scale analysis has been done, it is difficult to estimate the percentage of both natural and managed stands that are infected with LRR and also determine if there any spatial patterns or particular areas with high infection levels. It is also not possible to assess whether higher infection levels in managed stands are extensive enough to shift the disturbance regime and the development of late-seral structure across the Woods Creek LSR.

Due to the limited effect that thinning is though to have on the spread of LRR, current and recent thinning sales in the Woods Creek LSR are not likely having much overall effect on infection levels at the landscape scale. If anything, group selection treatments in stands with high infection levels may be slowing its spread. Also, elevated post-thinning windthrow in treated stands compared to un-thinned stands may be reducing inoculum levels by uprooting root systems and accelerating decomposition. Large scale windthrow has not been observed in many stands post-thinning in the area. The increased windthrow risk from thinning infected stands does not appear to threatening development of old growth structure.

4.4 Wildlife

The following section details the effects of the proposed Woods Creek Stewardship Thin timber sale and associated stewardship projects to the wildlife resource.

Proposed, Endangered, and Threatened Wildlife Species

Affected Environment

Proposed, Endangered and Threatened (PET) species that occur, or potentially occur, in the Woods Creek Stewardship Thin project area are displayed below in Table 4.4.1.

Table 4.4.1. Proposed, Threatened and Endangered species and Critical Habitats that occur, or may potentially occur in the Woods Creek Stewardship Thin project area.

Species	Listing status	Occurrence in project area	Comments
Northern spotted owl (*Strix occidentalis caurina*)	**Threatened**	**Documented**	**Five historic owl pairs known in project area, although only two have recent documentation.**
Gray wolf (*Canis lupus*)	**Threatened**	**Suspected**	**Historic sightings exist on CVRD, but none in the Lower Cispus watershed. No sightings have been verified as gray wolves.**
Northern spotted owl Critical Habitat Unit WA-38	**Designated**	**Occurs**	**CHU WA-38 includes entire Woods Creek project area.**

The Threatened grizzly bear will not be evaluated in this document, as there is no evidence that this species occurs on the Cowlitz Valley Ranger District, based on the lack of verified recent sightings, and the extreme rarity of this species overall in the state of Washington. Also, there are no grizzly bear recovery areas designated on the Gifford Pinchot National Forest, nor are there any recovery goals set for the Forest. Therefore, the conclusion is that the grizzly bear is not expected to occur in the WCST planning area and has been excluded from further analysis in this document.

The Threatened marbled murrelet (*Brachyramphus marmoratus*) is not expected to occur adjacent to project sites, as the 55-mile nesting limit range boundary is located north and west of proposed harvest units. Also, there is no designated marbled murrelet critical habitat in or near the planning area. The nearest marbled murrelet Critical Habitat Unit is WA-11-d, located north of the Cowlitz River in the Upper Cowlitz watershed. Its boundaries coincide with the Nisqually LSR allocation under the Northwest Forest Plan.

Survey results: Surveys were conducted during summer 2007 for northern spotted owls in the vicinity of proposed harvest units. These surveys, not to protocol standards, were conducted as a follow-up to historic survey data, which indicated that the Woods LSR contains a high density of barred owls (Pearson and Livezey 2007), with spotted owls only occurring near the edges of the LSR at higher elevations, away from the moist Woods Creek valley bottom and associated ponds and wetlands. The 2007 survey results were consistent with the historic data, with a total of 15 barred owls detected and only one spotted owl, which was located outside the boundary of the LSR and not in proximity to proposed WCST units or stewardship projects (Pearson 2007, unpub. report, on file at CVRD). These data do not conclusively demonstrate absence of spotted owls from the WCST project sites, as current survey techniques depend on vocal responses to imitated calls, and there is evidence that at least some spotted owls are still present, but much less vocal, in the presence of resident barred owls (R. Pearson, pers. comm.).

Environmental Consequences

Alternative 1 (No action)

There would be no potential adverse effects to the gray wolf from either direct, project-related disturbance, or secondary impacts to their big game prey species, deer and elk, from this alternative. Suitable habitat for the gray wolf in the WCST project area is limited on a year-round basis due to high open road densities. This species may occur during the winter months, when road densities are reduced due to winter range road closures and snow, and deer and elk are concentrated on their winter range during severe winter conditions, although these severe conditions are relatively uncommon in this low elevation area.

There would be no direct disturbance or habitat effects to the northern spotted owl, or to spotted owl Critical Habitat Unit WA-38, from this alternative.

The stands which contain proposed commercial thinning units, which are not presently suitable spotted owl habitat, would slowly succeed to a suitable habitat condition over the long-term, as competition-related tree mortality results in increases in snag and down wood levels, and tree diameters increase along with understory vegetation and canopy layering. There would be some losses of deciduous tree component in these stands over time, particularly bigleaf maple, as these trees are overtopped and out competed by conifers. The importance of the reduction in deciduous tree habitat with respect to spotted owl habitat is unknown, as spotted owls regularly occur in stands without deciduous trees. Regardless of habitat conditions, the greatest threat to the continued existence of the northern spotted owl, which is declining in the state of Washington (Anthony et al. 2004) is almost certainly the high density of barred owls; the ponds, streams and wetlands in the Woods Creek area appear to provide ideal habitat for barred owls, which prey on a wide variety of species associated with wet areas, including amphibians, fish, snails and crayfish, in addition to birds and mammals (Liveszey 2007). The high density of barred owls may make it impossible for spotted owls to persist in the planning area regardless of the amount or quality of suitable owl habitat present, although the long-term result of barred owl/spotted owl competition is unknown.

There would be no construction of temporary roads under this alternative, and existing, revegetated temporary roads would continue to provide connectivity for a wide variety of organisms, including small mammals (i.e. owl prey species).

The determination is that Alternative 1 (no action) would have "**no effect**" to the gray wolf, northern spotted owl, or designated spotted owl Critical Habitat Unit WA-38.

Alternative 2

Under this alternative, the largest amount of young forest stands would be restored (i.e. treated via thinning or snag/down wood release). Also, all associated stewardship projects would be implemented, with the exception of two non-system roads near the Cispus River which would not be closed, and the Woods Creek conifer release site would not be treated. This alternative would therefore present the greatest potential for project-related noise disturbance to the gray wolf, northern spotted owl, and marbled murrelet (Units 11 and 12 only) of the two action alternatives. However, most of these noise disturbance impacts would be mitigated with Limited Operating Period (LOP) project timing restrictions (see Mitigation Measures, Section 3.2). For the gray wolf, project operations during the time when LOPs are not in effect would cause deer and elk prey to be temporarily displaced from unit and project sites, however this would occur during the summer and fall months when gray wolves are least likely to occur in the planning area due to the presence of a high open road density of approximately 2.6 miles per square mile on winter range (USDA Forest Service 2003) and associated human use.

For the northern spotted owl, 534 acres of non-suitable, "dispersal" habitat would be treated (thinned or released with snags and down wood) in the 12 harvest units, the largest amount of the two action alternatives. As stated above, an LOP restriction (March 1 to June 30) would limit harvest at sites adjacent to suitable spotted owl nesting habitat in the event that an unknown pair(s) of spotted owls occurs near these locations, and may be adversely impacted by project noise. The closest proposed harvest unit to an historic spotted owl pair location is one-half mile, although this pair has not been observed since 1995 and is likely no longer extant. It therefore appears that project-related disturbance to nesting spotted owls in the Woods Creek planning area is very unlikely.

Within spotted owl Critical Habitat Unit WA-38, Alternative 2 would also restore the largest number of acres of spotted owl habitat of the two action alternatives. It would provide the greatest increase of constituent habitat elements such as snags, down wood, understory vegetation, and the development of large trees and canopy layering as a result of the increased number of acres treated. There would be a short-term decrease in canopy closure in these spotted owl dispersal habitat stands, although no stands are projected to fall below 50% canopy closure, with most stands remaining at 60% canopy closure and above. Due to their high site productivity, the tree canopies in the thinned stands should close relatively rapidly (10-20 years) due to accelerated tree growth. Dispersal habitat for spotted owls, however, is not considered to be limiting in the Lower Cispus watershed (USDA Forest Service 2003), which still contains large amounts of mature and old-growth forest habitat, with decreasing fragmentation over time due to the rapid growth of managed (i.e. former clearcut) forest stands, such as those being proposed for thinning in this project. There would also be some

losses or breakage of existing snags and pieces of down wood in the harvest units during logging activities, although snag levels are low, and much down wood will be protected in no-thin skips.

As previously stated, barred owls occur in high densities within the sale planning area and in CHU WA-38, and are common overall on the Cowlitz Valley Ranger District (Pearson and Livezey 2003). Barred owls favor the same mature forest habitats as spotted owls, and there is the potential that commercial thinning could enhance habitat conditions for barred owls over the long-term at the expense of northern spotted owls, particularly in the managed, dispersal habitat stands proposed in the WCST project, and within the home ranges of existing barred owl pairs. Accurate predictions regarding the long-term effects of commercial thinning related to barred owl/spotted owl competition are not possible at this time. However, the assumption that anticipated, positive effects from thinning would benefit only spotted owls may not be true considering barred owl competition. If barred owls are benefited from thinning and other restoration treatments (for example, by increasing prey species abundance and availability), the end result could be greater long-term competitive pressure on spotted owls in the Woods Creek Stewardship Thin sale area and elsewhere.

The effects to listed species from stewardship projects included in the Woods Creek Stewardship Thin project are summarized in Table 2. The effects from these projects are either neutral or beneficial, although some associated noise disturbance will occur. These noise effects will be mitigated with the LOP restrictions discussed above (see Mitigation Measures). The effects from Alternative 2 are very similar to Alternative 3, with the exception that two "non-system roads" along the Cispus River would not be rehabilitated, and would remain open to access dispersed recreation sites. This will result in some additional site-specific impacts in these two riparian, old-growth forest locations, both of which are spotted owl nesting habitat and big game winter range, including loss of large, down wood from camping use and firewood theft. Alternative 2 does not include the Woods Creek conifer release site, which may provide some foraging habitat for spotted owls, although it is much more likely to serve as habitat for barred owls at the present time.

The determination is that alternative 2 "**may affect, but is not likely to adversely affect**" the gray wolf, northern spotted owl, or northern spotted owl Critical Habitat Unit WA-38 due to a small potential for noise disturbance outside of Limited Operating Period restriction periods, and short-term reductions in spotted owl dispersal habitat quality in treated stands within CHU WA-38.

Alternative 3

This alternative would treat 468 acres within proposed harvest units, a reduction of 66 acres from Alternative 2. This reduction is a result of the elimination of all new temporary road construction in Alternative 3 (i.e. new temporary roads and reconstruction of "ecologically recovered" roads). This would result in a small reduction in potential project-generated noise disturbance to any unknown spotted owl pairs that may be present, or marbled murrelets adjacent to Units 11 and 12, as mitigated by Limited Operating Period restrictions (see Mitigation Measures). There would be less short-term loss or breakage of existing snags and

down wood from logging activities under this alternative and less overall reduction to spotted owl dispersal habitat canopy closure. This alternative would reduce the amount of northern spotted owl habitat restored in CHU WA-38 over the long-term, and mean that these stands would take longer to reach a suitable habitat condition. The elimination of new temporary road construction under Alternative 3 may have some long-term benefits to federally-listed species by reducing future potential for down wood removal via firewood theft and noise disturbance from off-road vehicle use, but these benefits are likely fewer than those displayed for mollusks, amphibians and arthropods (see Sensitive species section).

Table 4.4.2 summarizes effects to listed species from stewardship projects for the action alternatives. The effects from Alternative 3 are very similar to those of Alternative 2, with the exception that two additional non-system roads along the Cispus River would be rehabilitated, and be closed to vehicular traffic. This will result in reduced potential for the loss of large, down wood from camping use and firewood theft at these two locations. Although localized in nature, these impacts are cumulative to ongoing losses of down wood and habitat disturbance from these non-system roads in this river corridor. They are also cumulative to the larger scale, historic loss of down wood habitat in old-growth stands throughout the Woods LSR from timber salvage, and legal/illegal firewood cutting. Alternative 3 includes the Woods Creek conifer release site, which may provide some foraging habitat for spotted owls, although it is much more likely to serve as habitat for barred owls at the present time. The effects of implementing this conifer release project site to federally-listed species are small, as mitigated by LOP restrictions.

The determination is that Alternative 3 "**may affect, but is not likely to adversely affect**" the gray wolf, northern spotted owl, or northern spotted owl Critical Habitat Unit WA-38 due to a small potential for noise disturbance outside of Limited Operating Period restriction dates, and some short-term reductions in dispersal habitat quality in thinned stands within CHU WA-38.

Indirect Effects from the Action Alternatives

Indirect effects from Alternatives 2 and 3 include the potential for the reduction in the amount of coarse wood at project sites, as well as the other adverse effects described above, if temporary roads are not securely closed to vehicular traffic following the sale which is considerably reduced in Alternative 3 due to the reduction of 1.2 miles of temporary road construction. This same indirect effect may occur at two non-system roads under the access/travel management stewardship project in Alternative 2, which will remain open under this alternative and not restored to a natural condition in this riparian, old-growth stand.

Cumulative Effects from the Action Alternatives

There has been extensive, recent clearcutting on private timber lands near the Cispus River, including along FR 2508 which accesses proposed harvest units 6 and 7. This private timber harvest has reduced dispersal habitat (and possibly foraging habitat) for northern spotted owls within the Lower Cispus watershed, and also provided extensive forage areas for deer and elk. This timber harvest is cumulatively detrimental to the northern spotted owl, although it may be beneficial to the gray wolf by providing extensive forage areas for deer and elk, which have

become scarce on National Forest lands in the watershed. Indirect impacts relating to indirect losses of down wood, as related above, are cumulative to larger scale losses of coarse woody material throughout the Woods LSR due to historic, widespread timber salvage (usually in old-growth stands), as well as legal and illegal firewood harvest. These effects are most pronounced on flat, easily accessible sites in the Woods Creek drainage along the Forest Road 25 corridor, and have reduced habitat capability for those species associated with large, down trees including small mammals which spotted owls prey upon.

Table 4.4.2. Summary of Stewardship project effects related to Threatened and Endangered species, Woods Creek Stewardship Thin project.

Project	T & E habitat effects?	Potential for noise disturbance?	Comments
Snag and down wood creation	**yes (beneficial)**	**yes**	**All snag and down wood creation will occur within harvest units, LOP will be in effect due to chainsaw noise.**
Redcedar underplanting	**yes (beneficial)**	**No**	**Project will occur within harvest units, purpose is to restore redcedar component to these sites.**
Access/travel management	**yes (beneficial)**	**Yes**	**Project will reduce potential for further losses of snags and coarse wood in spotted owl habitat.**
Riparian conifer release (outside harvest units)	**no**	**Yes**	**Project occurs adjacent to, but not within, suitable habitat for PET species**
Salmon rearing habitat restoration	**no**	**Yes**	**No LOP for noise due to distance from suitable owl nesting habitat**
Cispus river riparian/instream	**no**	**Yes**	**No LOP for noise due to distance from suitable owl nesting habitat**

Sensitive and 'Survey and Manage' Animal Species

Affected Environment

Sensitive animal species from the April 2004 update of the Region 6, Regional Forester's Sensitive species list that are known or suspected to occur in the vicinity of the Woods Creek Stewardship Thin units or stewardship projects are displayed in Table 2. Three of these species are also "survey and manage" under the Northwest Forest Plan. Occurrence data is based on a pre-field review of District and Regional observation databases, aerial photographs, personal knowledge from previous field reconnaissance, field surveys, relevant literature, and other sources.

Table 4.4.3. Sensitive and "survey and manage" animal species documented or suspected to occur in the Woods Creek Stewardship Thin project area and its vicinity.

Species	Status	Comments
Puget Oregonian snail (*Cryptomastix devia*)	**Documented (Sensitive and "survey and manage")**	**Relatively common on CVRD, with 154 documented locations, including some within and adjacent to proposed units. This species is strongly associated with bigleaf maple trees, usually with a moist understory containing swordferns (Burke et al 2005).**
Malone jumping-slug (*Hemphillia malonei*)	**Suspected (Sensitive and "survey and manage")**	**Very rare species on CVRD (3 known locations), all north of Cowlitz River in old-growth stands. Coarse woody debris is an important habitat feature for this species.**
Blue-gray tail-dropper (slug) (*Prophysaon coeruleum*)	**Suspected (Sensitive and "survey and manage")**	**Very rare species on CVRD (4 known sites), three of which are in the Woods LSR. Habitat is coarse woody debris and deciduous leaf litter, especially bigleaf maple. All known sites are in old-growth Douglas-fir stands with large bigleaf maples and other deciduous trees.**
Cope's giant salamander (*Dicamptodon copei*)	**Suspected (Sensitive)**	**Predominately aquatic species that rarely transforms into terrestrial adults. Rare-to-uncommon on CVRD based on surveys performed to date**
Cascade torrent salamander (*Ryacotriton cascadae*)	**Suspected (Sensitive)**	**Semi-aquatic species that is relatively common in cold stream edges at mid- and higher elevations, but limited in distribution. Has been documented within the planning area at a steep gradient stream.**
Townsend's big-eared bat (*Corynorhinus townsendii*)	**Suspected (Sensitive)**	**Rare on CVRD, has been occasionally documented roosting under concrete bridges.**
California wolverine (*Gulo gulo*)	**Suspected (Sensitive)**	**Very few historic sighting records on the District. More likely to occur in higher-elevation, alpine habitats and wilderness, but possible during winter at lower-elevation sites such as Woods Creek.**

Northern bald eagle (*Halieetus leucocephalus leucocephalus*)	**Documented (Sensitive)**	**Occurs mainly along Cispus River, and occasionally at smaller streams where fish are available. De-listed from Threatened status in 2007.**
American peregrine falcon (*Falco peregrinus anatum*)	**Documented (Sensitive)**	**Has nested in the planning area, but not recently. De-listed from Threatened status.**

Survey results: Mollusk surveys were conducted for this project in 2006 and 2007. Because the objective of this project is habitat restoration in young forest stands less than 80 years old, and protection and "release" of bigleaf maple sites is a primary objective, these surveys were opportunistic in nature (i.e. not to protocol standards per Duncan et al 2003). They were primarily conducted to assess the habitat suitability within and especially adjacent to proposed harvest stands, and to ascertain if *Cryptomastix devia* occurred adjacent to units in mature/old-growth sites, and therefore able to colonize stands when suitable habitat is restored. *C. devia* was detected adjacent to proposed units 2, 4, 6, and 7, with historic sites occurring adjacent to proposed units 3, 11 and 12. Additionally, four sites were detected within proposed unit 7 near the boundary with the adjacent old-growth stand. The proposed units south of the Cowlitz River (8, 9 and 10) do not contain *C. devia* sites adjacent to units as a result of the limited amount of bigleaf maple in these moderate elevation sites. These surveys confirmed that *C. devia* is relatively common and widespread in suitable habitat in the Woods Creek and Cispus valleys, and colonization of maple habitat within harvest units is anticipated when conditions become suitable following thinning.

Environmental Consequences

Alternative 1 (No Action)

Due to the absence of ground disturbance or vegetation manipulation, no direct beneficial or adverse impacts would occur to sensitive species under this alternative. Over the long-term, habitat capability for *Cryptomastix devia*, the Puget Oregonian snail, would decline within the twelve proposed harvest stands, due to the loss of many existing bigleaf maple trees from conifer competition. Some maples that occur within canopy gaps formed by laminated root rot pockets or windthrow would persist, but most maples not occurring in these locations would gradually be shaded out by Douglas-firs and western hemlocks, which are growing at a faster rate. This would result in much lower habitat capability for *C. devia* over the long-term (20-50 years), and restrict its potential dispersal into these stands to a few, scattered locations. The same may be true for the blue-gray tail-dropper slug, *Prophysaon coerulem*, which also occurs in old-growth deciduous leaf litter (particularly bigleaf maple), although its habitat relationships in Washington are less clear than *C. devia* due to the very low number of documented locations. However, it is possible that a reduction in long-term bigleaf maple abundance, and perhaps a reduction in the amount of swordfern from canopy shading, will limit this species ability to re-colonize these young forest stands if they occur in adjacent, old-growth areas.

Due to the long-term potential for the loss of many bigleaf maple trees in proposed thinning units due to conifer competition, Alternative 1 (no action) "**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**" for the Sensitive snail *Cryptomastix devia* and possibly the blue-gray tail-dropper, *Prophysaon coeruleum*. There would be "**no impact**" to the other Sensitive species from the implementation of Alternative 1 due to the absence of habitat disturbance or project-related noise.

Table 4.4.4. Acres of habitat restored by alternative for the Puget Oregonian snail, *Cryptomastix devia.* Acres restored include riparian and individual tree "skips" where snags and down wood will be used for bigleaf maple (and large conifer tree) release.

	Alt. 1 (No action)	Alt. 2	Alt. 3
Total acres of habitat restored*	0	472	417
Acres of potential high quality habitat restored**	0	362	310
Miles of temporary road constructed	0	1.8	0.6
Acres of existing mollusk habitat degraded (at Woods Creek conifer release site)	0	22	0

* includes all units except 9 ** includes proposed harvest units 1, 2, 3, 4, 6, 7, 11, 12.

Alternative 2

This alternative would treat (thin and release) 472 acres of potential habitat for *Cryptomastix devia*, as well as the blue-gray tail-dropper, *Prophysaon coeruleum*, and possibly the Malone jumping-slug (*Hemphillia malonei*) in all units except 9 (which is above the elevation limit for bigleaf maple), although the presence of the Malone jumping-slug in the project area is unlikely based on present knowledge of its local distribution. Of this total, 362 acres of "high quality habitat" would be treated in units with the greatest abundance of bigleaf maple trees. This alternative provides the greatest amount of habitat restoration of the action alternatives, and therefore would have the greatest positive benefits to these species from bigleaf maple release, and stimulation of the forest understory, especially where swordfern predominates in moist sites. It would also provide the most habitat restoration for other species associated with deciduous trees and leaf litter, including many migratory birds, amphibians, and arthropods. To avoid disturbance to presently suitable *C. devia* habitat within harvest units, no bigleaf maple will be cut during harvest operations, except for an occasional tree within cable logging corridors when avoidance is not possible. Also, larger, more robust maples will be protected with a 40 foot radius, no-disturbance "skip." Within these individual tree skips, maple release may be done following harvest, as appropriate, with snag and down wood creation to limit ground disturbance and potential impacts to any *C. devia* that may be present.

Under Alternative 2, 1.8 miles of temporary road would be utilized to access the acres listed above, of which 1.2 miles are either new temporary roads, or extensive reconstruction of

vegetated, existing temporary roads. Roads can form dispersal and connectivity barriers for amphibians, mollusks, arthropods and other species (Forman and Alexander 1998, Marsh et al 2004), provide conduits for invasive species, and result in avoidance of deer, elk, birds and other species from road edges (Gucinski et al 2001). In addition to these effects, if they are not securely closed to vehicular traffic following use, they provide access for illegal firewood cutting and timber theft, as well as off-road vehicle use, both of which result in additional wildlife and habitat impacts. Long-term effects are dependent upon the standard to which the temporary roads are constructed, and the effectiveness of temporary road closure and rehabilitation following completion of harvest activities (which has historically been inconsistent). In general, the higher the standard to which these temporary roads are constructed, including the amount of surface rock utilized, the greater the risk for the adverse ecological effects described above to Sensitive mollusks like *Cryptomastix devia*, and many other species.

This alternative eliminates the "riparian conifer release" stewardship project site along Woods Creek. Retaining the mature alders and other deciduous trees to promote conifer establishment and growth will maintain existing suitable habitat conditions for *C. devia* in the short-term. Long-term effects are unknown, and dependent on whether this site will naturally succeed to coniferous forest in the absence of active management.

There will be "**no impact"** to Sensitive aquatic or semi-aquatic species such as Van Dyke's salamander (*Plethodon vandykei*), Cope's giant salamander (*Dicamptodon copei*), or Cascade torrent salamander (*Rhyacotriton cascadae*) due to the retention of unharvested riparian buffers in all sale units in all alternatives. These species are oriented to perennial, steeper gradient streams and are not expected to occur near most of the WCST commercial thinning units, or associated stewardship project sites with the possible exception of Yellowjacket Creek and Iron Creek. Treatments at these sites would improve habitat conditions for aquatic salamanders over the long-term with discountable short-term effects.

There is the very small potential that the rare Townsend's big-eared bat may roost in the Woods Creek Stewardship Thin units. No species-specific surveys were conducted for this mammal. The only known occurrence of big-eared bats on the Cowlitz Valley District are individual big-eared bats roosting under concrete bridges, although there have been very few bat surveys conducted on the District so they may be more common than indicated by these few incidental observations. This species (as well as other bats) would be far more likely to occur in late-successional and old-growth stands such as those that occur adjacent to most of the Woods Creek Stewardship Thin project units where roosting sites would be more abundant, or at caves, abandoned mines, or other similar sites elsewhere in the Woods Creek and Cispus drainages. However, its occurrence within the Woods Creek Stewardship Thin units cannot entirely be discounted. Due to the very low likelihood that individual Townsend's big-eared bats would be impacted from the felling of snags, or from project noise disturbance within the Woods Creek Stewardship Thin sale units, the determination is that alternative 2 **"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".**

The Woods Creek Stewardship Thin project area contains a relatively high road density and heavy human use due to its proximity to Randle, and along a main travel corridor to Mt. St.

Helens. This results in a very low probability that the rare and wide-ranging California wolverine would occur in the WCST harvest units or vicinity. Any transient wolverines would be far more likely to occur at more remote, higher elevation areas, although the occasional use of the Woods Creek area by wolverines during the winter months cannot be entirely discounted. The deer and elk winter range LOP will serve to reduce or eliminate disturbance to any wolverines that may be present during the December to April period. The likelihood that the project will result in any measurable effects to transient wolverines is judged to be so low that the determination is "**no impact**" to the California wolverine under any action alternative.

There would be "**no impact**" to the northern bald eagle or the American peregrine falcon from Alternative 2, as habitat for these species would not be altered from project activities. The big game winter LOP would prevent noise disturbance to wintering bald eagles along the Cispus river corridor at stewardship project sites.

Alternative 3

Alternative 3 would restore 55 fewer total acres than Alternative 2 in stands containing potentially suitable C. devia habitat, and 52 fewer acres within the most suitable mollusk habitat units in the Woods Creek/Cispus valley bottom. This will result in the loss of an unknown number of bigleaf maple trees from conifer competition in the acres that are not treated, and a corresponding decrease in long-term habitat capability for the sensitive mollusk C. devia, and probably P. coeruleum. This alternative, however, would also eliminate the construction of 1.2 miles of new or extensively reconstructed temporary roads. The reduction in the amount of habitat restoration (thinning and snag/down wood release) under this alternative must be weighed against the potential degradation of habitat originating from temporary road construction, as described above under Alternative 2. Again, the lower the standard of temporary road construction, and the more vigilant the post-harvest closure and rehabilitation, the fewer long-term, adverse impacts will accumulate to mollusks, salamanders, arthropods, and other species. Mitigation measures designed to limit the spread of invasive species on scarified and rehabilitated temporary roads are essential to preserving this long-term habitat capability for the above species.

