United States
Department of
Agriculture

Forest
Service

Mt. Hood National Forest

Hood River Ranger District

Polallie Cooper Hazardous Fuels Reduction

Environmental Assessment

USDA Forest Service
Hood River Ranger District
Mt. Hood National Forest
Hood River County, Oregon
T. 1 S., R. 10E., S32-33; T. 2 S., R. 09 E., sec. 1-3, 10-15;
T. 2 S., R. 10 E., sec. 3-9, 17-18; Willamette Meridian

Polallie Cooper (Stephanie McKinney, 2014)

for the greatest good

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January 2016

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Summary

The Polallie Cooper Hazardous Fuels Reduction Planning area is located on the Hood River Ranger District of the Mt. Hood National Forest. The entire 7,300 acre planning area falls within the East Fork Hood River watershed.

Over the past several decades, the combination of fire exclusion, several large scale disturbance events, endemic insect mortality and logging activities has resulted in higher stand densities, increased fuel, changed species composition, and an altered fire regime. Stands in the planning area east of Highway 35 are susceptible to stand-replacing wildfires, and forest health west of Highway 35 are currently declining in many of the Douglas-fir/grand fir stands. Fuel concentrations range from moderately high to high and could cause resource loss and damage to private property if a wildfire should occur. Private landowners have requested that the adjacent NFS lands be managed so that wildfire suppression can be effective and successful.

Because of these conditions, there exists the threat of a large scale disturbance outside of the range that historically occurred on the landscape that could threaten both NFS land and adjacent privately owned lands. The overall purpose of this proposal is to reduce the fire hazard in order to protect life and property and to restore forest to conditions that are more resilient to wildfire on National Forest System (NFS) lands. This planning area is the last untreated wildland urban interface (WUI) on the eastside of the Mt. Hood National Forest.

The Proposed Action includes treating approximately 2,830 acres and includes sapling thinning, plantation thinning, and recently unmanaged stand thinning. In addition to these treatment blocks, follow-up fuel treatments would be applied to reduce the fuel loading. A suite of fuel treatments would be applied depending on site, on the ground fuel, and desired future condition. In addition to the vegetative and fuel treatments, road closures are also proposed on less than 2 miles of road. All thinning activities proposed in this project would apply variable density thinning (VDT), which allows flexibility to achieve overall treatment objectives. This allows emphasis to be placed on leaving vigorous trees of all sizes without concern for spacing. Leave tree spacing associated with VDT would vary within and between blocks. Tree density would be measured by basal area, canopy closure, trees per acre or relative density depending on the ecological needs for each block.

The desired future condition of the project is to develop an uneven-aged stand with canopy closure that would allow fire behavior to change from crown fire to surface fire, and to have stand species composition reflecting historic conditions. Achieving this desired future condition would enable meeting the overall goals of the land allocations within the planning area. The desired future condition for the upland and riparian vegetation treatments areas is a multi-layer canopy with large diameter trees, well-developed understory, more than one age class, and snags and down woody debris.

Within areas in the WUI and dryer sites, the desired future condition is to develop an uneven-aged stand with canopy closure that would allow fire behavior to change from crown fire to surface fire, and to have stand species composition reflecting a low departure from the central tendency of the natural (historical) regime. Achieving this desired future condition would assist in meeting the overall goals of the land use allocations and the community wildfire protection plan within the planning area and recommendations within the East Fork Hood River watershed analysis.

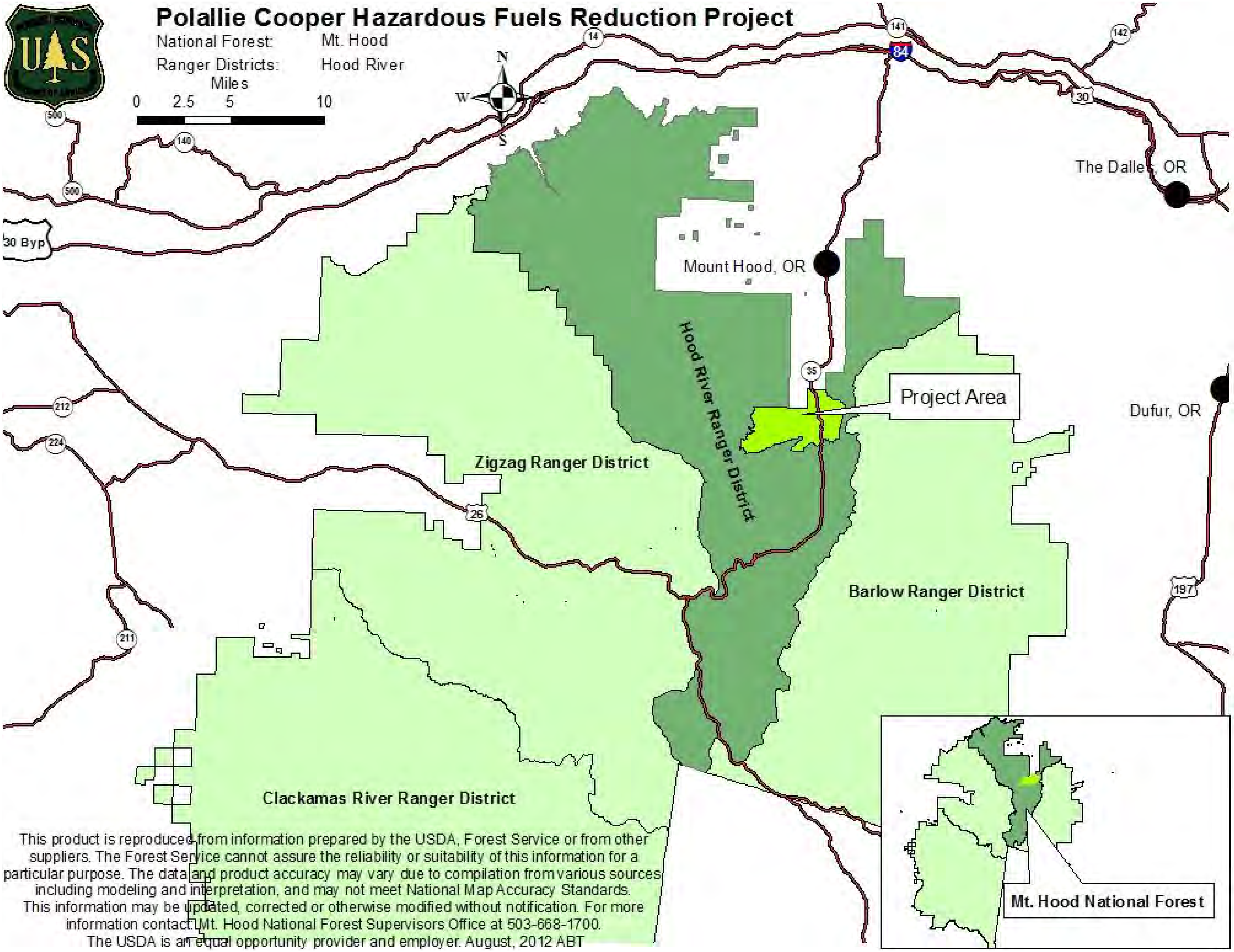


Figure 1. Vicinity Map of Polallie Cooper Hazardous Fuels Reduction Planning area

Chapter 1 – Introduction

The Polallie Cooper Hazardous Fuels Reduction (PCHFR) Project area is located on the Hood River Ranger District of the Mt. Hood National Forest. The large majority of the roughly 7,300 acre planning area falls entirely within the East Fork Hood River Watershed. The planning area consists of over 95% National Forest System (NFS) Lands.

The Forest Service has prepared this Environmental Assessment in compliance with the National Environmental Policy Act (NEPA), the Healthy Forest Restoration Act (HFRA), and other relevant Federal and State laws and regulations. The Polallie Cooper project qualifies under Title 1 - Hazardous Fuel Reduction on Federal Land of the HFRA. It is authorized as described in Section 102 of the HFRA because it is within a wildland urban interface area on federal land identified in a community wildfire protection plan. The Hood River County Community Wildfire Protection Plan (CWPP) of 2006 identifies Cooper Spur as a high priority fuel reduction project given the fire risk.

HFRA authorized fuel projects must be designed to retain or culture old-growth forest structure and large trees according to provisions in the law. Additionally, authorized projects must be conducted consistent with all current laws or policies governing forest management in the area. HFRA authorized projects require collaborative planning, monitoring and assessing forest and rangeland health, and the Act contains provisions that streamline the environmental review of a project.

1.1 Document Structure

This Environmental Assessment discloses the direct, indirect, and cumulative environmental effects that would result from the No Action (baseline) and Proposed Action alternatives. The document is organized into four parts:

- *Introduction:* The section includes information on the history of the project proposal, the purpose and need for action, and the agency's proposal for achieving that purpose and need. This section also details the collaboration process among state, local and tribal governments, non-governmental organizations, and interested parties for this project as required by HRFA, as well as how the Forest Service informed the public of the proposal and how the public responded.
- *Alternatives, including the Proposed Action:* This section provides a more detailed description of the No Action and Proposed Action Alternatives. This discussion also includes project design criteria and mitigation measures that were added as a result of environmental analysis.
- *Environmental Consequences:* This section describes the environmental effects of no action as well as the trade-offs and effects of implementing the Proposed Action alternative. This analysis is organized by resource area. Within each section, the existing environment is described first, followed by the estimated effects of no action that provides a baseline for evaluation, and finally the estimated effects of the Proposed Action alternative.
- *Consultation and Coordination:* This section provides information on agencies consulted during the development of the Environmental Assessment and a list of preparers.

Additional documentation, including more detailed analyses of planning area resources, may be found in the project record located at the Hood River Ranger District Office in Mount Hood/Parkdale, Oregon.

1.2 Background

Over the past several decades, the combination of fire exclusion, several large scale disturbance events, endemic insect mortality and logging activities has resulted in the current vegetative and fuel conditions in the planning area. These conditions include higher stand densities, increased vertical and horizontal fuel continuity, changed species composition, and an altered fire regime.

Due to ladder fuel, timber stands in the Polallie Cooper Planning area east of Highway 35 are susceptible to stand-replacing wildfires. Timber growth, yield, and health west of Highway 35 are currently declining in many of the Douglas-fir/grand fir stands. Fuel concentrations, on both National Forest System (NFS) and private lands within the "urban interface" range from moderately high to high and could cause potential resource loss and damage to dwellings and other private property if a wildfire should occur. Additionally the Cooper Spur Road, which bisects the western part of the planning area, is a popular travel recreation route.

The CWPP describes this area as a potential project to support wildfire reduction hazards by reducing fuel in and around the wildland urban interface (WUI). The planning area has moderate slopes on the northeast side of Mount Hood and is in the East Fork Hood River watershed with both surface and ladder fuel creating a fire-conducive landscape. There has been a history of large wildfires with a moderate frequency of occurrence.

Fire regimes are a national classification of the historic combined conditions for fire severity and frequency for a particular environment. Fire Regime 3 is characterized by 25-100+ year frequency and mixed severity, and is the fire regime of the majority of the planning area. The majority of land in the planning area has been mapped as Condition Class 3, indicating these lands have missed multiple natural fire events and now contains unnaturally high fuel situations. The three classes are based on low (condition class 1), moderate (condition class 2), and high (condition class 3) departure from the central tendency of the natural (historical) regime. The planning area is in a Fire Regime 3, condition class 3, which is part of the reason this planning area is a high priority within the CWPP.

Private lands within and adjacent to the planning area contain a mix of residential homes, outbuildings, forestlands, and agricultural lands. Private landowners have requested that the adjacent NFS lands be managed so that wildfire suppression can be effective and successful.

1.3 Purpose and Need for Action

Fire suppression efforts over the past 100 years, favorable climatic conditions, vegetation growth and dead fuel resulting from insects and diseases have altered stand composition and structure, and increased tree and brush densities. The high density of the stands contributes to mortality of trees because of competition for nutrients, water and sunlight. Insects and diseases are more likely to kill trees that grow in dense, crowded conditions. Dwarf mistletoe-infected trees, diseased trees, insect-killed trees, and down fuel are creating continuous fuel ladders from the ground to the tree crowns. The majority of National Forest System lands in the planning area have been mapped as Condition Class 3, indicating these lands have missed multiple natural fire events and now contain unnaturally high fuel situations.

Because of these conditions, there exists the threat of a large scale disturbance outside of the range that historically occurred on the landscape that could threaten both NFS land and adjacent privately owned lands. The overall purpose of this proposal is to reduce the fire hazard in order to protect life and property and to restore forest to conditions that are more resilient to wildfire on National Forest System (NFS) lands. This planning area is the last untreated wildland urban interface (WUI) on the eastside of the Mt. Hood National Forest.

In order to meet these purposes, the underlying needs for this project are to:

- Reduce or maintain levels of hazardous fuel, including surface, ladder, and crown fuel to reduce the risk of unwanted effects of wildfire on NFS lands and adjacent privately owned land;

- Create defensible space in the communities throughout the WUI to meet the objectives and goals of the CWPP;
- Move the landscape toward more historic conditions to reduce fuel loading and restore forest resiliency;
- Reduce levels of hazardous fuel to protect Cooper Spur Ski Area recreation objectives and Cloud Cap Historic District special interest area objectives;
- Reduce the risk of large stand replacing events using management strategies such as thinning overstory and understory trees (thinning from below), prescribed burning, piling and burning, masticating of underbrush, reducing down woody fuel, and swamper burning; and,
- Move tree species composition to a higher proportion of fire tolerant ponderosa pine, western larch and Douglas-fir.

1.3.1 Management Direction

The Polallie Cooper Hazardous Fuels Reduction Project is proposed to respond to goals and objectives of the Mt. Hood Land and Resource Management Plan, as amended (US Forest Service, 1990a) and the recommendations in the East Fork of Hood River Watershed Analyses (US Forest Service, 1996b). This Environmental Assessment has been completed in accordance with direction contained in the National Forest Management Act, the National Environmental Policy Act, the Council on Environmental Quality regulations, Clean Water Act, the Endangered Species Act and other applicable laws, policies and regulations.

This Environmental Assessment is tiered to the Mt. Hood National Forest Land and Resource Management Plan Final Environmental Impact Statement (US Forest Service, 1990b) and Record of Decision (US Forest Service, 1990c), and incorporates by reference the accompanying Forest Plan. The Forest Plan guides all natural resource management activities and establishes management standards and guidelines for the Forest. It describes resource management practices, levels of resource production and management, and the availability and suitability of lands for resource management. Goals, objectives and desired future conditions of the management areas within the planning area are discussed below in the description of land allocations. In addition, management direction for the area is provided in three major Forest Plan amendments:

- The Northwest Forest Plan (NWFP) - Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl and Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl (1994);
- Survey and Manage – Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines (2001); and,
- Invasive Plants– Pacific Northwest Invasive Plant Program Preventing and Managing Invasive Plants Record of Decision (2005).

Additionally, this Environmental Assessment considers and incorporates, as appropriate, the recommendations of the East Fork Hood River Watershed Analyses. The NWFP Record of Decision requires a watershed analysis for all Key Watersheds prior to resource management (page C-3).Watershed analysis is a systematic procedure to characterize the aquatic, riparian, and terrestrial features within a watershed. The information is used to refine riparian reserves boundaries, prescribe land management activities, including watershed restoration and develop monitoring programs (NWFP ROD page 10).

The forest recommendations found in the East Fork Watershed analysis for the Polallie Cooper Planning area include:

- Management in this area should focus on late seral habitat management
- Participate with landowners who border the national forest in managing fuel and late seral stand structure.
- Stand management needs to reduce fire hazard and improve late seral habitat and general forest health
- Stands adjacent to the National Forest boundary should be managed with objectives of developing fuel that support urban interface with fire and late seral stand structure objectives.

1.3.2 Desired Future Conditions

The desired future condition of the project is to develop an uneven-aged stand with canopy closure that would allow fire behavior to change from crown fire to surface fire, and to have stand species composition reflecting Condition Class 1. Achieving this desired future condition would enable meeting the overall goals of the land allocations within the planning area. The desired future condition for the upland and riparian vegetation treatments areas is a multi-layer canopy with large diameter trees, well-developed understory, more than one age class, and snags and down woody debris.

Within areas in the WUI and dryer sites, the desired future condition is to develop an uneven-aged stand with canopy closure that would allow fire behavior to change from crown fire to surface fire, and to have stand species composition reflecting a Condition Class 1, low departure from the central tendency of the natural (historical) regime. Achieving this desired future condition would assist in meeting the overall goals of the LUAs and the CWPP within the planning area and recommendations within the watershed analyses as described below. Figure 2 through Figure 3 illustrate the existing conditions and desired future conditions for the vegetation treatments throughout the planning area.

Existing Conditions Plantation Thinning. Dense, Overstocked Stands.

Existing Conditions Plantation Thinning. Dense, Closed Canopy.

Desired Future Condition Plantation Thinning.

Figure 2. Existing Condition and Desired Future Condition for Plantation Thinning

Existing dense multi-story stand within recently unmanaged stands

Hazardous Fuel Loading within recently unmanaged stands

Desired Future Condition – Dry

Figure 3. Existing Condition and Desired Future Condition for WUI and Recently Unmanaged Thinning in Dry Conifer

1.3.3 Land Use Allocations & Special Designations

Northwest Forest Plan

The Northwest Forest Plan land use allocations overlap allocations within the Forest Plan. This planning area includes Riparian Reserve, Late-Successional Reserve, Congressionally Reserved Areas, Administratively Withdrawn and Matrix. Treatments would be located in Matrix, Administratively Withdrawn and Riparian Reserve areas, but not within Late Successional Reserves. Riparian Reserve includes areas along rivers, streams, wetlands, ponds, lakes, and unstable or potentially unstable areas where the conservation of aquatic and riparian-dependent terrestrial resources receives primary emphasis. Late-Successional Reserves, in combination with other allocations and standards and guidelines, are to maintain a functional, interactive, late-successional and old-growth forest ecosystem. Congressionally Reserved Areas incudes Wilderness, Wild and Scenic Rivers, National Monuments, as well as other federal lands not administered by the Forest Service or BLM. Administratively Withdrawn Areas are identified in current Forest and District Plans and include recreation and visual areas, back country, and other areas where management emphasis precludes scheduled timber harvest. While scheduled timber harvest is precluded, fuel reduction thinning meets the objectives of the area and would not change the recreation emphasis of the area. Matrix consists of Forest Service lands outside of designated areas (i.e., Congressionally Reserved Areas, Late-Successional Reserves, Adaptive Management Areas, Administratively Withdrawn Areas, and Riparian Reserves).

During the field reconnaissance for Polallie Cooper, existing Late Successional Reserve areas in the planning area were identified as not providing the suitable habitat for Northern Spotted Owls and were a likely mapping error. However, adjacent lands were identified that did provide the suitable habitat, and the LSRs were relocated.

Prior to this planning effort, there were 117 acres of LSR in the planning area. Of these, 103 acres had been harvested in the past and did not provide a functional, interactive, late-successional and old-growth forest ecosystem that LSRs were identified to have. With the mapping correction, an acre for acre swap has been completed for acres in habitat that is suitable and has the forest structure and composition that serves beneficial purposes to the Northern Spotted Owl. This mapping refinement relocated the LSRs to adjacent land that has known spotted owl activity centers, to conform to site delineation criteria and operationally identifiable features.

For amendments to the Northwest Forest Plan (NWFP), the Regional Interagency Executive Committee (RIEC) provides for coordination and review of proposed amendments to standards and guidelines and land allocations established by the NWFP. The RIEC consists of executives from the federal agencies, and the Forest Service representatives are the R6 and R5 Regional Foresters along with the Pacific Northwest and Pacific Southwest Research Station Directors.

However, the adjustments and modifications completed did not constitute land allocation changes in this context, and therefore were not subject to provisions in the NWFP regarding review of changes to land allocations. The provisions include:

- Map and data refinements to improve accuracy and delineation of land allocations;
- Map and data interpretations regarding illogical inclusions on a map, such as small areas of matrix within a large block of LSR;
- Map refinements of LSRs based on occupied marbled murrelet sites and known spotted owl activity centers, to conform to site delineation criteria and operationally identifiable features; and,
- Map and data corrections which are part of routine data management.