This alternative includes the "riparian conifer release" stewardship project site along Woods Creek, which features mature alder, cottonwood, and some bigleaf maple trees, in contrast to the other proposed riparian conifer release sites. The Woods Creek site provides suitable habitat for C. devia, which is occasionally found some distance from bigleaf maple trees in mixed deciduous species stands such as this one. Falling mature alders in small gaps to promote conifer establishment and growth will degrade suitable habitat conditions for C. devia in the short-term over this 22 acre stand. Long-term effects are unknown and are dependent on the effectiveness of the project and/or natural succession to a conifer stand, which is speculative based on the intensive big game use (movement and browsing) in this well-used travel corridor.

Effects to all stewardship projects to Sensitive and "survey and manage" species are summarized in Table 4.4.5.

The determination is that Alternative 3 **"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"** for the Sensitive mollusks *C. devia, P. coeruleum* and possibly *H. malonei***.**

Effects to other Sensitive species remain the same as those portrayed under Alternative 2.

Indirect Effects from the Action Alternatives

Indirect effects from Alternatives 2 and 3 include the potential for the reduction in the amount of coarse wood at project sites, as well as the other adverse effects described above, if temporary roads are not securely closed to vehicular traffic following the sale (see previous discussion of temporary roads), which is considerably reduced in Alternative 3 due to the reduction of 1.2 miles of temporary road construction under this alternative. This same indirect effect may occur at two non-system roads under the Access Management stewardship project under Alternative 2, which will remain open under that alternative, and not restored to a natural condition in this old-growth, riparian forest stand which is presently suitable habitat for both *Cryptomastix devia* and *Prophysaon coeruleum*.

Cumulative Effects from the Action Alternatives

Effects to Sensitive and "survey and manage" species in the planning area are cumulative to those that have occurred recently on adjacent, private forest lands along the Cispus river, where extensive private clearcuts have eliminated habitat for Sensitive species such as *Cryptomastix devia*, and in some cases eliminated connectivity and dispersal options to National Forest land for this species for several decades. Effects relating to indirect losses of down wood are cumulative to larger scale losses of coarse woody material throughout the Woods LSR due to widespread, historic timber salvage (usually in old-growth stands), as well as legal and illegal firewood harvest. These effects are most pronounced on flat, easily accessible sites in the Woods Creek drainage along the FR 25 corridor, and have reduced habitat capability for those species associated with large, down trees.

Table 4.4.5. Summary of Stewardship projects related to Sensitive and "survey and manage" species, Woods Creek Stewardship Thin project.

Project	Sensitive species habitat impacts?*	Comments
Snag and down wood creation	**Yes (beneficial)**	**Snag and down wood creation will be used to "release" bigleaf maple trees within harvest units, and supplement existing down wood levels. Beneficial impacts anticipated under all alternatives.**
Redcedar underplanting	**Yes (beneficial)**	**Project may eventually benefit sensitive mollusks through increased tree species diversity and canopy layering, depending on survival of planted stock.**

Access/travel management	**Yes (beneficial)**	**Project will restore connectivity for mollusks and other species as decommissioned roads return to a vegetated condition.**
Riparian conifer release (outside harvest units)	**Yes (adverse)**	**Will degrade 22 acres of habitat for Sensitive mollusks under alt. 3 due to falling of mature hardwoods at Woods Creek project site.**
Salmon rearing habitat restoration	**No**	**Project site is not presently suitable for Sensitive species due to flood damage.**
Cispus river riparian/instream	**No**	**Project sites not suitable habitat.**

*** includes both potential beneficial and adverse impacts**

Management Indicator Species

Affected Environment

Management Indicator Species (MIS), as designated in the Gifford Pinchot NF Land and Resource Management Plan, as amended, are those that are in high demand for consumptive or non-consumptive use, or represent other species with similar habitat requirements. Within the project area, the species that are known to occur, or likely occur, are Roosevelt elk and black-tailed deer, the pileated woodpecker, the group known as "cavity excavators" (which are mainly woodpeckers), the pine marten, and mountain goat. The northern spotted owl, addressed under PET species above, is also a MIS.

Table 4.4.6. GPNF Management Indicator Species that occur, or potentially occur, within the Woods Creek Stewardship Thin planning area*.

Species	Occurrence in project area	Reason for MIS selection
Northern spotted owl	Documented	Represents species requiring large amounts (2200 acres) of mature and old-growth forest
Roosevelt elk and black-tailed deer	Documented	High level of demand for hunting and viewing
Pileated woodpecker	Documented	Represents species requiring moderate-sized areas (300 acres) of mature and old-growth forest
Pine marten	Suspected	Represents species requiring smaller areas (160 acres) of mature and old-growth forest
"Cavity excavators"	Documented	Represents species that use or require snags and down wood.
Wood duck	Documented	Indicator for mature riparian hardwood habitat
Bald eagle and peregrine falcon	Documented	(Formerly) federally-listed Threatened and Endangered species, both now listed as "Sensitive"

* Source: Gifford Pinchot Land and Resource Management Plan, as amended

Environmental Consequences

Alternative 1 (No Action)

No MIS will be adversely impacted from this alternative due to the lack of upland disturbance, as well as the lack of noise disturbance. In the short-term, snag levels in the proposed Woods Creek Stewardship Thin sale units will remain low, as relatively few new snags will be formed except locally from root disease mortality or other sources. This will keep habitat for the pileated woodpecker, and "cavity excavators" at low levels within the proposed units until such time as additional snags are formed through natural processes such as mortality from conifer competition, insects and disease. The same is true of coarse woody material (down trees), which are also presently at low levels, particularly sound, class I and II "hard" logs. The amount of coarse woody material will increase slowly over the long-term as existing snags, and ones created in the future from root rot mortality and other factors, fall over. Adjacent old-growth habitat does provide relatively high-quality habitat for pileated woodpeckers, "cavity excavators", and pine marten, so local populations of these species should remain at viable levels under this alternative. However, many old-growth stands, especially those on flat or gentle slopes and easily accessible from forest roads, have been salvaged in the past, which have degraded habitat conditions for species requiring both snags and down wood.

Habitat conditions for deer and elk in the planning area will not change as a result of this alternative; the amount of thermal and optimal cover will remain at high levels, with forage at low levels on National Forest land, but at much greater abundance on nearby private lands near the Cispus River because of large, recent clearcuts. These areas should provide abundant forage for the next 10 to 15 years, until the tree canopy closes in and forbs and shrubs are shaded out. The benefits however will be relatively localized to sites close to these clearcut areas.

No noise disturbance will occur under this alternative to nesting, roosting or wintering birds, including the wood duck and northern bald eagle. The implementation of Alternative 1 will have no adverse impacts to Management Indicator Species.

Alternatives 2 and 3

Under the project action alternatives, deer and elk will be impacted from both project-related habitat effects, and from logging-generated noise disturbance. The primary adverse effect of the action alternatives is that deer and elk will be temporarily displaced from the project area during summer harvest operations, and locally during post-sale projects such as snag and down wood creation and access management. There is abundant "displacement habitat" surrounding the project area for animals to use temporarily. Due to the potential for disruption of fawning and/or calving sites, a Limited Operating Restriction will be used to eliminate noise effects above ambient levels (which are presently very low in the area) from May 15 to July 1 (see Mitigation Measures).

Over the long-term, the proposed thinning will improve big game habitat within the proposed sale units by allowing additional light to reach the forest floor, and stimulating understory production. This will provide additional forage for deer and elk, although the quantity and quality of this forage will vary depending on site conditions and the actual use of this forage in the thinned stands cannot be quantified. Overall, all action alternatives are expected to have a long-term, beneficial effect to deer and elk.

The pileated woodpecker is present within the sale area, based on this species' distinctive foraging sign observed during field reconnaissance, as are several other species of "cavity excavators" including the hairy woodpecker and red-breasted sapsucker. The pileated woodpecker and the "cavity excavator" group would temporarily suffer a reduction in snag habitat from losses incurred during logging operations, as well as adverse effects from noise disturbance, which may lead to temporary displacement from sale units. The reduction in snag habitat would be small however, as the Woods Creek Stewardship Thin units presently have low snag levels and very few of these are large enough to serve as nesting habitat for the above species.

The wide-ranging pine marten would also suffer short-term habitat degradation from the commercial thinning, as habitat components such as coarse woody debris are disturbed or broken during logging. Again, the riparian reserve buffers, and no thin "skips", which will be situated in areas with higher densities of existing snags and down wood, will help mitigate these impacts by providing habitat patches for marten and their prey. Adjacent old-growth forest habitat will continue to provide high quality denning, resting, and foraging habitat for pine martens. The short-term effects of thinning and an increase in canopy closure to the pine marten is not known- marten are well-adapted to traveling over deep snow- so the impacts during the winter would likely be minimal. Any adverse impacts would be short-term in nature (5-15 years) at which time the canopy closure would return to pre-harvest conditions. Over the long-term, increased tree diameter and crown growth will result in an increased ability to intercept snow, which may benefit pine marten.

An increase in understory vegetation from thinning may benefit small mammal populations on which marten prey, although the extent of these benefits is not predictable. An increase in snag and down wood habitat from the sale would benefit the pine marten by providing future resting and denning habitat, as well as habitat for small mammals. Due to the retention of patches of undisturbed, higher-quality habitat in unthinned buffers and "skips," the short-term reduction in canopy closure, and the addition of snags and coarse woody debris in conjunction with the sale, adverse effects to the pine marten from the Woods Creek Stewardship Thin project are judged to be small and discountable over the short-term, and beneficial effects are anticipated over the long-term.

Adverse effects to the wood duck from the two action alternatives are possible from noise disturbance, particularly at units and project sites near ponds. Limited Operating Period restrictions designed to reduce noise impacts to spotted owls and marbled murrelets will also serve to minimize adverse effects to nesting wood ducks, who usually nest at approximately the same time as spotted owls.

Indirect Effects

Indirect effects to MIS are similar to those described for Sensitive and "survey and manage" species. Down wood levels may be reduced along temporary roads if they are not securely closed to vehicular traffic, and noise disturbance may also occur to MIS species from off-road vehicle use as well.

Cumulative Effects

Cumulative effects are also similar to those previously described. Recent clearcuts on private lands have provided large forage areas for deer and elk, which will benefit these species in these localities, with cover provided mainly on adjacent National Forest lands. These harvested areas however have removed habitat for other MIS species like the pileated woodpecker, "cavity excavators" and pine marten.

Migratory Birds

A diversity of forest age classes, and the presence of numerous, ponds, wetlands and riparian habitats in the Woods Creek Stewardship Thin planning area produce excellent habitat conditions for numerous migratory bird species, including various species of warblers, vireos, flycatchers, thrushes and swallows.

Environmental Consequences

The Woods Creek Stewardship Thin action alternatives will have a long-term, beneficial effect to migratory birds by stimulating stand understory development and layering, which will enhance stand structure and habitat capability for these species. Particularly beneficial will be the retention and stimulation of bigleaf maples and other deciduous trees, which are important habitat components for migratory birds.

In the short-term, the sale will likely disrupt some migratory bird nesting, although no tree felling or logging will occur before July 1 in most units due to the spotted owl LOP (later in Units 11 and 12), which is late in, or following, the nesting season for most low and mid-elevation migratory bird species. As the sale is surrounded by thousands of acres of forest habitat where nesting will not be disrupted, these short-term adverse effects would be relatively small and localized, and birds will return to nest in the Woods Creek Stewardship Thin stand in future years following the completion of harvest operations. The expected loss of some habitat features such as snags and down wood from logging operations would have relatively small impacts to migratory birds, which are not typically cavity nesters, or forage on snags or down wood. Again, long-term effects would be beneficial due to snag and down wood creation projects, which will increase the abundance of these habitat features in the treated units.

Proposed stewardship projects will also have a long-term benefit to migratory birds, particularly the Access/travel management road project, which will reduce human disturbance at the roads (and wood tracks) proposed for decommissioning. The Woods Creek conifer

release site in Alternative 3 will degrade habitat for migratory birds, at least in the short-term, by falling mature hardwood trees at this site, which will adversely affect many hardwood-associated bird species such as Wilson's warbler, Pacific-slope flycatcher, warbling vireo, western tanager and others. Adverse effects are expected to be relatively small and localized however, due to the large amount of hardwood habitat in the planning area.

Indirect and cumulative effects are similar to those portrayed previously, although potential losses of coarse wood from temporary roads would have fewer impacts to migratory birds than for mollusks, amphibians, or MIS such as the pileated woodpecker.

Recent private clearcuts will provide habitat not otherwise available for migratory birds in the planning area over the short-term, such as MacGilvray's and orange-crowned warblers, who prefer young seral habitat.

Effects to migratory birds are summarized in Table 4.4.7 below:

Table 4.4.7. Summary of WCST project effects to migratory birds by alternative

Alternative	Potential for noise disturbance to nesting birds?	Habitat effects to migratory birds
1 (No action)	no	Adverse habitat effects anticipated due to loss of hardwoods, particularly bigleaf maple, due to conifer competition if proposed stands are not treated.
2	yes*	Greatest beneficial effects due to most acres of habitat restoration, including bigleaf maple release, and stimulation of forest understory and canopy layering.
3	yes*	Beneficial effects anticipated due to restoration of treated stands, although less than alternative 2. Woods Creek conifer release site under this alt. will degrade habitat conditions for migratory birds at this location due to loss of riparian hardwoods.

* disturbance mitigated via spotted owl LOP restriction (March 1 to June 30)

4.5 Botanical Resources

This section evaluates the potential effects of the project alternatives on Threatened, Endangered, Proposed and Sensitive (TEPS) plant species and Survey and Manage species. This section also evaluates the potential effects of the proposed action on other botanical resources of concern, and includes a discussion of the potential effects of the proposed action on noxious weed and invasive plant spread, with project design features and/or mitigations recommended to ameliorate these effects.

Affected Environment

The thinning areas contain Douglas-fir-dominated plantations, with associated hemlock, cedar, Pacific silver fir, as well as red alder and big-leaf maple clusters that originated from clearcut harvest. The units are generally low elevation high site index stands that are healthy and growing well. Stands range in age from 39 to 50 years. Common plant association in the units are; Hemlock/sword fern, Hemlock/dwarf Oregon grape/sword fern, Hemlock/dwarf Oregon grape, and Hemlock/vanilla leaf. Most of the units have some level of riparian influence including seeps and springs, small wetlands, intermittent and perennial streams with associated riparian vegetation. All stands also have some level of hardwood composition increasing the diversity of lichens and bryophytes found in the stands.

In general, the units contain mainly young forest habitat and common vegetation as most riparian, rocky, and unique habitats are already excluded from unit boundaries. Some less-common habitat areas and habitat conditions were observed within the units. Unit 4 has some well-utilized big game forage areas. Unit 6 has some dense lichen and bryophyte populations and some forest health concerns. Unit 7 has some excellent hardwood areas and some high density lichen areas. Unit 10 has some excellent riparian conditions and a large area with abundant soil moisture and hardwood diversity. Some of the units (11 and 12) also contain undrained seasonally wet swales. Large down woody debris that is habitat for species such as *Tetraphis geniculata* (bent-knee moss) is generally limited. There is a known site for the sensitive species tall bugbane (*Actaea elata*, synonym *Cimicifuga elata*) in the Woods Creek area, but no sites were found within units.

Botanical surveys were conducted in the Woods Creek Stewardship Thin area during August 2006 (Units 1-10) and September 2007 (Units 11-12). Due to the seasonal nature of plant identification it is not always possible to completely survey a given area with a one time survey; however, the knowledge of plant-habitat relationships, growth habit, and flowering dates helps the investigator in this regard. The phenology of Sensitive lichens, bryophytes and the fungus *Bridgeoporus nobillisimus* is such that they can be identified throughout most of the year. Based upon this, surveys for these species are generally conducted at the same time as surveys for TEPS species.

In the 2004 Survey and Manage Record of Decision (USDA & USDI 2004, pg. 6), the assumption was made that species being transferred from the Survey and Manage Program to the Sensitive Species Program that were not considered "survey practical" under the Survey

and Manage Standards and Guidelines (most category B & D species, including most fungi), and would not require survey under the Sensitive Species Program. Rather, other components of pre-project clearances (habitat evaluations etc.) will be utilized to evaluate potential risks to the species resulting from project activities. This evaluation is then used to prescribe project design features and/or mitigations to address these risks. Species that fall into this category are indicated in the Biological Evaluation in the project record. Of the Sensitive species not specifically targeted during surveys, the project area may provide habitat for eleven fungi and one lichen species. These species are addressed within the Determination of Effects section of this report.

Complete survey documentation is on file at the Cowlitz Valley Ranger District in the Botany Project files.

Current Condition

Threatened, Endangered, and Proposed Plant Species: None were located within the project area.

Sensitive Plant Species: Multiple sites for one Sensitive Species, *Usnea longissima*, were found within planned units for the Woods Creek Stewardship Thin planning area. Sites and locations are listed in Table 4.5.1.

Table 4.5.1. Regional Forester's Sensitive Species found within units of the Woods Creek Stewardship Thin

Location (Unit)	Species
6	*Usnea longissima* (3 sites)
11	*Usnea longissima*

Survey and Manage Plant Species: In addition to being a Sensitive Species, *Usnea longissima* is a Category F Survey and Manage Species.

Threatened, Endangered & Proposed Plant Species

Direct and Indirect Effects

At this time there are no federally listed (Threatened, Endangered, or Proposed (TEP)) plant species known to occur on the Forest; however, one federally threatened species (*Howellia aquatilis*) is suspected. *Howellia aquatilis* has an extremely narrow habitat tolerance, generally confined to palustrine emergent wetlands with seasonal drawdown. No such wetland habitats will be impacted by the implementation of this project. In addition, wetlands to be impacted by this project were surveyed and no TEP species were located. Thus, the action alternatives will have **no effect** on federally listed species.

Sensitive Species

Direct and Indirect Effects

Surveys performed within project units located one Sensitive species: *Usnea longissima.* A determination of impact for this species is documented below.

Usnea longissima
Four new sites for this species were located in Woods Creek Stewardship Thin units during surveys in 2006 and 2007. Since this species can grow high in the canopy, there may be other individuals in the area that were not detected. This species primarily reproduces asexually by fragmentation of the thallus, with the majority of vegetative propagules dispersing only short distances (i.e. typically less than 5 meters) from their source locations, and thus the species is considered to be dispersal limited. Experiments have shown that *Usnea longissima* can thrive in young stands if transplanted. Retention of colonized green trees is therefore considered to be the most important design feature to preserve this species in harvest areas (Survey Protocols for Survey and Manage Category A lichens in the Northwest Plan area, Derr et al. 2003). Under Alternatives 2 and 3, fifty-foot radius buffer areas would be created around the known populations as a project design feature, and trees outside the buffers would be felled directionally away from the buffers. For these reasons, Alternatives 2 and 3 **may impact individuals or habitat for this species, but will not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species as a whole**. Alternative 1 (no action) for this project would have **no impact** upon this species.

Non-Surveyable Sensitive Species

Within all units of Woods Creek Stewardship Thin there is potential habitat for a number of Sensitive species, including eleven fungi species and one lichen species that were not specifically targeted during surveys. These species are all thought to be associated primarily with late-successional/old growth forests (USDA & USDI 1994, 2001), though some of these species have been located in forests <80 years old. Because fungi "fruit" (produce visible sporocarps) unpredictably (i.e. may not fruit each year, vary in fruiting timing from year to year), surveys are not reliable indicators of presence or absence (absence of evidence is not evidence of absence). In addition, many fungi species require laboratory examination by experts for reliable identification. As a result, it is probable that many Sensitive fungi species are under-reported and under-collected across their ranges. In addition, the habitat requirements for many of the species are too broad or too poorly understood to allow for reasonable mitigations at a project scale, particularly when no sporocarps have been located within the project area.

It is unknown whether the 'non-surveyable' Sensitive species occur within the project's area of impact. For the purpose of analysis, we assume that there is potential for occurrence within the project area and estimate whether the likelihood of occurrence is low, moderate or high, using guidelines set by Region 6 of the Forest Service (Likelihood of Occurrence Key 2004); the effects analysis (see Botany Resource Report in the project record) reflects this assumption.

Direct and Indirect Effects

Timber harvest has demonstrated negative effects upon fungi (Amaranthus & Perry 1994; Byrd et al. 2000; Kranabetter & Kroeger 2001; Kranabetter & Wylie 1998; Perry et al. 1989; and others). Direct effects include removal of host trees necessary to sustain mycorrhizae, and destruction of mycelial networks. Indirect impacts include a reduction in the moisture retention capability of soils, duff and woody debris that provide habitat for fungal species, as a result of increased solar and wind penetration into stands. In addition, land based harvest techniques result in soil compaction that can harm mycelia in the soil. The same techniques also tend to disturb existing woody debris and duff layers that support saprobic species of fungi.

Because land-based harvest techniques result in soil disturbance and compaction, alternatives incorporating these techniques impact fungal diversity and preservation of rare fungal species. Skyline logging techniques may have less impact than ground-based techniques, particularly for compaction. Any harvest impacts to habitat, such as soil compaction, would be slightly less under Alternative 3 than for Alternative 2 because smaller units are harvested, but the impacts under either action alternative are essentially the same. The likelihood of occurrence in the project area and the effects from thinning under each alternative are summarized in Table 4.5.2. Table 4.5.3 summarizes the effects of the proposed restoration projects to threatened, endangered, proposed, or sensitive species.

Table 4.5.2. Occurrence of species in the Woods Creek Stewardship Thin project area and effects by alternative.

Species	Likelihood of Occurrence within Project Area	Alt. 1 Effect	Alt. 2 & 3 Effect
Chaenotheca subroscida	Low	No Impact (NI)	MIIH
Albatrellus ellisii	Low	NI	MIIH
Gomphus kauffmanii	Low	NI	MIIH
Leucogaster citrinus	Moderate	NI	MIIH
Otidea smithii	May occur	NI	MIIH
Pseudorhizina californica	Low	NI	MIIH
Ramaria cyaneigranosa	Low to Moderate	NI	MIIH
Ramaria gelatiniaurantia	Low to Moderate	NI	MIIH
Ramaria rubrievanescens	Low	NI	MIIH
Sarcodon fuscoindicus	Low to Moderate	NI	MIIH
Sowerbyella rhenana	Low	NI	MIIH
Spathularia flavida	Moderate	NI	MIIH

- MIIH: May impact individuals or habitat, but will not likely lead to a trend towards federal listing or a loss of viability to the species

Table 4.5.3. Effects of restoration projects on Threatened, Endangered, Proposed, and Sensitive (TEPS) species.

Project	TEPS effects
Snag and down wood creation	Alt 2. 534 Acres. In units where down wood is scarce or lacking, resulting from past clearcut management, the creation of down wood would benefit rare species of fungi and mosses that use down or decayed wood as a substrate, such as the fungus *Otidea smithii* or the moss *Tetraphis geniculata*. Alt 3. This alternative would have the same benefits discussed under Alt. 2 above, but on 468 acres.
Road closures, stabilization, and decommissioning	Alt 2. 5.0 mi. Road closure and stabilization is expected to protect rare plant habitat and undiscovered populations from impacts from vehicles, washouts, erosion and compaction. In addition, plant communities would be protected from unintentional introduction of invasive weeds and plant diseases that can be carried on vehicles or equipment, and materials that can be carried by vehicles such as soil, firewood, or yard waste. Alt 3. 5.2 mi. Benefits expected under this alternative are the same as those described above under Alt 2.
Riparian conifer release (outside harvest units)	Alt 2. 13 acres. By increasing sunlight to the ground, conditions would be improved for invasive plants. However, mitigation #8 under restoration project mitigations calls for control of Scotch broom, Canada thistle, and tansy ragwort. This mitigation, if implemented, is expected to prevent expansion of invasive weed populations, and thus prevent effects to rare plant habitat. Alt 3. 35 acres. Similar to Alt 2 above
Salmon rearing habitat restoration	Alt 2. The restoration project would require ground-disturbing construction which could provide opportunities for invasive plants. Mitigation #8 under restoration project mitigations calls for control of Scotch broom, Canada thistle, and tansy ragwort. This mitigation, if implemented, is expected to prevent expansion of invasive weed populations, and thus prevent effects to rare plant habitat. Alt 3. Same as Alt 2
Cispus River riparian and floodplain restoration	Alt 2. 60 acres. This project would have removal of non-native vegetation as one of its components and would thus help protect the Cispus River from impacts of aggressive non-native plant species such as Scotch broom. This would help to maintain and restore habitat for disturbance-adapted native plants of the floodplain. Alt 3. 60 acres. Same as Alt 2
Western Redcedar underplanting	Alt 2. No effects expected to rare plant habitat Alt 3. No effects expected to rare plant habitat

Cumulative Effects

The cumulative effects area chosen for this analysis is the western portion of the Cowlitz Valley Ranger District. This area was chosen because it is large enough to contribute to or receive the lightest propagules, such as fungal spores, of local populations of Sensitive or

Survey and Manage plant species that may exist or have habitat in the project area. Some species with very light propagules may achieve distribution greater than this, but establishment is most likely near the source. The choice of the district boundary was determined because the size was suitable, and information about habitat conditions is usually available in terms of mapped political units, although the boundary is not biologically meaningful. The past time horizon for comparison of cumulative effects to rare species is approximately 1900, when large-scale European settlement with land clearing began to alter pre-settlement forest disturbance patterns and habitat availability for rare species. The future time horizon is 2022, when all activities associated with the stewardship project will probably be complete. Effects will not end at this horizon, but become increasingly speculative in longer time frames.

Eight thinning projects (treating approximately 1600 acres) have been approved or are being implemented within or near the Woods LSR. Additionally, there has been recent, extensive clearcutting on private land near Units 6 and 7. These projects may have had some effects similar to the possible effects of the Woods Creek Stewardship Thin project, such as impacts to undetected individuals of TES or S&M species, or effects to habitat suitability such as soil compaction. These effects may overlap in time with the effects of the Woods Creek project, as soil recovers from past compaction in completed timber sales, and thus accumulate in the cumulative effects area. No measurement is available for impacts to undetected individuals, but pre-project surveys on Forest Service harvest areas are believed to lower the probability of such impacts in recent actions.

Cumulative effects of timber harvest upon "non-surveyable" species sites and habitat quality are largely unknown. Project design attempts to minimize impacts upon these species. We assume that, by practicing thinning, retaining a high degree of species diversity within stands, maintaining woody debris substrate (for saprobes), and live trees (for mycorrhizal species), that this project, while impacting species, will not devastate entire mycelial networks and colonies, and thus will reduce the contribution to cumulative effects. Though project level mitigations attempt to preserve potential habitat or analyze risk associated with particular projects upon these species, a true understanding of the impacts of these projects will require more complete understanding of habitat associations, distribution, and abundance of these species across their ranges. Currently, there are multiple efforts proceeding across Region 6 of the Forest Service to gain more information about the habitat associations, distribution and abundance of these species (compilation of the results and statistical inferences based on the CVS random grid study is one example). Additional information gained through these surveys and studies will help us better identify potential habitat, judge risk, and mitigate for impacts in the future.

In summary, none of the Sensitive botanical species that were located within the project area, or that are (for the sake of analysis) presumed to exist within the project area (non-surveyable species) are either so limited in distribution, habitat, or number that project activities (with incorporated design features), in combination with past or reasonably foreseeable future actions on nearby federal land and adjacent private land, are likely to lead to a trend towards federal listing for these species, or threaten the viability of entire populations or species as a whole.

Noxious Weeds/Invasive Plants

Invasive weeds are common in the Woods Creek planning area. While these weed species are primarily associated with roads, populations are also located in small openings within the general forested area and in association with wetlands, and a few invasive plants, such as English holly (*Ilex aquifolium*, ILAQ) can spread under forest canopy. Established species include Canada thistle (*Cirsium arvense*, CIAR), bull thistle (*Cirsium vulgare* CIVU), Scotch broom (*Cytisus scoparius*, CYSC), herb Robert (*Geranium robertianum*, GERO), St. Johns Wort (*Hypericum perforatum*, HYPE), reed canarygrass (*Phalaris arundinacea*, PHAR), Himalayan blackberry (*Rubus armeniacus*, RUAR), evergreen blackberry (*Rubus laciniatus*, RULA), and Tansy Ragwort (*Senecio jacobaea*, SEJA). There are invasive weeds on most roadsides and also concentrations in some units, as reported in weed survey reports and botanist field observations.

Table 4.5.3. Invasive weeds found in Woods Creek thinning units.

	CIAR	CIVU	CYSC	GERO	HYPE	ILAQ	PHRU	RUAR	RULA	SEJA
unit										
1		x							x	x
2	x	x				x			x	x
3	x	x				x	x		x	
4	x					x			x	
5	x	x			X					x
6	x									x
7					X					x
8	x	x								x
9	x	x	x		X					x
10	x				X					x
11	x	x		x	X	x	x	x	x	x
12	x	x		x	X		x			x

Weeds listed in botany survey reports by unit. Sources: K. H. Hewitt Forest Resources 8/8-14/06, PBS Environmental and Engineering, 9/18-19/07, botanist observations

Because invasive weeds are widely established in Woods Creek LSR, we don't expect to eradicate most of them. The goal is to prevent invasive plants from spreading further, particularly in association with the disturbance of thinning the stands and road work, and to take control measures against pioneering invasives that can invade forest stands under tree canopy, such as holly. Some invasive plants, like herb Robert (*Geranium robertianum*) are of concern because of their potential effects to wildlife, but we do not at present have any effective means of control.

Under the Woods Creek Stewardship Thin action alternatives, there would be ground disturbance, and opening of the canopy during the course of timber harvest activities. Ground disturbance exposes available habitat for noxious weeds, while timber harvest exposes newly created disturbed areas to increased sunshine, ideal conditions for early seral, weedy species. Areas experiencing ground disturbance within the timber sales would, therefore, be highly susceptible to noxious weed and invasive plant colonization, particularly since there are

already invasive species growing along access roads to the units and in some of the units. Canopy closure is not expected to be reduced below 50%, and tree canopies are expected to close within 10-20 years. Therefore the effect of increased light within stands is expected to be temporary. Roads function as "pipelines" for weed spread, as well as adding to disturbed area. Alternative 2 incorporates temporary road heavy reconstruction and new temporary road construction (1.2 mi), so it provide more suitable habitat for weed establishment than Alternative 3 (0 mi) or Alternative 1 (0 mi). Under Alternative 1 (no action), invasive weeds already in the area would continue to exist and spread by natural processes and recreational use. Under Alternative 2 (proposed action) weeds would have additional opportunities to establish and spread in areas disturbed by project activities and temporarily where shade is decreased. Alternative 3 would have a reduced weed-enhancing effect in proportion to the reduction in proposed disturbance and less reduction in shade, compared to Alternative 2 (see Table 4.5.1). Proposed mitigations would reduce but not eliminate these effects for Alternatives 2 and 3 (see section 3.2, Mitigations). Table 4.5.4, below, displays the effects of the restoration projects on invasive weeds.

Table 4.5.4. Woods Creek Stewardship restoration project effects to invasive weeds.

Project	Invasive Weed Effects
Snag and down wood creation	Alt 2. 534 Acres. This project would increase light to the ground, which can favor the growth of invasive plants. However, the snag and down wood creation would be a component of the desired thinning of stands, to increase tree growth, and therefore the effects are not considered to be added to the thinning effects, but are contained within them in the thinning effects analysis. Alt 3. 468 acres. Effects discussed under thinning as above.
Road closures, stabilization, and decommissioning.	Alt 2. 5.0 mi. Road closure and stabilization is expected to allow tree growth to increase shade to the ground, and to prevent fresh soil disturbance that creates opportunities for invasive plants. Increased shade may also reduce or prevent expansion of existing weed populations. In addition, risk of introduction of invasive weeds that can be carried on vehicles or equipment, and materials that can be carried by vehicles such as soil or yard waste, will be reduced. Alt 3. 5.2 mi. Benefits expected under this alternative are the same as those described above under alt 2.
Riparian conifer release (outside harvest units)	Alt 2. 13 acres. By increasing sunlight to the ground, conditions would be improved for invasive plants. However, mitigation #8 under restoration project mitigations calls for control of Scotch broom, Canada thistle, and tansy ragwort during project implementation. This mitigation, if implemented, would help to prevent expansion of invasive weed populations until the conifers grow enough to create more shade. Alt 3. 35 acres. Similar to Alt 2 above
Salmon rearing habitat restoration	Alt 2. The restoration project would require ground-disturbing construction which could provide opportunities for invasive plants. Mitigation #8 under restoration project mitigations calls for control of Scotch broom, Canada thistle, and tansy ragwort. This mitigation, if implemented, is expected to prevent expansion of these invasive weed populations. Alt 3. Same as Alt 2

Cispus River riparian/instream	Alt 2. 60 acres. This project would have removal of non-native vegetation as one of its components and would thus help protect the Cispus River from impacts of aggressive non-native plant species such as Scotch broom. Alt 3. 60 acres. Same as Alt 2

In order to control noxious weed colonization and spread under the action alternatives, weed-spread prevention and weed eradication activities are recommended to be implemented before, during and after project activities.

Noxious Weed and Invasive Non-Native Species Risk Assessment with Project Design Criteria

Non-native plants include those species introduced intentionally or unintentionally to areas where they do not naturally occur. Invasive non-native plants in the Pacific Northwest most often originate from Europe and Asia. Problems can arise when the associated natural predators, diseases, and competitors that controlled these species in their native habitats are not present in the habitat where they are introduced. If a species is unchecked by competition or predation, it may become invasive, dominating the site and altering ecosystem balance. The results may include changes in biodiversity, fire frequency, soil erosion and hydrology of a site. Other effects include poisoning of livestock and reducing the quality of recreational experiences. There are an estimated 2,000 invasive and noxious weed species in the U.S and 134 class A, B & C weeds listed in Washington State in 2007.

Forest Service Manual direction requires that Noxious Weed Risk Assessments be prepared for all projects involving ground-disturbing activities. For projects that have a moderate to high risk of introducing or spreading noxious weeds, recent Forest Service policy requires that decision documents must identify noxious weed control measures that will be undertaken during project implementation (FSM 2081.03, 11/29/95). To be in compliance with the EIS for Managing Competing and Unwanted Vegetation, it is also recommended the applicable *Standard Procedures to Reduce the Risk of Spreading Weeds* be implemented in all projects, regardless of weed risk ranking. In addition, the Pacific Northwest Region Invasive Plant Program Record of Decision for Preventing and Managing Invasive Plants (USDA 2005) provides invasive plant prevention and treatment/restoration standards and direction on all National Forest Lands within Region 6.

Risk Ranking

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

FACTORS

1. Known noxious weeds in close proximity to project area that may foreseeably invade project.
2. Project operation within noxious weed population.

3. Any of vectors 1-8 in project area.

VECTORS

1. Heavy equipment (implied ground disturbance including compaction or loss of soil "A" horizon.)
2. Importing soil/cinders/gravel/straw or hay mulch.
3. ORVs or ATVs.
4. Grazing.
5. Pack animals (short term disturbance).
6. Plant restoration.
7. Recreationists (hikers, mountain bikers, etc…).
8. Forest Service or other project vehicles.

High, moderate, or low risk rankings are possible. For the high ranking the project must contain either a combination of factors A+C or B+C above. The moderate ranking contains any of vectors #1-5 in the project area. The low ranking contains any of vectors #6-8 in the project area or known weeds within or adjacent to the project area, without vector presence.

Weed Risk Ranking Results

Project	Factors	Vectors	Risk Ranking
Woods Creek Stewardship Thin	A, B, C	1, 2, 8	High

Project Design Feature Standards for Preventing and Managing Invasive Plants

Project design criteria for preventing and managing invasive plants are located in Section 3.2, numbers 27-38 under "Timber Harvest Mitigation Measures and Project Design Criteria," as well as numbers 7-13 under "Stewardship Restoration Project Mitigation Measures and Project Design Criteria."

Cumulative effects

Please see the previous section for cumulative effects boundary, time horizons, and other timber sales planned in the cumulative effects area.

Past land clearing and trade have introduced invasive plant species to the Cowlitz Valley Ranger District. Invasive plants have established on most roadsides and in many riparian areas and are widely established within the LSR.

An Environmental Impact Statement for the site-specific invasive plant treatment project detailing known sites is available at http://www.fs.fed.us/r6/invasiveplant-eis/site-specific/GIP/. The Woods Creek Stewardship Thin project is expected to contribute to the further spread of invasive plants. This incremental increase in invasive plant populations, added to the effects of past sales and activities on private land, may reduce the capacity of the

district to provide habitat for native species and produce timber products (Pacific Northwest Region Invasive Plant Program: Preventing and Managing Invasive Plants, Section 1.1, available at http://www.fs.fed.us/r6/invasiveplant-eis/). The proposed mitigations, if adopted, would reduce this cumulative effect.

4.6 Soils

The effects of the proposed action and alternatives on the soil resource and the extent of detrimental soil conditions within units of the action alternatives were analyzed for the Woods Creek Stewardship Thin. Quantitative analysis and professional judgment were used to evaluate soil quality in terms of the percent area in a detrimental condition. The term "project area" refers to the larger scale boundary surrounding all the units in the proposed action, also referred to as the "planning area."

The Gifford Pinchot National Forest Land and Resource Management Plan, Amendment 11 (p. 2-58 to 2-62) requires losses in soil productivity be limited to 20 percent or less of the activity area. Site treatment practices and harvest methods, particularly the use of fire and pesticides, are to be modified to minimize soil and litter disturbance. The Plan also uses the "Soil Management Guidelines, Gifford Pinchot National Forest" as guidelines. The guidelines have since been clarified and enhanced in Gifford Pinchot National Forest Soil Resource Inventory (Wade, et al., 1992).

Regional direction and clarification of terms is given in the Forest Service Manual, Chapter 2520, R-6 Supplement No. 2500.98-1. In the standard, "activity area" is the total area in which ground-disturbing activity is planned and includes the transportation system, in and directly adjacent to, the activity area. The Northwest Forest Plan requires designating unstable and potentially unstable lands as riparian reserves.

Soil quality is maintained when soil compaction, displacement, puddling, burning, erosion, loss of organic matter and altered soil moisture regimes are maintained within defined standards and guidelines. Under the action alternatives, these standards and guidelines would be achieved in all activity areas.

Affected Environment

Current soils information for this project area was collected on a site-specific basis through field surveys conducted from May to August of 2007. Soils of the project area were mapped as part of the Gifford Pinchot National Forest Soil Resource Inventory (Wade, et al., 1992). This information is available at the Gifford Pinchot National Forest Headquarters.

Table 4.6.1 lists the Soil Mapping Units. (A map of the soils units can be found in the project record.) The table shows units of Alternative 2 because they are more inclusive than Alternative 3. Limitations to tractor logging equipment within the existing units are also shown in the table. A "No" under the Tractor Logging heading means tractor logging is not permitted for that soil type under the guidelines in the Forest Plan (Wade, et. al., 1992). Generally, restrictions are on slopes greater than 30 percent.

Table 4.6.1. Selected Soil Mapping Interpretations, from (Wade, et. al., 1992)

Woods Creek Thin Harvest Unit	Soil Map Unit	Acres	Landform	Erosion Potential	Displacement Potential	Compaction Potential	Tractor Logging Permitted
1	27	41.2	Smooth Sideslopes	Slight	High	Moderate	Yes
2	27	30.4	Smooth Sideslopes	Slight	High	Moderate	Yes
3	27	25.3	Smooth Sideslopes	Slight	High	Moderate	Yes
3	37	12.4	Steep Sideslopes	SEVERE	N/A	N/A	No
3	28	11.8	Valley Bottoms	Slight	High	Moderate	Yes
4	27	25.1	Smooth Sideslopes	Slight	High	Moderate	Yes
4	36	1.8	Undulating	Moderate	High	Moderate	Yes
5	5116	5.1	combination[1]	Moderate	N/A	N/A	No
5	36	43.5	Undulating	Moderate	High	Moderate	Yes
5	51	6.5	Steep Sideslopes	Moderate	N/A	N/A	No
6	13	40.3	Valley Bottoms	Slight	High	Moderate	Yes
7	13	59.4	Valley Bottoms	Slight	High	Moderate	Yes
8	27	28.4	Smooth Sideslopes	Slight	High	Moderate	Yes
9	25	62.7	Smooth Sideslopes	SLIGHT[2]	High	Moderate	<20%
10	31	1.5	Smooth Sideslopes	Moderate	N/A	N/A	No
10	27	11.4	Smooth Sideslopes	Slight	High	Moderate	Yes
11	28	53.6	Valley Bottoms	Slight	High	Moderate	Yes
11	27	4.6	Smooth Sideslopes	Slight	High	Moderate	Yes
12	28	56.5	Valley Bottoms	Slight	High	Moderate	Yes

[1] A complex of two slightly different soil map units is lumped together as one.
[2] Erosion potential is slight but when water is allowed to concentrate, erosion can be high.

Existing Condition

Soil Productivity

The extent and distribution of detrimental soil impacts such as compaction, displacement, and severe burning, measured in percent of each activity area, are used to describe the effects of management activities on long-term soil productivity. A detrimental soil condition occurs when site productivity and hydrologic function are adversely affected by soil displacement, compaction, soil puddling, severe burning or accelerated erosion. Soil displacement is the lateral movement of topsoil by mechanical forces such as equipment blades, vehicle traffic, or logs being yarded. Mixing of surface soil layers by disking, chopping, or bedding operation, are not considered displacement. Representative areas of the listed units were traversed on the ground to evaluate soil compaction and displacement.

Roads

National Forest system roads currently occupy between 1 and approximately 9 percent of the activity areas (Table 4.6.2).

Timber Harvest

Evidence of past ground-based timber harvest activities exists within the Woods Creek Stewardship Thin unit boundaries that has affected soil productivity in the managed stands. Soils in the project area have been converted to an essentially non-productive condition in the long term (greater than fifty years) due to system roads construction. Most of the precipitation that falls on the compacted surfaces becomes surface runoff.

Landings and skid trails occupy a range of between 0.2 percent of the activity areas in Units 4 and 6 to approximately 8.9 percent of the activity area in Unit 10 (Table 4.6.2). The area occupied by existing landings was calculated when they are on existing logging roads. They were not calculated on National Forest Service system roads where the road surface itself would constitute the bulk of the landing.

Table 4.6.2. Approximate extent of existing detrimental soil conditions within Woods Creek Stewardship Thin units (total stand acres) relative to Alternative 2

Unit	Acres	Acres of System Roads[3]	System Roads (% of unit)	Acres of logging roads and landings[4]	Existing detrimental soil conditions (% of unit)
1	41.2	1.5	3.6%		3.6%
2	30.4	1.3	4.3%		4.3%
3	49.6	0.8	1.6%	1.03	3.6%
4	26.9	1.6	5.9%	0.17	6.6%
5	55.1	1.8	3.2%	0.24	3.7%
6	40.4	1.4	3.4%	0.17	3.8%

[3] One-lane, NFS roads are an average of ~6m wide in this project area
[4] Assuming landings are a quarter acre and logging roads are 5m wide

Unit	Acres	Acres of System Roads[3]	System Roads (% of unit)	Acres of logging roads and landings[4]	Existing detrimental soil conditions (% of unit)
7	59.5	1.4	2.4%		2.4%
8	28.5	0.3	0.9%	1.37	5.7%
9	66.6	3.3	5.0%	0.45	5.7%
10	13.0	1.2	8.9%		8.9%
11	58.2	2.4	4.1%	0.92	5.7%
12	56.5	1.3	2.3%		2.3%
		18.2		4.36	

Existing detrimental soil condition ranges from a minimum of 0.4 percent in Unit 1 to a maximum of 13.1 percent in Unit 10 (Table 4.6.3).

Table 4.6.3. Approximate extent of existing detrimental soil conditions within Woods Creek Stewardship Thin units (total stand acres) relative to Alternative 3

Unit	Acres	Acres of System Roads	System Roads (% of unit)	Acres of logging roads and landings	Existing detrimental soil conditions (% of unit)
1	41.2	0.2	0.4%		0.4%
2	30.4	1.0	3.4%		3.4%
3	41.5	1.2	3.0%	0.28	3.7%
4	22.4	2.4	10.7%	0.17	11.4%
5	51.8	2.1	4.1%	0.24	4.5%
6	13.5	1.3	9.3%		9.3%
7	59.4	2.4	4.1%		4.1%
8	28.4	1.0	3.7%	0.62	5.9%
9	53.5	1.6	3.1%	0.20	3.4%
10	13.0	1.7	13.1%		13.1%
11	63.2	2.3	3.6%	0.42	4.3%
12	24.5	0.6	2.4%		2.4%
		17.9		1.9	

Woods Creek Harvest Unit 9 has an atypical soil mapping unit whose interpretation calls for restriction of tractor logging on slopes greater than 20 percent, as opposed to the usual 30 percent. This is because, as the SRI states, "Erosion potential is slight but when water is allowed to concentrate, erosion can be high." These following Mitigation Measures should be sufficient to avoid unnecessary resource damage (see also pp. 33-34):

1) Ground-based machinery will not operate where soil water content is high;

2) Prior to felling, skid trails will be pre-designated; and
3) Tractor logging would not be permitted on slopes steeper than 30 percent (20 percent in Unit 9).

Biological soil crusts
Biological soil crusts are not known to exist in the activity areas.

Slope Stability
No activities are proposed on soils designated as unstable or potentially unstable. Field surveys conducted May 1, 2007 identified unstable and potentially unstable slopes in some of the originally proposed units. Revisions to the proposal were made so that timber harvest activities avoided impacts to those soils. Therefore, none of the proposed activities will occur on unstable or potentially unstable soils. A map available in the project record shows where potentially unstable soils and inventoried landslides occur in relation to the proposed action.

Direct and Indirect Effects

Soil Productivity – Locally Concentrated Losses
The potential effects of the proposed activities on soil productivity are compaction, puddling, displacement, and erosion. Timber harvest, fuels treatment and site preparation can result in soil damage and loss of site productivity.

Soil compaction inhibits root elongation, reduces the infiltration and storage of water and decreases the gaseous exchange between roots and the atmosphere. This can inhibit seedling establishment and can reduce the growth of trees. Reductions in future timber volume are proportional to the degree and extent of compacted soil.

Puddling affects soil productivity in much the same way as compaction. Displacement of topsoil can remove soil nutrients from the root zone of desired vegetation and expose the soil to the forces of erosion. Soil erosion can result in nutrient-rich topsoil moving down slope, away from the root zone of desired vegetation. If eroded soil reaches a stream, it can impair water quality. Exposed mineral soil may promote the invasion of a site by undesirable vegetation.

Based on the best information available, the Standards and Guidelines are believed to be adequate to protect the soil resource. The extent and distribution of detrimental soil impacts such as compaction, displacement, and severe burning, measured in percent of each activity area, are used to analyze the effects of management activities on long-term soil productivity.

Logging and site preparation can affect the numbers of species and abundance of soil organisms. Some of these organisms, called mycorrhizae, have been shown to significantly affect forest growth and productivity. Mycorrhizal fungi assist trees in absorbing water, nutrients and provide protection from pathogen attack. Soil compaction, loss of soil organic matter, and changes in vegetation can affect soil organisms.

Efforts to minimize soil disturbance, maintain organic matter, and encourage rapid growth of native vegetation would help to conserve soil organisms, facilitate re-colonization, and

maintain forest productivity. Many of these efforts are covered by the mitigation measures listed in Section 3.2.

Changes in soil productivity are a function of the type, timing, and location of disturbances, and of soil properties in the disturbed areas. Direct effects due to soil disturbing activity occur on site and affect only the area where they occur. Off-site effects, such as sedimentation to streams, occur some time after or some distance away from the disturbance.

Soil productivity would be lost where temporary road and landing areas are built because the surface organic layer which provided nutrients for vegetative growth generally is displaced and not available. Under the action alternatives, the standards and guidelines for soil productivity would be achieved in all activity areas. Full recovery of productivity on temporary roads and landing areas would not be anticipated despite efforts to reclaim these areas because of the nutrient loss.

The losses in productivity from these areas would occur on a small part of the planning area, and the analysis between alternatives is mostly the comparison of the extent of this impact.

Alternative 1

Alternative 1 is the No Action alternative. All the activity areas currently meet the standards and guidelines for soil productivity. The current condition would not change significantly, other than as stated in the cumulative effects for other reasonably foreseeable actions that could cause soil disturbance within the project area.

Alternative 2

Alternative 2 is the Proposed Action of commercially thinning of up to 412 acres in the Woods Creek Watershed. A combination of skyline and ground-based logging systems are proposed.

Ground-Based Logging

This alternative would involve ground-based logging of all the Woods Creek Thin Units except Unit 3, which would use a skyline logging system.

Potential effects of the proposed activities on soil productivity are due to compaction, puddling, displacement, erosion, and loss of soil organic matter. Irretrievable losses in soil productivity due to soil disturbing activities are limited to permanent features of the transportation system including National Forest system roads, non-system roads, landings and skid trails that are not subsoiled because they are not part of the proposed action.

Soil impacts would remain less than 20 percent of the project, including existing skid trails. Locally concentrated losses in soil productivity would occur due to additional compaction and displacement. Additional soil damage is expected to be minor with the prescribed logging system design. The percent area to be affected by project temporary roads and landings ranged from 0 to approximately 3.3 percent, was calculated based on the proposed action, and is listed in the column "Project Specific Soil Disturbance" in Table 4.6.4. No net loss in soil productivity is predicted in any of the units according to the column "Remaining Compacted Soils (with mitigation measures)" in the table. The detrimental conditions listed include both

the new and existing roads and landings.

About 6.6 acres of new road and landing construction or reconstruction would occur within the harvest unit boundaries. Once areas have been cleared for roads and landings, the topsoil would not be completely restored. Decaying slash and other organic matter, seeding, and natural processes would be partially restored. In assessing soil disturbance, the column labeled "Remaining Topsoil Displacement" assumes a slow recovery in the short term (see Soils Report in project record).

Table 4.6.4. Alternative 2 potential for remaining detrimental soils conditions due to proposed (temporary) road and landing construction

Unit No.	Project-Specific Soil Disturbance[5]	**Remaining Topsoil Displacement (without mitigation measures)[6]**	Remaining Compacted Soils (with mitigation measures)[7]
1		3.6%	3.6%
2		4.3%	4.3%
3	1.9%	4.0%	1.6%
4	3.3%	9.9%	6.6%
5	1.4%	5.1%	3.7%
6	2.1%	5.9%	3.4%
7		2.4%	2.4%
8		3.1%	0.9%
9	0.3%	5.6%	5.0%
10		8.9%	8.9%
11	0.9%	5.7%	4.1%
12	3.1%	5.4%	2.3%

Skyline Logging

Monitoring of skyline logging has shown relatively little damage to soils when done correctly. An insignificant amount of detrimental soil conditions, including displacement and erosion would be expected.

Long-Term Effects (> 50 years)

Conditions in disturbed areas would have improved where restored by subsoiling, fertilization and revegetation. Logging slash is an important source of organic matter that supplies sites with nutrients and reduces the potential for surface erosion. Harvesting only the bole of trees does not greatly deplete nutrients, and losses tend to be associated with whole tree harvest and

[5] Temporary roads and landings
[6] "Worst case" scenario, using cumulative displacement of roads and skid trails that disturb the topsoil
[7] Using system roads and remaining skid roads & landings as permanent compaction features

short rotations. Neither whole tree harvest nor short rotations would be conducted or employed in this sale.

Alternative 3

Alternative 3 excludes the creation of any new temporary road construction, and modifies the unit boundaries where the new temporary road construction was the only viable means of harvest. The distribution of proposed and existing temporary roads and landings is displayed on a map that is available in the project record. Approximately 2.5 acres of landings and roads would be minimally reconstructed for purposes of timber harvest under Alternative 3.

Soil impacts would remain less than 20 percent of the project, including existing skid trails. Locally concentrated losses in soil productivity would occur due to additional compaction and displacement. Additional soil damage is expected to be minor with the prescribed logging system design. The percent area to be affected by project temporary roads and landings ranged from 0 to approximately 2.2 percent, was calculated based on the proposed action, and is listed in the column "Project Specific Soil Disturbance" in Table 4.6.5. No net loss in soil productivity is predicted in any of the units according to the column "Remaining Compacted Soils (with mitigation measures)" in the table. The detrimental conditions listed include both the new and existing roads and landings.

In assessing soil disturbance, the column labeled "Remaining Topsoil Displacement" assumes a slow recovery in the short term (Table 4.6.5). The percentages are based on calculations and assumptions listed in Appendix B.

Table 4.6.5. Alternative 3 potential for remaining detrimental soils conditions due to proposed (temporary) road and landing construction

Unit No.	Project Specific Soil Disturbance[1]	Remaining Topsoil Displacement (without mitigation measures)[2]	Remaining Compacted Soils (with mitigation measures)[3]
1		0.4%	0.4%
2		3.4%	3.4%
3	0.7%	3.7%	3.0%
4		11.4%	11.4%
5		4.5%	4.5%
6		9.3%	9.3%
7		4.1%	4.1%
8	2.2%	5.9%	3.7%
9	0.4%	3.4%	3.1%
10		13.1%	13.1%

11		4.3%	4.3%
12		2.4%	2.4%

[1] Temporary roads and landings
[2] "Worst case" scenario, using cumulative displacement of roads and skid trails that disturb the topsoil
[3] Using system roads and remaining skid roads & landings as permanent compaction features

Slope Stability

In this project proposal, slope stability is not a concern because slopes of the activity areas are not considered unstable or potentially unstable and were not delineated (Wade, et. al., 1992) as potentially unstable.

Alternative 1

There would be no change in the rate, size, or number of mass wasting (slope failure) events in Alternative A.