The changes to the LSRs are in accordance with the third bulleted item above, and are not subject to the provisions in the NWFP regarding review of changes to land allocations. The acres that are now classified as LSR meet the standards and guides and were improved based on the on-the-ground verification and map refinements. No treatments are proposed in the newly located Late Successional Reserve land use allocation, as shown in Table 1 below.

The East Fork Hood River Wild and Scenic River corridor is designated as Congressionally Reserved. The Outstanding Remarkable Values provide management direction for the treatment blocks within the Wild & Scenic River Corridor. The Omnibus Public Land Management Act of 2009 (Omnibus Act) designated 13.5 miles of the river from State Highway 35 to the Mount Hood National Forest Boundary and is to be administered by the Secretary of Agriculture as a scenic river. The geologic/hydrologic values were found to be outstandingly remarkable. The East Fork flows along the edge of a complex series of glacially and fluvial derived deposits before entering a narrower bedrock canyon. Recent debris flows from Newton, Clark and Polallie Creek drainages continue to shape the valley floor and influence the river's free-flowing nature. These attributes are deemed ORVs because they are an easily observable example of active glacial and geologic processes at the national level.

Table 1. Northwest Forest Plan Land Use Allocations within the Polallie Cooper Planning area

Land Use Allocation	Acres in Planning area (Percentage)	Acres in Proposed Action (Percentage)
Matrix	2,753 (39%)	1,938 (69%)
Riparian Reserves	1,228 (18%)	268 (9%)
Administratively Withdrawn	1,953 (28%)	44 (2%)
Congressionally Reserved Areas	949 (14%)	575 (20%)
Late Successional Reserves	117 (2%)	0 (0%)

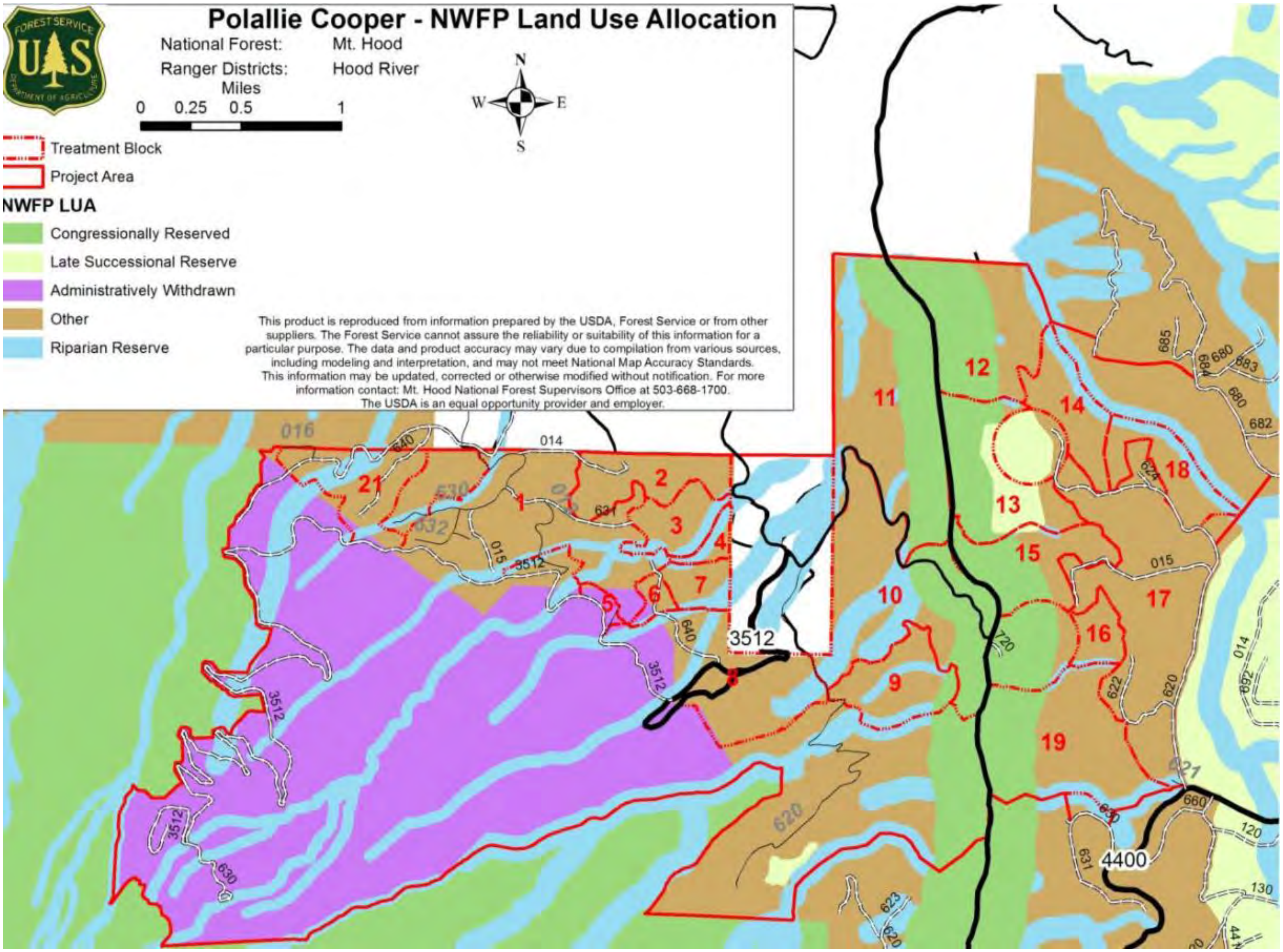


Figure 4. NWFP Land Allocations within Polallie Cooper Hazardous Fuels Reduction Planning area

Mt. Hood National Forest Land and Resource Management Plan

Several land allocations for NFS lands as designated by the Mt. Hood National Forest Land and Resource Management Plan (Forest Plan), as amended by the Northwest Forest Plan, are found within the planning area. The four primary Forest Plan land allocations in the planning area are Special Interest Area (A4), Winter Recreation Area (A11), Wild, Scenic and Recreational Rivers (B1), Scenic Viewshed (B2), Pileated Woodpeck/Pine Marten Habitat Area (B5), Deer and Elk Winter Range (B10), and Wood Product Emphasis (C1).

Table 2. Forest Plan Land Use Allocations within the Planning area.

Forest Plan Land Use Allocation	Management Goal For Land Use Allocation	Acres in Planning area (Percentage)	Acres in Proposed Action (Percentage)
A4- Special Interest Area	Protect and, where appropriate, foster public recreational use and enjoyment of important historic, cultural, and natural aspects of our national heritage. Preserve and provide interpretation of unique geological, biological, and cultural areas for education, scientific, and public enjoyment purposes. The emphasis for this area is historic.	1,150 (16.2%)	6 (0.2%)
A11 – Winter Recreation Area	Provide areas for high quality winter recreation (and associated summer) opportunities including: downhill skiing, Nordic skiing, snowmobiling, and snowplay within a natural appearing forest environment.	1,345 (19.0%)	42 (1.5%)
B1 – Wild, Scenic and Recreational Rivers	Protect and enhance the resource values for which a river was designated into the Wild and Scenic Rivers System	988 (13.9%)	576 (20.3%)
B2- Scenic Viewshed	Provide attractive, visually appealing forest scenery with a wide variety of natural appearing landscape features. Utilize vegetation management activities to create and maintain a long term desired landscape character.	3,127 (44.1%)	1,759 (62.1%)
B5 – Pileated Woodpecker/Pine Marten Habitat Area	Provide Forest wide mature or old growth forest habitat block of sufficient quality, quantity and distribution to sustain viable populations of pileated woodpecker and pine marten. A secondary goal is to maintain a healthy forest condition through a variety of timber management practices.	21 (0.3%)	20 (0.7%)
B10-Deer and Elk Winter Range	Provide high quality deer and elk habitat for use during most winters. Provide for stable population of mule deer and Rocky Mountain elk on the eastside and black-tailed deer and Roosevelt Elk on the westside of the cascades.	17 (0.2%)	13 (0.5%)
C1- Wood Product Emphasis	Provide lumber, wood, fiber, and other forest products on a fully regulated basis, based on the capability and sustainability of the land. A secondary goal is to enhance other resource uses and values that are compatible with timber production.	449 (6.3%)	415 (14.7%)

Land in A4-Special Interest Area is located within the planning area, but only has 0.2% of proposed activities occurring in this land use allocation. The emphasis for this area is historic. Any proposed fuel reduction would not change this emphasis and would support the special interest objectives of the allocation. B10-Deer and Elk Winter Range has less than 1% of the Proposed Action within this management area. Pileated Woodpecker/Pine Marten Habitat Area (B5) also occurs on less than 1% of the acres proposed for treatment.

The majority of the planning area (approximately 44% of the planning area, and 62% of acres proposed for treatment) is within B2-Scenic Viewshed land use allocation, as described by the Forest Plan (pages 4-218 thru 4-220). The goal for this land use allocation is to provide attractive, visually appealing forest scenery with a wide variety of natural appearing landscape features. This management area should utilize vegetation management activities to create and maintain a long term desired landscape character. The major characteristics are for the visual character of the landscape resulting from prescribed visual quality objectives within distance zones from selected viewer positions. For this project, Highway 35 serves as the main viewer position. Within the main corridor of Highway 35, vegetation should be comprised of primarily multi-age, multi-species stands with a diverse understory of natural plant associations. The foreground should contain numerous large diameter trees with small, natural appearing openings.

B1-Wild, Scenic and Recreational Rivers land use allocation in the planning area was designated in 2009. The Omnibus Public Land Management Act of 2009 (H.R. 146) added additional segments to the Wild and Scenic River System on the Forest, including portions of the East Fork Hood River, which is located within the Polallie Cooper planning area. The geologic/hydrologic values were found to be outstandingly remarkable. This land use allocation occurs on approximately 20% of the acres proposed for treatment in the planning area.

C1-Timber Emphasis land use allocation is approximately 6% of the planning area and 15% of the acres proposed for treatment. The goal for this land is to provide lumber, wood fiber, and other forest products on a fully regulated basis, based on the capability and suitability of the land. A secondary goal is to enhance other resource uses and values that are compatible with timber production (pages 4-289 thru 4-290).

Management area A11-Winter Recreation Area (pages 4-190 thru 4-191) encompasses approximately 19% of the planning area and 2% of the acres proposed for treatment. The goal of this area is to provide high quality winter recreation opportunities including: downhill skiing, Nordic skiing, snowmobiling, and snowplay within a natural appearing forest environment. The treatments conducted in this land use allocation are designed to protect the recreational infrastructure and thus help to achieve the recreation objectives, consistent with standard and guideline A11-025.

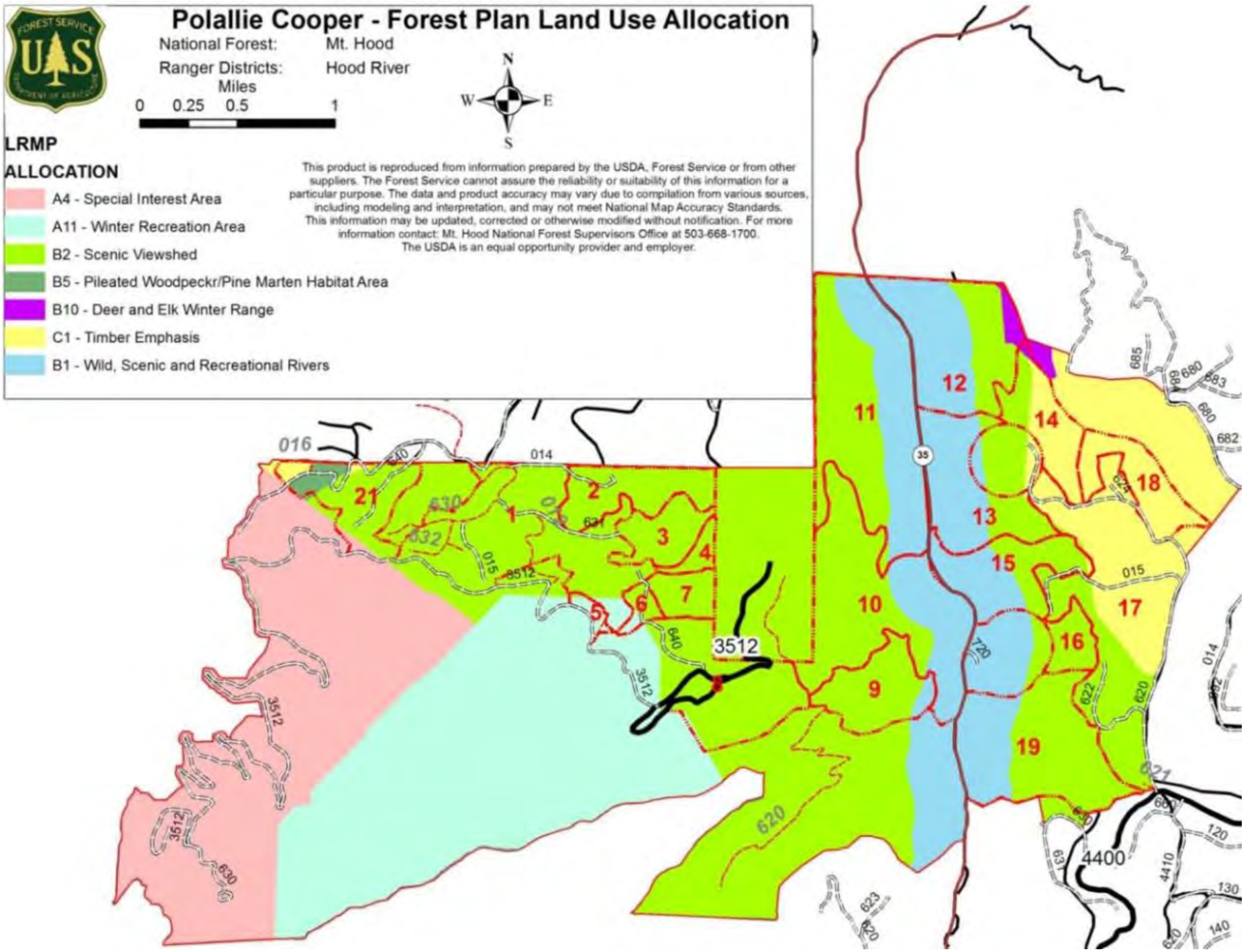


Figure 5. Forest Plan Land Use Allocations within Polallie Cooper Hazardous Fuels Reduction Planning area

Crystal Springs Watershed Special Resource Management Unit

Portions of the Crystal Springs Watershed Special Resource Management Unit as designated in the Omnibus Act are located within the Polallie Cooper planning area. This management unit will be established on completion of the Cooper Spur-Government Camp land exchange. None of the proposed management activities would prevent this designation in the future. The goals of this management unit are to ensure the protection of the quality and quantity of the Crystal Springs watershed as a clean drinking water source for the residents of Hood River County, Oregon; and to allow visitors to enjoy the special scenic, natural, cultural, and wildlife values of the Crystal Springs watershed. To protect these resources, the Forest Service can conduct fuel reduction and forest health management treatments to maintain and restore fire-resilient forest structures containing late successional forest structure characterized by large trees and multistoried canopies, as ecologically appropriate.

The Crystal Springs Watershed SRMU is approximately 2,800 acres. The Polallie Cooper Hazardous Fuels Reduction project contains approximately 2,080 acres of the SRMU. The Proposed Action alternative has activities that restore previously harvested stands, including the removal of logging slash, smaller diameter material, and ladder fuel proposed within 782 acres, or about 28% of the SRMU.

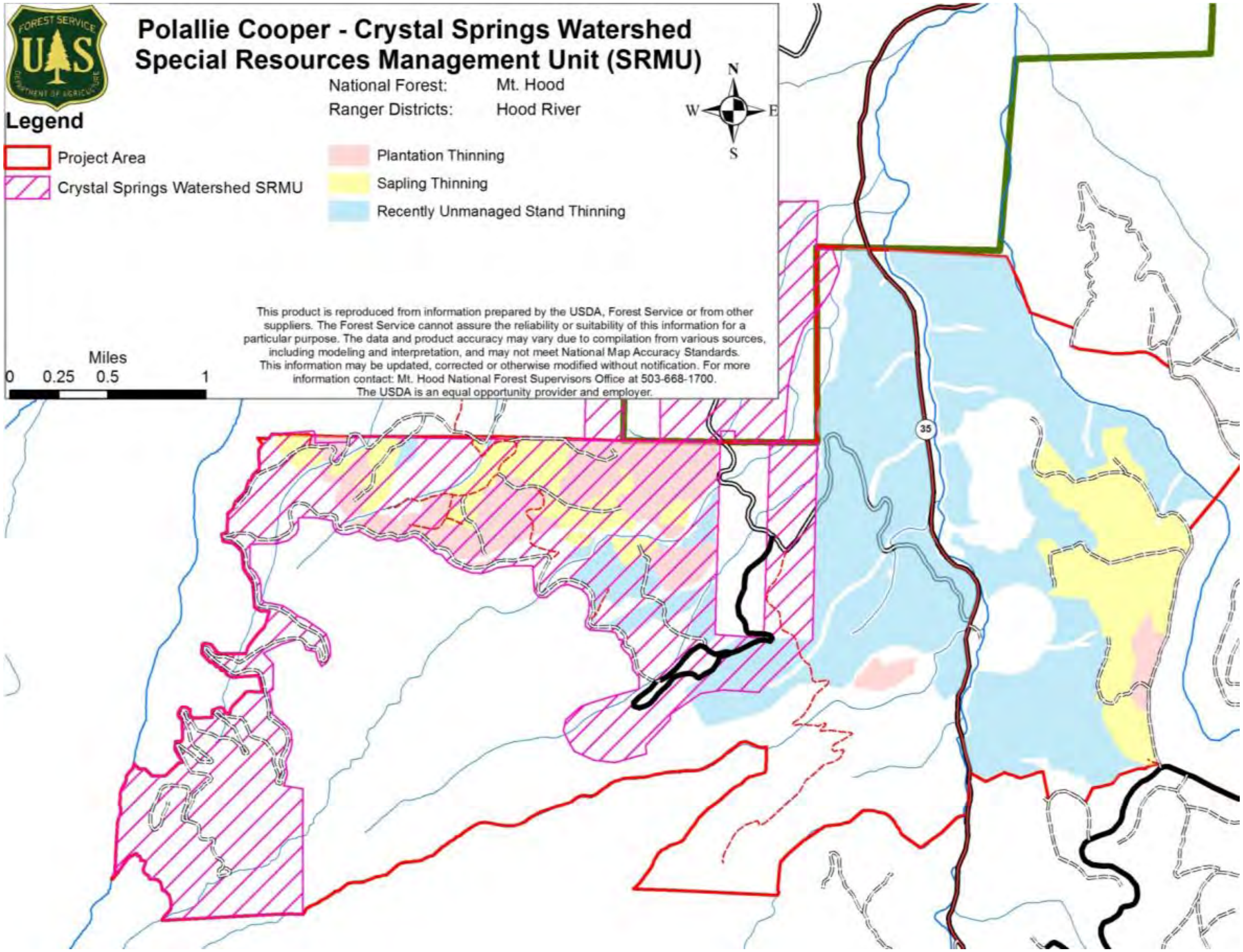


Figure 6. Map of the Polallie Cooper planning area and the Crystal Springs Watershed Special Resources Management Area

1.4 Proposed Action

Overall, the Proposed Action includes treating approximately 2,830 acres within the East Fork Hood River Watershed (Figure 1). The Proposed Action includes sapling thinning, plantation thinning, and recently unmanaged stand thinning. In addition to these treatment blocks, follow-up fuel treatments would be applied to reduce the fuel loading. A suite of fuel treatments would be applied depending on site, on the ground fuel, and desired future condition. In addition to the vegetative and fuel treatments, road closures are also proposed. The Proposed Action is summarized in Table 3 and Table 4 with each treatment type described in detail in Chapter 2, Section 2.2.