Alternatives 2 and 3

The risk of increasing landslide frequency or magnitude in the project area is negligible. The proposed activities will not occur on unstable or potentially unstable soils.

Cumulative Effects

Cumulative effects on the soil resource include all past, present, and reasonably foreseeable actions that cause soil disturbance within the project area.

Table 4.6.6. Actions Considered in Cumulative Effects Analysis

Action	Description	Date
Past		
Timber harvest on National Forest System Land	Previous timber harvest in managed stands of Woods Creek Stewardship Thin.	
Present and/or Ongoing		
National Forest System roads	Maintenance and use of system roads.	Ongoing
Timber Sales	Timber harvest on National Forest Lands in the watershed Regeneration harvest on private lands in the watershed	Ongoing
Forest Trails	Management of forest trails including erosion work, route signing, and maintenance.	Ongoing
Future		
Road decommission	Restoration of watershed through road decommission of National Forest System roads. Road decommission projects currently being planned as part of the Lower Cispus Roads Project. Up to 21 miles of road decommissioning and culvert replacement projects; up to 3.7 miles related to the proposed action, up to 2.1 harvest related.	

Soil Productivity

In general, the losses predicted are relatively minor in intensity, and vary with time. Short-term losses would be low to moderately damaging to soil quality. This should translate to similar effects on soil productivity.

For units where temporary road and landings would not be constructed or re-constructed, the existing condition would be same as the extent of detrimental conditions remaining (Table 4.6.4 and Table 4.6.5).

Slope Stability

Cumulative effects to slope stability could become an issue where a large amount of human-induced landslides are occurring in the area. There are no known cumulative effects to slope stability from the proposed action alternatives; because the rate, size, or number of mass failure events are not likely to change due to the proposed action alternatives or the no-action alternative.

Road Decommission

Road decommissioning will restore detrimental soil conditions where soil compaction is reduced by subsoiling and ripping. Restoration of watershed conditions will occur through road decommission of approximately 3.7 miles of National Forest System roads in the proposed action. Up to 2.1 miles of harvest-related road decommissioning will occur after timber harvest activities are complete. Refer to Section 4.7 for a detailed list of road decommissioning projects.

Vegetation Management

Roads represent the greatest amount of detrimental, lasting soil damage. Constraints and mitigation measures such as requiring the use of existing roads and skid trails and rehabilitation of any excesses by subsoiling will keep the impacts below the limit.

The proposed activities (with incorporated design features), in combination with past or reasonably foreseeable future actions on nearby federal land and adjacent private land, are not likely to increase the amount of detrimental soil conditions already existing. Soil disturbance from natural events and past management activity were described in the Affected Environment section.

Temporary roads and landings can be restored to accelerate their recovery and reduce long term losses in soil productivity. That recovery is accounted for in the right column of Table 4.6.4 and Table 4.6.5 labeled “Remaining Compacted Soils.” Between about 3.0 (Alternative 2) and 1.6 (Alternatives 3) acres of temporary roads and landings would be used within the harvest unit boundaries. The majority of the remaining compaction is from National Forest System Roads.

No new permanent roads are being proposed on Forest Service lands within these watersheds through any other projects. Areas of previous harvest that do coincide with Woods Creek Stewardship Thin harvest units are expected to decrease detrimental soil conditions by

restoring re-used skid trails and landings according to Mitigation Measures which would result in improved soil conditions.

Soil Organisms– Locally Concentrated Losses

Soil-dwelling organisms are not specifically addressed by standards and guidelines at either Forest or Regional levels. No long term net loss in populations of soil organisms would be expected in any of the units. Locally concentrated losses would occur in the short term due to compaction and displacement, but populations would recover in the long term as conditions improve and they have time to re-colonize disturbed areas.

Recreation Trails

Recreational use of trails is so spread out and limited in acres that the cumulative effects would be minimal across the units.

Summary of Cumulative Effects on Soil Productivity

The combined effects of most future activities, including the proposed action, would cumulatively improve productivity of the soil, mostly because due to restoration activity that reduces soil compaction by subsoiling and ripping.

4.7 Hydrology

Background

This analysis is based on an action area expected to be affected directly or indirectly by the proposed action and alternatives, and not merely the immediate area involved in the proposed action. The Woods Creek Stewardship Thin hydrologic analysis area, as designated as per this section and the Fisheries section, is located within one 5th field watershed (Lower Cispus) and a very small portion of the Middle Cowlitz watershed within the Woods LSR. Less than five acres is located within the Middle Cowlitz watershed. In this analysis, these 5 acres will be analyzed as part of the Woods Creek subwatershed within the Lower Cispus 5th field watershed, since they are located along flat hilltop areas where watershed lines may not have been mapped correctly due to the gross scale used to complete watershed delineation mapping. The proposed action includes six 6th field watersheds all contained in the Lower Cispus 5th field watershed, as shown on Table 4.7.1.

Table 4.7.1. Location of harvest unit acres and their respective Hydrological Unit Codes (HUC) for the Woods Creek Stewardship Thin, Lewis County WA.

Subwatershed Name	HUC Number	Total HUC Area (ac)	Analysis Area within LSR (ac)	Commercial Thinning area within each HUC (ac)	Restoration Sites[1] (Number of projects)
Yellowjacket Cr.	170800040501	29,725	245	0	2
Camp Cr. - Cispus R.	170800040503	11,619	4,751	0	3
Greenhorn Cr.	170800040504	10,000	5,828	6	3
Iron Cr.	170800040505	23,143	1,380	0	2
Woods Cr.	170800040506	8,030	6,804	204	4
Lower Cispus R. Frontal	170800040508	14,738	4,871	202	4

[1]several projects are in multiple watersheds

Physical Conditions

Annual precipitation in the analysis area ranges between 60-80 inches per year with the greater amounts of precipitation falling at the higher elevations between the months of October and May. Soils are volcanic in origin with high pumice and ash content. They are typically coarse textured and well drained with depth to bedrock greater than 40 inches. For more detailed information on soils see the Soils Effects Analysis for the project (Section 4.6).

Stream Temperature

Previous management activities in some areas have likely increased stream temperatures within the Lower Cispus River watershed, although to what degree is uncertain.. Stream temperatures exceed 16.0° C throughout the Lower Cispus River watershed. Several streams in this surrounding subwatershed areas have been rated as 303(d) waters, but only a few of these stream reaches are in close proximity or might have the potential to be affected by the project. Table 4.7.2 lists 303(d) streams in the project area and the project activity that could affect a listed stream or a tributary to a listed stream.

Table 4.7.2 Washington stated water quality-limited streams which are 303(d) listed water bodies and located near or adjacent to elements of the Woods Creek Stewardship Thin.

303(d) Category	Stream Name	Location on River	Proximity to Project Element
5	Cispus River	Just below confluence with Greenhorn Creek.	near timber unit 7
5	Cispus River	Just above confluence with Iron Creek.	near NS-7 road decommission
5	Greenhorn Creek	Just above confluence with Cispus River	near 7600667 road decommission
5	Iron Creek	Lower sections of stream before outlet into Cispus River.	near 7600012 road decommission and riparian underplanting and conifer release
4	Yellowjacket Creek	Lower sections of stream before outlet into Cispus River.	near Floodplain restoration and Riparian underplanting and conifer release on Yellowjacket Creek
2	Woods Creek	Downstream of confluence with Ames Creek.	near timber unit 12
2	Cispus River	Above and below confluence with Yellowjacket Creek.	near Floodplain restoration on Cispus River

The Cispus River is the main water body in the Woods LSR, and it regularly exceeds Washington State 303(d) standards. Water temperature data in the Cispus River above Greenhorn Creek was found to have a maximum 7-day high of 17.4^{o}C in 2000, 18.4^{o}C in 2003 and 17.9 ^{o}C in 2004. Several other streams in the Lower Cispus River watershed regularly exceed 303(d) water temperature standards. Greenhorn Creek, Yellowjacket Creek and Iron Creek have the warmest waters flowing into the Cispus River within the Lower Cispus River watershed and exceed 16^{o}C for prolonged periods during the summer (Table4.7.3). All the subwatersheds flowing into the mainstem Cispus River within the Lower Cispus River watershed have small relative flow contributions (10% or less) and so their stream temperatures are a limited influence on the temperatures of the mainstem. (USDA 2003b).

Table 4.7.3. Stream temperatures for fish bearing streams within the Woods LSR (USDA 2005).

Stream Name	*Year Surveyed*	*Rosgen Channel Type*	*Stream Temperature – 7 day average High (oC)*
Yellowjacket	2005	C/B	19.1
Greenhorn	2005	B/A	17.9
Iron	2005	B/F	17.7
Woods	2005	B/E	19.1
Ames	1999	C	14.3
Siler	2005	B	15.3

Several of the major tributaries (Yellowjacket Creek, Iron Creek, Greenhorn Creek, Woods Creek, and the lower portion of the Cispus River) regularly exceed 16° C during the summer rearing period. Only chinook salmon spawn during the monitoring period. Of the streams listed only the Cispus River and Yellowjacket Creek contain the typical spawning habitats of chinook salmon. Both of these streams have cooler water refuges upstream from the monitoring sites. Therefore the analysis area was rated as "Functioning at risk (USDA 2003x)."

Direct, Indirect, and Cumulative Effects of All Alternatives

Under the no action alternative, stream temperatures would likely decrease over time, but at a very slow rate. These temperature decreases would result from improved stream-side vegetation that would grow taller and eventually provide more shade to streams. Of course, some areas have few if any conifers along stream banks, and conifers branches are denser than hardwoods and therefore provide more effective shade to the ground and adjacent streams. Such areas will continue to have high water temperature problems for many years until conifers can become established, which is made difficult to a lack of immediate seed source. These processes are expected to occur at a slow rate, and the already identified water temperature problems would linger for possibly another century or more.

Additionally, existing roads and stream crossings provide increased sediment delivery if left unmaintained. This additional sediment can increase stream width and subsequently potentially increase stream temperatures by decreasing water column depth. As such, the no action alternative would likely again produce short term increases in stream temperature if roads go unmaintained, which is expected under the no action alternative due to the current shortfall of funding to maintain the full extent of Forest roads. Over time, the road and stream network would reestablish itself in a self-maintaining condition, and the effects of sediment on stream temperature would be alleviated. This long-term improvement of stream temperature would likely take centuries to occur.

Water temperatures would likely be affected by all action alternatives of this project with a long term trend toward lowering water temperature in Yellowjacket Creek and the Cipsus River. Timber harvest activities would not affect stream temperature. The only effects that are expected will result from the restoration activities that are proposed under both alternatives.

Commercial thinning can have the potential to increase stream temperature by cutting shade-producing vegetation and by increasing sediment delivery to streams. Commercial thinning in this project would not occur in close proximity to streams. No-cut buffers have been prescribed on all streams, ponds, and wetlands in part to protect existing shade-producing trees from being cut. The minimum no-cut buffers in the Woods Creek Stewardship Project of 280 foot on fishbearing streams and 140 foot on non-fishbearing streams (where the site potential tree height is 210 feet) are wider than the necessary primary shade zone for adequate shade to prevent increases in stream temperatures. Additionally, any possible sediment delivery from these activities would be within the natural range of variability and would not produce any significant change to geomorphic processes or stream temperature. The probability of increased temperatures as a result of commercial thinning in this project is very low due to the project design features.

Several restoration activities in this project would affect stream temperature and are specifically designed to decrease water temperature over the long term. The Riparian Conifer Release, Western redcedar underplanting (within the riparian reserves), and the Cispus River floodplain and riparian restoration projects all would produce lower stream temperatures. The riparian conifer release project and the cedar underplanting project would both decrease stream temperature by improving effective shade-producing vegetation within the riparian reserves. The Cispus River floodplain project would decrease stream temperature by affecting geomorphic processes and sediment delivery to the Cispus River. Although the closure treatment of stream-side non-system roads has the potential to improve stream shade in several areas by allowing trees to return to these currently compacted soils, stream-side shade is not expected to be improved enough to effectively lower stream temperature.

Some negative effects are anticipated as a result of one restoration project. Water temperature may initially increase as a result of the Riparian Conifer Release project, since hardwood vegetation within the riparian reserves would be cut to allow sun to reach the underlying conifers. This short-term affect would begin within the first summer after implementation and is expected to subside over time, since the targeted conifers would grow taller much faster than under current conditions and conifers provide more effective shade to streams than hardwood trees. This project accepts that a short-term negative effect on stream temperature would be a cost associated with attaining the goal of lower stream temperatures in a shorter amount of time than under current conditions and the no action alternative.

The effects of this project on stream temperature are indicative of the cumulative effects that are expected to occur in the project area. The Forest Service is focused on improving water temperature issues through restoration projects, while using Best Management Practices (USDA, 1988) on all projects to ensure stream temperature is not adversely affected. The net result of all land management activities are expected to decrease or maintain stream temperature from the current condition throughout the project area.

Suspended Sediment-Intergravel DO/Turbidity

Of the various surface erosion processes at work in the watershed, sediment delivery via roads is the most prevalent (USDA 2002). Principal mechanisms for sediment delivery to streams from roads in the analysis area are surface gravel from exposed cut-and fill-slopes, side-cast and fill-slope failures, and undermining of roadbeds due to gully erosion associated with insufficient drainage. Additionally, a lack of road maintenance has increased the risk of culvert failure, which could provide additional sediment delivery to streams.

The three subwatersheds in this analysis area where the most sediment delivery from roads is occurring are Iron Creek, Camp Creek-Cispus River, and Lower Cispus River Frontal (Table 4.7.4). The three subwatersheds with the most acres of management related landslides are Yellowjacket Creek, Iron Creek, and Camp Creek-Cispus River.

Table 4.7.4. Length of roads delivering high amounts of sediment and total area of management-related landslides delivering sediment in the Lower Cispus River watershed (adapted from USDA 2003).

Subwatershed	Total length of road in the high category of sediment delivery (miles)	Landslide from management related causes (acres)
Yellowjacket Creek	8.9	140
Camp Creek-Cispus R.	10.4	85
Greenhorn Creek	1.2	14
Iron Creek	38.0	104
Woods Creek	5.3	0
Lower Cispus R. Frontal	9.5	43

There is an influx of sediments from roads on Yellowjacket Creek, Pinto Creek, Greenhorn Creek, and the upper portion of Iron Creek. The large amount of fine sediment in Woods and Ames creeks is typical of low gradient streams and naturally limits the quality of spawning gravels in these streams. Observations along the Cispus River and its tributaries indicate that the condition of spawning gravel ranges from properly functioning to functioning at unacceptable risk.

Direct and Indirect Effects

Thinning

Thinning outside of Riparian Reserves occurs in all 12 units of the sale under Alternatives 2 and 3. Minimum no cut/equipment buffer widths were determined based on site specific information, including stream class, and site potential tree height. Thinning in Riparian Reserves would occur at least 140 feet away from non-fishbearing streams and a minimum of 280 feet from fishbearing streams. The presence of aquatic features, minimum untreated buffer width, and proposed logging system for each unit in this project can be found in Table 4.7.5.

Table 4.7.5. Logging systems, presence of aquatic features and untreated buffer widths for proposed thinning units Woods Creek Stewardship project.

Unit #	Presence of Aquatic features and inner no-cut buffer widths*				Logging System (throughout unit and within outer Riparian Reserves)
	Wet Swale (ft)	Stream Class III & IV (ft)	Stream Class I & II (ft)	Pond >1acre in size (ft)	
1	70	140	None	140	Ground
2	70	None	None	140	Ground
3	None	None	280	None	Skyline
4	None	140	None	None	Ground
5	70	None	None	None	Ground
6	None	140	None	None	Ground
7	None	140	None	None	Ground
8	None	140	None	None	Ground
9	70	140	None	None	Ground
10	None	140	None	None	Ground
11	70	None	280	None	Ground
12	70	140	280	140	Ground

* Definitions of Stream Class:

- Class I streams support anadromous fish
- Class II streams support resident fish
- Class III streams have perennial flow and are not known to support fish
- Class IV streams have intermittent flow and are not known to support fish

Felling of trees is not expected to cause appreciable ground disturbance. Surface soil disturbance from thinning inside Riparian Reserves would occur primarily as a result of yarding activities when the trees are dragged along the ground surface to landings. Trees cut in the units identified for skyline logging would be yarded upslope by cable, with the leading edge of the tree suspended above the ground and the trailing end of the tree dragging along the ground surface. Soil disturbance is expected to occur along skyline paths in these units, making soil available for transport to the stream. However, the probability of this material entering the stream is low because water bars will be created post-harvest on these paths to disrupt overland flow and due to the distance of the disturbance to the stream. Additionally, the area of untreated forest between the thinning area and the stream would provide significant opportunities for any sediment-laden surface runoff to infiltrate the ground or be detained so that sediment settles out as the water flows across the undisturbed forest floor.

Due to the distance of thinning from the stream and the intervening untreated riparian forest between thinned areas and the stream, the magnitude of any sediment reaching the stream from thinning and yarding activities would be very low and probably not detectable. The project design features (water bars), distance of the activities from streams, and the presence of intervening riparian areas provides filtering of any sediment laden surface discharges from thinning and yarding outside of Riparian Reserves.

Hauling and Timber Harvest-Related Road Activities

Several types of road-related activities have the potential to produce sediment in this project. These actions include log haul and the associated road work, specifically:

- Road maintenance and reconstruction
- Temporary road construction
- Temporary landing construction

No new permanent roads will be constructed under this project, but several temporary features will be needed to provide effective access to timber units, including temporary roads and landings. Additionally, several miles of roads are proposed for decommissioning, including both roads used for log harvest and many other roads throughout the LSR that will not be used for timber harvest. Additionally, this project proposes to decommission several non-system roads that have been created by users and are providing additional sediment to areas within the LSR.

Log Haul

Approximately 39 miles of FS road would be used for this project under Alternatives 2 and 3. Primary haul routes for this project would be Forest Roads 25 and 23, and some combination of arterial and local roads. A majority of the haul routes on the national forest are unpaved, gravel or native surface roads. Some segments of the road network parallel or are in proximity to streams. Approximately 7.6 miles of unpaved roads will be used for haul in this project that either cross or lay within 100 feet of streams. In addition to the stream crossings, there are an approximately 600 ditch relief culverts within the planning area, some of which would have surface channel connectivity with nearby streams during periods of runoff.

Road maintenance and reconstruction

Prior to hauling, portions of the Forest Service System road network (system roads) will be treated to repair and improve drainage structures, improve the running surface of the road, and to clear vegetation along roadsides. Following haul, portions of the haul route will again be treated to repair damage done during logging and to restore the roads to a condition that supports normal forest uses and to ensure proper drainage and stability of the roads. Portions of the haul route that are in particularly poor condition will be reconstructed prior to haul activities. Road reconstruction includes application of surface rock, replacing damaged or poorly functioning culverts, adding ditch relief culverts where necessary, replacing or stabilizing fill and subgrade materials, and removing roadside vegetation that is encroaching on the road surface and preventing vehicular passage. No new permanent road construction will occur with this sale.

Planned action for all open permanent roads includes construction of typical drainage control device (e.g. resloping road grades and reestablishing ditch drainage), but several miles of road will need definite reconstruction. The project will pre-treat 3.4 miles of existing roads prior to haul. To improve access to units, pre-harvest road repair or reconstruction will occur on approximately 0.7 miles of currently un-drivable roads, and an additional 2.7 miles of road will be only receiving brushing. Pre-harvest repair will be completed on 1.8 miles of road that are currently closed. Heavy pre-harvest repair will be completed on 0.6 miles of road that are

currently closed and another 1.2 miles of closed road will be brushed only. Pre-harvest repairs will not include construction or reconstruction of any temporary stream crossing construction on system roads. Table 4.7.6 summarizes the pre-treatment road work proposed on system roads under this project. (Please note: Construction, heavy reconstruction, and minimal reconstruction of *temporary* roads is shown on Table .7.10.)

Table 4.7.6. Categorized pre-treatment of system roads in the Woods Creek Stewardship Project.

Road Number	Access to unit(s)	Closed Roads		Open Roads		Install Temp Culverts (# sites)	Length of road within 100 ft of streams (miles)	Aquatic Risk Rating
		Length of Brushing Only (miles)	Length of Heavy Reconstruction (miles)	Length of Brushing Only (miles)	Length of Heavy Reconstruction (miles)			
2305026	2	-	0.10	-	-	0	-	L
2305027	3	0.5	-	-	-	0	-	L
2504041	2, 3	-	-	0.30	-	0	-	L
2506037	4, 5	-	-	0.70	-	0	-	L
2506040	5	-	-	-	0.10	0	-	L
2506608	5	0.24	-	-	-	0	-	L
2508039	6	-	0.10	-	-	0	0.09	M
2508049	7	-	0.30	-	-	0	0.07	M
7700036	8	0.18	-	-	-	0	0.08	L
7700063	9	-	-	0.30	-	0	-	L
7700064	9	-	-	0.20	-	0	-	L
7700660	10	0.22	-	-	-	0	0.08	H
7700663	9	-	0.14	-	-	0	-	L
Total Lengths		**1.14**	**0.64**	**1.50**	**0.10**	**0**	**0.32**	**-**

Road repair will occur within the riparian reserve on 0.3 miles of closed system road. Table 4.7.6 identifies the units and road that require system road reconstruction within the riparian reserve as well as the aquatic risk rating for each road to be pre-treated to allow access for timber harvest activities. Heavy reconstruction is proposed on 0.16 miles of road within the riparian reserve to allow haul on FR 2508039 and 2508049.

Table 4.7.7. Harvest-related road treatments for system Woods Creek Stewardship project. (Only includes roads that will be treated in relation to timber harvest activities. Other roads will receive post-treatment including decommission, but these roads will not be used for timber harvest activities).

Road Number	Unit Access	Treated Miles	Pre-harvest improvements	Post-harvest treatment
2305026	2	0.10	Reopen by removing road closure berm, improve surface and drainage for haul and perform roadside brushing.	Restore surface road drainages in a self-maintaining condition and install road closure berm
2305027	3	0.50	Reopen by cutting overgrown vegetation, including some small tree removal	Restore surface road drainages in a self-maintaining condition and install road closure berm
2504041	2, 3	0.30	Perform roadside brushing, including some small tree removal	Restore road to a self-maintaining condition.
2506037	4, 5	0.70	Perform roadside brushing, including some small tree removal	Restore road to a self-maintaining condition.
2506040	5	0.10	Improve surface and drainage for haul and perform roadside brushing.	Restore road to a self-maintaining condition.
2506608	5	0.24	Reopen by cutting overgrown vegetation, including some small tree removal	Restore hydrologic connectivity, sub-soil and install road closure berm.
2508	6, 7	0.67	None	Restore hydrologic connectivity, sub-soil and install road closure berm.
2508039	6	0.10	Reopen by removing road closure berm, improve surface and drainage for haul and perform roadside brushing including some tree removal.	Restore hydrologic connectivity, sub-soil and install road closure berm.
2508049	7	0.30	Reopen by improving surface and drainage for haul and perform roadside brushing.	Restore hydrologic connectivity, sub-soil and install road closure berm.
7700036	8	0.18	Reopen by cutting overgrown vegetation, including some small tree removal	Restore hydrologic connectivity, sub-soil and install road closure berm.
7700063	9	0.30	Perform roadside brushing, including some small tree removal	Restore road to a self-maintaining condition.

Road Number	Unit Access	Treated Miles	Pre-harvest improvements	Post-harvest treatment
7700064	9	0.20	Perform roadside brushing, including some small tree removal	Restore hydrologic connectivity, sub-soil and install road closure berm.
7700663	9	0.14	Reopen by cutting overgrown vegetation, including some small tree removal	Restore hydrologic connectivity, sub-soil and install road closure berm.
7700660	10	0.22	Reopen by removing road closure berm, improve surface and drainage for haul and perform roadside brushing including some tree removal.	Restore hydrologic connectivity, sub-soil and install road closure berm.

Road Decommission

Several roads will be decommissioned to reduce road density, reduce harassment to wildlife, and reduce sediment input from under-maintained roads. Stream crossing structures (culverts) will be removed during decommissioning activities. A total of 3.74 miles of system road and between 1.3 and 1.5 miles of non-system road are proposed for decommission in this project.

Of the 1.8 miles of closed system road that will be opened for this project, 0.4 miles will be returned to a closed and stable condition after harvest, since these roads provide access to other parts of the LSR and will be needed in the future. The remaining 1.4 miles of reopened closed road will be decommissioned after timber harvest. An additional 0.7 miles of road used to harvest units will be decommissioned after timber harvest activities are complete for a total of 2.1 miles of harvest-related road decommissioning. A more detailed description of the timber harvest-related road work is found in Table 4.7.7.

Several other roads will be decommissioned during this project that are not related to timber harvest activities. A complete list of all system roads to be decommissioned and whether decommissioning will occur during post-harvest timber activities is summarized in Table 4.7.8. All of these roads are proposed for decommission under both alternatives.

Table 4.7.8. All system roads proposed for decommission as part of Woods Creek Stewardship Project.

Road Number	Beginning Mile Post	Ending Mile Post	Length to be decom-missioned (miles)	Aquatic Risk Rating	Within Deer and Elk Winter Range?	Timber harvest-related work?
2308658	0	0.10	0.10	L	yes	no
2308659	0	0.08	0.08	L	yes	no
2308660	0	0.06	0.06	L	yes	no

2500109	0	0.14	0.14	M	yes	no
2504630	0	0.10	0.10	L	yes	no
2504631	0	0.31	0.31	L	yes	no
2505016	0	0.10	0.10	M	yes	no
2506608	0	0.24	0.24	L	yes	yes
2508000	3.23	3.90	0.67	H	yes	yes
2508039	0	0.10	0.10	M	yes	yes
2508046	0	0.53	0.53	M	yes	no
2508047	0	0.10	0.10	M	yes	no
2508049	0	0.30	0.30	M	yes	yes
7600012	0	0.07	0.07	M	yes	no
7600667	0	0.10	0.10	M	yes	no
7700036	0	0.18	0.18	L	yes	yes
7700064	0	0.20	0.20	L	no	yes
7700660	0	0.22	0.22	H	yes	yes
7700663	0	0.14	0.14	L	no	yes

Some additional sites located off the Forest Service network (non-system roads) have been identified for decommissioning in this project. The non-system roads and proposed treatments under each alternative are summarized on Table 4.7.9. Approximately 1.3 and 1.5 miles of non-system road would be decommissioned under Alternatives 2 and 3, respectively.

Table 4.7.9. Non-system (NS) sites/roads to be decommissioned under each alternative of the Woods Creek Stewardship Project.