1.4.1 Vegetative Treatments

Vegetation treatments are proposed on approximately 2,830 acres with the goal being variable density thinning (VDT) across the planning area. These stands would be treated according to the existing condition on the ground. Three main treatment types have been developed; recently unmanaged stand thinning, plantation thinning and sapling thinning (see Table 3). Within these three main treatment types, multiple densities have been identified to meet the goals for fuel reduction and restoring resilient stands.

Within moist mixed conifer sites, desired densities range from 80-150 basal area. Within dry mixed conifer sites, the desired densities range from 80-190 basal area. The desired basal area would be accomplished throughout the stand, providing for opportunities to have VDT across the stands; achieving goals across the planning area (see Table 4).

All thinning activities proposed in this project would apply VDT, which allows flexible local density levels to achieve overall treatment objectives. This allows emphasis to be placed on leaving vigorous trees of all sizes without concern for spacing. Additionally, fuel treatments in harvested stands would be applied when all thinning treatments have been completed. This is expected to be within five years of mechanized treatments. Post-activity assessments would be completed to determine specifically when and where prescribed fire would be applied.

Table 3. Proposed Action for the Polallie Cooper Planning area

Proposed Action	Acres
Recently Unmanaged Stand Thinning	1,805
Plantation Thinning	420
Sapling Thinning	605
Total	**2,830**

Table 4. Existing and Desired Future Conditions for the Polallie Cooper Proposed Action

Proposed Action	Acres	Existing Basal Area	Desired Average Basal Area	Existing Canopy Cover	Desired Average Canopy Cover	Existing Trees Per Acre	Desired Average Trees Per Acre
Recently Unmanaged Stand Thinning	1,805	120-280	80-190	45-75	30-50	380-2750	NA
Plantation Thinning	420	120-280	80-190	45-80	30-40	450-2750	NA
Sapling Thinning	605	NA	NA	60-68	50	590-2750	150-250 in MMC* / 80-150 in DMC*

**Recently Unmanaged Stand Thinning and Plantation Thinning blocks would use basal area and canopy cover to determine desired outcome. Sapling Thinning stands do not have sufficient structure to calculate basal area and would utilize trees per acre to establish desired condition.*

**MMC = Moist Mixed Conifer stands*

**DMC = Dry Mixed Conifer stands*

1.4.2 Fuel Treatments

A variety of fuel treatment methods would be used throughout the approximately 2,830 acres within the planning area. Mechanical fuel reduction treatments are a non-commercial thinning and mechanical brush treatment to promote and develop more resilient stand conditions. The goal for the area is to reduce the fuel loadings and modify the fuel profiles of the planning area. Treatment of any residual surface fuel left over from timber harvest would be machine piled and burned. Underburning could also be used to treat any residual fuel left on harvested blocks. Surface fuel would be reduced from approximately 25-55 tons per acres to 15 tons per acre on the dry plant communities of the planning area and from 45-60 tons per acre to 25 tons per acre in the moist plant communities within the planning area.

In some instances a combination of treatments would occur in the same area. It is likely that an area would need to have an initial vegetation treatment to reduce the horizontal and vertical fuel prior to safely and effectively applying a suite of prescribed fire techniques.

An example would be a block that is first treated with a vegetation treatment, and the slash materials are piled. Burning of the piles may occur the following year, and would then be followed by a series of underburning several years after the initial treatment.

1.4.3 Road Treatments

Year Round Road Closure (1.6 miles) treatments would block vehicles from entering the closed road the entire year through the use of gates, rocks, earth berms, large logs etc. If hydrologic and ecological processes are adversely impacted by the road, a closed road would also be stabilized before it would be put into storage. A closed road remains on the Forest’s transportation system and receives minimal maintenance as there is no public traffic allowed. These roads remain on the system to allow for future fire suppression or search and rescue operations.

1.5 Decision Framework

Based on the interdisciplinary analysis presented in the final Environmental Assessment and the project record, the District Ranger will decide whether or not to authorize the implementation of vegetation treatments and fuel reduction activities to reduce the fire hazard in order to protect life and property and to restore forest to conditions that are more resilient to wildfire on National Forest System (NFS) lands; and what, if any, project design criteria/mitigation measures are needed.

1.6 Public Involvement

1.6.1 Collaboration

In 2011, the Hood River Watershed Group and Hood River Soil & Water Conservation District (SWCD) formed the Hood River Collaborative Stewardship Crew made of representatives from Confederated Tribes of Warm Springs, US Forest Service, local and state governmental agencies (Oregon Department of Fish & Wildlife, Oregon Department of Forestry, Hood River County), watershed groups (Hood River Watershed Group), non-profit groups (Bark, Oregon Wild, Crag Law Center, Rocky Mountain Elk Foundation, Backcountry Horseman), timber industry (WKO/High Cascade), and individual residents/landowners. The group was formed "to learn about national forest health issues in the Hood River watershed and to develop recommendations on particular projects and/or planning areas to the District Ranger for potential stewardship contracting." The community members decided to launch the collaborative group and began with discussions on the Red Hill Restoration project as their first collaborative effort.

The Polallie Cooper Hazardous Fuels Reduction Project represents the third collaborative effort undertaken by the Hood River Collaborative Stewardship Crew. Collaborative participants met from October 2012 to August 2014 to identify restoration opportunities within the Polallie Cooper planning area. The group discussed a range of topics including fuel reduction, forest health, road maintenance, ecological needs, and legacy pine. The group participated in several field trips to visit potential treatment blocks and see the outcomes associated with a previous thinning project. In August of 2014, the Hood River Collaborative Stewardship Crew submitted recommendations for the Polallie Cooper Hazardous Fuels Reduction Project to District Ranger, Janeen Tervo (see Appendix 1).

1.6.2 Scoping/Public Involvement

Polallie Cooper was listed in the Mt. Hood National Forest quarterly planning newsletter (Schedule of Proposed Action [SOPA]) beginning in February 2013. The project also listed on the Mt. Hood National Forest website beginning in October 2012 at:

http://www.fs.usda.gov/projects/mthood/landmanagement/projects

In February 2015, a scoping letter providing information and seeking public comment was mailed to approximately 160 individuals and groups. Approximately 1,229 comments were received during the public scoping period. Over 1,220 comments were form letters received from members of Bark and Oregon Wild. The remaining seven comments were received from Oregon Wild, Bark, Hood River Valley Residents Committee, Cooper Spur Wild and Free Coalition, Friends of Mt. Hood, Hood River Collaborative Stewardship Crew, and American Forest Resource Council (AFRC).

An additional 30 day comment period was provided to improve the level of clarity with our collaborators and stakeholders. While this comment period was not required, the Responsible Official wanted to provide the Draft EA for review prior to the public meeting.

In addition to these scoping efforts, the Forest Service participated in government-to-government consultation as detailed in Chapter 4.

1.6.3 Objection Process (218 Objection Regulations)

Section 428 of The Consolidated Appropriations Act of 2012 included a provision establishing a pre-decisional objection process (36 CFR 218) for projects and activities implementing land management plans in lieu of the post-decisional appeal process (36 CFR 215) used by the agency since 1993. Since this project is a Healthy Forest Restoration Act-(HFRA) fuel reduction project, it is subject to the Project-Level Pre-decisional Administrative Review Process (Objection process) as identified in 36 CFR 218, Subparts A and C.

Rather than being able to seek higher-level review of unresolved concerns after a project decision has been made under 36 CFR 215 (Appeal process), those who are eligible would be able to seek that review before the project decision has been signed under 36 CFR 218 (Objection process). The Forest Service believes that considering public concerns before a decision is made aligns with our collaborative approach to public land management and increases the likelihood of resolving those concerns resulting in better, more informed decisions. The Forest Service also believes this will aid in our efforts to be more efficient with documenting environmental effects (NEPA).

Individuals and entities (non-governmental organizations, businesses, partnerships, state and local governments, Alaska Native Corporations, and Indian Tribes) who submit timely, specific written comments regarding a proposed project or activity during any designated opportunity for public comment may file an objection. Opportunity for public comment on this project includes scoping and this 30 day public review period.

Written comments are those submitted to the Responsible Official or designee during a designated opportunity for public participation provided for a proposed project. Specific written comments should be within the scope of the Proposed Action, have a direct relationship to the Proposed Action, and must include supporting reasons for the responsible official to consider.

1.7 Issues

Issues serve to highlight effects or unintended consequences that may occur from the Proposed Action, giving opportunities during the analysis to reduce adverse effects and compare trade-offs for the Responsible Official and public to understand. Issues are best identified during scoping early in the process to help set the scope of the actions, alternatives, and effects to consider; but, due to the iterative nature of the NEPA process, additional issues may come to light at any time. Issues are statements of cause and effect, linking environmental effects to actions, including the Proposed Action (Forest Service Handbook 1909.15, 12.4). Issues are used to generate additional action alternatives to the Proposed Action. See Section 2.5, Alternatives Considered, but Eliminated from Detailed Study for further information.

Several concerns and specific recommendations were raised during the scoping, notice and comment and the collaborative group processes which were specifically addressed in adjustments to the Proposed Action, changes to the project design criteria/mitigation measures (PDC) and environmental analysis. Some of the issues and concerns related to this project include but are not limited to the following discussions:

1.7.1 Crystal Springs Watershed Special Resources Management Unit (CSWSRMU)

Several scoping comments stated that the Proposed Action was not consistent with the Omnibus Act, specifically 16 USC 539n. (a) Crystal Springs Watershed Special Resources Management Unit. Several comments suggested that the Proposed Action was not incompliance and stating "...your proposal to be outside of the parameters of this agreement in many ways." Other more specific comments suggested that any activities could only occur within 400 feet of existing structures on public or private land and within 400 feet of Cloud Cap road (Forest Service Road 3512). Additionally comments outlined that the direction for the management unit prohibits new road construction or renovation of existing non-system roads.

While the Crystal Springs Watershed Special Resources Management Unit was included in the Omnibus Act, its establishment is contingent upon the completion of the Cooper Spur/Government Camp land exchange that has not currently been completed. Forest Service cannot conduct any management actions that would prevent this future land from being designated as described in the Omnibus Act. As such, the Forest Service used the direction proposed for this management unit when developing the proposed treatments.

The purpose of the Management Unit are "(A) to ensure the protection of the quality and quantity of the Crystal Springs watershed as a clean drinking water source for the residents of Hood River County, Oregon; and (B) to allow visitors to enjoy the special scenic, natural, cultural, and wildlife values of the Crystal Springs watershed."

The purpose of the project is to reduce or maintain levels of hazardous fuel to reduce the risk of unwanted effects of wildfire on NFS lands and adjacent privately owned land and move the landscape toward more historic conditions to restore forest resiliency. One of the unwanted effects of wildfire is the impacts on the quantity and quality of drinking water. By reducing fuel loading and restoring forest structure to historic conditions, the Proposed Action would increase the quantity of water available in the watershed, and reduce the risk of impacts from wildfire on the quality of the water as a clean water source for the residents of Hood River.

Additionally, the language outlines that the Secretary may conduct fuel reduction and forest health management treatments in three areas:

- in any area located not more than 400 feet from structures located on—
    - National Forest System land; or
    - private land adjacent to National Forest System land;
- in any area located not more than 400 feet from the Cooper Spur Road, the Cloud Cap Road, or the Cooper Spur Ski Area Loop Road; and
- on any other National Forest System land in the Management Unit, with priority given to activities that restore previously harvested stands, including the removal of logging slash, smaller diameter material, and ladder fuels.

The Proposed Action along with the areas proposed for treatment are included in the three areas outlined above. Specifically, the third bullet authorizes other NFS land in the management unit outside of the 400 feet from structures and Cooper Spur Road, Cloud Cap Road, or the Cooper Spur Ski Area Loop Road. The purpose and need of the project, along with the Proposed Action comply with the removing of logging slash, small diameter materials, and ladder fuels. The purpose of this project is to reduce the risk of unwanted effects from fire, and any commercial product produced are byproducts of activities conducted to further the purposes of the project, which includes the compliance with the Management Unit.

For prohibited activities, the Proposed Action does not include any plans to construct new roads or renovate existing non-System roads. The agency does not consider temporary roads to be new road construction since the roads would not be included in the road system, and the impacts from temporary road use are minimized through the use of project design criteria and best management practices. For additional information about temporary roads, see the response to issue 1.7.2 Roads.

These concerns were not considered key concerns because the agency developed the Proposed Action with all applicable law, policy and regulation in mind, and there are no substantive unresolved issues.

1.7.2 Use of Temporary Roads

Some comments received stated concerns about using temporary roads or reopening old road alignments where vegetation had begun to reestablish for access to the treatment areas.

The Proposed Action would re-open approximately 4 miles of existing temporary or decommissioned roads and would construct approximately 8 miles of new temporary roads. Where feasible, proposed temporary roads would re-trace the alignment of older overgrown or decommissioned roads. Under the Proposed Action temporary roads could be reopened with minimal earth movement, without side casting material and would be rehabilitated after project completion. Re-opening these roads and the construction of new temporary roads would pose an overall low risk of introducing sediment to streams because almost all of these roads would be outside of the Riparian Reserves and away from streams. Of the approximately 4 miles of old existing temporary roads that would be reopened, only approximately 804 feet are within Riparian Reserves. None of the new temporary road construction would be within Riparian Reserves.

The 804 feet of temporary road proposed to be reopened represents 2 different incursions into Riparian Reserves that are approximately 315 feet to 489 feet in length. No new or existing stream crossings would need to be constructed or reconstructed for this project. For a full analysis of the effects to water quality from temporary road construction, please see Section 3.6.3.

Additional PDCs were developed to further reduce the impacts from temporary roads inside of the Crystal Springs Watershed SRMU. This includes decompacting temporary roads to a depth of 24" prior to completion of the fuel reduction activities. For a full list of all PDCs applied to the project, see Section 2.3, Project Design Criteria.

Chapter 2– Alternatives

This chapter is intended to describe the alternatives and how they were formulated for the Polallie Cooper Hazardous Fuels Reduction Project. This chapter provides readers and the Responsible Official with a description of the Proposed Action components, project design criteria/mitigation measures, monitoring requirements, and regulatory framework.

2.1 No Action Alternative

Under the No Action alternative, current management plans would continue to guide management of the area. No fuel reduction thinning, burning or other associated actions would be implemented to accomplish project goals.

Stands would continue to have high levels of surface, ladder, and crown fuel compared to historical conditions. Defensible space adjacent to private lands would remain overstocked and would not meet the objectives and goals of the CWPP. Stands would continue to remain uniformly dense and the overstocked condition would result in stands with reduced vigor, small trees, increased mortality, and decreased resilience. This reduced resiliency would put the forest at an increased risk of large stand replacing events.

Stand species composition would continue to be not resilient to wildfires and other disturbance activities. Ponderosa pine, western larch and Douglas-fir would continue to compete poorly for nutrients and resources from the historical lack of disturbance activities. Fire resilience in stands would be poor from both small and large scale future events.

Additionally, the riparian conditions would not be improved. Over the next 50 years there would be more trees dying and then falling in Riparian Reserves as the stands decay and fall apart. As such, there would be an increase in the amount of down wood, but this wood would generally be smaller in diameter and thus would decay faster both in and out of stream channels. Fewer trees would grow to a larger size that would last longer once on-the-ground and in larger stream provide more stable habitat creating characteristics. See Section 3.5, Water Quality and Section 3.6, Fisheries and Aquatic Fauna for more impacts on the riparian areas.

In areas of the Cooper Spur Ski Area and Cloud Cap Historic District, fuels would continue to build and the likelihood of a wildfire event that put these resources at risk would continue to rise. The historic and recreational objectives of these areas would likely not be met after a wildfire.

The No Action Alternative would not maintain, repair or close any roads. The current use pattern of roads within the planning area would not change. Volume of public use on this system would not change over the near term, but could decrease slightly over time due to decreased navigability of the roads. Administrative use on this system would not change. No action would mean that current minimal road maintenance would occur, and no road reconstruction would occur. Lack of road maintenance exhibits a strong adverse effect with respect to both safety and the environment. Road surface, road subgrade, and road base failures present physical hazards to drivers, reduce a driver's ability to maintain positive control of a vehicle, and increase the potential for the development of erosion hazards on road slopes including soil slumps and slides due to pooling of water and increased soil saturation in the road bed.

2.2 Proposed Action Alternative

Over the past several decades, the combination of fire exclusion, several large scale disturbance events, endemic insect mortality and logging activities has resulted in the current vegetative and fuel conditions in the planning area. These conditions include higher stand densities, increased vertical and horizontal fuel continuity, changed species composition, and an altered fire regime.

Due to ladder fuel, timber stands in the Polallie Cooper Planning area east of Highway 35 are susceptible to stand-replacing wildfires. Timber growth, yield, and health west of Highway 35 are currently declining in many of the Douglas-fir/grand fir stands. Fuel concentrations, on both National Forest System and private lands within the "urban interface" are moderately high in many areas and could cause potential resource loss and damage to dwellings and other private property if a wildfire should occur. Additionally the Cooper Spur Road (Forest Service Road 3512), which bisects the western part of the planning area, is a popular travel recreation route.

The CWPP describes this area as a potential project to support wildfire reduction hazards by reducing fuel in and around the WUI. The planning area has moderate slopes on the northeast side of Mount Hood and is in the East Fork Hood River watershed with both surface and ladder fuel creating a fire-conducive landscape. There has been a history of large wildfires with a moderate frequency of occurrence.

Private lands within and adjacent to the planning area contain a mix of residential homes, outbuildings, forestlands, and agricultural lands. Private landowners have requested that the adjacent NFS lands be managed so that wildfire suppression can be effective and successful. Additionally, the Cooper Spur Ski Area has facilities and infrastructure located on NFS lands within the planning area.

Fire regimes are a national classification of the historic combined conditions for fire severity and frequency for a particular environment. Fire Regime 3 is characterized by 25-100+ year frequency and mixed severity, and is the fire regime of the majority of the planning area.

The Proposed Action includes treating approximately 2,830 acres within the East Fork Hood River Watershed. The Proposed Action includes sapling thinning, plantation thinning, and recently unmanaged stand thinning. In addition to these treatment blocks, follow-up fuel treatments would be applied to reduce the fuel loading. A suite of fuel treatments would be applied depending on site, on the ground fuel, and desired future condition. In addition to the vegetative and fuel treatments, road closures are also proposed. It is anticipated that these treatments would start in the summer of 2016.

2.2.1 Vegetation Treatments

Vegetation treatments are proposed on approximately 2,830 acres with the goal being variable density thinning (VDT) across the treatment acres. These blocks would be treated according to the existing condition on the ground. Three main treatment types have been developed; recently unmanaged stand thinning, plantation thinning and sapling thinning (see Table 5). Within these three main treatment types, multiple densities have been identified to meet the goals for fuel reduction and restoring resilient stands.

Within moist mixed conifer sites, desired densities range from 80-150 basal area. Within dry mixed conifer sites, the desired densities range from 80-190 basal area. Basal area is the common term used to describe the average amount of an area (usually an acre) occupied by tree stems. It is defined as the total cross-sectional area of all stems in a stand measured at breast height, and expressed as per unit of land area (typically square feet per acre).The desired basal area would be accomplished throughout the stand, providing for opportunities to have VDT across the stand, achieving goals across the planning area (see Table 6 and Figure 8).

All thinning activities proposed in this project would apply VDT, which allows flexible local density levels to achieve overall treatment objectives. This allows emphasis to be placed on leaving vigorous trees of all sizes without concern for spacing. Additionally, fuel treatments in harvested stands would be applied when all thinning treatments have been completed. This is expected to be within five years of mechanized treatments. Post-activity assessments would be completed to determine specifically when, where, and which fuel treatments would be applied.

Table 5. Proposed Action for the Polallie Cooper planning area

Proposed Action	Acres
Recently Unmanaged Stand Thinning	1,805
Plantation Thinning	420
Sapling Thinning	605
Total	**2,830**

Table 6. Existing and Desired Future Conditions for the Polallie Cooper Proposed Action

Proposed Action	Acres	Existing Basal Area	Desired Average Basal Area	Existing Canopy Cover	Desired Average Canopy Cover	Existing Trees Per Acre	Desired Average Trees Per Acre
Recently Unmanaged Stand Thinning	1,805	120-280	80-190	45-75	30-50	380-2750	NA
Plantation Thinning	420	120-280	80-190	45-80	30-40	450-2750	NA
Sapling Thinning	605	NA	NA	60-68	50	590-2750	150-250 in MMC* / 80-150 in DMC*

**Recently Unmanaged Stand Thinning and Plantation Thinning blocks would use basal area and canopy cover to determine desired outcome. Sapling Thinning stands do not have sufficient structure to calculate basal area and would utilize trees per acre to establish desired condition.*

**MMC = Moist Mixed Conifer stands*

**DMC = Dry Mixed Conifer stands*

Vegetative Treatments

Sapling Thinning (605 acres) treatments would mechanically thin small trees leaving approximately 80 to 150 trees per acre in the dry forest type and 150 to 250 trees per acre in the wet forest type to promote and develop more resilient stand conditions. The material (slash) generated by this activity would be treated in a variety of methods including but not limited to piling and burning, lop and scattering, masticating, or biomass collection. Biomass collection would include machine piling and removal of materials to be used to generate electricity.

Plantation Thinning (420 acres) treatments would be a variable density thin from below treatment in existing even-aged managed blocks designed to address high density issues that are leading to forest health concerns. These concerns are stress-related mortality, limited species diversity, and limited structural diversity. Riparian areas within these plantations have the same forest health concerns. Figure 2 illustrates some of the forest health concerns within these blocks. The overall desire for these treatments would be to move the riparian and upland portions of the selected plantations towards a more late seral like structure with a large tree component that is currently absent in the majority of these stands. Late seral stands have their main canopy dominated by older, large trees; canopy closure variable; 2-3 canopy layers distinguishable; mortality both scattered and clumped and in higher proportion of stand than other stages The material (slash) generated by this activity would be treated in a variety of methods including but not limited to piling and burning, lop and scattering, masticating, or biomass collection. Biomass collection would include machine piling and removal of materials to be used to generate electricity.

Recently Unmanaged Stand Thinning (1,805 acres) treatments may have had past vegetation manipulation, but are no longer actively managed plantations. These stands may have missed a fire cycle or other disturbance event and have a reduced resiliency to disturbance events in the future. Fuel reduction thinning treatments include prescriptions to thin conifer trees predominately grand fir and Douglas-fir dominated stands to an average canopy closure of 30 to 50 percent on these acres. Treatments would promote and develop more resilience to large scale disturbance events and provide defensible space around WUI.

Table 7. Block Information for the Proposed Action

Block	Thinning Treatment Type	Acres	Age (yr)	Tree Species	Current Canopy Cover	Target Canopy Cover	Logging System	Temporary Roads
1	Plantation, Sapling, Recently Unmanaged Stand	311	50	DF, GF, NF, MH, LP	65	30	Ground, Skyline	Yes
2	Plantation	114	44	DF, GF, WRC, PP	80	30	Ground, Skyline	Yes
3	Sapling, Plantation	56	76	GF, DF, VM	68	40	Ground, Skyline	Yes
4	Recently Unmanaged Stand	16	87	GF, DF	70	40	Ground	Yes
5	Recently Unmanaged Stand	15	172	GF, DF	50	40	Ground	No
6	Recently Unmanaged Stand	17	94	GF, WH	45	30	Ground	No
7	Plantation, Recently Unmanaged Stand	37	98	GF, WH	65	30	Ground, Skyline	Yes
8	Recently Unmanaged Stand	161	93	GF, DF, WRC, WH	70	40	Ground	Yes
9	Plantation, Recently Unmanaged Stand	60	58	GF	60	30	Ground, Skyline	Yes

Block	Thinning Treatment Type	Acres	Age (yr)	Tree Species	Current Canopy Cover	Target Canopy Cover	Logging System	Temporary Roads
10	Recently Unmanaged Stand	356	88	GF, DF	60	30	Ground, Skyline, Helicopter	Yes
11	Recently Unmanaged Stand	318	107	GF, DF, WWC	60	30	Ground, Skyline, Helicopter	Yes
12	Recently Unmanaged Stand	206	131	GF	55	40	Helicopter	No
13	Recently Unmanaged Stand	81	106	GF, VM, Chiquapin, DF	70	40	Helicopter	No
14	Recently Unmanaged Stand	94	159	GF, DF	50	50	Helicopter	No
15	Recently Unmanaged Stand	89	105	GF, VM, RA, DF	75	40	Ground, Helicopter	No
16	Sapling, Recently Unmanaged Stand	31	179	GF, DF	65	50	Ground, Skyline, Helicopter	Yes
17	Plantation, Sapling	413	65	GF, DF	60	40	Ground, Skyline, Helicopter	Yes
18	Recently Unmanaged Stand	81	177	GF, DF	70	40	Ground, Skyline	Yes
19	Recently Unmanaged Stand	266	110	GF,DF	70	40	Ground, Skyline, Helicopter	Yes
21	Plantation, Sapling, Recently Unmanaged Stand	109	45	PP, DF, GF	60	30	Ground, Skyline	Yes

Abbreviations used in the table are: DF = Douglas-fir; GF = grand fir; LP = lodgepole pine; NF = noble fir; WH = western hemlock; MH = mountain hemlock; PP = Ponderosa Pine; WRC = Western Red Cedar; VM = Vine Maple; RA = Red Alder

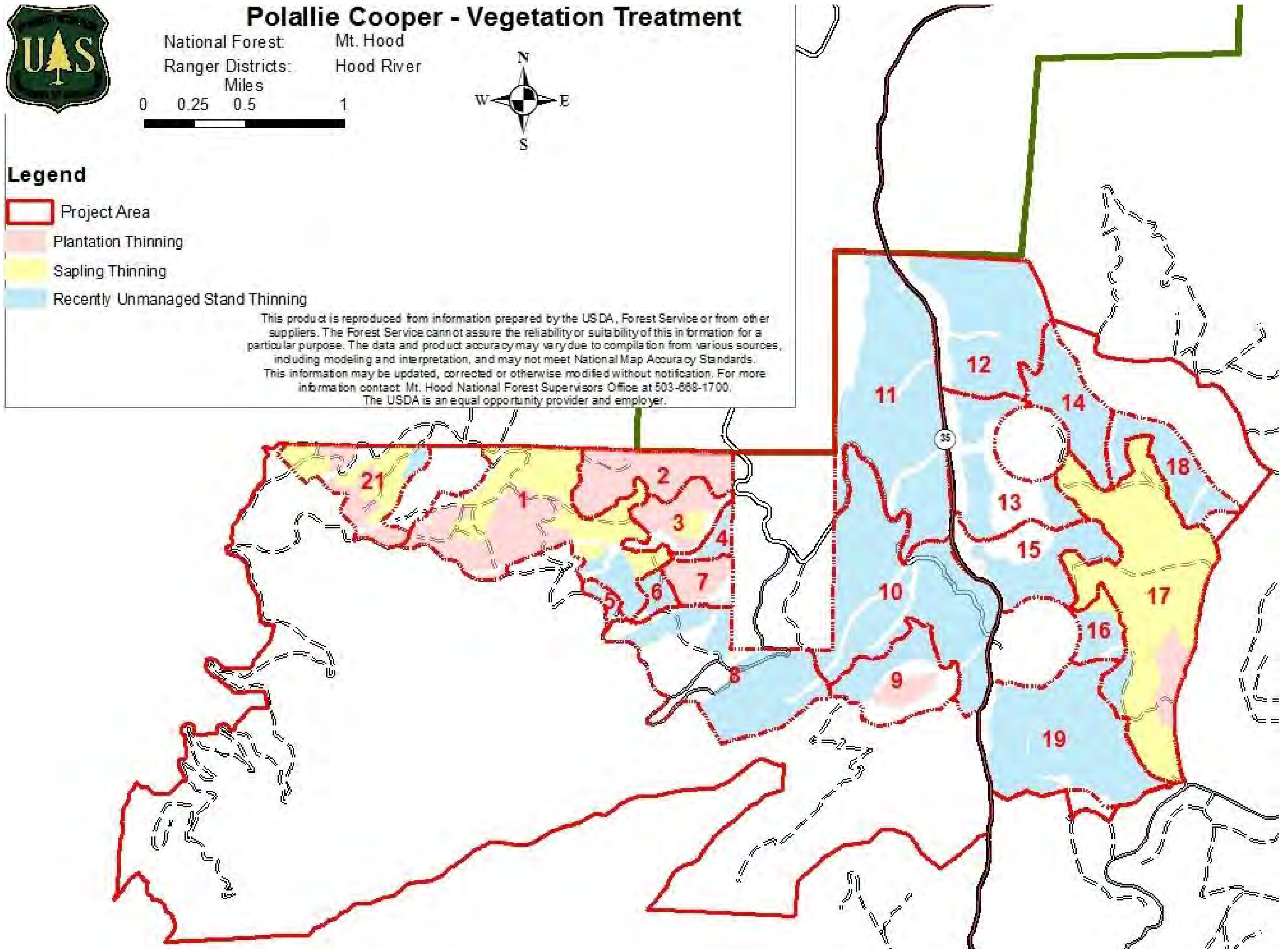


Figure 7. Proposed Action for Polallie Cooper Hazardous Fuels Reduction Project

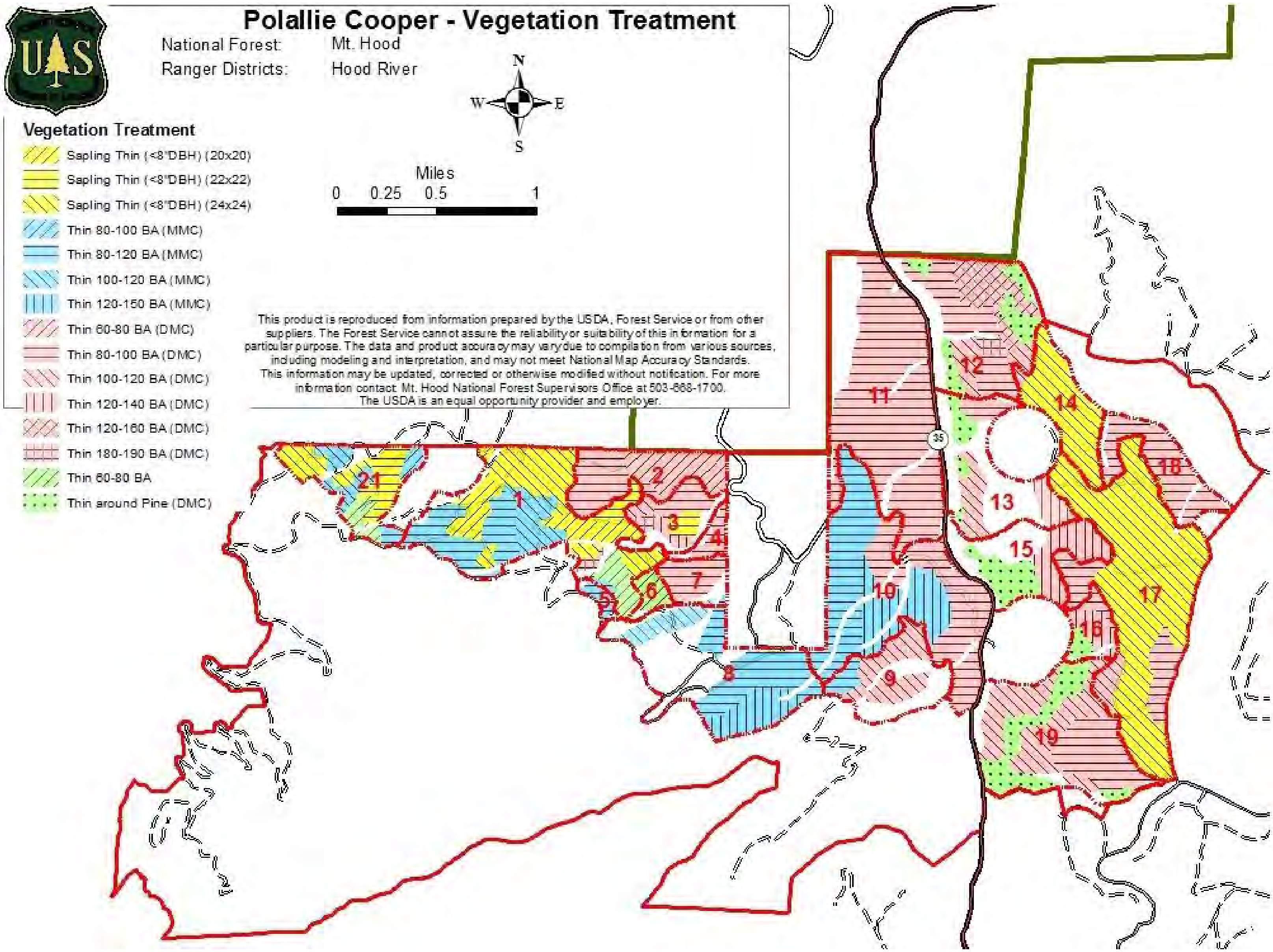


Figure 8. Desired Basal Area for the Proposed Action

Variable Density Thinning

Plantation thinning and Recently Unmanaged Stand Thinning activities proposed in this project would apply variable density thinning (VDT), which allows flexible local densities levels to achieve overall treatment objectives. This allows emphasis to be placed on leaving vigorous trees of all sizes without concern for spacing. Leave tree spacing associated with VDT would vary within and between blocks as seen in Figure 8. Tree density would be measured by basal area, canopy closure, trees per acre or relative density depending on the circumstances for each block. Where the historical conditions and fuel types dictate a delay the time at which the stand reaches the stem exclusion stage, a heavy VDT would be prescribed (wide leave tree spacing). In other areas, the objective would be to have stands reach the stem exclusion stage sooner and they would have moderate or light VDT. Leave trees would include minor species and would include trees with the elements of wood decay. Minor tree species are those species which would be expected to be present within a stand but which make up a relatively small number of the total trees. The minor tree species vary within each block based on plant associations. See Section 3.1, Vegetation Resources for more details.

Included in VDT are skips and gaps, which are intended to mimic more natural structural stand diversity. Skips are areas where no trees would be removed; gaps are areas where few trees would be retained. The gaps for this project would vary from one to five acres in size based on the stand specific conditions and treatment types within each block, and are outlined by Block in Section 2.3, Project Design Criteria.

The criteria used to determine the gap size would include percentage of shrub cover present; existing disease pockets; existing shade intolerant species; and plant association. Gaps are intended to create openings to support regeneration of shade intolerant species and more rot resistant species while also providing structural diversity. Gap areas would be incorporated into the average target canopy cover identified in Table 6. Gaps would be created in root disease pockets. Gaps would be reforested in accordance with site conditions

In the western and central portion of the planning area (Blocks 1-11 and 21) no gaps would be placed in plantations under 20 years old. Plantations over 20 years old (within Blocks 1-3,6,7 and 9 gap sizes would not exceed 5 acres and would maintain a minimum of 30% canopy cover. Gaps larger than 2 acres within commercial plantations would be focused in dry plant communities and/or around forest health concerns Gaps in recently unmanaged stands, (Blocks 8, 10, and 11) would be no more than 2 acres.

In the eastern portion of the planning area (Blocks 12-19) gaps in commercial plantations (Block 17) would not exceed 5 acres and would maintain a minimum of 30% canopy cover. In recently unmanaged stands (Blocks 12-16, 18, and 19) gaps would be no more than 2 acres.

Within Riparian Reserves for perennial streams, gaps would only be allowed within 1 site potential tree (130 feet) if the stream is glacially or spring fed or the gap is located on the north side of the stream. If these conditions are met, gaps could be created, but they would be located outside protection buffers outlined in the PDCs. If gaps are created along intermittent streams they would be outside the protection buffer.

If a gap is placed in a Riparian Reserve directly adjacent to a stream designated as listed fish habitat (LFH) such as Dog River, Polallie Creek, or the East Fork Hood River, the gap would be located one site potential tree height or further from the LFH stream regardless of the protection buffer width. Additionally, no gaps would be located in Riparian Reserves within skyline blocks.

Gaps would be created in root disease pickets, and would be reforested in accordance with site conditions and National Forest Management Act (NFMA) requirements.

2.2.2 Fuel Treatments

A variety of fuel treatment methods would be used throughout the approximately 2,830 acres within the planning area. Mechanical fuels reduction treatment is a non-commercial thinning and mechanical brush treatment to promote and develop more resilient stand conditions. The goal for the area is to reduce the fuel loadings and modify the fuel profiles of the planning area. Treatment of any residual surface fuel left over from timber harvest would be machine piled and burned. Underburning could also be used to treat any residual fuel left on harvested blocks. Surface fuel would be reduced from approximately 25-55 tons per acres to 15 tons per acre on the dry plant communities of the planning area and from 45-60 tons per acre to 25 tons per acre in the moist plant communities within the planning area.

Yarding of Unutilized Material

Required yarding of unutilized material (YUM yarding), specify that all substandard logs must be yarded to landings or to specified locations on the sale area. This material is then piled and burned to reduce fuel loading to specified levels after thinning activity. YUM yarding is effective in reducing the coarse logging residues throughout the block and reducing fuel loading after thinning activities have completed

Generally, the smoke from broadcast slash burning can be reduced or eliminated, particularly in the smoke sensitive period of early fall. This allows for the piles to be burned later in the season, on overcast or rainy days, and on days when air movement is away from population centers. These piles generally burn with less smoke than a broadcast ground fire.

Hand Piling

Handpiling is the piling of understory brush, small trees, and down dead woody material by hand crews into piles of woody debris that may be later burned or utilized. Chainsaws and hand tools would be used to cut the material to aid in the piling operation. Ladder fuels are reduced as a result of the piling of brush and small trees. The fuel loading is reduced by the piling and subsequent burning of the down dead woody material. The piles are burned in the fall season.

Machine Piling

Machine piling is the use of mechanical devices to pile activity and residual fuel. Bulldozers are generally more efficient in collecting and piling vegetative debris and creating compact piles. Typical mechanical use on the Mt. Hood National Forest is grapple piling to reduce soil disturbance.

Pile Burning

Pile burning is the consumption of landing, hand and/or mechanical piles. The hand piles would contain woody material from brush, small trees, and other dead woody material found on the surface. Mechanical piles would contain woody material from within a treatment block consisting of residual and activity fuel. The landing piles would contain the woody material (limbs, needles, bark and portions of the trunk) removed from the tree during the harvesting procedure. Landing piles are much larger than hand piles to disposes of the piled fuel concentrations. Pile burning would occur in the fall season. A burn plan would be written which outlines the parameters under which the burning would occur.

Jackpot Burning

Jackpot burning involves igniting concentrations of fuel on the forest floor, whether they are natural fuel or fuel resulting from a silvicultural cutting treatment. This differs from piling and burning because the fuel burned in jackpot burning were not collected and placed into piles. However, in areas where jackpot burning would occur there are sufficient concentrations of fuel to accomplish fuel reduction objectives with the existing and created fuel.

Mowing/Mastication

This treatment consists of mowing the understory of brush, small trees, and other vegetation. A mowing attachment is towed behind a dozer or tractor, or attached to the head of an excavator. The vegetation is chopped into small pieces and left on the surface. Subsequent underburning can be used to reduce the created fuel.