Site ID	Location	Alternative 2	Alternative 3
NS-1	Just south of 2505.016 spur	Place boulders at junction with 2505 and rip first 150 feet of track past corner.	Same as Alt. 2
NS-2	Opposite 2508.046 spur	Rip a few feet or berm entrance of track (2 locations), or just drop small boulders to create a visual deterrent. Lower priority for closure, and should be done in conjunction with a closure of 2508.046 spur of opposite track, which is a much higher priority.	Same as Alt. 2
NS-3	Along Cispus River, opposite 7600.014 spur	Allow motorized access to dispersed camping area and fire ring. Limit motorized access beyond camping area. Restrict vehicle motorized access to Cispus River with rock placement or parking bollards.	Rip entire length and rehab with native vegetation. Install traffic barrier.
NS-4	Along Cispus River, FR 76	Rip entire length and rehab with native vegetation	Same as Alt. 2
NS-	Along Cispus River, FR	Restrict motorized access beyond 40 feet from	Rip entire length

5	76	FR 7600. allow walk-in dispersed camping. Direct foot traffic away from steep Cispus River access.	and rehab with native vegetation. Install traffic barrier.
NS-6	Along Cispus River, FR 76	Rip entire length and rehab with native vegetation.	Same as Alt. 2
NS-7	Along Cispus River, FR 76	"Berm" entrance of track.	Same as Alt. 2.
NS-8	Just north of 7605.024 spur (Note: 024 spur was recently decommissioned)	Place boulders or large berm at entrance, whichever is easier or more efficient. Lower priority for closure.	Same as Alt. 2
Note: In Alt. 3, may just "rip" the first 70 feet of NS-3 and NS-5 to prevent traffic and scarify the remaining length to break up the compacted soil and restore hydrologic process.			

Temporary Road Construction

Approximately 1.8 miles of temporary road will be constructed to enable harvest activities, but not all of this road construction will occur on undisturbed soil. The goal of using temporary features in this project is to ensure they are effectively restored after they are used, but this goal was not always adopted in previous land management projects. Several temporary features to be used in this project have been used in the past, but not all of them have been effectively restored to natural conditions. Use of such features in this project would ensure these features receive effective restoration, so that they do not have lingering detrimental effects to the landscape.

During field reviews, these old, unrestored temporary roads were characterized by how much reconstruction would be necessary to use them for timber harvest activities. Old roads that needed the most reconstruction were categorized as needing "extensive" reconstruction, since they have effective recovered and were sometimes very difficult to identify on the ground. Old temporary roads that need little if any reconstruction prior to use were characterized as needing "minimal" reconstruction. These minimal reconstruction temp roads represent the roads that could be used to benefit timber activities and are in dire need of restoration in order to remove their negative effects on the landscape. As such, these roads were included in both alternatives, whereas roads that required new construction or extensive reconstruction were only included in alternative 2. A summary of these road lengths by category are summarized in Table 4.7.10.

Table 4.7.10. Lengths and types of temporary road construction associated with timber harvest of each unit under alternatives 2 and 3 of the Woods Creek Stewardship Project.

Unit	Length of temp roads with NEW construction (miles)	Length of temp roads needing EXTENSIVE reconstruct (miles)	Length of temp roads needing MINIMAL reconstruct (miles)	TOTAL length of temp roads (miles)	Length of temp Roads construction within RR (miles)	Which kind of Temp road is in the RR?	What type of aquatic feature is the RR protecting?
Alternative 2 - Temporary Road Construction							
1	0	0	0	0	0		
2	0	0	0	0	0		
3	0.07	0	0.14	0.21	0		
4	0.16	0	0	0.16	0		
5	0.12	0	0	0.12	0		
6	0.14	0.09	0	0.23	0.08	EXTENSIVE	Stream
7	0	0	0	0	0		
8	0	0	0.32	0.32	0.18	MINIMAL	Stream
9	0.08	0	0.10	0.18	0.10	NEW, MINIMAL	Pond
10	0	0	0	0	0		
11	0.00	0.22	0	0.22	0		
12	0.32	0	0	0.32	0		
Total	**0.9**	**0.3**	**0.6**	**1.8**	**0.4**		
Alternative 3 - Temporary Road Construction							
1	0	0	0	0	0		
2	0	0	0	0	0		
3	0	0	0.14	0.14	0		
4	0	0	0	0	0		
5	0	0	0	0	0		
6	0	0	0	0	0		
7	0	0	0	0	0		
8	0	0	0.32	0.32	0.18	MINIMAL	Stream
9	0	0	0.10	0.10	0.09	MINIMAL	Pond
10	0	0	0	0	0		
11	0	0	0	0	0		
12	0	0	0	0	0		
Total	**0**	**0**	**0.6**	**0.6**	**0.3**		

Temporary roads will be managed throughout the life of the project and then obliterated. If in use more than one season, roads will be weatherized prior to the onset of wet weather in the fall. Following completion of harvest, all temporary roads and skid trails will be treated including out-sloping, sub-soiling to a depth of approximately 18 inches to reduce ground compaction (in areas where greater than 60 feet of continuous soil compaction or displacement as identified by 6-inch deep ruts has occurred), and seeding and mulching. Native seed will be

applied as described in the mitigation measures. Prior to any expected seasonal period of precipitation and runoff, and after sale activities are complete, cross drains and grade breaks will be installed on all temporary roads and skid trails. In addition, the temporary spur road would be sub-soiled post-sale. In special cases (i.e. stream crossings, contributing areas near streams, or other sensitive areas along existing roads), mulch, erosion matting or re-contouring may be used as needed to prevent or reduce sedimentation. The expectation of this treatment includes the maintenance of soil permeability and soil productivity, and the near-elimination of increased channelization of surface flows in harvest units near streams originating from temporary roads and harvest related activities. Following harvest, all Forest roads used as haul routes will be restored to pre-harvest conditions with the exception of those that will be decommissioned for restoration purposes.

Table 4.7.11. Summary of temporary road construction proposed under each alternative within the Woods Creek Stewardship Project.

Road Construction Activity	Alt 2	Alt 3
Length of Temp Roads outside RR (miles)	1.41	0.30
Length of Temp Roads in RR (miles)	0.36	0.27
Total Length of Temp Roads (miles)	**1.77**	**0.57**
Temporary Stream Crossings (count)	**1**	**0**

Table 4.7.11 summarizes temporary road construction proposed under Alternatives 2 and 3. Road construction within the riparian reserve has the highest potential to effect sediment production. Approximately 0.4 miles would be constructed within the riparian reserve to provide access into units 6, 8, and 9 under Alternative 2, while Alternative 3 will include temporary road construction within the riparian reserves of units 8 and 9 (see Table 4.7.10). The road work within units 8 and 9 would be occurring in the outer edges of the riparian reserve and therefore provide no additional sediment to streams due to the extent of intercepting vegetation between the road work and the closest stream or pond.

One temporary stream culvert is to be placed for completion of this project under Alternative 2 and no crossings are proposed in Alternative 3. The placement of a single temporary stream culvert will require some excavation of stream material, placement of a new pipe, and replacement of fill material. Some direct excavation within the channel would need to occur to provide an adequate size and condition of the bed prior to laying new pipe. Although best management practices will be used to minimize the actual sediment introduced to the stream (see Mitigation Measures), there is no way to completely avoid sediment introduction and disturbance of the stream channel in this process. Fortunately, this stream flows intermittently and is not surficially connected to any other stream channel. This channel is expected to be dry at the time of the work and would not experience the increased turbidity until it is rewatered and as loose fill material and soil is mobilized and entrained in the flow. As transportable material is removed from the site, the turbidity levels decrease rapidly to near pre-project levels. These effects would be relatively short term pulses of high turbidity and sediment movement in the impacted stream, but this sediment would be deposited on the forest floor where the channel goes subsurface. As such this temporary stream crossing is expected to only

have effects on a site scale, and these effects will not be propagated downstream to any fish-bearing streams.

Temporary Landing Construction

Approximately 58 to 65 landings will be needed to harvest timber under Alternatives 2 and 3, respectively. Many of these landings are on existing road systems and will require only minor brushing around the edges to make them functional. However, some earthwork would be required to clear and establish a site that is suitable to landing logs and to provide access for log trucks. Some of these landings are located at previously used sites, while other landings will require totally new construction. Table 4.7.12 summarizes the landings to be constructed for each unit under each alternative, including which landings are roadside, reconstruction, or new constructions.

Table 4.7.12. Landing construction for each timber harvest unit within the Woods Creek Stewardship Project.

Unit	Treated Area (acres)	Area Disturbed by Landing construction (acres)	Landings needed to log each unit (#)	Construction Needed*
Alternative 2 - Landing Construction Info				
1	31.7	0	5	roadside
2	25.8	0.13	5	roadside (4), reconstr (1)
3	30.3	1.00	6	reconstr (4), constr (2)
4	16.1	0.25	6	roadside (4), reconstr (2)
5	54.1	0.19	6	roadside (4), reconstr (2)
6	36.1	0.63	7	roadside (4), reconstr (1), constr (1), reconstr in RR (1)
7	51.3	0.00	3	roadside
8	19.1	0.31	4	reconstr (3), constr (1)
9	62.1	0.50	10	roadside (8), reconstr (2)
10	10.4	0.06	3	roadside (2), reconstr (1)
11	47.2	0.50	6	roadside (4), reconstr (2), constr (1)
12	27.4	0.50	4	reconstr
Total	411.5	4.06	65	
Alternative 3 - Landing Construction Info				
1	31.7	0	5	roadside
2	25.8	0.13	5	roadside (4), reconstr (1)
3	24.2	0.5	4	reconstr
4	12.2	0	5	roadside
5	50.8	0.06	5	roadside (4), reconstr (1)
6	11.5	0.25	6	roadside (4), reconstr (1), reconstr in RR (1)
7	51.3	0	3	roadside
8	19.1	0.56	4	reconstr (3), constr (1)
9	50.8	0.13	9	roadside (8), reconstr (1)
10	10.4	0.06	3	roadside (2), reconstr (1)

Unit	Treated Area (acres)	Area Disturbed by Landing construction (acres)	Landings needed to log each unit (#)	Construction Needed*
11	50.6	0	6	roadside
12	14.8	0	3	roadside
Total	353.1	1.69	58	

*roadside = located on a currently open road and does not require construction
reconstr = located on a closed system or temporary road and needs reconstruction
reconstr in RR = located within a Riparian Reserve on a closed system or temporary road and needs reconstruction
constr = located on a new temp road and requires new construction

The total area of newly constructed landings is approximately 4.1 acres under Alternatives 2 and 1.7 acres under Alternative 3. Landings that lie outside normally traveled road surfaces would be rehabilitated by scarification, waterbarring where necessary, and application of seed and/or mulch as described in mitigation measures. Landings that are located in riparian reserves are likely to have the greatest effect on sediment production in streams. All landings in this project are located outside of riparian reserves, with the exception of one landing in unit 6 under both alternatives.

Summary of Effects of Road Activities

There is high likelihood that some sediment from the road surface will enter the Cispus River and tributaries from haul traffic, but also as a result of the road reconstruction and maintenance activities. In particular, small amounts of sediment are expected to reach riparian reserves from the 7.6 miles of non-paved roads that will be used for haul within 100 feet of streams, as well as the 350 feet of road within 100 feet of streams that will need repair or reconstruction. The operating season for road reconstruction and maintenance work and for hauling logs has been limited to include only the months of June through September. This has been done to reduce the amount and duration of erosion that occurs from the road-related activities. Nevertheless, disturbance of the road surface both by construction-related activities and by hauling will generate sediment and dust, and some of this material will be transported to the aquatic system either during the time of disturbance or during subsequent periods of runoff.

Road maintenance and reconstruction work and timber hauling will all create conditions that would allow increased erosion and sediment delivery to streams. Some sediment introduction would be expected during the summer months from the dust created by these activities and by subsequent vehicle traffic on the newly treated roads. Since the road work and hauling are scheduled for the dry months, most of the sediment delivery from these actions would occur later in the fall when precipitation and runoff levels increase. During the first significant runoff event of the fall, there would be flushing of sediments from road surfaces and roadside ditches into tributaries and surface channels that are connected to the stream. Based on research conducted elsewhere in the state of Washington, turbidity and suspended sediment levels would climb rapidly as ditchflow begins to occur during the first fall freshet, but would then rapidly decline as roads and ditches are essentially cleaned by the precipitation and runoff

(Reid 1981, Reid and Dunne 1984, Bilby 1985). Assuming all haul activities and road work occur during the dry months and that there are no unseasonable precipitation events, the amount of material actually transported to streams is expected to be relatively low during the period of haul and maintenance or reconstruction.

Restoration Activities

Only a few of the proposed restoration activities have a potential to affect the production of sediment into streams. Road decommissioning, restoring salmon rearing habitat, and restoring the Cispus River floodplain would all likely produce an increase in fine sediment delivery in the short-term, but sediment production is expected to decrease over time. The Cispus River floodplain and road decommissioning projects are specifically designed to provide a long-term reduction in sediment production to streams.

The greatest amount of sediment production is expected to occur as part of the salmon rearing habitat restoration, since this project would include excavation using heavy equipment to reestablish hydrologic connectivity between Yellowjacket Creek and stream-side salmon rearing habitat that has been cutoff due to both human and natural activities. The remaining restoration projects (Riparian conifer release, snag and downed wood creation, and western redcedar underplanting) would not affect sediment production into streams.

Project design criteria and mitigations would be used to minimize the effects of sediment production during restoration projects. All work that would be located within the bankfull channel, e.g. within the Salmon rearing habitat restoration and Cispus river floodplain restoration projects, would be limited to low-flow period, e.g. a state-mandated operational period of August 1-15, to minimize the production of sediment and the risk to fish. Although these mitigations would help reduce sediment production from restoration activities, sediment production is likely to occur, but would be limited to short term increases. Sediment would likely be produced during implementation and during the first substantial runoff event. Subsequent runoff events would contribute less and less sediment production, particularly as a result of the Cispus River floodplain and riparian restoration project. This project would reduce current sediment production along the banks of the Cispus River by providing in-stream and floodplain features (log jams and a bar retaining structure) and riparian vegetation that would halt sediment degradation. This project would provide decreased sediment production in the Cispus River immediately following implementation, once any loose sediment generated during implementation is redistributed during the first substantial runoff event.

Additionally, road decommissioning would eliminate sediment production in streams related to roads and road-side ditches. Road decommissioning would reduce sediment by improving infiltration through decompaction, reducing overland runoff in ditches by filling in ditches and outsloping road surfaces, and reducing road washouts by restoring hydrologic connectivity at road-stream crossings. These crossings would be restored by removing culverts that would otherwise restrict water passage and increase the risk of road failure. Excavation is used to remove culverts and restore the natural stream gradient, and this excavation would be the primary sediment producing activity in the road decommissioning activities. The only known culverts (4) that would be removed as a result of this project are located on the 2508 road in

streams that seem to be surficially disconnected to the Cispus River. Any sediment produced would be deposited on the forest floor where these streams go subsurface. Although road decommissioning activities would disturb between 7.3 (Alt 2) and 7.6 (Alt 3) acres of ground, the sediment produced from these activities are expected to be distributed on the forest floor and not contribute any additional sediment to fish-bearing streams.

Comparison of Alternatives

The primary differences between the proposed action alternatives can be illustrated by examining the commercial timber thinning activity, since the proposed restoration activities vary only slightly between alternatives. The proposed timber harvest activities can be compared using standard, measurable evaluation criteria. Table 4.7.13 summarizes the effects of Alternatives 2 and 3 through the water quality criteria related to increased sediment production.

Table 4.7.13. Comparison of proposed timber harvest activities from the Woods Creek Stewardship Project on maximum potential risk to increased stream sediment production.

Description	Indicator	Alt 2	Alt 3
Risk to increased stream sediment as a function of logging systems	Area of Skyline Corridor disturbance (acres)	0.3	0.2
	Area of Ground-based logging disturbance (acres)	72.9	65.0
	Total Area of Ground Disturbance (acres)	**73.2**	**65.2**
Risk to changes in stream sediment as a function of ground disturbance from temporary transportation features	Temp Roads construction outside RR (acres)	2.1	0.4
	Temp Roads construction within RR (acres)	0.5	0.4
	Area of New Landing construction (acres)	4.1	1.7
	Total Area of Ground Disturbance (acres)	**6.6**	**2.5**
Risk to changes in stream sediment as a function of crossing aquatic features	Temporary Stream Crossings on reopened roads (#)	0	0
	Temporary Stream Crossings on temp roads (#)	1	0
	Total Stream Crossings (#)	**1**	**0**

Sediment movement and production is likely to occur within timber harvest units due to ground-disturbing activities. Ground disturbing activities will not exceed those identified in Table 4.7.14 and are likely to be less. The areal extent of timber harvest units is greater in Alternative 2, therefore more vegetation removal and potential ground-disturbance is likely occur in these areas through Alternative 2 as compared to Alternative 3. Although more non-system road decommissioning will occur in alternative 2, this road will not produce sediment in streams since none of the targeted sites cross streams. Alternative 2 would produce the highest risk to sediment production in streams, but these effects are being mitigated as specified above. Fine sediment may reach the stream through timber harvest and the road activities, but the effects of this sediment should be short-term and should not reach detectable quantities above the baseline condition.

Cumulative Effects of All Action Alternatives

The effects described above for Alternatives 2 and 3 would be cumulative with other forms of sediment production and introduction in the Lower Cispus River watershed. General forest road use and maintenance contribute sediment to the river system. Also, road washouts and landslides have the potential to increase suspended stream sediment. No road washouts occurred in the Lower Cispus River watershed during the 2006 floods, and one washout occurred in the Quartz Creek subwatershed during the 2007 floods. Future flooding could create additional suspended stream sediment at any time.

Some additional work may be completed by the Forest Service in this area in regards to road stabilization, closures, and stream-crossing improvements. Table 4.7.14 summarizes several ongoing projects on Forest Service lands within the Lower Cispus River watershed.

Table 4.7.14. Project activity completed (2003-2008) or proposed in the foreseeable future on federal lands between in the Lower Cispus watershed. Lewis County, Washington.

Project Name	Primary Subwatershed	Thin/ Salvg Hrvst (ac)	Ripn Rsve Trmt (ac)	New Temp Rds (mi)	Recnd Temp Rds[3] (mi)	Road Decm (mi)	Clvert Replc[4] (no.)	Road Stbz (mi)	Instrm Hab (mi)	Fldpln Habitat (ac)
Yellowjacket Rd Decommissioning	Yellowjacket					6.0				
Iron Creek Road Stabilization Project	Iron							3.22		
Galena Thin Timber Sale	Yellowjacket	54				3.85				
Woods Creek Fish passage	Woods						1			
Iron Creek Road Decommissioning	Iron					0.3				
Upper Iron Thin 1 Timber Sale[1,2]	Iron	494 (891)	111	2.3	-	-	2			
Upper Iron Thin 2 Timber Sale[1,2]	Iron									
Iron Summit RR Timber Sale[1,2]	Iron	306 (342)	30	2.6	7.4	2.0	3			
Lower Iron Thin RR Timber Sale[1]	Iron									
Iron Horse Thin[1]	Iron	317	75	-	2.7	-	-	7.1		
Helitower Thin (units 6, 25)	Greenhorn	277 (165)	0		9.7		0			
Upper Greenhorn Timber Sale (unit 3)	Greenhorn	378 (54)	0				0	0		
Woods Creek Stewardship	Lower Cispus		94			2.2	1	1.0	0.5	60

Contracting										
Lower Cispus Roads	Yellowjacket / Iron					12.5		5.0		

[1]Acre value from Timber Information Management (TIM) database and value in parenthesis is as per the consultation LOC/BO (NOAA 1998)
[2]Upper Iron and Lower Iron DN both divided into two sales
[3]New Temp Rd construction is slated for restoration following timber operations.
[4]Culvert replacements accounts for Only live stream crossings

The cumulative effects for the Woods Creek Stewardship Project and these project will result in a trend toward restoring the long-term function and process of the aquatic ecosystem by improving vegetation diversity and reducing the effects of roads on stream sediment production.

Change in Peak/Base Flows

Vegetation manipulation can affect hydrologic processes at the stand scale, including changes in the interception of precipitation, changes in evapotranspiration, changes in snow accumulation, and changes in rates and timing of snowmelt. These hydrologic changes brought about by vegetation modification can affect the amount and timing of water that is available for runoff from a site, and thus can cumulatively affect streamflows. The degree to which these stand scale changes are manifested at the subwatershed scale in terms of changes in streamflow is dependent upon a number of factors related to both the extent and intensity of the forest manipulation, and characteristics of the site and subwatershed.

A model-generated index called the Aggregate Recovery Percentage (ARP) has been used to represent the proportion of a watershed in a "hydrologically mature" condition. As timber harvest occurs, a portion of the watershed land cover is no longer hydrologically mature, thus the ARP for that drainage is reduced from 100%. Over time, vegetation grows back and will eventually return to a hydrologic mature condition, thereby "recovering." The GPNF considers above 90 percent to represent a low risk of increased peak flows causing stream damage, while values between 80 to 90 represents a moderate risk and values below 80 percent represent a high risk. The peak flow risk cannot be adequately modeled using ARP for composite or frontal watersheds, which typically include a group of tributaries flowing directly a main stream (Philbin, 1998).

The second prediction factor for estimating peakflow sensitivity is by calculating Water Available for Runoff (WAR) percentages. WAR is an estimate of the predicted increase in streamflow due to changes in vegetative cover based on rainfall, tree size, temperature, antecedence snow accumulation and elevation. The GPNF considers WAR percentages below 10% to be below the detection limit, and no adverse effects are expected from increases of this magnitude (low risk). WAR percent changes above 10% have the potential for adverse effects and require further analysis (moderate or high risk). Site specific information is necessary to accurately determine high risk streams, since some streams have a higher sensitivity to peak

flow increases. Channel morphology, stream bed composition, and stream gradient all influence the potential sensitivity to peak flow increases. For example, particles smaller than cobble are more easily mobilized than those cobble or larger. Therefore, a smaller increase in peak flows is likely in streams dominated by larger rock.

Current Condition

The values of ARP, WAR, and peak flow risk rating for subwatersheds containing the Woods Creek Stewardship Sale area are summarized in Table 4.7.15.

Table 4.7.15. Peak flow risk ratings for subwatersheds in the Woods Creek Stewardship Sale area (adapted from USDA 2003).

Subwatershed	Drainage[1]	ARP in 1994 (%)	Estimated ARP (%) given over 10 years of recovery	WAR (% Increase in Peak flow During a 2 Yr. Unusual Event)	Risk of disturbance to flow regime from changes to hydrologic maturity of stands	Risk of disturbance to flow regime rating for the subwatershed
Yellowjacket Cr.	R	95	94	11	Low	Low
	Y	85	89	10	Low	
	S	85	89	4	Low	
	T	85	89	5	Low	
	U	90	84	7	Low	
Camp Cr-Cispus R.	Q	68	72	13	Moderate	Moderate – Camp Creek Drainage only
Greenhorn Cr.	K	87	91	4	Low	Low
	L	95	99	9	Low	
Iron Cr.	G	59	63	10	Moderate	Moderate
	H	61	64	10	Moderate	
	F	83	87	5	Low	
	I	69	73	7	Moderate	
	J	98	100	9	Low	
Woods Cr.	E	74	78	16	Moderate	Moderate
Lower Cispus R. Frontal	M	67	71	5	Moderate	Moderate – M drainage only

[1]Drainages represent true sub-basins, which enclose a single integrated stream network that drains to a single watershed outlet as found in the Lower Cispus Watershed Analysis (USDA 2003b).

These ARP values are not necessarily representative of the current condition, since they were developed based on 1994 data. The ARP values have likely increased over time due to stand growth and limited stand management, which would increase hydrologic maturity.

Increases in drainage network can provide additional information to assess peak flows in these drainages. Because roads can act to impede surface water infiltration, intercept subsurface flows, and provide a direct surface linkage to stream channels, the road network can substantially increase the natural drainage density of a watershed. Particularly during periods of high runoff, this effect can accelerate the rate at which water moves from hillslopes into

stream channels, and in this way can cause increases in the magnitude of peak stream flows (Wemple et al., 1996). Unfortunately, information regarding the increase in drainage density network was only available for the Yellowjacket, Greenhorn and Iron Creek subwatersheds, and no additional information could be gained on the watersheds where more information was needed to determine an accurate affect of peak flow risks (Camp Creek, Woods Creek, and a portion of the Lower Cispus River Frontal). As such, peak flow risk for these subwatersheds were assumed to be moderate since some vertical cut streambanks have been found on occasion. Since cutbank features do not dominate the mainstem channels, none of them were considered to be a high risk of disturbance due to peak flow increases.

Table 4.7.16. Baseline condition of risks to peak flow changes in subwatersheds of the Woods Creek Stewardship Project.

Subwatershed	Risk of disturbance to flow regime rating for the subwatershed from		Baseline rating of disturbance risk for the subwatersheds
	Changes to hydrologic maturity of stands	Increased drainage density network	
Yellowjacket Cr.	Low	Moderate	Low-Mod
Camp Cr-Cispus R.	Moderate - Camp Ck drainage only	Not analyzed	Moderate - Camp Ck drainage only
Greenhorn Cr.	Low	Low	Low
Iron Cr.	Moderate	High	Mod-High
Woods Cr.	Moderate	Not analyzed	Moderate
Lower Cispus R. Frontal	Moderate - Nash Creek drainage only	Not analyzed	Moderate - Nash Creek drainage only

Timber harvest is the only action within this project that may affect peak flows by reducing hydrologic maturity. Timber harvest activities will only occur in the Greenhorn Creek, Woods Creek, and Lower Cispus River Frontal subwatersheds. These primary subwatersheds have a low to moderate potential for adverse effects related to peak flows. Due to this rating, this element on a project scale remains "Functioning at risk."

Direct and Indirect Effects

This project is expected to have no measurable effects on peak or base flows in the Cispus River due to the high retention of riparian and upland vegetation. The alternatives being considered would thin between 353 and 412 acres with a commercial harvest prescription, and thinning would occur in about 68 percent of that area due to skips and riparian and wildlife management buffers. The area being treated with a commercially harvest prescription ranges between 0.1 and 2.5 percent of the each contributing subwatershed areas, as shown in Table 4.7.18.

Table 4.7.17. Acres and percent of each subwatershed receiving commercial treatment within the Woods Creek Stewardship Project.

Subwatershed	Total Subwatershed Area (acres)	Woods Creek Thinning Units within each subwatershed	Alt 2	Alt 3
Greenhorn Creek 170800040504	10,000	Total Unit Area (acres)	6.4	6.4
		Percent of Subwatershed	0.1%	0.1%
Woods Creek 170800040506	8,030	Total Unit Area (acres)	203.6	181.1
		Percent of Subwatershed	2.5%	2.3%
Lower Cispus R. Frontal 170800040508	14,738	Total Unit Area (acres)	201.5	165.6
		Percent of Subwatershed	1.4%	1.1%

The post-treatment canopy closure of all commercially thinned units will range between 50 and 69 percent. These areas will have the greatest density of vegetation removed in this project with all other portions of the Woods Creek Stewardship project leaving higher canopy closures. Since all proposed canopy closures exceed the 40 percent threshold presented earlier, we assume that thinning the forest to this canopy closure may have some effects on the amount of water available for runoff, but changes at the site scale would be moderated by the remaining forest cover, and not likely to get translated into measurable changes in stream discharge because of the complexities of water routing from hillslopes into nearby streams. Consequently, changes in peak flows or WAR at the stand or site scale are not expected to occur from the proposed thinnings. As such, the magnitude of any changes in peak flows resulting from timber harvest in the Woods Creek Stewardship project is estimated to be low and undetectable in the normal variation of streamflow levels found in these streams based on the intensity of the proposed thinning treatments and small proportion of the subwatersheds treated in all alternatives.

Cumulative Effects of All Action Alternatives

These alternatives would cumulatively affect forest canopy conditions in the analysis area due to the proposed modifications in canopy cover. Table 4.7.18 summarizes past regeneration harvest and commercial thinning activity on National Forest land by subwatershed. This table also summarizes the distribution of timber harvest proposed under Alternative 2.

Table 4.7.18. Past and Proposed commercial thinning on National Forest System Lands by subwatershed within the Lower Cispus River Watershed. (Adapted from USDA 2003).

Commercial Thinning By Subwatershed and Decade										
	Historical Harvest Area by Decade (acres)							Proposed area of Comm Thinning (acres)	Total area of Comm Thinning (acres)	% of Sub-watershed area
Subwatershed	1940	1950	1960	1970	1980	1990	2000			
Yellowjacket Cr.			82	384	489	781	55	0	1,791	6%
McCoy Cr.						113		0	113	1%
Camp Cr Cispus R			642	288	1189	351	37	0	2,507	22%
Greenhorn Cr.			21		267	6	655	6	955	10%
Iron Cr.							1310	0	1,310	6%
Woods Cr.					171	60	18	204	453	6%
Quartz Cr.					129			0	129	1%
L Cispus R Frontal			117		56		5	202	380	3%
Totals	0	0	862	672	2,301	1,311	65	411	7,637	6.21%

Approximately 6 percent of the National Forest lands within the Lower Cispus River watershed have been commercially thinned between now and 1940 (USDA 2003). An unknown amount of the non-National Forest ownership has also been harvested. This project does not include any regeneration harvest.

The post-treatment canopy closure of all commercially thinned units in this project will range between 50 and 69 percent. This project is expected to have no measurable effects on peak or base flows in the Cispus River due to the high retention of riparian and upland vegetation.

Increase in Drainage Network

Roads can increase the total volume of water available for rapid transport to stream channels in two ways. The drainage network extension is rated as "Functioning at risk" at the subwatershed scale and project scale. Table 4.7.19 summarizes stream length and drainage density of non-frontal subwatersheds in the Woods Creek Stewardship area. This table also includes estimated increases in the stream channel network that have occurred as a result of existing road construction on National Forest Lands. Only non-frontal subwatersheds were estimated herein since this methodology is only appropriate for true watersheds.

Table 4.7.19. Estimated drainage network increases within the Woods Creek Stewardship Project analysis area.

Drainage	Area (mi^2)	Drainage network length, miles		Drainage density, mi/mi^2		Percent change
		Streams (L_S)	Road-related extension (L_{RC})[1]	Streams (D_d)	[1]Total (D'_d)	
Yellowjacket Cr.	46.4	90.3	8.8	1.94	2.13	10%
Greenhorn Cr.	15.6	28.7	2.1	1.84	1.97	7%
Iron Cr.	36.2	44.6	10.2	1.23	1.52	23%

[1] Assumes distances between stream crossings and relief culverts is 200 feet. Drainage network increase is considered high "risk" >20% and moderate 10% to 20%.

Drainage network increase is considered high risk at greater than 20 percent increase in drainage density and at a moderate risk when increases range between 10 and 20 percent. Stream channel network extensions were estimated to be highest in the Iron Creek subwatershed with a 23 percent increase over the pre-management (and pre-road) drainage density condition.

Direct and Indirect Effects

Drainage network extension will be decreased by this project in two subwatersheds. The only project element that is expected to affect the drainage network is road decommissioning, which is proposed for 3.74 miles of road in this project. No permanent roads would be constructed, so drainage network is not expected to increase at all. All proposed action alternatives would construct temporary roads to access landings and thinning units, including one temporary stream crossing in unit 6, but drainage densities will not change due to temporary roads since these roads will be removed after use. Any temporary roads constructed for logging that are not decommissioned prior to the wet season would have stream crossings removed and be weatherproofed through the construction of waterbars, crossdrains and grade breaks. This will ensure that surface waters do not concentrate on the road surface and contribute directly to increases in drainage network density.

Road decommissioning activities would remove 16 stream crossings. These crossings were identified using GIS, which is the same base information used to calculate drainage network extension. The removal of these crossings would reduce the drainage network extension slightly. All of these crossings are located in frontal watersheds that were not summarized in Table 4.7.19 due to lack of road information on private lands. Of these 16 crossings, 14 are located in the Lower Cispus River frontal subwatershed and 2 are located in the Woods Creek subwatershed. Although sufficient data does not exist to accurately quantify the decrease in drainage network herein, the resultant effect of these road decommissions on drainage network extension is expected to be highest in the Lower Cispus River Frontal subwatershed. The reduction of stream crossings on National Forest Lands will be from approximately 87 to 73 crossings in the Lower Cispus River Frontal subwatershed and from approximately 71 to 69

crossings in the Woods Creek subwatershed. None of these stream crossings are located on fish-bearing streams.

Cumulative Effects of All Action Alternatives

Several projects have the potential to decrease drainage network density within the Lower Cispus watershed. Road decommissioning activities are the only actions expected to effect drainage network extension by removing road-stream crossings. Although several timber sales are on-going and proposed for the future, none of the timber sales nor any other project on Forest Service land will construct new permanent roads. It is difficult to predict if the road density on private land in and near the project area will increase, decerease, or remain neutral, as there is little to no information on future timber sales, road closures, residential developments, or other projects that would occur on private land.

Most timber sale activities will likely construct temporary roads to access landings and thinning units, but drainage densities will not change due to temporary roads since these roads will be removed after use. Any temporary roads constructed for logging that are not decommissioned prior to the wet season would have stream crossings removed and be weatherproofed through the construction of waterbars, crossdrains and grade breaks. This will ensure that surface waters do not concentrate on the road surface and contribute directly to increases in drainage network density.

Many roads are proposed for decommission in the Lower Cispus watershed. Decommissioned roads will have hydrologic connectivity restored at all road-stream crossings, thus these crossings would no longer contribute additional length to the drainage network. Once these crossings are removed, the resultant drainage density would decrease. The primary projects that will implement future road decommissions in this analysis area is the Lower Cispus Roads Project, Iron Horse Thin Timber Sale, and the Iron Creek Road Decommission Project, which will decommission roads within the Yellowjacket and Iron Creek subwatersheds. Table 4.7.20 illustrates the drainage network densities that are likely to result after these projects are implemented. Once these projects are implemented, the drainage network increase would be reduced from 10 to 9 percent in the Yellowjacket Creek subwatershed due to the removal of 18 road-stream crossings and from 23 to 18 percent in the Iron Creek subwatershed due to the removal of 53 crossings. In addition, all upcoming and anticipated activities in this watershed are anticipated to decrease the drainage network, as no new permanent road construction is being planned or considered.

Table 4.7.20. Estimated cumulative drainage network increase within the Woods Creek Stewardship Project analysis area.

Drainage	Area (mi^2)	Drainage network length, miles		Drainage density, mi/mi^2		Percent change
		Streams (L_S)	Road-related extension (L_{RC})[1]	Streams (D_d)	[1]Total (D'_d)	
Yellowjacket Cr.	46.4	90.3	8.1	1.94	2.12	9%
Greenhorn Cr.	15.6	28.7	2.1	1.84	1.97	7%
Iron Cr.	36.2	44.6	8.2	1.23	1.46	18%

[1] Assumes distances between stream crossings and relief culverts is 200 feet. Drainage network increase is considered high "risk" >20% and moderate 5% to 20%.

Road Density & Location

Roads can impede surface water infiltration, intercept subsurface flows, and provide a direct surface linkage for delivering water to stream channels. The road network can substantially increase the natural drainage density of a watershed. Road density and location are currently rated as "functioning at unacceptable risk". The road density for the area ranges from 2.2 to 3.9 miles per square mile with the highest road density in the Camp Creek – Cispus River subwatershed. Additionally, many of these roads are located within the riparian reserve and generate numerous stream crossings. Table 4.7.21 summarizes the road densities of the subwatersheds within the Woods Creek Stewardship analysis area.

Table 4.7.21. Road length and density of subwatersheds in the Woods Creek Stewardship Project analysis area, (USDA 2003a).

Subwatershed Name	Total Area (mi^2)	Total Road Density (mi/mi^2)	Road Density in Riparian Reserve (mi/mi2)	Stream Crossings (#/mile of road)
Yellowjacket Cr.	46.4	2.2	2.0	1.5
Camp Cr. -Cispus R.	18.2	3.9	3.0	1.4
Greenhorn Cr.	15.6	2.4	1.2	0.9
Iron Cr.	36.2	3.1	2.4	1.9
Woods Cr.	12.5	3.9	3.7	1.4
Lower Cispus R. Frontal	23.0	3.4	3.6	2.3

Three subwatersheds in the project area have over 3 miles of road in riparian per square mile of watershed; Camp Creek-Cispus River, Woods Creek and the Lower Cispus River Frontal subwatersheds. All of these subwatersheds have significant private land with roads that contribute to these values. Additionally, the Iron Creek and Lower Cispus River Frontal

subwatersheds have close to or more than 2 or more stream crossings per mile of road. Both of these factors illustrate the areas where road-related impacts are occurring in this project area.

Yellowjacket and Greenhorn Creek were the only subwatersheds that are functioning at risk for road density and location within the Lower Cispus watershed. The remaining subwatersheds are rated as "Functioning at an Unacceptable Risk". These subwatersheds include Camp Creek – Cispus River, Iron Creek, Woods Creek, and the Lower Cispus River Frontal.

In this planning area, most road prism erosion is associated with unvegetated cut slopes and stream crossings. While road prism erosion displaces soil particles, this material must be delivered to a stream to effect water quality. This delivery generally occurs where roads are either close to or cross a stream. Where roads are not close to streams, sediment is efficiently trapped on the hillslopes with fine gravels (2-8 mm) and sands (.05-2mm) being filtered out first and silts and finer particles being delivered further down slope. Since this delivery would occur during high flows (storm events or snow melt) the fine material would then likely remain in suspension and move rapidly through the system to settle in low gradient reaches.

Overall, the Woods Creek Stewardship road network is likely contributing sediment from 7.6 miles of unpaved roads that either cross or lay within 100 feet of streams within the Woods Creek LSR boundary. Table 4.7.22 summarizes the miles of unpaved roads within 100 feet of streams in each subwatershed that contains the Woods Creek Stewardship Project. Yellowjacket Creek subwatershed has the highest number of unpaved stream crossings and the longest amount of unpaved road within 100 feet of streams in this analysis area.

Table 4.7.22. Miles of unpaved road within 100 feet of streams in subwatersheds that contain the Woods Creek Stewardship Project.

Subwatershed Name	Length of unpaved road (miles)	Number of unpaved stream crossings	Length of unpaved road within 100 feet of streams (miles)
Yellowjacket Cr.	81.2	247	14.9
Camp Cr. -Cispus R.	53.8	68	3.9
Greenhorn Cr.	36.2	58	3.9
Iron Cr.	96.8	215	14.0
Woods Cr.	31.1	55	3.6
Lower Cispus R. Frontal	17.5	32	1.7

Direct and Indirect Effects

Road density and location would be improved by this project over the long term due to restoration of several miles of system and non-system roads. These road decommission projects will reduce road density in several subwatersheds as well as decrease the amount of road located near streams. Decommissioned roads will have hydrologic connectivity restored

at all road-stream crossings and vehicular access will be eliminated. Table 4.7.23 summarizes how much road will be decommissioned in each subwatershed.

Table 4.7.23. Length of system and non-system roads to be decommissioned by subwatershed in the Woods Creek Stewardship Project.

Subwatershed Name	Length of system road to be decommissioned (miles)		Length of non-system road to be decommissioned (miles)	
	Alt 2	Alt 3	Alt 2	Alt 3
Camp Cr. -Cispus R.	0.24	0.24	0.13	0.13
Greenhorn Cr.	0.16	0.16	0.05	0.05
Iron Cr.	0.07	0.07	0.00	0.00
Woods Cr.	0.63	0.63	0.26	0.26
Lower Cispus R. Frontal	2.64	2.64	0.84	1.09
Total Length	3.74	3.74	1.28	1.53

Alternatives 2 and 3 will both decommission 3.7 miles of system road with the greatest concentration of roads of 2.6 miles located in the Lower Cispus River Frontal subwatershed. This same subwatershed is proposed to receive the greatest concentration of non-system road decommission with 1.3 miles proposed under Alternative 2 and 1.5 miles proposed under Alternative 3.

Decommissioning of non-system roads will effectively reduce natural resource damage in several ways, although non system roads are not included in the assessment of road density. Standard data is needed to effectively track roads on any forest. Since these non-system roads were not constructed by the Forest Service and have not been inventoried or maintained as part of the system road network, little to no information is available regarding the extent or locations of these non-system roads. The Gifford Pinchot has been making some effort to inventory and track all non-system roads that are identified on the ground, but this information is not comprehensive enough to use in a watershed characteristic such as road density. Since insufficient information exists regarding non-system roads, they are not accounted for in road density calculations.

The effects of decommissioning 3.7 miles of system roads on subwatershed road density are summarized in Table 4.7.24. Both alternative 2 and 3 propose decommissioning on all 3.7 miles of system road. Although the greatest length of road will be decommissioned in the Lower Cispus River Frontal subwatershed, the greatest decrease in road density will occur in the Woods Creek subwatershed with a 5.5 percent decrease in road density. Of course, the reduction in Lower Cispus River Frontal is very similar at 4.8 percent. Despite these reductions, the road density in all of these subwatersheds will remain above the high risk standard of 2.0 miles / square mile, resulting in the subwatersheds being considered as "functioning at Risk".

Table 4.7.24. Pre and post-project road density for subwatersheds within the Woods Creek Stewardship Project.

	Total Road Density (mi/mi²)		Percent Change in Road Density
Subwatershed Name	**Pre-Project**	**Post Project Alt 2 & 3**	**Post Project Alt 2 & 3**
Yellowjacket Cr.	2.19	2.18	0.2%
Camp Cr. -Cispus R.	3.89	3.88	0.2%
Greenhorn Cr.	2.41	2.41	0.2%
Iron Cr.	3.12	3.10	0.6%
Woods Cr.	3.86	3.65	5.5%
Lower Cispus R. Frontal	3.41	3.25	4.8%

Although no new permanent road would be constructed under any of the alternatives, Alternatives 2 and 3 would construct temporary roads to access landing and thinning units. Temporary roads and the temporary stream crossing constructed under Alternative 2 would be eliminated at the end of the project by scarification, waterbarring and revegetation in order to ensure there is little to no effect of these temporary features. Any temporary roads constructed for logging that are not decommissioned prior to the wet season would have stream crossings removed and be weatherproofed through the construction of waterbars, crossdrains and grade breaks. This will ensure that surface waters do not concentrate on the road surface and contribute to road-related runoff.

Cumulative Effects of All Action Alternatives

Some additional work may be completed by the Forest Service and other entities in the Lower Cispus watershed in regards to road decommissions, closures, and stream-crossing improvements. The primary projects that will implement future road decommissions in this analysis area is the Lower Cispus Roads Project, Iron Horse Thin Timber Sale, and the Iron Creek Road Decommission Project, which will decommission roads within the Yellowjacket and Iron Creek subwatersheds. As a result of these projects, the road density in Yellowjacket Creek will likely be reduced by 9.5 percent from current conditions to 1.98 miles/square mile. This indicator would successfully have fallen below the critical standard of 2.0 miles/square mile on the Gifford Pinchot National Forest. Additionally, road density in the Iron Creek subwatershed would be reduced by 14.1 percent from current conditions to a density of 2.68 miles/square mile. Otherwise, no other new road construction is being considered in the project area, thus the road density and location would only be positively affected by these proposed road decommissions.

4.8 Fisheries

This section evaluates the proposed action of a commercial thin, as well as evaluates the six restoration projects, all of which are designed to maintain, enhance, and restore watershed functions that affect aquatic species. The Lower Cispus watershed is currently *not properly functioning* (USDA 2003).

A combination of skyline and ground-based logging systems are proposed. All twelve stands were historically commercially harvested and regenerated between 40-50 years ago and are currently dense overstocked stocked plantations dominated by Douglas fir. The riparian silvicultural management objective is to develop late seral characteristics, structural and compositional diversity and promote channel stability.

There are a total of 224 acres of riparian reserve acres receiving silvicultural treatment. Up to 94 acres of outer riparian reserve would be commercially harvested, and up to 130 acres of inner riparian reserve will receive a non-commercial treatment to enhance down wood. All commercial harvest riparian acres have stable conditions and are considered low risk for sediment delivery. There are approximately 4 acres of ground in harvest Unit 3 which are outside of the riparian reserve but have severe erosion potential. However, Unit 3 transitions from near 30 percent slope to a gradual bench which provides approximately 200 feet of run-out before meeting the inner riparian reserves no- harvest buffer strip. Combined landscape positioning and riparian buffers give Ames Creek rearing habitat approximately 450 feet of protection from commercial harvest-related ground disturbance.

Up to 1.8 miles of temporary road may be constructed or reconstructed, which includes reconstruction of one temporary stream crossing on an intermittent disconnected (subterranean flowing) stream. After logging operations are complete, these roads will be subsoiled, seeded, and closed to vehicular traffic. No new permanent roads would be constructed.

Affected Environment

The aquatic analysis is based on an action area expected to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the proposed action. The Woods Creek Stewardship project analysis area (informally designated as per this report) is located within the Lower Cispus 5th field watershed portion of the Woods Creek Late Successional Reserve.

Disturbance

The most significant management-related disturbance regimes are mass wasting in the form of large landslides, hillslope erosion, simplification of stream channels, and road conditions all concentrated in Iron Creek and Yellowjacket Creek (USDA 2003a) (see also Section 4.6.). Sediment contribution from roads and management-related landslides is relatively high in the Lower Cispus subwatershed with the most acres of management related landslides originating

in Yellowjacket Creek and Quartz Creek and Iron Creek (USDA 2003a). Finally, the depositional reaches within the lower alluviated reaches of the Cispus River (RM 15-20), and the lowest couple miles of the mainstem Yellowjacket and Iron Creek are impacted by excessive bedload. High width-to-depth ratios and lateral instability are evidence of instream channel sediment conditions. Large wood was added and redistributed along the lowest mile of Iron Creek in 1999 and Yellowjacket creeks to retain sediment and restore stability.

Channel stability

Channel stability and risk of sediment input is, in part, a function of underlying geology and physical processes that shape the valley, channel types (Rosgen and Silvey 1989) and land management (e.g. density and vigor of vegetative cover, down wood). Field surveys (USDA 1998 and 2006) classified channel physical characteristics along with stream Rosgen channel types and channel stability.

The channel conditions within the project area fall into three distinct geographic areas. The Woods Creek flats units are typically low elevation (less than 1400 ft), moist and flat with the presence of ponded water and low gradient second order perennial streams (Units 1, 2, 3, 11, and 12). Unit 3 has an abrupt hill ascending from the Ames Creek bottoms with slopes exceeding 30%. The four units (4, 5, 6, and 7) found along the moderate gradient rolling hills of Krause Ridge typically are mid-elevation (1400-1600) and have 1st order intermittent channels which dry up seasonally. Units 6 and 7 are located on a high bench of deep colluvium which creates a subterranean flow and disconnects the channels hydrologically from perennial water sources. Units 8, 9, and 10 are located south of the Cispus River higher elevation (above 2000 ft) with steeper, incised channels. The relatively dense network of stream channels drain the hillslope with intermittent channels (Class IV) ranging from 10-30% slope.

Unmanaged Recreation

Unmanaged recreation has a substantial impact within the planning area. Most of the inventoried disturbed areas (94%) are centered on the Cispus River corridor and located off FR 7600 according to a Campground Site Inventory (USDA 2003). The Cispus River riparian reserve is readily accessible from user-developed non-system roads and campsites. Impacts within the riparian reserve include human waste and trash disposal, wood theft, plant loss and ground compaction from foot and vehicular traffic (USDA 2003). Human disturbance from the 22 inventoried campsites and two public campgrounds (Iron Creek and Tower Rock) has impacts to threatened and endangered (TES) fish species spawning and rearing habitat. Unmanaged recreation appears to be increasing along the Cispus River corridor as new sites have been developed and existing sites have continued to expand within the riparian area since the 2003 inventory.

Fish Distribution

Anadromous fish distribution in the Upper Cowlitz basin extends up the Cispus River into project area streams including Woods Creek, Iron Creek, Greenhorn Creek, and the Cispus

River (Table 4.8.1). Anadromous species documented as present in the planning area include Chinook salmon, Coho salmon, and steelhead trout.

Table 4.8.1. Threatened, endangered, and sensitive (TES) fish species presence within the Lower Cispus Watershed (USFS Fish Distribution Database, 2006).

Stream Identification		Distribution		
Stream Name	**Sixth Field HUC**	**Begin RM[1]**	**End RM[1]**	**Species**
Greenhorn Creek	170800040504	0.0	1.6	C, Co, S
Cispus River	170800040504	8.0	20.0	C, Co, S
Ames Creek	170800040506	0.0	1.4	Co, S
Woods Creek	170800040506	0.0	5.0	Co, S

[1]RM – Total river miles within the Lower Cispus subwatershed area in Fed ownership
[2] Species Code, C -= Chinook, Co = Coho, S= Steelhead

Of these fish, the National Marine Fisheries Service (NMFS) has listed Lower Columbia River steelhead trout (*Onchorynchus mykiss*), Lower Columbia River Chinook salmon (*O. tshawyscha)* and Coho salmon *(O. kisutch)* as threatened under the Endangered Species Act (1974). Chum salmon (*O. keta*) populations have never been documented above the Cowlitz River Dams and are not expected to be included in salmon reintroduction efforts above the mainstem Cowlitz River dams. Steelhead trout, Chinook and Coho salmon are transported (trucked) around the three dams on the Cowlitz River making the Cowlitz River and its tributaries accessible to these species.

Lower Columbia River Chinook salmon

Trends for natural production in the Upper Cowlitz Basin have remained relatively low. High hatchery production continues to pose risks to natural populations. At the regional scale, most populations have not seen pronounced increases in recent years as occurred in other Evolutionarily Significant Units (ESUs). (See Fisheries Effects Analysis in project record.)

Lower Columbia River/Southwest Washington Coho salmon

Trends in abundance are slightly negative in the short-term in the Upper Cowlitz Basin. The reintroduced population is dominated by hatchery origin fish. Current limits to smolt collection efficiency at the Cowlitz Falls dam has an appreciable limit to natural production in the upper basin. Local production within the project area appears to be limited by stable spawning gravel and off channel rearing habitat. At the regional scale, the most serious overall concern of the BRT was the nearly total absence of naturally produced spawners throughout the ESU

Lower Columbia River steelhead

The Upper Cowlitz population has a sizable fraction of hatchery origin natural spawners. Since reintroduction, the populations have a short-term declining trend. Populations are at relatively low abundance, but there have been periods of improvement in the past three to five years. The reintroduced population is dominated by hatchery-origin fish. A limit to

downstream collection efficiency at Cowlitz Falls Dam has an appreciable limit to natural production in the upper basin.

Resident salmonids present in the Lower Cispus include cutthroat trout (*Onchorynchus clarki*) and rainbow trout (*O. mykiss*) (USDA 1991). Bull trout (*Salvelenus confluentus*) have not been documented in the planning area. The Gifford Pinchot National Forest has determined bull trout to not be present in the Upper Cowlitz basin (Perez-Rose, personal comm. 2003)

The life history of fish varies by species. An assortment of life stages of fish is present in the planning area throughout the year. Migration into natal spawning streams is typically initiated by onset of the rainy season. Adult anadromous fish spawn and die shortly afterwards while resident fish persist for many years in fresh water. Approximately 2-3 months following spawning juvenile fish emerge and reside in freshwater for a additional 5-36 months. Juvenile anadromous fish typically leave freshwater with the spring freshets.

Riparian Habitat & Potential Large Wood Recruitment

The quality of riparian habitat in the analysis area has been influenced by timber harvest and private land development. The entire planning area is within a Late Successional Reserve (LSR), one of the goals of which is dedicated to promoting large wood development. Most of the riparian reserve areas have had past timber harvest in the last century and there has been a significant reduction (average 27%) from large trees toward grass/pole and small trees. Woods Creek and Iron Creek stand out as the most heavily impacted subwatersheds (Table 4.8.2)

Table 4.8.2. A Comparison of Historic Riparian Vegetation (1880) to Current Riparian Vegetation.

	Hardwoods	Non-Forest	Grass/Pole	Small Tree	Large Tree
170800040501 –Yellowjacket Creek					
Historic%	0.1	9.3	1.5	34.3	54.8
Current%	0.1	9.3	19.4	41.4	29.8
Differences[1]	0	0	17.9	7.1	-25
170800040502 - McCoy Creek					
Historic%	0	25.3	0.4	30.4	43.9
Current%	0	25.3	18.7	37.5	18.4
Differences	0	0	18.3	7.2	-25.4
170800040503 – Cispus River-Camp Creek – Cispus River					
Historic%	0.3	14.9	10.2	35.6	39
Current%	0.3	17.1	10.4	38	34.3
Differences	0	2.2	0.1	2.4	-4.7
170800040504 – Greenhorn Creek					
Historic%	0.1	2.6	17.2	41.8	38.3
Current%	0.2	2.6	17.2	61.7	18.3
Differences	0.1	0	0	19.9	-20
170800040505 - Iron Creek					
Historic%	0	1.9	1.5	2.4	94.2
Current%	0	1.9	29.1	30.8	38.1
Differences	0	0	27.6	28.5	-56.1

170800040506 – Woods Creek					
Historic%	0	5.5	0.3	0	94.2
Current%	0	5.5	34.5	30.7	29.1
Differences	0	0	34.3	30.7	-65.1
170800040507 – Quartz Creek					
Historic%	0.5	4.3	49	8.9	37.3
Current%	0.5	4.3	27.9	23.9	43.4
Differences	0	0	-21.1	15	6.1
170800040508 – Lower Cispus River Frontal					
Historic%	0	3.5	6.8	4.5	85.2
Current%	0	4.4	34.9	30.6	30.1
Differences	0	0.9	28.1	26	-55

Environmental Consequences

Alternative 1 (No Action)

Direct and Indirect Effects

Short-Term

Under the No-Action Alternative (Alternative 1), no new ground disturbance is proposed. Stream habitat conditions would not markedly adjust up or down from the baseline conditions for all habitat indicators due to forest management activities. Risk to channel stability is expected to remain at the existing level.

Current disturbance from dispersed recreation use and timber salvage will continue to impair channel stability conditions in Cispus frontal and Yellowjacket. Undisturbed reserved areas will not meet desired condition of mature stands with robust root cohesion, increased large wood recruitment potential and increased down wood. Areas with heavy past timber management including Iron Creek will benefit most.