Underburning

Underburning is the use of prescribed fire underneath existing or residual trees to treat natural and /or created fuel, such as dead woody material, needle litter and dead brush. The majority of the blocks in the planning area would require thinning and/or mowing before underburning could be done safely and effectively. Underburning block boundaries would be coordinated with individuals from archaeology, silviculture, and fire management. In most of the blocks needing to be underburned, the burning would be completed one to four years after the original hand piling or mowing is completed. The underburning is conducted in the spring and fall seasons.

A burn plan would be written which outlines the parameters under which the burning would occur. Burn plans are written in accordance with the current 5140 directive (FM-5140), and must meet all required elements prior to approval of the plan by the District Ranger or Forest Supervisor.

Swamper Burning

Swamper burning typically occurs in the rain and can work well when there are a few inches of snow on the ground. These conditions help control fire spread and allow for fuel reduction treatment in areas that, because of slope or other conditions, do not allow for traditional piling and burning of accumulated fuel. This provides a flexible method for reducing down fuels while using the weather to reduce spread risk.

Combined fuel treatments

Across the planning area, a combination of treatments would occur in the same area. It is likely that an area would need to have an initial vegetation treatment to reduce the horizontal and vertical fuel prior to safely and effectively applying a suite of prescribed fire techniques.

An example would be a block that is first treated with a vegetation treatment, and the slash materials are piled. Burning of the piles may occur the following year, and would then be followed by a series of underburning several years after the initial treatment.

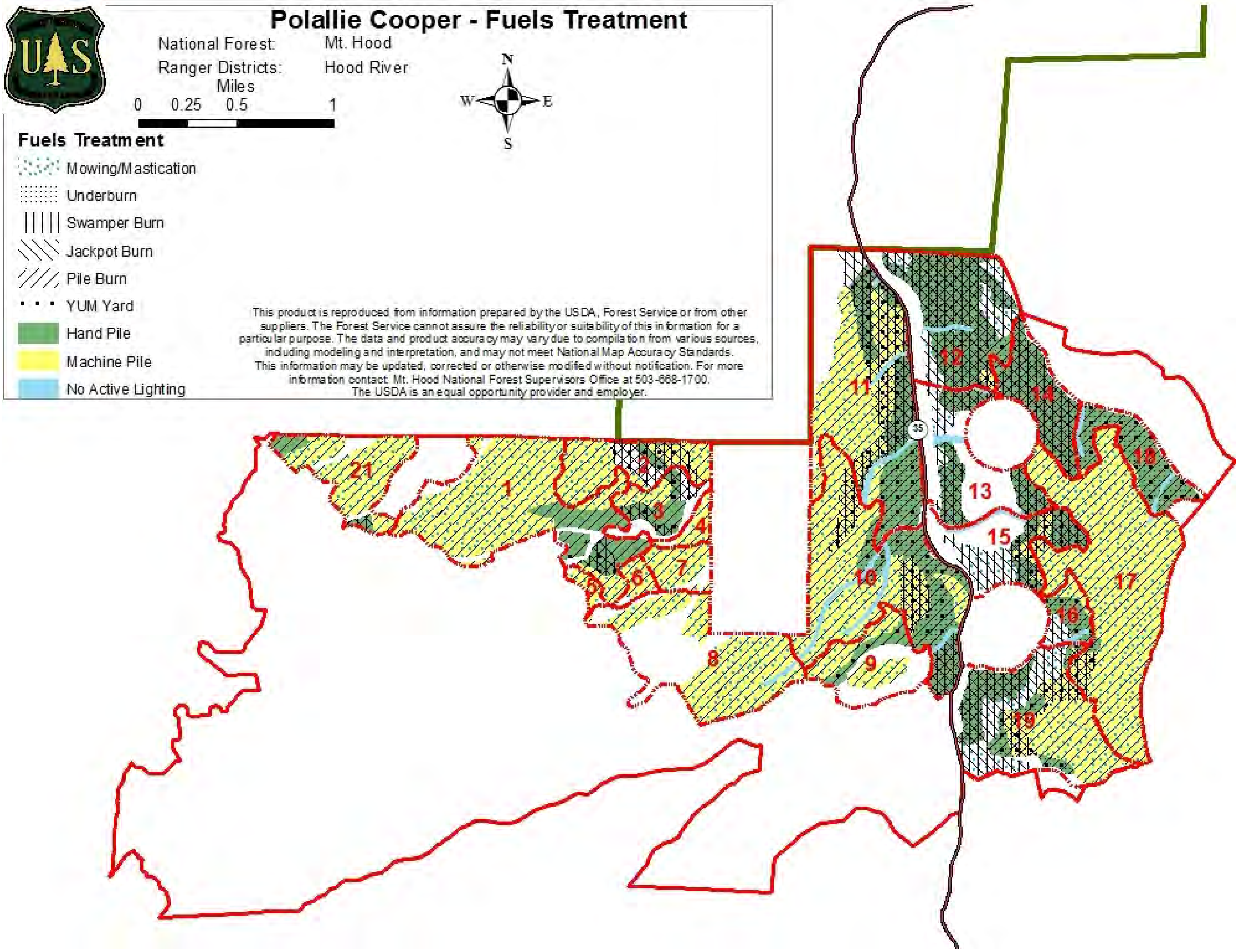


Figure 9. Suite of fuel treatments in the Proposed Action

2.2.3 Landings & Logging Systems

The project also includes landings to facilitate all logging systems (helicopter, cable yarding and ground-based logging). Landings are areas on or directly adjacent to roads where logs are brought to be loaded onto log trucks. Landing sizes vary based on the logging system and the types of equipment that need to be safely accommodated. For similar projects on the eastside of the Forest, the following landing sizes are typical:

- An average ground-based logging landing is 50-feet wide by 70-feet long. The average landing size increases to 100-feet wide by 100-feet long for blocks with whole tree yarding and fuel reduction projects. This landing size allows room for tractors to enter and leave, a loader to sort logs, and a log deck.
- An average skyline logging landing is 40-feet wide by 70-feet long. The cable logging landings increase to 40-feet wide by 100-feet long on average for blocks with whole tree yarding and fuel reduction projects. This allows room for a yarder, a loader to sort logs, and a log deck. Some landings provide access for a tractor block on one side of a road and a skyline block on the other side.
- An average helicopter landing size is approximately 100-feet wide by 200-feet long with some additional trees removed for the flight path coming into the landing. Some service landings approximately 60-feet wide by 60-feet long are also needed where helicopters land and refuel. Where possible, helicopter landings utilize existing openings, such as rock quarries or road intersections.

Every effort would be made to minimize the acres of disturbance associated with landings during lay-out and logging implementation. All landings would be located within existing treatment areas for this project. Existing landings would be reused whenever feasible. Many landing locations occur on the existing road system and would require minor maintenance and rebuilding to become functional. Some existing landings have brush or small trees growing on them that would be removed before use. Landing locations are determined using the design criteria within thePDCs.

Proposed logging systems for the Proposed Action are outlined in Figure 10 below. Applicable logging systems were determined

Table 8. Logging System by Acres in the Proposed Action

Logging System	Acres
Ground Based	1530
Skyline	815
Helicopter	485
Logging System Access	230

Logging system access blocks are associated with proposed skyline logging systems. Two areas are identified in the planning area, one to the south of Block 19 (13 acres), and one to the east of Block 14 and 18 (217 acres). The approximately 13 acres near Block 19 would have skyline corridors in order to access roads or potential landing sites. The block could include skyline corridors, skid trails, landings and/or temporary roads. It is estimated that no more than 10 percent of the trees would be removed to facilitate the logging activities in the adjacent blocks. No other activities are proposed within these blocks. The approximately 217 acres to the east of Block 14 and 18 would be used only to have tail hold trees to facilitate skyline logging activities. No yarding would occur across the stream and there would be no skyline corridors, skid trails, landings or temporary roads. Incidental trees may be removed to facilitate the use of this area.

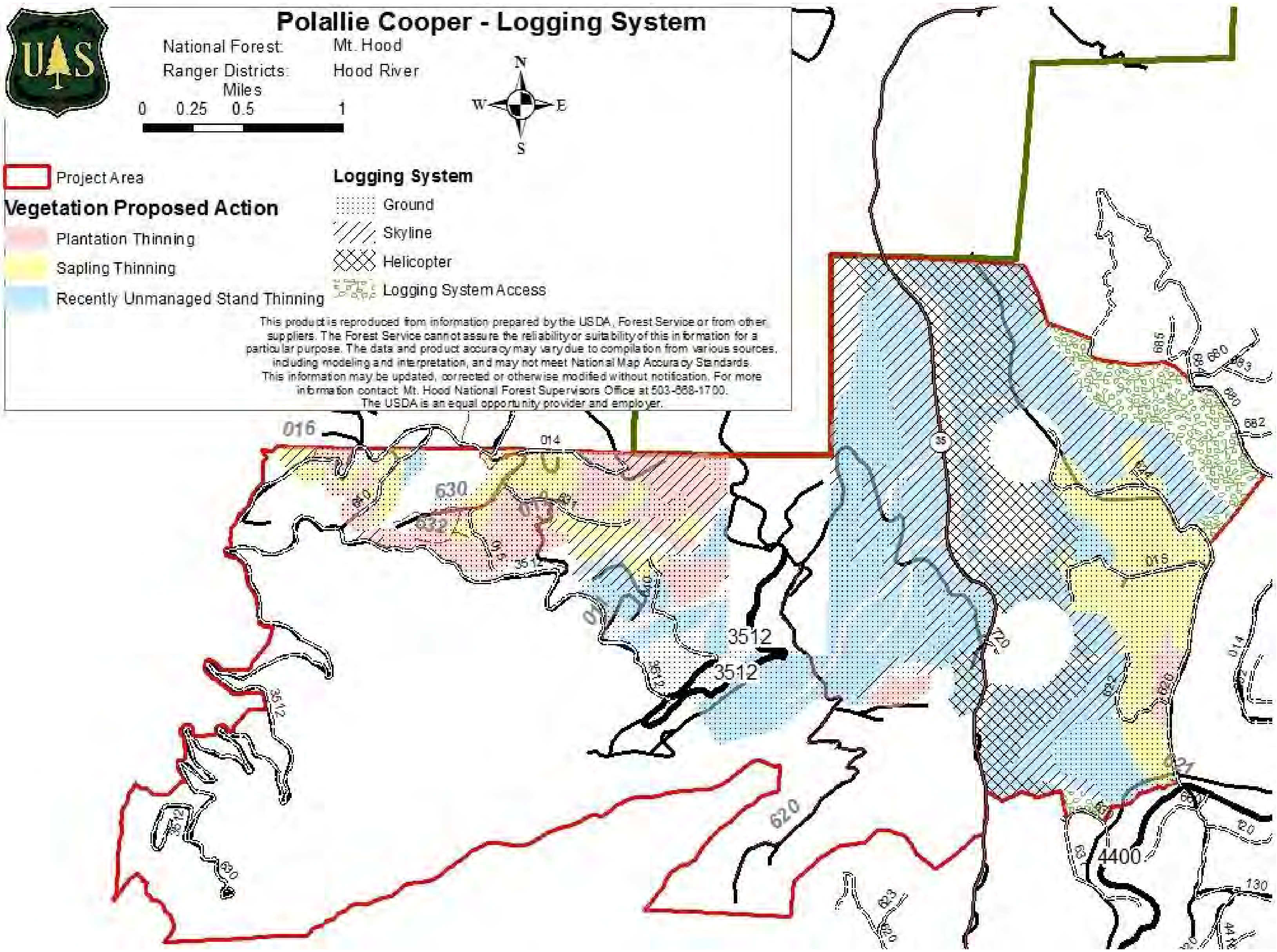


Figure 10. Logging Systems for the Proposed Action

2.2.4 Temporary Roads

In addition, the project includes proposed temporary roads that were identified to facilitate conventional logging systems (ground-based and skyline yarding). Temporary roads are roads that are built or reconstructed to access landings and are rehabilitated upon completion of all harvest activities. After use, temporary roads are water barred, culverts removed, decompacted, and roughened as needed with the jaws of a loader or excavator. Also, debris, such as rootwads, slash, logs or boulders, are placed near the entrance and along the first portion of the road.

Within the Crystal Springs Watershed Special Resources Management Unit additional measures would be applied to ensure that the impacts of temporary roads on the landscape are minimal. This includes temporary roads and landings on temporary roads would be decompacted to a depth of 24" prior to the block being released.

To minimize impacts to the environment and natural resources, pre-existing temporary road alignments and alignments of previously decommissioned system roads are utilized wherever practical. There are cases where it is not feasible or undesirable to use the same alignments or landings. In some places, in order to protect residual trees, soil, and water, new temporary roads are proposed to access landings where existing system roads and old alignments are not adequate for accessing strategic locations on the ground. Stream crossings were minimized as much as possible when identifying the location of temporary roads. However, it is anticipated that three existing stream crossings over intermittent streams would need to be rebuilt and one existing stream crossing over a perennial spring would need to be reused. See Section 3.5, Water Quality for more information regarding these crossings.

The temporary roads located on previously decommissioned roads minimize environmental impacts by utilizing old road prisms and previously disturbed grounds. Proposed temporary roads were only located on decommissioned roads that had an aquatic risk rating of low to moderate. None of the new temporary road construction would be within Riparian Reserves. As defined by the 2003 Roads Analysis Report, an aquatic risk rating was assigned to each road segment based on combining the values of individual aquatic risk factors. The individual risk factors are: riparian areas/floodplains; fish passage; landslide hazard; surface erosion hazard; hydrologic hazard; high risk stream crossings; stream crossing density; and, wetlands. The reuse of existing alignments is consistent with Forest Service policy as described in Forest Service Manual 7703.22. The manual direction states: "Motor vehicle use off designated roads, trails, and areas may be authorized by a contract, easement, special use permit, or other written authorization issued under federal law or regulation (36 CFR 212.51(a)(8); FSM 7716.2)."

The exact locations of temporary roads may change during the layout phase of this project, but the total mileage of the temporary roads would not exceed 11.8 miles. Of the proposed temporary roads, 7.8 miles are new temporary roads, 4.0 miles are previous temporary or decommissioned roads that would be reconstructed for this project.

The intent is to have the temporary roads located as depicted in the map; however, they may need to be adjusted during the layout phase. Any changes would have to meet the design criteria stated in this section and all Project Design Criteria (Section 2.3). Any change to the Proposed Action following a signed Decision Notice would have to follow the change condition requirements in NEPA and be approved by the Responsible Official.

2.2.5 Road Closures

All of the National Forest System roads within the planning area were analyzed to determine if road closures were appropriate following the completion of the proposed vegetation treatments to support fuel reduction efforts.

The criteria used to determine if the road would be closed included: risk of fire start, accessibility for fire suppression or search and rescue operations, public and administrative access; likelihood and timing of future timber/fuel treatment; level of aquatic risk; current road conditions; and, future road maintenance needs.

As defined by the 2003 Roads Analysis Report, an aquatic risk rating was assigned to each road segment based on combining the values of individual aquatic risk factors. The individual risk factors are: riparian areas/floodplains; fish passage; landslide hazard; surface erosion hazard; hydrologic hazard; high risk stream crossings; stream crossing density; and, wetlands.

This project would close approximately 1.6 miles of road. The three roads proposed for closure would help reduce the open road densities in the planning area, reducing the risk of human caused wildfires. The 2015 fire season saw almost 88% of its fires occurring from human caused sources (through August 1, 2015). However, by maintaining these roads as system roads, if access were needed in the future for suppression or search and rescue operations, little ground disturbing activities would need to occur.

Closure may be by a physical barrier or gate, or by regulation. Basic custodial maintenance would be performed for future resource access and to prevent damage. Closed roads are to be left in a stable hydrologic state and are to be periodically maintained.

Table 9. Roads proposed for closure in the Proposed Action

Road Number	Miles
3511-015	0.4
3511-640	0.5
3512-640	0.7
Total	**1.6**

2.2.6 Road Reconstruction/Maintenance

Road maintenance and reconstruction is necessary on haul routes identified for this project. Weak areas would be reconstructed as needed. The roads would be repaired to a minimum standard for both safety and resource protection before use. No new permanent road construction would be necessary to implement the Proposed Action. The proposed roads activities include actions on National Forest System roads that would be used for timber hauling.

Table 10 displays the basic maintenance and repair work categories that would be utilized on all roads during and after use to maintain minimum standards. These work categories include brushing, drainage, blading, maintenance, and surface repair. Maintenance work consists of providing minimum access required for contractors operations and associated Forest Service contract administration and preventing unacceptable resource or road damage. All work would be within the existing road structure.

Brushing work consists of cutting all vegetative growth including trees and other vegetation less than 4-inches in diameter measured 6-inches above the ground, on roadway surfaces and roadsides. Brushing generally occurs within a distance of 8 feet from the road shoulder. Cut material is placed on the downslope (fill) side of the road. Drainage work consists of maintaining ditches and drainage structures to prevent erosion and excess sedimentation. Ditch spoils would be placed below the road prism outside riparian protection buffers listed in the Project Design Criteria. Blading includes shaping the crown or slope of road surface, berms, and drainage dips. Surface repair work consists of placing surface aggregate as designated on the ground. It includes preparing the area, furnishing, hauling, and placing all necessary materials and other work necessary to blend additional material with the adjacent road cross section.

Road reconstruction is any road work that seeks to create or improve an existing system road where such work is not covered by standard maintenance specifications included within a typical timber/stewardship sale contract and which is engineered to meet all applicable standards and guidelines required by federal regulation. Finally, roadbed reconditioning is a particular type of road reconstruction work that consists of repairing soft and unstable areas by removing unsuitable material and filling with approved structural quality backfill, base aggregate, or surface aggregate as required. All oversized material larger than 6-inches from the top 6-inches of subgrade would be removed; the subgrade would be scarified to a 6-inch depth; surface irregularities would be removed; the roadway would be shaped to provide a uniform surface; and, the surface would be compacted to specifications.

Table 10. Road Maintenance Needs for Log Haul

Road	Length	Description
3511-000	2.1	Blading, Brushing, 150 cubic yards (cy) Spot Rock, 0.52 mile (mi) Ditch Cleaning
3511-000	1.8	Blading, 0.11mi Brushing, Clean 14 Inlets, 120cy Spot Rock * Snowmobile Route - No Plowing beyond mile post (MP) 2.09 Specified Road Clearing MP 2.20 - 3.87 Fall 60 DTs MP 3.02 - 3.87
3511-014	0.6	Maintenance Level (ML) 1 Road: * Snowmobile Route - No Plowing
3511-015	0.4	Remove & Replace Berm, Cut New Temp Road Move to ML1
3511-630	0.7	ML1 Road: Blading, Brushing, Clean 4 Inlets, 0.31mi Ditch Cleaning * Snowmobile Route - No Plowing beyond MP 0.46 Add new Gate at MP 0.03
3511-631	0.7	Blading, 20cy Spot Rock, 10 DTs * Snowmobile Route - No Plowing beyond MP 0.26 Specified Road Clearing Full Length Replace Gate at MP 0.29
3511-632	0.3	ML1 Road: Blading, Brushing, Log-Out, Clean 2 Inlets
3511-633	0.1	ML1 Road: Blading, Brushing, Log-Out, Clean 2 Inlets
3511-640	0.5	Blading, Brushing, Ditch Cleaning Full Length Move to ML1 at Completion with Berm, Add 12 Water Bars (WB)
3512-000	0.6	Brushing, Ditch Cleaning Full Length, Clean 3 Inlets, Road Maintenance Deposit
3512-000	0.9	Brushing, Ditch Cleaning 0.3mi, Clean 5 Inlets, 3 Danger Trees/mi, Road Maintenance Deposit
3512-000	1.2	Blading, Brushing, Ditch Cleaning 0.36mi, 140cy Spot Rock Specified Ditch Reconditioning MP 1.53-1.73
3512-000	7.9	Blading, Brushing, Ditch Cleaning 1.24mi, Clean 5 Inlets, 700cy Spot Rock, Maintain 20 Drainage Ditches

3512-011	0.2	ML1 Road
3512-012	0.6	ML1 Road: Brushing, Blading, 20cy Pit Run, Maintain 2 WBs, 12 DTs
3512-620	0.8	Brushing, Road Maintenance Deposit
3512-630	0.4	Blading, Brushing, Ditch Cleaning 340 feet, Clean 4 Inlets, 40cy Spot Rock
3512-640	0.7	Blading, Brushing, Clean 1 Inlet, Maintain 10 WBs Move to ML1 at Completion with Berm, Add 1 WB
4400-000	3.6	Brushing, 60cy Ditch Cleaning, Clean 4 Inlets, Road Maintenance Deposit
4400-015	0.9	Blading, 33 Danger Trees Specified Road Clearing Full Length
4400-620	2.5	Blading, 0.3mi. Brushing, 10cy Spot Rock, 0.3mi Ditch Cleaning, 5 DTs/mi Specified Road Clearing 2.2mi
4400-622	0.6	Blading, Brushing, 10cy Spot Rock, 21 DTs Specified Ditch Reconditioning Full Length;
4400-624	0.1	Blading, Brushing, 5 DTs/mi

2.3 Project Design Criteria/Mitigation Measures

The National Environmental Policy Act defines “mitigation” as avoiding, minimizing, rectifying, reducing, eliminating or compensating project impacts. The following design criteria and mitigation measures are an integral part of this project and would be carried out if the project is implemented under the Proposed Action. The effects analysis in Chapter 3 is based on these project design criteria and mitigation measures being implemented.