Existing low-magnitude and persisting chronic sources from periodic slumps and washouts of surface sediment would continue to deliver fine material (< 0.84 mm) to fish bearing streams and impact instream channel conditions. Maintaining a dense vegetative cover in existing stands will reduce the short term risk of surface soil erosion. The primary source of fine sediment under the no-action alternative is expected to originate directly or indirectly from the existing system and non-system roads (see Hydrology Report).

Risk of surface soil movement and streambank sources of unconsolidated stream sediment will be unaffected in the sort term. Densely stocked mid-seral stage stands (sapling pole and small tree) will moderate risk of surface movement on the uplands.

Risk to instream habitat will be unaffected because of no proposed harvest activity. Channel forming process and flow timing will continue to operate at a baseline level (USDA 2003) and have no affect to instream habitat. Large wood recruitment and channel transport mechanisms

will generally persist as the unacceptable risk condition consequently short-term existing stream structure will continue to function below desired conditions.

Under the No-Action alternative, there would be no affect in the short term to aquatic Proposed, Endangered, Threatened, and Sensitive (PETS) species or non-listed aquatic species as conditions are expected to persist at or near a baseline level.

Long-Term

Long-term stream habitat conditions would gradually improve the baseline conditions for all habitat indicators due to passive restoration and natural regeneration. The rate of natural succession and recovery will be slow.

Risk to channel stability is expected to gradually improve as structural development increases in the riparian vegetative and ground cover over the next several decades. Persistent disturbance from recreation use and timber salvage will slow recovery rates in readily accessible areas such as Cispus frontal and Yellowjacket Creek subwatersheds. Undisturbed reserved areas will slowly move toward desired condition through development of mature stands and increased down wood. Areas with heavy past timber management including Iron Creek and Woods Creek will benefit most.

Risk of fine sediment delivery will decrease over time if conditions remain undisturbed. Natural development of stand structure and increased vegetative cover will incrementally reduce the long term risk of surface soil erosion, however; the road system is expected to continue to directly and indirectly contribute as a primary source of the persisting source of fine sediment under the no action (see Hydrology Report).

Risk of deep-seated mass movement and sources of unconsolidated stream sediment will be reduced as stands mature over the next several decades. Increased development of seral conditions will eventually strengthen the root cohesion and moderate the subsurface soil moisture content through increased evapotranspiration. This should result in a long-term gradual reduction in risk of mass movement potential.

Instream habitat will respond to a natural structural development in riparian reserve. Similarly, channel forming process and flow conditions (magnitude and timing) will gradually improve habitat baseline conditions (USDA 2003). Large wood recruitment and channel transport mechanisms will gradually improve to a fully functioning condition; however, Alternative 1 proposes no riparian silvicultural treatments, therefore the reserved area structural development and species diversification will proceed at a modest rate. Channel connectivity will continue to *not properly function* if no actions are taken to restore road crossings and develop instream structure.

Under the No Action alternative, the long term risk to PETS and other aquatic conditions may improve through passive restoration and decreased disturbance.

Cumulative Effects

The cumulative effects for the Woods Creek Stewardship Thin will typically result in a trend toward restoring the long-term function and process of the aquatic ecosystem by improving vegetation structure and diversity and reducing the effects of roads on stream sediment production.

Cumulative effects are not expected to impact aquatic species, including PETS species, resulting from actions proposed in Alternative 1. Mitigation measures and restoration projects focused on re-establishing properly functioning watershed conditions will provide instream habitat for all life stages.

Non-federal portions of Lower Cispus subwatershed riparian areas are expected to provide substantial ongoing commercial harvest opportunities into the future. Private land in the Cispus Frontal subwatershed and in Woods Creek is expected to remain rural/residential, with little vegetation. Current non-functional watershed conditions within private lands are expected to persist or diminish below the existing baseline.

Forest thinning operations on substantial acreage of managed stands on National Forest lands are expected to persist along with restoration activities. The most significant improvements in riparian area structure are expected to occur on National Forest lands where the predominant riparian structure class is currently sapling/pole or small-tree. These 30-80 year old stands include: the lower portions of Iron, Woods, Yellowjacket and Lower Cispus Frontal.

There are no known ongoing activities and/or project proposed in the foreseeable future which may result in an irretrievable or irreversible impact to TES species.

Alternative 2 (Proposed Action)

Direct and Indirect Effects

Short-Term

The timber management proposed in Alternative 2 will result in neutral short-term effects to fish and their habitat.

This alternative proposes to treat 412 acres total, 94 acres or 22% of which is designated as riparian reserve. All riparian commercial harvest is situated in the outer riparian reserve and will be more than 240 feet from fish bearing streams (Class I and II) and 140 feet from non-fish bearing streams (Class III and IV). In addition, the outer riparian reserves will retain 3 trees per acre of down wood and 1 snag per acre. The inner riparian reserves will have non-commercial silvicultural treatment on approximately 123 acres which proposes to fall and leave 5% ground cover in down wood (or, approximately 25 trees per acre). See Table 4.8.3, below, for the effects of the non-commercial treatment on riparian areas within the project area.

Table 4.8.3. Effects to riparian conditions resulting from the riparian reserve treatment under Woods Creek Stewardship Thin Alternative 2.

Unit No.	Total Comrcl Mngd Area (Ac)[1]	Comrcl Thinned Outer Riparian Area (Ac)	Temp Rd Stream Crossing (count)	Surface Soil Sediment Delivery Potential (Ac)	Non-Comrcl Treated Riparian Acres (Ac)	Surface Soil Sediment Delivery Potential (Ac)
1	31.72	19.4	0	0.0	11.0	0.0
2	25.75	6.7	0	0.0	3.0	0.0
3	30.28	5.2	1	3.0	19.3	7.0
4	16.12	4.0	0	0.0	10.9	0.0
5	54.07	2.7	0	0.0	0.8	0.0
6	36.10	5.2	0	0.0	4.2	0.0
7	51.27	4.3	0	0.0	8.2	0.0
8	19.13	3.8	0	0.0	14.1	0.0
9	62.09	6.4	0	0.0	5.0	0.0
10	10.36	1.5	0	0.0	13.1	0.0
11	47.21	21.2	0	0.0	11.2	0.0
12	27.43	13.5	0	0.0	29.1	0.0
	411.5	93.9	1	3.0	129.9	7.0

Disturbance in proximity of fish bearing streams is minimal in the absence of commercial harvest in interior riparian reserves. Consequently, Alternative 2 should have no direct adverse impact to fish and their habitat. All trees managed within 240 feet of fish bearing streams will be dropped and left in place on site to contribute to fish habitat and channel stability conditions. The riparian silviculture prescription should directly support large wood recruitment goals and provide habitat complexity in the riparian ecosystem which is currently functioning at risk.

One temporary stream crossing reconstruction is proposed on an intermittent channel in Unit 6. This intermittent channel has disconnected surface flow and goes subterranean more than 800 feet upslope from any perennial water body. The reconstruction will have no direct impact to fish and their habitat due to the intermittent nature of the channel and distant proximity to fish bearing streams. Limited operating period will restrict harvest activities to the dry season and therefore, reduce the risk of soil disturbance and related sediment transport.

Short-term indirect risk to channel stability may increase slightly in the 5-10 years following thinning as stumps in thinned stands decay and root-mass soil cohesion decreases in cut trees. Furthermore, the short-term indirect effects of Alternative 2 may slightly increase the risk of susceptibility of erosion prone soils (SMU 37) adjacent to Ames Creek (see Soils report). Approximately 7 acres of soils sensitive to surface soil erosion in Unit 3 may be impacted by proposed land management inside the riparian reserve. However, there should be no measurable increase in sediment delivery as no ground- disturbing activity is proposed within the inner riparian reserve. Commercial harvest limited to the reserve outer portion should result in a neutral short term effect in part because the riparian reserve prescription of down wood treatment in the inner riparian reserve should moderate the impacts of harvest and restore hydrologic function. Additionally, because the inner reserve will have a 20-foot no-cut buffer bordering the channel, there is a discountable likelihood to increased sediment delivery above baseline conditions and actions proposed in alternative 2 should have discountable effect to TES species.

Long-Term

In the long-term, Alternative 2 activities will have minor positive direct impact on aquatic habitat including riparian stand development and/or future recruitment of large wood.

The expected long term indirect impact to surface soil erosion is positive as trees mature on areas of high risk soils (Unit 3). Silvicultural treatment should increase stand structure and vigor thereby reducing the risk of soil movement within the riparian reserve. Riparian stand development should have a positive indirect impact to baseline physical channel characteristic by moderating microclimate temperature extremes, promoting structural development and retaining slope stability. Consequent instream habitat should maintain or improve with the reduction in of channel bedload. Minor positive adjustments to water quality (see Hydrology Effects Analysis) will recognizable in terms of fish habitat.

Cumulative Effects

The cumulative effects for Alternative 2 of the Woods Creek Stewardship Project will result in a trend toward restoring the long-term function and process of the aquatic ecosystem by improving vegetation structure and diversity and reducing the effects of roads on stream sediment production.

Cumulative effects are not expected to impact aquatic species, including PETS species, resulting from actions proposed in Alternative 2. Mitigation measures and restoration projects focused on re-establishing properly functioning watershed conditions will provide instream habitat for all life stages.

Non-federal portions of Lower Cispus subwatershed riparian are expected to provide substantial ongoing commercial harvest opportunities into the future. Private land in the Cispus Frontal subwatershed is expected to remain residential, with little riparian vegetation. Current non-functional watershed conditions within private lands are expected to persist or diminish below the existing baseline.

Forest thinning operations on substantial acreages of managed stands on National Forest lands are expected to persist along with restoration activities. The most significant improvements in riparian area structure are expected to occur on National Forest lands where the predominant riparian structure class is currently sapling/pole or small-tree. These 30-80 year old stands include: the lower portions of Iron, Woods, Yellowjacket and Lower Cispus Frontal.

The following table summarizes several ongoing projects on Forest Service lands within the Lower Cispus River watershed.

Table 4.8.4. Project activity completed (2003-2008) or proposed in the foreseeable future on federal lands between in the Lower Cispus watershed.

Project Name	Primary Sub watershed	Thin/ Salvg Hrvst (ac)	Ripn Rsve Trmt (ac)	New Temp Rds (mi)	Recnd Temp Rds[3] (mi)	Road Decm (mi)	Clvert Replc[4] (no.)	Road Stbz (mi)	Instrm Hab (mi)	Fldpln Habitat (ac)
Yellowjacket Rd Decommissioning	Yellow jacket					6.0				
Iron Creek Road Stabilization Project	Iron							3.22		
Galena Thin Timber Sale	Yellow jacket	54				3.85				
Woods Creek Fish passage	Woods						1			
Iron Creek Road Decommissioning	Iron					0.3				
Upper Iron Thin 1 Timber Sale[1,2]	Iron	494 (891)	111	2.3	-	-	2			
Upper Iron Thin 2 Timber Sale[1,2]	Iron									
Iron Summit RR Timber Sale[1,2]	Iron	306 (342)	30	2.6	7.4	2.0	3			
Lower Iron Thin RR Timber Sale[1]	Iron									
Iron Horse Thin[1]	Iron	317	75	-	2.7	-	-	7.1		
Helitower Thin (units 6, 25)	Greenhorn	277 (165)	0		9.7		0			
Upper Greenhorn Timber Sale (unit 3)	Greenhorn	378 (54)	0				0	0		
Woods Creek Stewardship Contracting	Lower Cispus		94			2.2	1	1.0	0.5	60
Lower Cispus Roads	Yellowjacket / Iron					12.5		5.0		

[1]Acre value from Timber Information Management (TIM) database and value in parenthesis is as per the consultation LOC/BO (NOAA 1998)
[2]Upper Iron and Lower Iron DN both divided into two sales
[3]New Temp Rd construction is slated for restoration following timber operations.
[4]Culvert replacements accounts for Only live stream crossings

There are no known ongoing activities and/or project proposed in the foreseeable future which may result in irretrievable or irreversibly impact to TES species.

Alternative 3

Direct and Indirect Effects

Short-Term

Alternative 3 will result in neutral direct effect to fish and/or their habitat.

This alternative proposes to treat of 353 acres total, 76 acres or 22% of which are recognized as riparian reserve. All commercial harvest is situated in the outer riparian reserve and will be more than 240 feet from fish bearing streams (Class I and II) and 140 feet from non-fish bearing streams (Class III and IV). In additions, the outer riparian reserves will retain 3 TPA down wood and 1 TPA of created snags. The inner riparian reserves will have non-commercial silvicultural treatment on approximately 123 acres which proposes to fell and leave 5% ground cover in down wood (approx 25 TPA). Table 4.8.5 shows the effects of the riparian reserve treatment under Alternative 3.

Table 4.8.5. Effects to riparian conditions resulting from the riparian reserve treatment under Woods Creek Stewardship Thin Alternative 3.

Unit No.	Comrcl Mngd Area (Ac)[1]	Commercially Treated Riparian Resv Area (Ac)	Temp Rd Stream Crossing (count)	Surface Soil Erosion Potential (Ac)	Total Inner Riparian Acres, Non-Commercial (Ac)5	Surface Soil Erosion Potential (Ac)
1	31.72	19.0	0	0.0	11.0	0.0
2	25.75	6.7	0	0.0	3.0	0.0
3	24.21	4.3	0	3.0	19.3	7.0
4	12.22	3.3	0	0.0	10.9	0.0
5	50.78	2.5	0	0.0	0.8	0.0
6	11.48	1.6	0	0.0	4.2	0.0
7	51.27	4.3	0	0.0	8.2	0.0
8	19.13	3.8	0	0.0	14.1	0.0
9	50.76	4.0	0	0.0	5.0	0.0
10	10.36	1.5	0	0.0	13.1	0.0
11	50.63	20.1	0	0.0	11.2	0.0
12	14.78	4.5	0	0.0	21.8	0.0
	353.1	75.6	0	3.0	122.6	7.0

In the absence of commercial harvest-related ground disturbance in proximity of fish-bearing streams, there should be no direct adverse impact to fish and their habitat or other aquatic organisms which may result from Alternative 3. All trees managed within the immediate

riparian area will be left on-site to contribute to fish habitat and channel stability conditions. Riparian silviculture on 123 acres should directly benefit large wood recruitment goals and provide habitat complexity in the aquatic ecosystem which is currently improperly functioning.

No new temporary road construction is proposed and the existing stream crossings in need of reconstruction have been eliminated from Alternative 3. In the absence of stream crossing construction, there will be no direct impact to fish and their habitat. All prospects of direct sediment delivery are similarly eliminated.

Non-commercial thinning on 123 inner riparian reserve acres may increase short term indirect risk to channel stability. Hillslope stability may be compromised in the short term for 5-10 years following thinning as stumps in thinned stands decay and root-mass soil cohesion decreases in cut trees. Furthermore, short term indirect effects of Alternative 3 may slightly increase the risk of susceptibility of erosion prone soils (SMU 37) adjacent to Ames Creek (see Soils report). Approximately 7 acres of soils sensitive to surface soil erosion in Unit 3 may be impacted by proposed land management inside the riparian reserve. However, the lack of commercial harvest and associated log transport systems in the riparian area should make the likelihood of sediment reaching the stream highly improbable. No measurable increase in sediment delivery is anticipated because no ground disturbing activity is proposed within the inner riparian reserve. Commercial harvest limited to the reserve outer portion should result in a neutral short term effect in part because the riparian silviculture down wood treatment in the inner riparian reserve should moderate the impacts of harvest and restore hydrologic function. Additionally, because the inner reserve will have no timber extraction and the treatment prescribes a 20 foot no-cut buffer bordering the channel, there is a discountable likelihood to increased sediment delivery above baseline conditions and Alternative 3 should have no effect to TES species.

Proposed actions will not likely affect any life stage of PETS fish including downstream PETS species and their critical habitat.

Long-Term

In the long-term, Alternative 3 activities will have minor positive direct impact on aquatic habitat including riparian stand development and/or future recruitment of large wood. The prescribed silvicultural treatment will serve to increase stand structure and composition. Development of target species, including western redcedar, will serve as a lasting source large wood contribution directly to the stream corridor.

Long-term indirect impact to surface soil erosion in Unit 3 is positive as large trees develop over time. Future surface soil erosion is reduced on 7 acres of high-risk soils (Unit 3) over the long term. And in general, silvicultural treatment should increase stand structure and vigor thereby reducing the risk of soil movement within the riparian reserve. Riparian stand development should have a positive indirect impact to baseline physical channel characteristic by moderating local temperature extremes, promoting forest floor roughness and retaining slope stability. Instream habitat including quality pool development should maintain or improve with the reduction fine channel bedload. Minor positive adjustments to water quality

(see Hydrology report) will indirectly improve conditions for both rearing fish and the aquatic insects upon which they depend on for food.

Cumulative Effects

The cumulative effects for Alternative 3 will typically result in a trend toward restoring the long-term function and process of the aquatic ecosystem by improving vegetation structure and diversity and reducing the effects of roads on stream sediment production. Cumulative effects would be the same as those under Alternative 2.

There are no known ongoing activities and/or project proposed in the foreseeable future which may result in irretrievable or irreversibly impact to TES species.

Effects Common to All Action Alternatives

Six restoration projects are proposed under the Woods Creek Stewardship Thin that would opportunities to restore aquatic ecosystem elements. The Northwest Forest Plan Final Supplemental Environmental Impact Statement (NWFP FSEIS) includes a watershed restoration component to help accelerate recovery rates and bridge the time gap in natural restoration by proactively addressing priority restoration needs. The NWFP FSEIS (Appendix B-121) describes watershed restoration designed to restore currently degraded habitat conditions in key watershed (USDA, USDI 1994).

The Woods Creek Stewardship Thin planning process identified several restoration opportunities exist that are consistent with the NWFP including the most important category of opportunities 1) control and prevention of road erosion and sedimentation; 2) riparian silvicultural and 3) stream channel improvements (FEMAT V-J). The restoration projects are classified into two groups: Group 1 projects are those which, in part, fall within the bankfull channel width, and Group 2 projects are located outside the bankfull channel. Those projects are shown in the table below:

Table 4.8.6. Restoration projects by group.

Group	Project
Group 1	Access/travel management (road decommissioning)
	Cispus River riparian and floodplain restoration
	Salmon rearing habitat restoration
Group 2	Snag and down wood creation
	Riparian conifer release
	Western redcedar underplanting
	Access/travel management dispersed recreation site and wood tracks)

Group 1: Direct and Indirect Effects

The Group 1 projects are proposed to occur within the bankfull stream channel and may result in one or more of the following: project-related turbidity and mobilization of fine sediment; short-term riparian disturbance; and/or harassment of ESA-listed fish.

Both action alternatives have nearly the same restoration components with only a minor variation in output. For the sake of analysis, Table 4.8.7 describes the output by alternative. Because of the difficulty in discerning the environmental consequences, however, all action alternatives are combined together.

Table 4.8.7. Summary of Group 1 proposed restoration projects by alternative in Woods Creek Stewardship Thin

Project Name	Group[1]	Description	Alt 1	Alt 2	Alt 3
Cispus River and Yellowjacket Ck riparian/instream[5]	1	Establish stable large wood in the flood plain, stabilize lower banks with riparian planting	0	60 ac	60 ac
Access/Travel management (Rd decom)	1	Decommission and close system and non system roads.	0	5.0 mi	5.2 mi
Side Channel connection	1	Reconnect alcove to Cispus River	0	1500 ft	1500 ft

Short-Term

The Group 1 activities proposed for Woods Creek Stewardship project work within the bankfull channel to treat habitat elements and watershed conditions that are not properly function or functioning at risk (USDA 2002). The three proposed projects will have a positive direct short term effect as follows:

1. Increase stream complexity over 60 acres of floodplain and stabilize 2500 feet of eroding bank to reduce sediment delivery and increase bank stability to >80%.
2. Accelerate the recovery of approximately 100 acres of flood plain vegetation.
3. Increase large wood count to >100 pieces/river mile, >24" in diameter.
4. Restore channel connectivity and hydrological function along 5.0 miles of system road.
5. Reconnect or restore existing side channels and alcoves to increase rearing habitat for juvenile fish.

Instream projects will result in unavoidable short-term construction related effects including:

1. Disturbance of riparian vegetation
2. Exposure of bare soil and increased stream turbidity
3. Increased risk of chemical contamination from fuel and lubricants.

Most adverse effects resulting from the proposed restoration activities are expected to be minor and of short duration (a few weeks to two years). Degraded water quality and increased turbidity resulting from instream construction will last a maximum of a few weeks. Riparian disturbance and disturbed soils resulting from accessing work sites will stabilize and begin to

revegetate in one year. Proposed mitigations to limit timing and magnitude will reduce the risk to fish and other aquatic life. A limited operating period will minimize the impacts to the vital egg-fry life stage. Operating restriction will reduce risk associated with contamination.

Long-Term

The proposed restoration actions are expected to have a positive impact on channel process and function in the long term. Improved channel structure will have a positive impact on channel stability and add complexity for fish hiding and holding habitat and shade. Numerous authors have highlighted the importance of large woody debris to lotic ecosystem (Bilby 1984, Keller *et al.* 1985, Lassettre and Harris 2001). Large woody debris influences channel morphology, traps and retains spawning gravels, and provides food for aquatic invertebrates that in turn provide food for juvenile salmonids. Large woody debris, boulders, and other structures provide hydraulic complexity and pool habitats that that serve as resting and feed

Cumulative Effects

The cumulative effects of a restoration program will help offset long term adverse impacts of past, present and future disturbance resulting from natural causes and land management activities.

Group 2: Direct and Indirect Effects

The Group 2 projects are proposed outside of the bankfull channel and will result in small amounts of turbidity and mobilized fine sediment. The following table summarizes the projects and their acreages:

Table 4.8.8. Summary of Group 2 proposed restoration projects by alternative in Woods Creek Stewardship Thin

Project Name	Group	Description	Alt 1	Alt 2	Alt 3
Riparian conifer release and under plant (outside harvest units)	2	Release conifers at three sites	0	13ac	35 ac
Riparian silviculture, snag/down wood creation	2	Down Wood: 5% (25 TPA) Snags: 3 TPA	0	130 ac	123 ac
Western Redcedar development/Conifer release w/in commercial unit	2	Plant and release, promote development of underrepresented spp. (West Redcedar)	0	9400 seed-lings	9000 seed-lings
Access/Travel management (Dispersed rec site and wood tracks)	2	Close and/or stabilize unmanaged recreation sites	0	10214 ft^2	22677 ft^2

Short-Term

The four Group 2 activities proposed for Woods Creek Stewardship project would occur outside the bankfull channel to treat upland habitat elements and watershed conditions that are

not properly functioning or functioning at risk (USDA 2002). The four proposed projects will have a positive direct short-term effect as follows:

1. Increase riparian species diversity and promote underrepresented and desirable tree species over approximately 123-130 acres
2. Add approximately 25 TPA down wood to riparian communities to increase the forest floor roughness and habitat complexity for riparian species
3. Reduce sources of erosion following timber harvest through riparian planting

Negative impacts of Group 2 projects are limited since there is no resource extraction or substantial ground disturbing activity. However, there is expected to be some incidental riparian vegetation disturbance and sediment delivery from closing dispersed recreation sites located in the riparian area. Restoration activity could also temporarily flush fish from hiding cover but it is not expected to result in significant behavior modification of listed salmon and steelhead. In the long term, planting of riparian vegetation will increase shade, hiding cover, woody debris, and streambank stability.

Long-Term

In the long term the restoration projects are designed to have positive impacts as follows:

1. Increase riparian species diversity and promote underrepresented and desirable tree species in approximately 123-130
2. Increase the channel stability with well rooted woody vegetation
3. Increase long term recruitment potential for down wood and instream LW
4. Increase the shade potential and moderate the temperature extremes along streams

Cumulative Effects

The cumulative effects of a restoration program will help offset long-term adverse impacts of past, present and future disturbance resulting from natural causes and land management activities.

Proposed Endangered and Threatened Species Effects Determination

The effects determination for Woods Creek Stewardship project activities is **May Affect - - Likely to Adversely Affect (LAA)** for PETS species and critical habitat. This determination is based on the aggregated effects of proposed watershed restoration projects and commercial timber harvest. While timber management activities are **Not Likely to Adversely Affect (NLAA)** local TES species and their critical habitat, the restoration projects do have the potential for short-term direct and indirect effects. Specifically, those restoration projects which propose to work within the bankfull channel (Group 1) may have some unavoidable consequences that are LAA to the Columbia River Coho, Lower Columbia River Spring Chinook and Lower Columbia River/Southwest Washington Steelhead.

The proposed action in Woods Creek Stewardship project will have **No Effect (NE)** to Lower Columbia River/Southwest Washington Chum Salmon. The proposed action is physically

removed from the species distribution and critical habitat as determined NOAA Fish.

No suitable bull trout habitat is within the planning area and no individual TES species been found within in the planning area based on ground reconnaissance and stream surveys. The project area is outside of the "Bull Trout Consultation Area" prescribed by the Level I Team. All projects within the upper Cowlitz watershed which are compliant with the Forest Plan (USDA 1994) will have **No Effect** to Lower Columbia River Bull Trout (Perez-Rose, personal comm. 2003).

Table 4.8.9. Summary of effects determination for PETS species listed in the Woods Creek Stewardship Thin planning area.

Species	Distinct Population Segment	Status	Effects Determination	
			Individuals	Critical Habitat
Steelhead trout (Onchorynchus mykiss)	Lower Columbia River Southwest Washington	Threatened	NLAA[1]	LAA[2]
Spring Chinook (Oncorhynchus tshawytscha)	Lower Columbia River	Threatened	NLAA	LAA
Coho (Oncorhynchus kisutch)	Columbia River	Threatened	NLAA	LAA
Chum (Onchorynchus keta)	Lower Columbia River Southwest Washington	Threatened	No Effect	No Effect
Bull trout (Salvelinus confluentus)	Lower Columbia River Bull Trout	Threatened	No Effect	NA

[1]NLAA: May Affect, Not Likely to Adversely Affect
[2]LAA: Likely to Adversely Affect

4.9 Social Sciences: Historical and Present Use

Historical Human Uses

The Lower Cispus River Watershed Analysis (1995) provides a comprehensive history of the area, but a brief summary is provided here. The lower Cispus River valley is historically and culturally rich. Archaeological evidence from sites located in the watershed reveals human use of the area as early as 7,000 years ago. More recently, during the 19th century, the Taitnapam, or Upper Cowlitz Indians, lived in settlements scattered along the Cispus and Cowlitz Rivers between Mossyrock and Packwood. Ethnographic accounts list nearly 40 fishing stations throughout Taidnapam territory, attesting to the significance of salmonids as a subsistence resource. Fishing sites, seasonal camps, and primary settlements were connected by a series of trails. Among the best documented of these was the "Yakima Trail" or "Yakima-Cowlitz Trail" which followed the south side of the Cowlitz River, crossing the Cispus River near its mouth (Fechtner 1939).

The first Euroamerican homesteaders moved into the valley near present-day Randle in the period between 1882 and 1890. A shift in human land use occurred between 1880 and 1890, when English-speaking immigrants replaced Sahaptin-speaking indigenous populations. Homesteaders supplemented small-scale farming with subsistence hunting and fishing. A shift from an agricultural society to one based around the extraction of forest products occurred in the 1930s and 1940s.

Evidence of past human use in the form of prehistoric and historic archaeological sites and features, standing historic structures, and trails have been documented in the Lower Cispus watershed. While there are numerous documented sites, undocumented sites are likely to exist throughout the area.

Heritage Resources

Heritage surveys were conducted in the Woods Creek Stewardship Thin project area. No sites eligible to the National Register of Historic Places were documented within the project area, and it was determined that the proposed project would have no effect on heritage resources.

Recreation, Forest Product Harvesting and Scenic Values

Recreational Activities

The planning area for the Woods Creek Stewardship Thin contains numerous opportunities for developed and dispersed recreation, trails and trailheads for hiking,

waterways for activities like fishing, and roads used for driving for pleasure and sightseeing.

Developed Recreation

Several trails or trailheads are located within the planning area. Under Alternative 3, Unit 11 contains a portion of the Woods Creek Watchable Wildlife Old Growth Loop Trail #247A. Other trails within the planning area boundary include the Burley Mountain Trail #256, Colvel Creek Trails #228(A&B), and the trails found within the Iron Creek Campground; Trails #83 and #187. Two developed campgrounds, Iron Creek Campground and Tower Rock Campground, are also located within the planning area boundary. In addition, the Cispus Environmental Learning Center is located within the planning area boundary. Forest Roads 23, 25, 28, 76, all experience significant levels of recreational driving for pleasure, and provide cross Forest access.

Units 9, 10, 11, and 12 are within the management prescription of VL or Visual Emphasis. The desired condition for these areas is to meet the Visual Quality Objective (VQO) of partial retention. This means that the management action should be visually subordinate to the characteristic landscape. Most retention harvests (thinning) meet the VQO of partial retention.

Wild and Scenic River Candidate

The Cispus River is a candidate for inclusion into the National Wild and Scenic Rivers System from its headwaters in the Goat Rocks Wilderness Area to the slack water 1.5 miles above its confluence with the Cowlitz River, approximately 52 miles. The "outstandingly remarkable values" (ORVs) identified for the Cispus River are scenic, archaeological, and recreation and they are rated as outstanding. Values to be protected include "large conifers that often form a colonnade effect" as seen from the river, whitewater boating opportunities, and evidence of Native American occupation of the river corridor. Harvest Units 6 and 7 as well as non-system roads NS-3 through NS-7 lie in the corridor of the Wild and Scenic River land allocation.

User-Developed Trails & Dispersed Recreation

There are a number of user-developed trails within the planning area. These trails are used by a variety of user groups, primarily "local resident" hikers, stock users and motorized recreationists. Forest Plan direction is to prohibit unlicensed motorized vehicles (ATVs and non-street-legal motorcycles) from traveling on Forest Roads or cross country, and user-developed motorized trails are considered illegal trails. Numerous dispersed camping opportunities exist in the planning area, often occurring on short spur roads left from previous management activities as well as on user-created "wood tracks;" the activity of dispersed camping is not an illegal activity, although the impacts caused by dispersed camping should be reduced in riparian habitat. Restoration activities associated with this project include the closure of up to three dispersed recreation locations.

Dispersed camping opportunities will be reduced in the project area. Up to three dispersed recreation locations have been identified for closure through the restoration

activities identified in this project, and they are heavily utilized by campers. In Alternative 2, one of the dispersed recreation locations will be closed to motorized access and rehabilitated. One location (NS-3) will not be closed to motorized access, but barriers to vehicles will be placed at the dispersed camping location to prohibit vehicle access beyond the camp location or to the Cispus River. One location (NS-5) will have vehicle access blocked near FR 7600; however, a walk-in camp location will be provided. In Alternative 3, all locations identified in the project will be closed and rehabilitated and vehicle access will be prohibited. User displacement will occur under either alternative.

Direct and Indirect Effects of Harvest Activities

Forest visitors who recreate or gather forest products in the area may be affected by visual impacts of harvest activity, temporary closure of recreation or gathering sites, log truck traffic, or landing operations adjacent to units. There would be no direct or indirect effects to recreation under Alternative 1, the No-Action Alternative.

Developed Recreation

Approximately 500 individuals access Woods Creek Watchable Wildlife Old Growth Loop (Trail #247A) trailhead each year, including local school groups. Access will be affected by harvest activities because the trail will be closed during harvest activities. A short section of the northern most portion of Trail #247A is located in Unit 11.

Under Alternative 2, no harvest would occur within 100' of one side of the trail (no harvest would occur at all on the other side of the trail). There would be short-term impacts to trail users because access would be limited or closed during harvest activities. Long-term impacts to trail users would be minimal as the harvest unit would be buffered from view by vegetation, and no damage to the trail would occur.

Under Alternative 3, no harvest would occur within 50' of either side of the trail. Short-term effects to hikers will be limited or delayed access during harvest activities. There would be long-term impacts to the trail experience as skyline corridors will create linear visual impacts inconsistent with "partial retention" objectives of having management activities visually subordinate to the characteristic landscape, even though these impacts will be mitigated by minimizing the number of crossings, and through utilizing natural openings to the greatest extent possible. Impacts to the trail structure will be mitigated by requiring trail restoration after timber management activities have taken place.

Wild and Scenic River Candidate

Units 6 and 7 fall within the Wild and Scenic River management prescription (NA). Neither of these units is visible from the river, and the proposed thinning will activity will enhance the development of the Cispus River's Outstandingly Remarkable Values under both action alternatives.

User-Developed Trails and Dispersed Recreation

User-developed trails within the harvest units will not receive mitigation measures to protect them under either action alternative. It is likely that sections of user-developed

trails will be obliterated through the harvest process. These trails are not maintained by the Forest Service and are not part of our inventoried recreational facilities. Mitigation measures have been identified to reduce illegal motorized access, particularly ATV access, in some of the harvest units. This includes obliterating and rehabilitating temporary roads, and re-closing roads that were temporarily opened for harvest activities.

Besides the types of dispersed recreation that require the use of user-developed trails, other forms of dispersed recreation (hunting, bird watching, etc.) would be impacted by timber harvest in the short term under both alternatives. While harvest operations were occurring in the units, they would be unavailable for dispersed recreation. In the long term, opportunities for dispersed recreation would be similar to those that were present before harvest.

Cumulative Effects of Harvest Activities

It is difficult to accurately predict the cumulative effects the proposed action will have on recreation within the western half of the Cowlitz Valley Ranger District. Many recreational opportunities exist in this portion of the district, including trails, wildlife observation, dispersed camping, and more. It is expected that the implementation of this project would have little to no effect on recreational opportunities or the quality of the recreation experience for users.

Direct and Indirect Effects of Restoration Projects

Forest visitors who recreate or gather forest products in the area may be affected by visual impacts of the implementation of the projects, noise from machinery, or temporary or permanent closure of recreation or gathering sites. There would be no direct or indirect effects to recreation under Alternative 1, the No-Action Alternative.

Developed Recreation

There would be little or no impact to developed recreation due to restoration activities. While there are developed campgrounds and trails within the planning area, they are not in close enough proximity to the proposed projects that there would be a measurable effect to the quality or quantity of developed recreation opportunities.

Wild and Scenic River Candidate

Several of the restoration projects will occur on or near the Cispus River (road decommissioning, salmon rearing habitat restoration, riparian conifer restoration, and Cispus River floodplain and riparian restoration). Temporary effects under both action alternatives would be the sight and noise of machinery as well as the visible scarification of soil and gravel. Natural materials would be used in the restoration projects (i.e. boulders to prevent motorized traffic on decommissioned roads, a log structure to slow stream velocity in the floodplain restoration), and the scarified soil would be revegetated following implementation. In the long term, there would be no impacts under either action alternative.

User-Developed Trails and Dispersed Recreation

It is possible a large number of campers will be displaced through the closure of the dispersed campsites, and it is not possible to predict where they will choose to camp when faced with the closures. It is unlikely that they will choose to camp in a developed campground, as dispersed camping offers a sense of freedom not experienced in a developed campground. There are other dispersed camping locations in the project area and it is possible that these locations will receive heavier use; it is also possible that new dispersed camping locations will be created, most likely within riparian areas as these are the most desirable locations from a dispersed camper's point of view.

Cumulative Effects of Restoration Projects

It is difficult to accurately predict the cumulative effects the recreation projects will have on recreation, but it is expected that the implementation of this project would have little to no effect on recreational opportunities or the quality of the recreation experience for users.

Non-Timber Forest Products

Generalized information regarding harvest of non-timber forest products (NTFP) in the Lower Cispus River Watershed and the Woods Creek Stewardship Thin planning area is based on anecdotal knowledge gleaned from permit administration records, law enforcement, Forest Service employees and forest visitors and harvesters.

The proposed action would allow for continued opportunities for the collection of mushrooms, salal, boughs, personal use firewood and Christmas trees. It is not expected that there would be impacts to the harvest of NTFP.

Direct and Indirect Effects of Harvest Activities

Thinning of units may affect the distribution of non-timber forest products. Mushrooms and salal are the products most likely impacted from timber harvest activities. The potential effect to supply of products would be direct on site, where thinning and yarding occurs. While it is not known whether the project units have crops of mushrooms such as chantrelles, it is important to consider the potential effects.

Skyline harvest methods would likely have the least impact on mushrooms, with ground-based yarding with the highest. A 5-10% reduction in mushroom crops is likely, based on research done in similar forest types (Colgan et al. 1999, Foragty et al. 2001). However, adjacent habitat (both skips and areas outside the units) is expected to provide sufficient sources and crops.

Harvest would negatively impact salal due to mechanical damage; however, populations are expected to recover after 2 to 5 years and then significantly increase due to the additional light available through the thinned canopy. In the short-term, harvesters who currently utilize salal "stands" in the thinning units may be displaced to other collection

areas. Abundant habitat in adjacent collection areas is expected to provide sufficient sources of this crop.

Similarly, other forest products such as boughs, firewood, and Christmas trees are abundant in other portions of the planning area and the proposed action is not expected to have a significant impact on the collection of those items.

Cumulative Effects of Harvest Activities

As stated above, non-timber forest products are plentiful in the area analyzed (the western side of the Cowlitz Valley Ranger District). The Woods Creek Stewardship Thin would have little to no effect on the collection of forest products.

In the long term, the thinning project would increase opportunities for collection. By encouraging the development of late-successional stand characteristics within thinning units, as well as restoring those characteristics in some of the restoration projects, the amount of most of the products would increase. A more open canopy would increase the amount of salal, a more structurally diverse forest with a more diverse mix of species would eventually increase the amount of mushrooms, and an older stand would eventually produce more firewood as trees die or are windthrown. Opening the canopy (especially in gaps) would also encourage the regeneration of trees, and the saplings could be used for Christmas trees or boughs.

Direct, Indirect, and Cumulative Effects of Restoration Projects

Similar to the effects of harvest activities, NTFP collectors may be temporarily displaced by temporary or permanent closures of some areas. There would be no long-term effects to the harvest of NTFP from the restoration activities. Because of the small scale of the restoration projects given the larger scope of the planning area, and the limited availability of desirable forest products in the project areas (for example, the lack of salal in dispersed campsites), the restoration projects would have no cumulative effects to the harvest of non-timber forest products.

4.10 Economics – Financial Analysis

Background

Timber values are dependent on market conditions and logging costs. As of this writing, a decrease in housing starts has reduced the demand for lumber, and fuel costs have increased the costs of logging and transportation. By the time the timber from Woods Creek Stewardship Thin is harvested, however, timber values may have either increased or decreased. While this analysis cannot accurately predict future market conditions, fuel prices, or other factors, this analysis does approximate the economic feasibility of the timber sale and estimate the potential value generated, and it provides a comparison of the alternatives.

One of the aspects of the Purpose and Need for this project (Section 2.3) is to provide forest products. One of the dual goals of the Northwest Forest Plan is to provide a sustainable level of forest products for local and regional economies and to provide jobs. The Northwest Forest Plan Final Environmental Impact Statement has an in-depth analysis of the economic basis behind the goal of providing forest products for local and regional economies. It also contains an analysis of the social and economic benefits and impacts of preservation, recreation and other values. To benefit local and regional economies, timber is auctioned to bidders. For logging contracts to sell, the contractors must have products that prospective purchasers are interested in, and they must have log values greater than the cost of harvesting and any additional requirements.

The purpose of a stewardship contract, which is the preferred type of contract on this sale, allows the contractor to use receipts generated from timber harvest to implement the restoration projects. The number of stewardship restoration projects implemented is dependent upon the value of the timber harvested and the cost of implementing the restoration project. In the event that timber receipts do not cover the cost of all restoration projects, they will be prioritized for implementation as follows:

1) Snag and down wood creation
2) Road closures, stabilization and decommissioning: high risk[1] and half of medium risk roads, and all non-system roads
3) Salmon rearing habitat restoration
4) Riparian conifer release
5) Western redcedar underplanting
6) Cispus River riparian and floodplain restoration
7) Road closures, stabilization and decommissioning: low risk and half of medium risk roads

[1] The aquatic risk rating for each road was identified in the Gifford Pinchot National Forest Roads Analysis (2002), and the rating describes the potential for negative impacts that the road has on aquatic resources (like fish and water quality).

Comparison of Timber Values by Alternative

In terms of volume outputs and value, the two action alternatives would meet the economic objectives under the Northwest Forest Plan (NFP), and the no-action alternative would not. Alternative 2 would create the most volume and revenue, and Alternative 3 would create less volume and revenue because fewer acres would be treated.

Alternative 1 (No Action) would not contribute to the Northwest Forest Plan goal of maintaining the stability of local and regional economies through the provision of forest products. The action alternatives would provide for jobs associated with logging and sawmill operations and would contribute to meeting the current demand for forest products. The annual incremental contribution of each million board foot of wood harvested from National Forest is expected to provide approximately 8.3 jobs (NFP, p. 3, 4-297).

Table 4.10.1 displays a summary of the cost and benefits associated with the timber harvesting only, for each alternative. The table displays present value benefits, cost, and net value, as well as the benefit/cost ratio for each alternative as if it was sold as one timber sale. These figures display the relative difference between the alternatives. If timber prices or other factors fluctuate in the future, the relative ranking of alternatives would not likely change.

Table 4.10.1. Woods Creek Stewardship Thin Volume Removed and Value

	No-Action Alternative	Alternative 2	Alternative 3
Net acres commercially thinned	0	349	295
Total MBF removed	0	3845.3	3291.3
Gross revenue	0	$1,345,857	$1,151,945
Logging and haul costs	0	$1,104,905	$948,404
Road construction and decommissioning	0	$37,628	$15,705
Net revenue	0	$203,325	$185,219
Benefit/Cost Ratio	0	1.18	1.19

Gross Revenue: This is the present day value based on delivered log prices, estimated at $350/mbf (assumes 1/3 #3 saw and 2/3rd #4 saw).

Logging and Haul Costs: This is the present day value of the cost associated with harvesting. Costs include: Logging costs: $160/mbf ground-based, $260/mbf cable yarding, $80/mbf haul, and $20/mbf other costs (road maintenance, slash disposal, etc).

Road Construction and Decommissioning: This is the cost of reopening, constructing, or reconstructing roads used for harvest, as well as the cost of closing or decommissioning those roads after harvest is complete. This figure assumes a cost of $15,000 per mile for roads under Alternative 2, and $14,000 per mile under Alternative 3 (because the roads work will be less intensive, i.e. will not involve extensively reconstructing temporary roads).

Net Revenue: This is the present net value of the alternative, which is based on the value of delivered logs to a mill less the value of costs associated with harvesting.

Benefit/Cost Ratio: This is a ratio derived from dividing the Gross Revenue by the Net Revenue. It shows the relative value of the two alternatives as a function of the amount of work performed versus the amount of value gained; in other words, it shows "bang for the buck."

The following two tables show the breakdown of cost by unit for each alternative:

Table 4.10.2 Costs per unit for Alternative 2

Unit	Net Com. Thin Acres	Standing MBF/Ac	Removed MBF/Ac	Total MBF Removed	Gross Revenue	Logging & Haul Costs	Road Construct & Decom.	Net Revenue
1	24	32.0	10.1	243.0	$85,036	$68,029	$0	$17,007
2	22	23.2	8.1	180.7	$63,257	$50,605	$1,500	$11,151
3	28	23.8	12.8	352.7	$123,459	$126,986	$3,200	-$6,728
4	14	27.5	12.0	171.1	$59,871	$47,897	$2,418	$9,556
5	50	26.0	13.6	675.9	$236,578	$189,262	$3,351	$43,964
6	32	18.6	6.3	199.9	$69,953	$55,963	$4,890	$9,100
7	43	20.6	10.8	462.8	$161,966	$129,573	$4,500	$27,893
8	16	27.9	17.0	280.1	$98,048	$78,438	$4,829	$14,780
9	50	22.2	14.0	691.8	$242,130	$193,704	$4,864	$43,562
10	10	26.3	9.0	86.5	$30,276	$24,221	$0	$6,055
11	38	22.2	6.8	261.6	$91,558	$73,246	$3,253	$15,059
12	23	33.4	10.3	239.2	$83,727	$66,982	$4,822	$11,924
Tot	**349**			**3845.3**	**$1,345,857**	**$1,104,905**	**$37,628**	**$203,325**

Table 4.10.3 Costs per unit for Alternative 3

Unit #	Net Com. Thin Acres	Standing Mbf/Ac	Removed MBF/Ac	Total MBF Removed	Gross Revenue	Logging & Haul Costs	Road Construct. & Decom.	Net Revenue
1	24	32.0	10.1	243.0	$85,035	$68,028	$0	$17,007
2	22	23.2	8.1	180.7	$63,250	$50,600	$1,200	$11,250
3	22	23.8	12.8	279.4	$97,800	$100,595	$1,708	-$4,787

4	11	27.5	12.0	126.8	$44,381	$35,505	$0	$8,876
5	46	26.0	13.6	632.6	$221,395	$177,116	$1,200	$42,879
6	9	18.6	6.3	59.2	$20,736	$16,589	$1,200	$2,747
7	43	20.6	10.8	462.8	$161,985	$129,588	$3,600	$28,197
8	16	27.9	17.0	280.1	$98,030	$78,424	$3,863	$15,099
9	39	22.2	14.0	541.7	$189,606	$151,685	$2,934	$34,498
10	10	26.3	9.0	86.5	$30,291	$24,233	$0	$6,058
11	41	22.2	6.8	280.8	$98,289	$83,124	$0	$15,165
12	11	33.4	10.3	117.6	$41,147	$32,918	$0	$8,229
Totals	**295**			**3291.3**	**$1,151,945**	**$948,404**	**$15,705**	**$185,219**

Administrative costs are not included in the analysis above. Administrative costs for planning are already spent and would be the same for all alternatives including the no-action alternative. Other costs for timber sale preparation and sale administration for the action alternatives would be approximately proportional to the acres of each alternative.

Comparison of Restoration Activities by Alternative

The cost of each of the six restoration projects has been estimated by using the cost of doing similar work on previous projects (Table 4.10.2). The cost of having Forest Service personnel administer the project has been included except for those projects with an asterisk (*) next to the title. Administrative costs would not vary between action alternatives. Please see the Project Record for a detailed breakdown of the costs.

Table 4.10.4 Comparison of restoration activities by alternative

Project	Alt. 1	Units	Alt. 2	Units	Alt. 3
Snag and down wood creation*	0	534 ac	$112,140	468 ac	$97,352
Access and travel management	0	5.0 mi	$78,600	5.2 mi	$78,300
Cispus River riparian and floodplain restoration*	0	60 ac	$50,000	60 ac	$50,000
Riparian conifer release	0	11 ac	$3,630	33 ac	$10,890
Western redcedar underplanting (seedlings planted)	0	9400 trees	$56,620	9000 trees	$56,470
Salmon rearing habitat restoration	0	1 site	$45,000	1 site	$45,000
Total			**$345,990**		**$338,012**

All six restoration projects are feasible given the current value of the timber harvested and the cost of implementing the restoration project.

4.11 Other Environmental Consequences

This section addresses those effects for which disclosure is required by National Environmental Policy Act regulations, Forest Service policy or regulation, various Executive Orders, or other laws and direction covering environmental analysis and documentation. In some cases, the information found here is also located elsewhere in this document.

Irreversible and Irretrievable Commitment of Resources

Irreversible Commitments

Irreversible impacts result from the use or modification of resources that are replaceable only over a long period of time, such as old-growth trees, rock, and soil.

Soil Productivity

Soil productivity would be lost or reduced to some degree on temporary roads and landings due to soil displacement. Full recovery of productivity on temporary roads and landings would not be anticipated despite efforts to reclaim these areas. The losses in productivity from the above would occur on a small part of the planning area. Project design criteria and mitigation measures included with all action alternatives are designed to minimize potential losses in productivity (see Section 4.6, Soils).

Rock Resource

The rock that is removed from quarries or rock pits and used during the construction of roads for surfacing and other needs would not be replaceable.

Old Growth

No late-successional (>170 years old) or old growth stands or trees are proposed for harvest in any alternative.

Irretrievable Commitments

Irretrievable commitments are opportunities for resource uses that are foregone because of decisions to use that land in another way.

Timber Production

Generally, management activities such as thinning improve timber production. However, opportunities to increase the net production of timber (for example, capturing mortality) would be forgone in those areas not thinned at this time to protect other resources.

Relationship between Short-term Uses and Long-term Productivity

Long-term impacts to site productivity from soil disturbance are discussed above in Irreversible Commitments of Resources.

Relationship to Other Agencies and Jurisdictions

The Washington State Department of Ecology (DOE) is responsible for enforcing the Clean Water Act of 1972. A Memorandum of Agreement (2003) prepared and agreed to by the Forest Service and DOE states that Best Management Practices, used by the Forest Service to control or prevent non-point sources of water pollution, would meet or exceed State water quality standards and other requirements, as outlined in Washington State Forest Practices Rules. The project design criteria and mitigation measures listed in Chapter 2 comply with terms and conditions of the Memorandum of Agreement.

The Washington State DOE is also responsible for enforcing the Clean Air Act of 1977. The State Smoke Implementation Plan provides guidelines for compliance which are intended to meet the requirements of the Clean Air Act. All burning plans for activities associated with this project would comply with this Plan.

The Washington State Department of Fish and Wildlife and the Forest Service entered into an agreement in the form of a Memorandum of Understanding (USFS, WDFW 2005). The MOU provides standard provisions and serves as a Hydraulic Project Approval for instream work. The project design criteria and mitigation measures listed in Chapter 2 incorporate and comply with terms and conditions of the Memorandum of Understanding.

The United States Department of Interior Fish and Wildlife Service (FWS) is responsible for the protection and recovery of threatened and endangered species. The Forest Service consulted with the FWS on the fisheries portion of this analysis and gained concurrence with the determination. The Forest Service did not consult separately with FWS on wildlife species because the proposed action is consistent with the "Programmatic Biological Assessment for Forest Management, Gifford Pinchot National Forest, August 2001."

The United States Department of Commerce National Marine Fisheries Service (NMFS) is responsible for the protection and recovery of Threatened and Endangered fish species. The effects determination for Lower Columbia River steelhead trout, Lower Columbia River Chinook salmon, Lower Columbia River Coho salmon, and Designated Critical Habitat is "May Effect and is Not Likely to Adversely Affect ." Informal consultation was initiated with NOAA-Fisheries and a letter of concurrence is expected in May 2008.

All steps in the cultural resource process are coordinated with the Washington State Historic Preservation Office (USDA, 1990). Cultural Resource Site Reports are filed and approved by the Washington State Historic Preservation Officer. Based on the

information documented in the Cultural Resource Report, there would be no adverse effects to cultural resources by the implementation of any alternative.

Prime Farm Land, Range Land, and Forest Land

There are no prime farm lands or prime range lands within the Woods Creek Stewardship Thin planning area. Prime forest land is a term used only for non-public lands and does not apply to any land within the planning area.

Environmental Justice

Executive Order 12898 (February 11, 1994) directs federal agencies to focus attention on the human health and environmental condition in minority communities and low-income communities. The purpose of the Executive Order is to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects on minority populations and low-income populations.

Environmental Justice is simple: people should not suffer disproportionately because of their ethnicity or income level. While the sale of National Forest timber would create or sustain jobs and provide consumer goods, none of the alternatives is expected to have a disproportionately high and adverse human health or environmental effect on minority populations and low-income populations.

Minority communities may harvest timber and non-timber forest products from the project area (Section 4.9). Travel to and from harvest sites along Forest roads may be affected by log truck traffic. Signage and posting signs communication location and time periods of harvest and haul would mitigate this potential effect.

Wetlands and Floodplains

There would be no adverse effects to wetlands or floodplains due to the implementation of project design criteria and mitigation measures included with the action alternatives. Wetlands, riparian areas, and streams would be protected with buffers consistent with Northwest Forest Plan standards and guidelines.

5.0 CONSULTATION AND COORDINATION

The Forest Service consulted the following individuals, Federal, State, and local agencies, tribes and non-Forest Service persons during the development of this environmental assessment:

Interdisciplinary Team Members

Ken Wieman: Interdisciplinary Team Leader; North Zone Fisheries Biologist

Kristy Boscheinen, Gery Ferguson, Karen Thompson, and Jessica Call: North Zone Planning Team Leaders and Writer/Editors

Derek Churchill, Stewardship Forestry Consulting, and Ron Pfeifer, Pfeifer Forestry Consulting: Consulting Silviculturists

Stephen Boyer, North Zone Silviculturist

Tom Kogut: North Zone Wildlife Biologist

Amy Lieb: North Zone Hydrologist

Terry Lawson: Fisheries Technician; GIS

Aldo Aguilar: Soil Scientist

Linda Swartz: North Zone Botanist

Steve Freitas: Heritage and Cultural Resources

Steve Hansen: Logging Systems

Diane Bedell: Recreation Planner

Dean Lawrence: Engineering and Transportation Systems Specialist

Federal, State, and Local Agencies

Vince Harke: U.S. Fish & Wildlife Service

Jody Walters: NOAA Fisheries

Tribes

The following Tribal representatives were contacted during the scoping process:

John Barnett, Chairman, Cowlitz Indian Tribe
Lee Carlson, Yakama Indian Nation
Dave Lopeman, Chairman, Squaxin Island Tribe
Karen Lucei, Env. Rev. Coord., Yakama Indian Nation
Joan Ortez, Chair, Steilacoom Tribe
Carrol Palmer, Dir. Natural Resources, Yakama Indian Nation
Dorian Sanchez, Chairman, Nisqually Indian Community Council
Bill Sterod, Chairman, Puyallup Tribal Council

Others

Representatives of environmental groups, participants of the Pinchot Partners (a local collaborative working group), and members of the local community were actively involved and provided comments regarding design and silvicultural prescriptions. Comments were solicited from individuals, tribal representatives and other agencies.

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