2.3.1 Vegetation Management

V-1. Gap size and distribution (i.e. location and number) would vary depending on stand specific conditions and treatment types.

- In the western and central portion of the planning area (Blocks 1-11 and 21) no gaps would be placed in young plantations (<20 years). Plantations over 20 years (within Blocks 1-3,6,7 and 9 gap sizes would not exceed 5 acres and would maintain a minimum of 30% canopy cover in resistant species when available. Gaps larger than 2 acres within commercial plantations should be focused in dry plant communities and/or around forest health concerns Gaps in recently unmanaged stands (Blocks 8, 10, and 11) should be no more than 2 acres.
- In the eastern portion of the planning area (Blocks 12-19) gaps in commercial plantations (Block 17) would not exceed 5 acres and would maintain a minimum of 30% canopy cover in resistant species when available. In recently unmanaged stands (Blocks 12-16, 18, and 19 gaps should be no more than 2 acres.

V-2. Within Riparian Reserves for perennial streams, gaps would only be allowed within 1 site potential tree (130 feet) if the stream is glacially or spring fed or the gap is located on the north side of the stream. If these conditions are met, gaps could be created, but they would be located outside protection buffers outlined in the Project Design Criteria. If gaps are created along intermittent streams they would be outside the protection buffer. See (PDC A-2).

V-3. If a gap is placed in a Riparian Reserve directly adjacent to a stream designated as listed fish habitat (Dog River, Polallie Creek, or the East Fork Hood River) the gap would be located one site potential tree height or further from the LFH stream regardless of the protection buffer width. This pertains to the above streams in blocks 9, 10, 11, 12, 13, 14, 15, 17, 18, and 19.

V-4. No gaps would be located in Riparian Reserves within skyline blocks.

V-5. Tree planting would occur in gaps larger than 2 acres and interplanting would occur only where canopy cover is open enough to support the establishment of shade intolerant and/or fire resistant species (ponderosa pine, western larch, western white pine).

V-6. Openings would be created in root disease pockets. Openings would be reforested in accordance with site conditions

2.3.2 Fuels

F-1. Purchaser should pile all sale generated and previously created slash that has been disturbed by harvesting activities where the down woody tons per acre standards and guidelines are exceeded. Refer to W-5.

F-2. Slash piles should have a sound base to prevent toppling over and should be wider than they are tall. Pile branches with their butt-ends toward the outside of the pile, and overlap them so as to form a series of dense layers piled upon each other. Use a mixture of sizes and fuel throughout the pile. Piles should be kept compact and free of soil and noncombustible material, with no long extensions. Do not construct piles on stumps or on sections of large down logs.

F-3. Pile size and location should be such to minimize damage to residual trees. Piles should be located at least 20-feet inside the block boundary. Piles should not be placed on or in the following areas: pavement, road surface, ditch lines, the bottom of ephemeral channels, or within perennial or intermittent stream protection buffers.

F-4. Low severity burns[1] should constitute the dominant type of controlled burn within Riparian Reserves, resulting in a mosaic pattern of burned and unburned landscape.

F-5. Moderate severity burns[2] are permitted in no more than 20% of Riparian Reserves to invigorate desirable deciduous species.

F-6. Ignition could occur within the Riparian Reserve, but outside of the protection buffer.

F-7. Burning activities excluded in Riparian Reserves are as follows: mechanical fire line construction (e.g. dozer, tractor, etc.) and use of chemical fire retardant.

F-8. Within Riparian Reserves; wet line or black line would be used to control prescribed fire perimeter.

F-9. Where handline is constructed, implement BMP’s to reduce erosion and sedimentation risks, including constructing waterbars on all fire lines during initial fire line construction where slopes are greater than 20%.

2.3.3 Roads

[1] Low severity burn is defined as: “Small diameter woody debris is consumed; some small twigs may remain. Leaf litter may be charred or consumed, and the surface of the duff may be charred. Original forms of surface materials, such as needle litter of lichens may be visible; essentially no soil heating occurs.”

[2] Moderate severity burn is defined as: “Foliage, twigs, and the litter layer are consumed. The duff layer, rotten wood, and larger diameter woody debris is partially consumed; logs may be deeply charred; shallow ash layer and burned roots and rhizomes are present. Some heating of mineral soil may occur if the soil organic layer was thin.”

R-1. All signing requirements on roads that are open for public use within the Mt. Hood National Forest would meet applicable standards as set forth by the Manual of Uniform Traffic Control Devices (MUTCD). Some roads accessing State and County highways would require additional signing to warn traffic of trucks entering onto or across the highway.

R-2. Temporary roads and National Forest System roads which are designated for 'project use only' would be closed to public use. The purchaser should sign the entrance to such roads with "Logging Use Only" signs and make every reasonable effort to warn the public of the hazard and to prevent any unauthorized use of the road.

R-3. The use of steel-tracked equipment on asphalt or bituminous surfaced roads is strongly discouraged. If a suitable site for the loading and unloading of equipment and materials is not available, then use of a paved surface may be permitted provided that the purchaser uses approved matting materials (such as wood chip or crushed rock) to protect the road surface. Purchaser is responsible for restoring roads to existing condition.

R-4. Temporary roads and landings located on or intersecting National Forest System roads that are asphalt or bituminous surfaced would have 3-inch minus or finer dense graded aggregate placed at the approach to prevent surface damage. The purchaser should purchase the material from a commercial source and place the material so that the approach flares are wide enough to accommodate the off-tracking of vehicles entering onto or leaving the site.

R-5. Temporary roads and landings would not obstruct ditch lines. Temporary roads and landings that obstruct ditch lines or drainage ways should be improved by the purchaser, prior to commencing operations, with temporary culverts, french drains, drivable dips, or measures that provide effective drainage and prevent erosion.

R-6. On aggregate surfaced roads, mineral soil contamination degrades and reduces the load bearing capacity of the existing road surface. All appropriate measures would be taken to prevent or reduce such contamination. If contamination occurs, the purchaser should repair contaminated areas with specified aggregate surfacing.

R-7. Temporary roads and landings on temporary roads would be decompacted to a depth of 24" in the Crystal Springs Watershed Special Resources Management Unit (CSWSRMU) prior to the block being released. Outside of the CSWSRMU temporary roads and landings on temporary roads would be scarified before the block is release. Culverts would be removed and cross-drain ditches or water bars would be installed as needed. Disturbed ground should be seeded and mulched and available logging slash, logs, or root wads should be placed across the road or landing surface. Post-harvest motorized access would be prevented through the construction of a berm, placement of large boulders, or other approved techniques.

R-8. Pit run rock may be used when necessary to reduce erosion risk, puddling, rutting, and soil displacement on temporary roads and landings. To provide an efficient substrate for vegetative growth and water infiltration, rock would be removed or incorporated into the soil by decompacting to a depth of 24" (inside the CSWSRMU), or scarifying the roadbed following harvest activities (outside the CSWSRMU).

R-9. Unsuitable excavation resulting from ditch cleaning and other operations would be disposed of only at Forest Service approved sites outside riparian protection buffers (PDC A-2 and Table 2-7). Material disposed of should be spread evenly over an appropriate area in non-conical shaped piles with a maximum layer thickness of 3 feet. All disposals should be seeded and mulched at the completion of operations.

R-10. Stockpiles of aggregate intended for use on the project would be staged only at Forest Service approved sites. Materials should be placed in non-conical shaped piles with a maximum layer thickness of

3-feet. Stockpiles should be covered with weighted plastic sheeting when inclement weather is expected to protect it from precipitation and to prevent water quality degradation from runoff.

R-11. Existing vegetation in ditch lines hydrologically connected to streams (as defined in NWFP[4]) must not be removed unless a biodegradable sediment control feature such as check dams constructed of bio-bags, straw bales, or other materials are installed. Sediment control features would be maintained until the sale is released and left in place.

R-12. Scheduled soil disturbing road maintenance or reconstruction should occur during the Normal Operating Season (generally June 1 – October 31), unless a waiver is obtained.

R-13. Follow the appropriate Oregon Department of Fish and Wildlife (ODFW) guidelines for timing of in-water work (in this watershed the in-water work window is July 15 – August 31[1]. Exceptions to the ODFW in-water work windows must be requested by the Forest or its contractors, and subsequently approved by ODFW, National Marine Fisheries Service (NMFS), U.S. Army Corps of Engineers, and Oregon Division of State Lands.

R-14. New temporary roads and landings should be located outside of Riparian Reserves. Use of existing facilities within riparian reserves may be allowed if erosion potential and sedimentation concerns could be sufficiently mitigated.

R-15. To ensure that temporary roads are constructed in a manner that provides for user safety, minimizes landform disturbance, and protects resource values such as water quality, soil stability, and visual quality of the Forest, Forest Service Roads Engineering should be consulted whenever:

a. Temporary roads would be constructed in areas with an existing cross-slope greater than 40%,
b. Temporary roads would have a road grade above 15% for any distance greater than 2,000 feet, or
c. Temporary roads would have a road grade above 18% for any distance greater than 600 feet.

2.3.4 Log and Rock Hauling

L-1. Log and rock haul outside of Normal Operating Season (June 1 – October 31) would not occur on the following roads or road segments: 3510620 and 3512012.

L-2. Log haul, rock haul and equipment transportation may be allowed outside the Normal Operating Season (June 1 – October 31) on aggregate and native surface roads not listed in L-1 if approved by the appropriate specialist(s) and the following criteria are met:

a. Haul routes must be inspected, or have responsible official approval weekly, or more frequently if weather conditions warrant.

b. Sediment traps would be installed where there are potential sediment inputs to streams. Sediment traps would be inspected weekly by the timber sale administrator (or qualified specialist) during the wet season and entrained soil would be removed when the traps have filled to 3/4 capacity. Dispose of these materials in a stable site not hydrologically connected to any stream.

c. Precipitation amounts are similar to those found during the normal operating season. This is defined as the following: The daily precipitation level remains below the average daily maximum precipitation for the June through October period at the precipitation gage nearest the planning area; AND the two-week cumulative total precipitation remains less than the average maximum two-week precipitation levels during the June through October period as measured at the nearest precipitation gage AND no visible sedimentation is occurring in road ditches and culverts caused by the haul. Additionally, all haul would stop with 24 hours of continuous rain regardless of amounts.

d. Proposed hauling on established snowmobile routes and/or weekend operations are approved beforehand by the recreation specialist.

L-3. Log haul and heavy vehicle transport on NFS roads would be prohibited when the temperature of the road surface, as measured at the lowest elevation along the haul route on National Forest System lands, is above 28 degrees Fahrenheit and when the temperature as measured at the highest elevation on the active haul route is between 28 and 38 degrees Fahrenheit or at any time when the designated Timber Sale Administrator determines that freeze-thaw conditions along the haul route exist

L-4. Within the normal operating season, log and rock haul on system and temporary roads would be prohibited at any time there is 1.5 inches of precipitation within any given 24-hour period as measured at the lowest elevation along the haul route. To measure precipitation, the purchaser may install a temporary rain gauge on National Forest System land near or adjacent to the lowest elevation along the haul route as agreed upon; otherwise, precipitation would be measured according to the Log Creek RAWS station (LGFO3). Data for the Log Creek RAWS station can be found at: http://raws.wrh.noaa.gov/cgi-bin/roman/raws_flat.cgi?stn=LGFO3

2.3.5 Aquatic Resources

A-1. No ground based mechanized equipment, including but not limited to tractors or skidders may operate within 100-feet of streams, seeps, springs or wetlands while conducting logging and fuel treatment operations.

A-2. Any incidental trees felled within designated protection buffers would be left on site as additional stream channel woody material. Protection buffers for perennial streams and wetlands would be a minimum of 60-feet and a minimum of 30-feet for intermittent streams, except as outlined in Table 63. Buffers are measured from the edge of the bankfull channel on both sides of the stream (or water's edge in the case of a pond or wetland). Buffers would be expanded to include slope breaks where appropriate. Trees can be felled towards streams but any tree, or portion thereof, directionally felled towards surface water that could land in the bankfull stream channel must be felled during the ODFW in-water work window (July 15 to August 31).

A-3. If a tree located outside a protection buffer lands wholly or partially within the protection buffer when felled, none of the tree located within the protection buffer would be removed.

A-4. Ground based mechanized equipment, such as skidders, dozers, and feller-bunchers, operation would not be allowed outside the Normal Operating Season (June 1 – October 31) within Riparian Reserves unless approved through the existing waiver process by a soils, hydrology, and/or fisheries specialist.

A-5. Locate new landings outside of Riparian Reserves. Use of existing landing locations within Riparian Reserves may be allowed if erosion potential and sedimentation concerns can be sufficiently mitigated as determined by a qualified Soil Scientist or Hydrologist. Existing landings within one site potential tree height from streams, seeps, springs or wetlands would not be used unless the slope between the landing and surface water is thirty percent or less and there is an intact vegetated buffer between the landing and surface water.

A-6. Refuel mechanized equipment at least 150-feet from water bodies. Parking of mechanized equipment overnight or for longer periods of time would be at least 150 feet from water bodies or as far as possible from the water body where local site conditions do not allow a 150-foot setback. Absorbent pads would be required under all stationary equipment and fuel storage containers. A Spill Prevention Control and Countermeasures Plan would be prepared by the contractor as required under EPA requirements (40 CFR 112).

A-7. Skyline yarding should allow at least one end log suspension at all times.

A-8. Skyline yarding corridors should not exceed 15-feet in width and should be spaced at least 100-feet apart on average.

A-9. Use erosion control measures (e.g., silt fence, sediment traps) where road maintenance or reconstruction may result in delivery of sediment to adjacent surface water.

A-10. Install suitable stormwater and erosion control measures (e.g., ditching, seeding, mulching) to stabilize disturbed areas and waterways on incomplete projects prior to seasonal shutdown of operations, or when severe storm or cumulative precipitation events that could result in sediment mobilization to streams are expected.

A-11. The timber sale administrator or qualified specialist would monitor disturbed areas, as needed, to verify that erosion and stormwater controls are implemented and functioning as designed and are suitably maintained.

A-12. No water would be withdrawn from any occupied LFH stream (East Fork Hood River and Dog River) except in an emergency (e.g. wildfire) situation. Limit water withdrawals for road maintenance or other purposes in unoccupied LFH (Polallie Creek) and within 1,500 feet of occupied or unoccupied LFH to 10 percent or less of stream flow at the point of withdrawal (visually estimated). In non - LFH streams greater than 1,500 feet from LFH limit withdrawal by 50 percent or less of the stream flow (visually estimated). Regardless of water withdrawal location, use of screen material with either of the following maximum openings is required: 1.75 mm opening for woven wire or 3/32 inch opening for perforated plate.

A-13. All ground based mechanized equipment would carry a hazardous material recovery kit.

PDCs within the Crystal Springs Zone of Contribution

A-14. Porta-potties or suitable toilet facilities would be provided on-site prior to any sale layout, construction, or harvest activity. These facilities would not be within 500 feet of any stream, spring, or seepage; secured from weather damage; and be maintained at necessary intervals. Special circumstances would be handled on a case by case basis.

A-15. Personal porta-potties are acceptable for use by personnel if such blocks are maintained daily and secured properly.

A-16. Personnel are to be instructed that the sanitary facilities are to be used and that such facilities must move with the job activity.

A-17. Disposal of composted human waste is prohibited inside the ZOC area.

A-18. Toilet facilities would be located in sites of activity concentration such as landings. The portable toilets would be located on a site where tipping over cannot occur.

A-19. No fuel would be stored within 1,000 feet of streams.

2.3.6 Soils

S-1. All skid trails would be rehabilitated immediately after harvest activities are completed. If those treatments are anticipated to be delayed beyond the current field season, then temporary effective closure of temporary roads and skid trails would occur to prevent unauthorized use.

S-2. Ground-based mechanized equipment used to harvest timber should not be used on slopes greater than 30 percent to avoid detrimental soil and/or watershed impacts. Ground based mechanized equipment used for fuel treatment would not operate on slopes greater than 40 percent unless approved beforehand by the soil scientist.

S-3. If a proposal to implement winter logging or outside the normal operating season is presented, the following should be considered by the line officer if the ground is not frozen hard enough and/or insufficient snow depth to support the weight and movement of machinery in moist to wet soil conditions:

a. The proposal should be considered on a block-by-block basis using soil types in the area since some soils may be more prone to detrimental damage than others

b. Because the margin of difference between not detrimental and detrimental soil damage can be so slim under moist to wet soil conditions, monitoring of the logging activity may need to occur daily, or more, as agreed to by sale administration and soil scientist

c. Equipment normally expected to traverse the forest, such as feller bunchers, track mounted shears, etc., should be restricted to skid trails once soil moistures are such that even one or two trips are causing detrimental soil damage out in the block (i.e. not on landings or skid trails)

d. Due to higher PSI's than track mounted equipment, no rubber tired skidders should be used even on skid trails once soils become fully saturated (approach their liquid limit)

2.3.7 Wildlife

W-1. Except for hauling and the removal of hazard trees to protect public safety, no activities would take place within the disruption distance of a known spotted owl activity center during the March 1 to July 15 critical nesting period.

a. The use of chainsaws and heavy equipment would not take place between March 1 and July 15 in portions of Blocks 1, 5, 10, 12, 13, 14, 15, 16, 17, and 19.

W-2. No activities would take place in B10 Deer/Elk Winter Range between December 1 and April 1. A portion of the Forest Service Road 44-620 & 17-680 (<¼ mile) is within B10. A seasonal restriction for hauling would be in place for this portion of the road.

W-3. All snags larger than 12 inches would be retained where safety permits. If snags must be cut for safety reasons they would be left on site.

W-4. Certain live trees would also be selected as leave trees that have the "elements of wood decay" as described in the DecAID advisor. This may include trees with features such as dead tops, broken tops and heart rot.

W-5. An average of 6 logs per acre in decomposition classes 1, 2 and 3 should be retained in northern spotted owl suitable habitat. Logs should be relatively solid, retention of additional hollow and substantially fractured logs should be encouraged, tops should generally not be included. Logs should be at least 20 inches in diameter at the small end and have a volume of 40 cubic feet. Prior to harvest, contract administrators would approve skid trail and skyline locations in areas that would avoid disturbing key concentrations of down logs or large individual down logs where possible.

W-6. Known Northern spotted owl core areas would be protected through the implementation of seasonal operating restrictions (March 1 to July 15) for blocks 1, 2, 3, 5, 6, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, and 19. In the event that new core area(s) is/are located during the period of the contract(s) seasonal operating restrictions would be implemented in the area affected.

W-7. No burning may take place within ¼-mile of spotted owl core areas between March 1 and July 15.

W-8. Survey and Manage species needing protection would be designated on-the-ground prior to ground disturbing activities occurring.

W-9. No heavy helicopter operations (Type 1) may take place within ¼-mile of spotted owl core areas between March 1 and Sept 30. Small helicopters would be subject to the same distance restriction between March 1 and July 15.

W-10. Continuous logging slash will be less than 24 inches deep to allow for deer and elk movement.

W-11. A no cut buffer of 50 feet around talus will be implemented to protect wood recruitment and stability of habitat for Survey and Manage Species.

2.3.8 Invasive Species

I-1. There are five invasive plant populations in the planning area that are approved for treatment under the 2008 Environmental Impact Statement for Site Specific Invasive Plant Treatments for Mt. Hood National Forest: Treatment ID #66-008 (Highway 35), 66-013 and 66-041 (road 3512-620 to block 8), 66-018 (road 44 to 4410 junction), and 66-043 (quarry at junction of road 3511-620, previously Forest Service land). The Forest Service would treat the areas or coordinate treatment with county/state weed departments prior to project activities or sale planning.

I-2. The quarry at the junction of roads 3511 and 3511-620 would be inspected by the District botanist or invasive plant program manager prior to project activity and sale planning. If invasive plants are found The Forest Service would treat the area or coordinate treatment with county/state weed departments prior to project activities or sale planning. [2005 Invasives ROD SG-7 applies]

I-3.All project activities (including brushing and ditch cleaning along access roads) in blocks 8, 17, and 18 should be scheduled last if possible to avoid spreading weeds to uninfected areas. Equipment that has operated blocks 8, 17, and 18, and along access roads to the blocks, should be washed prior to moving off the Hood River District to avoid spreading invasive plants elsewhere on or off Forest. The Forest Service would coordinate with Hood River County (HRC) to establish an equipment washing station at the HRC maintenance facility in Parkdale.

1-4. Schedule timing of brushing and ditch cleaning along roads in the treatment areas (Table 10) in consultation with the District botanist or invasive plant program manager to ensure activities occur before (if possible) invasive plants are in bloom, and identify disposal areas for weed infested ditch material. [2005 Invasives ROD SG-8 applies].

I-5. The District botanist or invasive plant program manager would monitor the treatment areas. Monitoring of treatment areas, haul routes, associated landings and equipment staging areas would continue for at least 3 years after project activity; follow-up treatment would be conducted if necessary [BMP Practice 18 applies].

I-6. Use only weed-free sources of gravel, fill, sand, rock, or re-usable/recovered rock material that has been inspected by the District botanist or invasive plant program manager. A list of rock/gravel sources that have been certified weed-free would be issued to contractors; if a contractor would like to use a rock/gravel source that is not on the list it would require inspection. [2005 Invasive ROD SG-7 applies].

I-7: *Arabis sparsiflora var. atrorubens* (sickle-pod rock cress) was not found in the planning area during surveys but does grow around the outer edges of Shellrock Quarry which might be used for rock and gravel or staging equipment. If it is determined at some point that use of the quarry is needed, consult with the Hood River or Barlow Ranger District botanists to assist with flagging a buffer to prevent impacting the habitat.

2.3.9 Heritage Resource Sites

H-1. All designated cultural resource sites requiring protection would have a 100-foot buffer zone where heavy machinery and timber harvest would be excluded. Prescribed burning would also be excluded from the buffer zone with hand-constructed fire control line. Treatment of vegetation by hand could still occur as necessary.

H-2. Culturally-modified trees would be flagged individually and avoided. Harvest trees would be felled directionally away from flagged trees.

H-3. Historic ditches would be flagged with 50-foot buffer zone where heavy machinery and timber harvest would be excluded. Treatment of vegetation by hand could still occur as necessary. Ditch crossings would occur only where designated on previous breaches.

2.3.10 Visuals

V-1. Landings and skyline corridors would use topographic and vegetation screening to meet Retention standards from Highway 35 and recreation sites along highway 35 once harvest activities are complete.

V-2. Piles would use topographic and vegetation screening to meet Retention standards within ½ mile of Highway 35 and recreation sites along Highway 35.

V-3. Piles would be visually subordinate along Forest Road 3512 and within trail shade buffers. They would be burned within 1 year of contract termination.

V-4. Tree stumps would be maintained at heights of 6 inches or less within Foreground (up to ½ mile) and be angled away from the roadway to meet Retention standards within ½ mile of Highway 35 or Forest Road 3512.

V-5. Landings along the 3512 and within the foreground of Forest Road 3512 would be less than ¼ acre and would be rehabilitated once harvest activities are complete

V-6. Temporary roads would be screened using topography and vegetation from viewer positions along Highway 35 and recreation sites along Highway 35. Temporary roads would be obscured from viewer positions along Forest Road 3512 within A11 and would not be visually dominant along the remainder Forest Road 3512.

V-7. All stumps would be maintained at 6 inches or less and angled away from the trails within 660 feet of trails within the planning area to meet Retention standards.

V-8. In foreground along scenic corridors (Highway 35 and Forest Road 3512 and trail corridors, leave trees would not be marked facing the roadway.

V-9. Boundary flagging would not be visible along Highway 35 when treatment is complete.

2.3.11 Recreation

RC-1. A 55 foot shade buffer would be retained on either side of all trails within the planning area. Inside the buffer all overstory and decomposition classes 1, 2 and 3 would be retained in order to maintain the current visual integrity and existing shade along the trail corridors. See W-5. There would be no ground-based yarding within the 55 foot buffer.

RC-2. No trailheads would be used as landings and any trailheads impacted from haul would be rehabilitated when treatment is complete.

RC-3. The temporary road currently accessing the CCC warming shelter would be utilized for haul and then reestablished to the previous use.

RC-4. No treatment activities would occur within the Cooper Spur Ski Area during winter operations.

RC-5. Coordinate with district recreation staff to place informational signs at trailheads and at trail junctions prior to initiation of timber harvest activities and underburning, jackpot burning and swamper burning activities. Signs would posted at least a season prior to initiation of activities.

RC-6. Work with recreation specialist to develop public information materials and outreach plan using a combination of key entry/exit portals, visitor information boards and outreach via websites and other information sources.

RC-7. Involve a recreation specialist during treatment layout to determine mitigation measures to reduce disruptions to recreation use to the greatest extent possible. Determine best management practice for spatial and temporal layout of blocks to maintain trail corridors.

RC-8. Due to recreation concerns no treatment activities and haul take place on weekends and holidays.

RC-9. Water would be used to reduce dust levels when appropriate. This includes all trail corridors for trails intersecting with the project boundary and Forest Road 17.

RC-10. Landings and skyline corridors would not be visible from trails and trailheads within the planning area once harvest activities are complete. Temporary road crossings of system trails within Block 19 would be coordinated with the recreation specialist.

RC-11. In Block 19 crossing points would be at least 100 feet apart. Equipment would cross at right angles to the trail. Location of crossing points would be coordinated with district trails manager. (Block 19)

RC-12. Include trails as protected feature in sale map. All harvest activities and rehabilitation affecting the trail in Block 19 would be completed within one season.

2.4 Monitoring Requirements

After the presale work for the timber/stewardship contract is completed, the project moves into the appraisal and contract preparation phase. One of the first steps in the process is to complete the contract project design and implementation crosswalk form. The purpose of the crosswalk is to ensure that all components of the NEPA Decision Notice, including the PDC, Best Management Practices (BMP) and terms and conditions from consultation, are incorporated into the timber/stewardship contract. For each required component of the NEPA decision, the crosswalk identifies how and what stage in the process the component would be addressed (e.g., presale, contract, sale administration, post contract monitoring). The information generated from the cross-walk process is used to guide the contract preparation process and to identify any issues that need to be addressed by resource specialists. The crosswalk is usually prepared by the primary person responsible for developing the appraisal and contract, and signed by the District Ranger.

Beginning in May 2012, the District Rangers are required to conduct a “Plan in Hand” review on a minimum of one timber/stewardship sale within each zone every other year. The review is conducted after all presale work is completed, including all timber marking, and prior to the timber/stewardship sale entering the appraisal and contract preparation stage. The goal of the review is to monitor and evaluate forest resource management prescriptions to measure compliance with goals and objectives, review effects, and adjust subsequent management actions when needed as required by Forest Service Manual direction. The overarching management direction is used as the basis for the review and includes the final NEPA decision as well as Forest Service Handbook, Forest Service Manual and Stewardship Guide (where applicable) regulations and direction.

Prior to advertisement, a final review is conducted by the interdisciplinary team and the Forest Service Representative (FSR)/Contracting Officer in order to ensure that the contract is prepared with the proper contract provisions and language; the PDC are properly inserted and contractually enforceable; and, the contract and appraisal meets Forest Service Handbook, Forest Service Manual and Stewardship Guide (where applicable) regulations and direction.

During implementation, the Sale Administrator in conjunction with the FSR and Contracting Officer are responsible to ensure that the contract is administered properly throughout all stages of implementation. The sale administration team monitors compliance with the contract which contains the provision for resource protection, including but not limited to: seasonal restrictions, snags and coarse woody debris retention, stream protection, erosion prevention, soil protection, road closure and protection of historical sites. The Sale Administrator records observations demonstrating compliance as well as any concerns/issues on inspection reports that are signed by both the Forest Service and Purchaser Representative. The inspection reports would also document any resolutions that have been identified. As needed during the implementation process, the sale administration team may request a resource specialist or Line Officer to come for a field visit to discuss a resource issue that has been identified. Also, a resource specialist may visit a sale without a formal request to conduct monitoring and to make sure that the project is being implemented as directed by the NEPA decision.

Also, resource specialists may visit the site to conduct a post-harvest review before completing any secondary activities, such as slash clean up, prescribed burning, KV or retained receipt projects. Based on these reviews, post-harvest activities would be adjusted where needed to achieve project and resource objectives.

Lastly, monitoring is also conducted at the Forest level as part of the Forest Plan implementation, including monitoring of noxious weeds and BMP. The monitoring of noxious weeds and invasive plants would be conducted where appropriate to track changes in populations over time and corrective action would be prescribed where needed. Monitoring reports including these findings as they are available can be found on the Forest's web site at http://www.fs.usda.gov/main/mthood/landmanagement/planning

BMP monitoring may be conducted on projects after treatment is complete. According to The National Best Management Practices for Water Quality Management on National Forest System Lands - Volume 1: National Core BMP Technical Guide (April 2012), monitoring is one of four steps outlined in the BMP process. Monitoring is used to inform and improve management activities and share with other appropriate Federal, State and local agencies. The Technical Guide states "The Forest Service Nonpoint Source Strategy uses "programmatic monitoring" to evaluate BMP implementation and effectiveness; that is, aside from project administration described above, BMPs are not monitored on every project or activity that occurs on National Forest System lands. Projects to monitor or specific monitoring sites are selected in a manner that results in objective and representative data on BMP implementation and effectiveness. Often, a random or systematic random selection procedure is used to choose monitoring locations across a forest or grassland where specific activities or BMPs are targeted." This project would go into a pool of similar projects to be selected for project level BMPs implementation and effectiveness monitoring as per the National BMP Monitoring Protocol. If selected an Interdisciplinary Team (IDT) would evaluate whether the site-specific BMPs were implemented and the effectiveness of the BMPs. Monitoring for each BMP is outlined in Appendix 2: Best Management Practices for Water Quality Protection.

2.5 Alternatives Considered, but Eliminated from Detailed Study

Subsequent to the collaborative process and scoping periods, two alternatives were brought forward for consideration based on the comments received. These alternatives are discussed below. In addition to the topics discussed in this section several additional concerns and specific recommendations were also raised by the public, which are discussed in Section 1.7, Issues.

2.5.1 Crystal Springs Watershed Special Resources Management Unit

A second alternative considered, but not fully developed responded to scoping comments that suggested that the fuel reduction treatments should not be proposed inside of the Crystal Springs Watershed Special Resources Management Unit (CSWSRMU) because these treatments do not comply with the management unit goals. See Section 1.7.1 – Issues for more information about why none of the proposed management activities would prevent this designation in the future. Additionally, while the Crystal Springs Watershed Special Resources Management Unit was included in the Omnibus Act, its establishment is contingent upon the completion of the Cooper Spur/Government Camp land exchange that has not currently been completed.

This alternative would have proposed no fuel reduction work inside the CSWSRMU, outside of any area located not more than 400 feet from structures located on private land adjacent to National Forest System land, or in any area located not more than 400 feet from the Cooper Spur Road, the Cloud Cap Road, or the Cooper Spur Ski Area Loop Road. This alternative also would not construct any temporary raods within the CSWSRMU.

This alternative was developed to determine the impact on the purpose and need of the project. Table 11 below shows the Polallie Cooper planning area, the proposed thinning activities, and the CSWSRMU. Within the CSWSRMU there are approximately 782 acres proposed for treatment. Of those 782, approximately 595 are outside of the 400 foot buffer applied from private land adjacent to NFS land or the roads identified above.

Table 11. Treatment acres in Crystal Springs Watershed Special Resource Management Unit Alternative

	Proposed Action	Crystal Springs Watershed SRMU Alternative	Change from Proposed Action
Plantation Thinning	420	146	(274)
Sapling Thinning	605	403	(202)
Recently Unmanaged Stand Thinning	1,805	1,686	(119)
Total Acres	2,830	2,235	(595)

The table above shows that the majority of the acres proposed for treatment in the SRMU are Plantation thinning and Sapling Thinning. Sapling Thinning treatments would mechanically thin small trees to promote and develop more resilient stand conditions. The material (slash) generated by this activity would be treated in a variety of methods including but not limited to piling and burning, lop and scattering, masticating, or biomass collection. Plantation Thinning treatments would be a variable density thin from below treatment in existing even-aged managed blocks designed to address high density issues that are leading to forest health concerns. These concerns are stress-related mortality, limited species diversity, and limited structural diversity. The overall desire for these treatments would be to move the riparian and upland portions of the selected plantations towards a more late seral like structure with a large tree component that is currently absent in the majority of these stands.

These areas in the CSWSRMU make up 80% of the plantation thinning and sapling thinning units in planning area that would not be treated under this alternative. By leaving these areas over-stocked, the project would not fully meet the purpose and need of the project. These areas are some of the most important to treat because they have the highest density trees per acre and are the most furthest removed from their historical range of variability as shown in the existing condition and Table 6.

Additionally, to create defensible space that would be effective for a wildfire along the property boundary with private land, the vegetation within the 400 foot buffer would need to be reduced to a much lower density. Currently, most of this area proposed to move the canopy cover to between 30% and 50% based on site specific information as shown in Table 6. To move an uncontrolled wildfire that is crown dominated to the surface would require that canopy covers be lowered substantially below 30% for the 400 foot buffer. Figure 11 below shows where treatments in the CSWSRMU would and would not occur in this alternative.

Additionally, the majority (70%) of the roads in the CSWSRMU are placed on existing roadbeds. These 3.26 miles of existing temporary roads would follow all of the BMPs located in the PDC and have been developed to minimize and reduce the impacts of their use to resources. The 1.4 miles of new temporary roads would be constructed outside of riparian areas and would pose an overall low risk of introducing sediment to streams. Section 2.3.5 includes additional PDCs for activities occurring inside of the CSWSRMU to further reduce and minimize impacts from activities on water quality. Section 3.5, Water Quality Effects Analysis outlines the effects to water quality from the Proposed Action, including any temporary road construction.

By creating an effective fuel break in this alternative, this action would meet the purpose of the project to reduce or maintain levels of hazardous fuel, including surface, ladder, and crown fuel to reduce the risk of unwanted effects of wildfire on NFS lands and adjacent privately owned land, but would not move the landscape toward more historic conditions in this area. As such, this alternative was not considered in detail because it does not fully meet the purpose and need for action.

Further, to treat many of the areas outlined in this alternative, including those along private land, either temporary roads would need to be constructed, or the area would need to be treated using helicopters. By not constructing temporary roads and not treating these areas within 400 feet of the property boundary, the project would not meet the purpose and need for the planning area further, and would be at a greater risk for a large scale wildfire and effects to adjacent private land in the WUI. By utilizing helicopters, cost of implementation would increase, increasing the risk of the sale not being implemented. Additionally, through helicopter harvest methods, the desired canopy cover and basal area targets for the planning area can be met. However, existing and created fuel loading on the ground can be more difficult or impossible to reduce through this treatment type.

The effects to the purpose and need from no temporary road construction are discussed in further detail in Section 2.5.2 where the effects of not building temporary roads and the acres treated from those roads would be removed, and Section 2.5.3, where the harvest method is changed from ground based or skyline from temporary roads to helicopter logging systems.

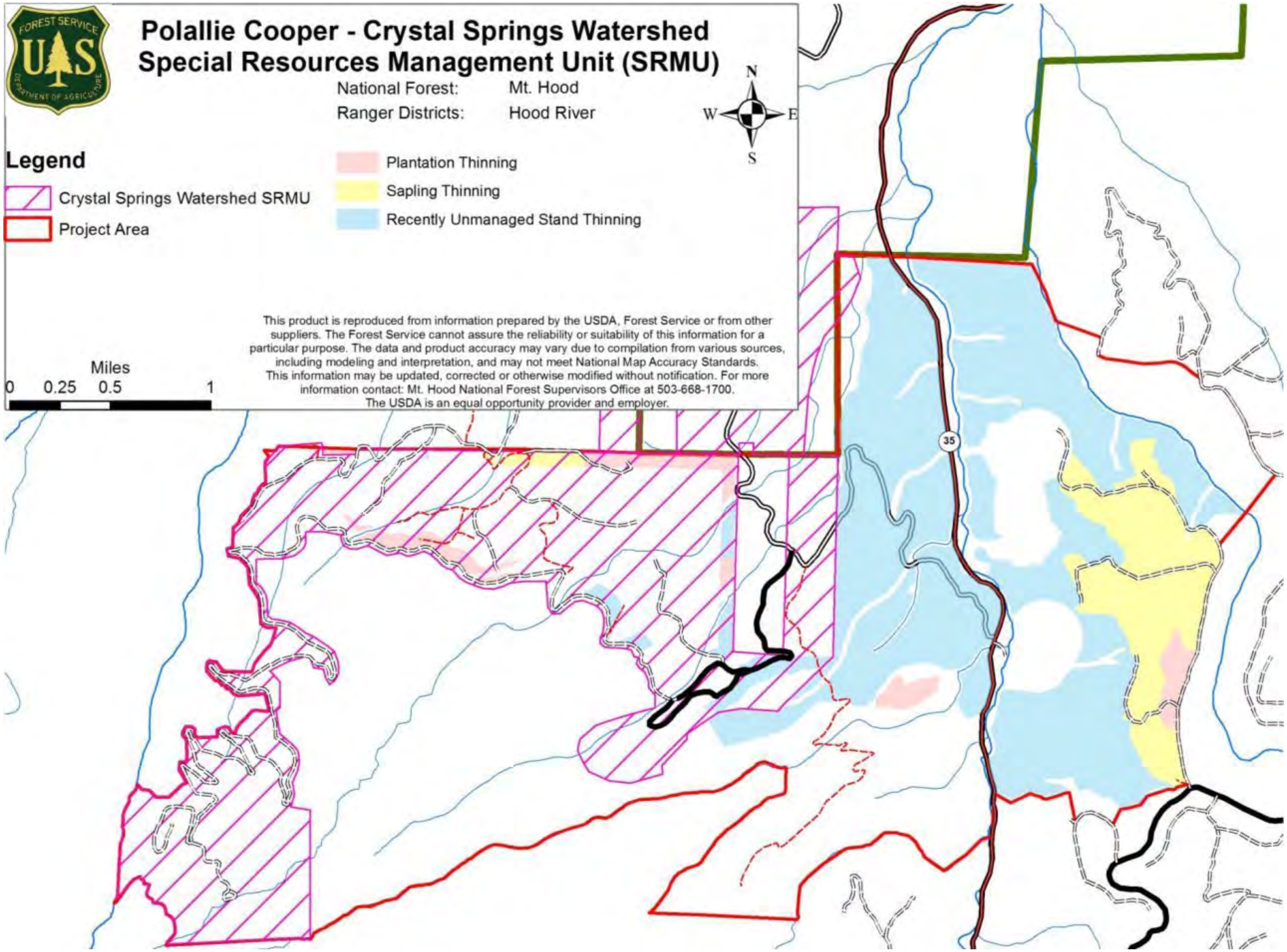


Figure 11. Treatment proposed inside the Crystal Springs Watershed Special Resources Management Unit inside of the 400 foot property and road buffers in the alternative considered, but not fully developed

2.5.2 No Temporary Road Use – Remove Acres Treated From Temporary Roads

One alternative considered would not build any temporary roads to avoid impacts to the water quality and aquatic habitat. See section 1.7.2, Use of Temporary Roads. This alternative would impact 1,068 acres of the Proposed Action within all three vegetation treatments.

The alternative approach would reduce the proposed action from 2,830 acres to 1,762 acres as shown in Table 12 below. This would impact almost 50% of recently unmanaged stands, as well as approximately 38% of Plantation Thinning blocks. Acres with Sapling Thinning would remove over 10% of the proposed action alternative.

In this alternative, all of the treatment areas that would have helicopter yarding were maintained. For treatment areas with ground base harvest methods, they would be retained if they were within 600 feet of an existing system road, and would not have to cross a stream or other area that would cause additional impacts. For treatment blocks with skyline harvest methods, areas where operations would be based off of existing roads were retained, and any harvest that was based off of temporary roads was removed.

Table 12. Vegetation Treatments in the Proposed Action Alternative and the No Temporary Road Alternative

Proposed Action	Proposed Action Alternative (Acres)	No Temporary Road Alternative (Acres)	Change (Acres)
Recently Unmanaged Stand Thinning	1,805	973	(832)
Plantation Thinning	420	257	(163)
Sapling Thinning	605	532	(73)
Total	**2,830**	**1,762**	**(1,068)**

In a general, the less acres that are treated, the less effective fuel reduction treatments can be and would reduce the risk of large stand replacing events. By reducing the fuel in large, contiguous stands, the agency would be more effective being able to reduce or maintain levels of hazardous fuel to reduce the risk of unwanted effects of wildfire on NFS lands and adjacent privately owned land as well as create defensible space in the communities throughout the WUI to meet the objectives and goals of the CWPP.

When the areas that would no longer be treated (cross hatched) in this alternative are viewed spatially in Figure 12, it shows that many of the acres being removed in this alternative are those directly adjacent to private land. In this alternative, treatment blocks 2, 3, 4, 7, 10 and 11 would have substantial portions of the treatment removed. The only treatment block that would have the majority of its interface of NFS and private land remaining is in block 12, which represents a small portion of the available NFS/Private interface available for treatment.

By not treating these areas, the project would not meet the purpose and need for the project because of the limited fuel reduction occurring along private land. Since this would not allow for fuel reduction in some of the most critical areas, this alternative was eliminated from detailed study.

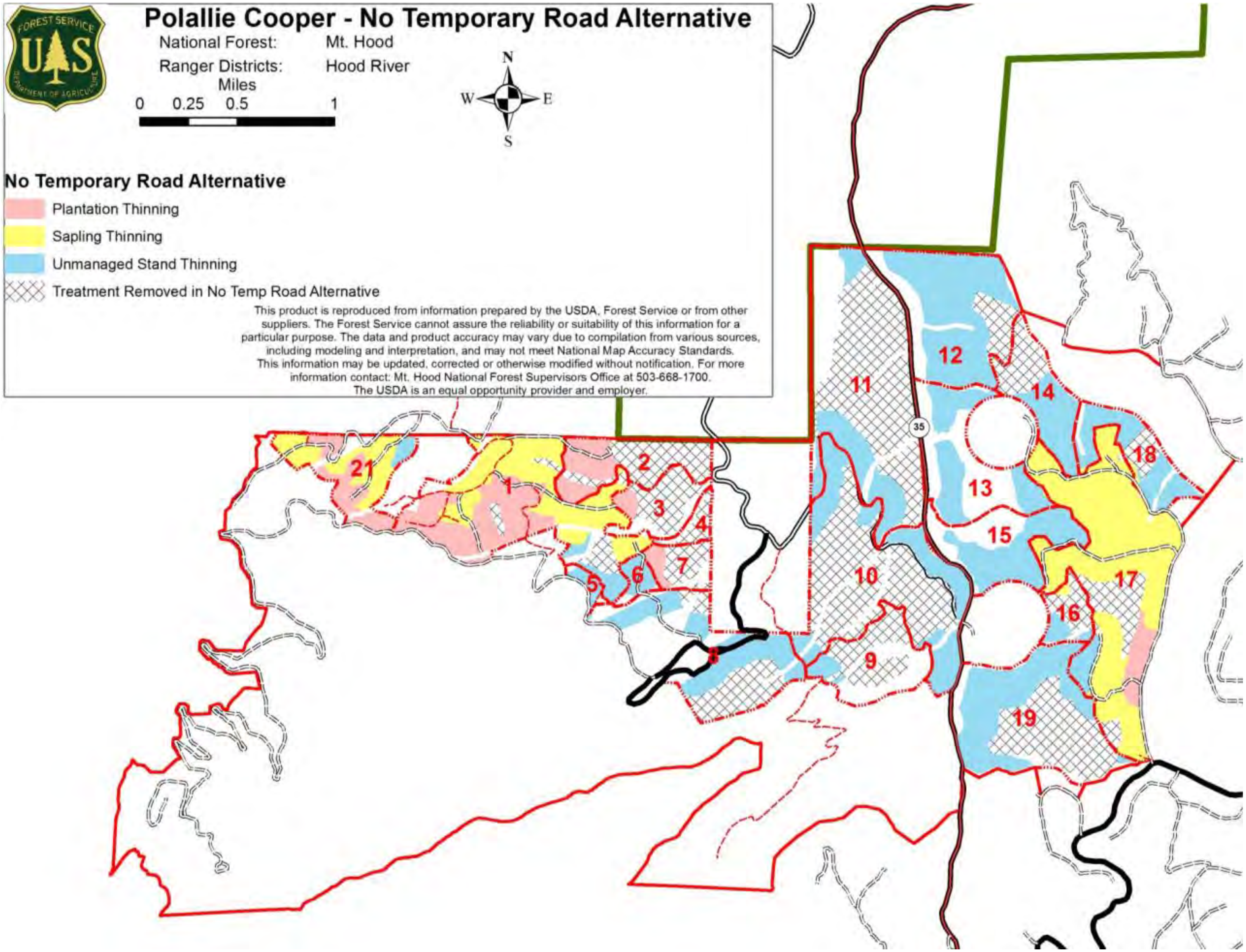


Figure 12. Hazardous Fuel Treatments in the No Temporary Road Alternative

2.5.3 No Temporary Road – Change Harvest Method to Helicopter

As analyzed in 2.5.2 No Temporary Road, Remove Acres Treated from Temporary Roads, dropping the acres from treatment would not meet the purpose and need for the project.

A second option for fuel reduction treatments in the planning area includes treating all the areas that require temporary roads with helicopters. This alternative removes the need to build temporary roads, but still completes some of the fuel reduction thinning in the planning area. There were two reasons for not fully analyzing this alterative; cost and ability to effectively treat fuel.

Table 13. Acres of Harvest Method in the Proposed Action and the No Temp Road - Change Harvest Method to Helicopter Alternative

	Proposed Action (Acres)	Percentage of Treatment	No Temp Road Alternative (Acres)	Percentage of Treatment	Percentage Change in Harvest Method
Ground Based	1530	54%	1000	35%	-19%
Skyline	815	29%	173	6%	-23%
Helicopter	485	17%	1657	59%	41%
Total	2830	100%	2830	100%	0%

In order to treat these stands without utilizing temporary roads approximately 60% of the proposed treatment acres would need to be helicopter yarded from less than 20% as shown in Table 13. The cost of implementing this project would increase approximately 70% over the Proposed Action due to the large increase in helicopter yarding requirements. Table 14 outlines the changes in harvest methods to treat the acres and the estimated costs associated with these treatments, comparing the Proposed Action Alternative to this alternative not fully developed.

Based on past experience with thinning's in comparable stands, it is not reasonable to expect that there would be sufficient value of timber removed to accomplish the proposed treatments with this increased cost.

Table 14. Cost of Hazardous Fuel Reduction Treatments in the Proposed Action and No Temporary Road - Change Harvest Method to Helicopter Alternative

	Proposed Action (Acres)	Proposed Action (Cost)	No Temp Road Alternative (Acres)	No Temp Road Alternative (Cost)	Change (Cost)
Ground Based	1,530	$1,697,153	1,000	$1,109,250	**$(587,903)**
Skyline	815	$1,435,239	173	$304,658	**$(1,130,581)**
Helicopter	485	$2,190,037	1,657	$7,482,250	**$5,292,213**
Total	**2,830**	**$5,322,429**	**2,830**	**$8,845,158**	**$3,573,729**

Additionally, through helicopter harvest methods, the desired canopy cover and basal area targets for the planning area can be met. However, existing and created fuel loading on the ground can be more difficult or impossible to reduce through this treatment type. Because Polallie Cooper is a hazardous fuel reduction project, with a purpose to reduce or maintain levels of hazardous fuel, including surface, ladder, and crown fuel to reduce the risk of unwanted effects of wildfire, this alternative does not meet the purpose and need for the project, and was not analyzed in full detail.

2.6 Mt. Hood Land and Resource Management Plan Consistency

2.6.1 Forest Plan Standards and Guidelines

There are some Forest Plan standards that would not be met in order to meet the Purpose and Need for Action as described above. Exceptions to the Forest Plan standards are allowed under the Forest Plan, if they are identified during the interdisciplinary process. The exceptions were identified during the interdisciplinary planning analysis and the IDT process concluded that these exceptions were within the Purpose and Need for Action. Forest Plan page 4-45 states that for "should" standards "action is required; however, case-by-case exceptions are acceptable if identified during interdisciplinary project planning, environmental analyses. Exceptions are to be documented in environmental analysis (National Environmental Policy Act 1969) public documents." Also, the exceptions were shared with the public during the scoping period. All other standards and guidelines are expected to be met with this proposal.

- Snags and Down Log Associated Species (FW-215): Where new timber harvest blocks occur (e.g., regeneration harvest and commercial thinning), wildlife trees (i.e., snags and green reserve trees) should be maintained in sufficient quantity and quality to support over time at least 60 percent of the maximum biological potential of primary cavity nesting species, e.g., woodpeckers.
- Snags and Down Log Associated Species (FW-219): An average total of at least 6 logs per acre in decomposition classes 1, 2 and 3 (USDA Forest Service 1985, Brown editor) should be retained in all project activity areas, e.g., clearcut, commercial thin, salvage, or overwood removal.

Overall, these standards cannot be met because of the on-the-ground conditions present within the stands. Implementation of the Proposed Action would reduce the amount of small snag recruitment that would have occurred through the process of stress and mortality in the next 20 to 30 years. Some of the snags and downed logs that might have formed from the death of the intermediate and suppressed trees would be removed by thinning activities. As a result the attainment of moderate-sized snags and down wood would be delayed because of the reduction in density of the stands which would reduce the levels of suppression mortality. For more information see Section 3.8, Wildlife.

2.6.2 National Forest Management Act Findings for Vegetation Manipulation

Suitability for even-aged management

Forest Plan guidelines advise against uneven aged management in stands with dwarf mistletoe and/or root disease. Even-aged management is the effective way to manage dwarf mistletoe and root disease, based on Forest Plan direction found in Forestwide Standards (FW) 316 and 317, C1-019 through C1-021, and

C1-024. Project design criteria/mitigation measures, such as patch openings are written into the design of the Proposed Action in order to meet Forest Plan direction.

Suitability for reforestation

Forest plan guidelines advise timber harvesting would be completed in a fashion that reasonably assures each harvest area can be adequately restocked within 5 years after final harvest (FW-358) Replanting would occur to a minimum of 125 trees per acre (FW361-363) in root rot openings large enough to support resistant tree species establishment. Interplanting would be used to maintain genetic quality and desired species composition (FW-332). The proposed treatments would be consistent with all of the above mentioned standards for reforestation

2.6.3 Best Management Practices

Best Management Practices (BMP) are defined as “methods, measures or practices selected by an agency to meet its nonpoint source control needs. BMPs include, but are not limited to, structural and nonstructural controls, operations, and maintenance procedures. BMPs can be applied before, during, and after pollution-producing activities to reduce or eliminate the introduction of pollutants into receiving waters” (EPA Water Quality Standards, Regulation, 40 CFR 130.2). Appendix H of the Forest Plan provides management direction on the BMP implementation process. Appendix H states: “The general BMP’s described herein are action initiating mechanisms which are for the development of detailed, site-specific BMP prescriptions to protect beneficial uses and meet water quality objectives. They are developed as part of the NEPA process, with interdisciplinary involvement by a team of individuals that represent several areas of professional knowledge, learning and/or skill appropriate for the issues and concerns identified. BMP’s also include such requirements as Forest Service Manual direction, contract provisions, environmental documents, and Forest Plan Standards and Guidelines. Inherent in prescribing project-level management requirements is recognition of specific water quality objectives which BMP’s are designed to achieve.” Appendix H of the Forest Plan continues on to describe the implementation process and format for project specific BMP requirements.

According to the Northwest Forest Plan, BMP would be incorporated into the implementation of the project. BMP are drawn from General Water Quality Best Management Practices, Pacific Northwest Region (November 1988); Draft Environmental Protection Agency Region 10 Source Water Protection Best Management Practices for USFS, BLM (April 2005); Mt. Hood National Forest Standards and Guidelines, Northwest Forest Plan Standards and Guidelines and The National Best Management Practices for Water Quality Management on National Forest System Lands - Volume 1: National Core BMP Technical Guide (April 2012) and professional judgment. The BMP have been adjusted and refined to fit local conditions and then incorporated in the project design criteria/mitigation measures as described in Section 2.3 as well as the standard contract language for implementing these projects. According to the USFS National Core BMP Technical Guide (April 2012) “Site-specific BMP prescriptions are developed based on the proposed activity, water quality objectives, soils, topography, geology, vegetation, climate, and other site-specific factors and are designed to avoid, minimize, or mitigate potential adverse impacts to soil, water quality, and riparian resources. State BMPs, regional Forest Service guidance, land management plan standards and guidelines, monitoring results, and professional judgment are all used to develop site-specific BMP prescriptions.”

Appendix 2 of this EA details the site-specific Best Management Practices for Water Quality for this project. The appendix includes all the required components of the site-specific BMPs as specified in Appendix H of the Forest Plan, including BMP title, objective, explanation, ability to implement, effectiveness, and monitoring. In addition, the site-specific BMP table provides a cross-walk with the PDC and planning process. The refined BMP selected for this project have been found to be implementable and effective based on prior field observations and professional judgment, other pertinent research described in Chapter 3 of this document, and monitoring on the Mt. Hood National Forest. These BMPs are fully analyzed in Chapter 3 of this document (see Section 3.5, Water Quality and Section 3.6, Fisheries & Aquatic Fauna).

Consistency with the Healthy Forest Restoration Act

Old growth stands: The Healthy Forest Restoration Act (HFRA) (H. R. 1904-8) requires that projects designed under its authority fully maintain, or contribute toward the restoration of, the structure and composition of old growth stands according to the pre-fire suppression old growth conditions characteristic of the forest type, taking into account the contribution of the stand to landscape fire adaptation and watershed health, and retaining the large trees contributing to old growth structure. Section 102(e)2 states HFRA projects should "fully maintain, or contribute toward the restoration of, the structure and composition of old growth stands according to the pre-fire suppression old growth conditions characteristic of the forest type, taking into account the contribution of the stand to landscape fire adaptation and watershed health, and retaining the large trees contributing to old growth structure."

This project would retain the structure and composition of pre-fire suppression old growth by promoting fire-adapted species where their health condition does not threaten the overall health of the stand. Also, the treatments would not impact the Special Old Growth Area (A7) in the planning area.

HFRA provides that old growth direction in the Northwest Forest Plan Record of Decision is sufficient to meet the requirements of the Act. The Northwest Forest Plan Record of Decision recognizes that large-scale disturbances, such as fire, could eliminate spotted owl habitat on hundreds or thousands of acres. Elevated risk levels are attributed to changes in the characteristics and distribution of the mixed conifer forests resulting from past fire protection. Management activities designed to reduce risk levels are encouraged in Late Successional Reserves even if a portion of the activities must take place in currently late successional habitat (S &G C-13, ROD).

Large tree retention: HFRA Section 102(f) states that projects should be carried out in a manner that "(A) focuses largely on small diameter trees, thinning, strategic fuel breaks, and prescribed fire to modify fire behavior, as measured by the projected reduction of uncharacteristically severe wildfire effects for the forest type (such as adverse soil impacts, tree mortality or other impacts); and (B) maximizes the retention of large trees, as appropriate for the forest type, to the extent that the trees promote fire-resilient stands."

The proposed treatments meet this requirement by retaining large trees suitable to the site in mature stands, and reducing stand density that has increased since the exclusion of fire. Large trees would be retained where they do not threaten the overall health of the stand. Trees with dwarf mistletoe threaten the overall health of the stand and would either not be retained or would be girdled. The HFRA states that the large tree retention requirement must not prevent agencies from reducing wildland fire risk to communities, municipal water supplies, and at-risk Federal land.

Chapter 3 – Environmental Consequences

This chapter presents information on the physical, biological, social, and economic environments of the affected planning area, and the potential direct, indirect and cumulative effects to those environments due to the implementation of the alternatives. Each resource area discloses the direct, indirect and cumulative effects for that resource area. The National Environmental Policy Act defines these as:

- **Direct**: Effects which are caused by the action and occur at the same time and place
- **Indirect**: Effects which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable
- **Cumulative**: Impacts that result from the incremental impact of an action, when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions

The Environmental Assessment herby incorporates by reference the project record (40 CFR 1502.21). The project record contains specialist reports, biological evaluations, and other technical documentation used to support the analysis and conclusions in this Environmental Assessment. Specialist reports were completed for vegetation resources, transportation resources, soils, water quality, fisheries, wildlife, botany, invasive plants, recreation, visual quality, fuel, and heritage resources. Separate biological evaluations were completed for botanical species, aquatic species, and terrestrial wildlife species. Full versions of these reports are available in the project record, located at the Hood River Ranger District office in Mount Hood/Parkdale, Oregon.

Each of the specialist reports and biological evaluations conduct an analysis of cumulative effects resulting from this project. Table 15 lists the projects that the IDT considered in their analysis.

Table 15. List of Projects Considered in the Cumulative Effects Analysis

Past Activities
2000 Debris Flow in the East Fork Hood River
Dollar Lake Fire, including burn area rehabilitation
1980 Debris Flow in Polallie Creek
Gnarl Ridge Fire, including burn area rehabilitation
Timber harvests on federal, county and private lands (including associated road/landing construction)
Road decommissioning and road closures
Aquatic Restoration projects
Ongoing Activities
Timber harvests on federal, county and private lands (including associated road/landing construction)
Road decommissioning and road closures
Cloud Cap hazard tree removal
Crystal Springs Water District operations
Pre-commercial Thinning
Red Hill (and associated road treatments)
Lava Restoration (and associated road treatments)
National Forest System Road and Trail maintenance (within the project area)
Site-Specific Noxious Weed Treatments (along the haul route and within the project area
Tilly Jane Hazardous Fuels Reduction
Cooper Spur Ski Area operations and maintenance
Highway 35 road maintenance and sanding

Cooper Spur Road (3510/3512) maintenance and sanding
Snowmobile use along the haul route and within the project area
Developed and dispersed campsite use and maintenance within the project area
Future Activities
Timber harvests on county and private lands (including associated road/landing construction)
Eastfork Trail Relocation CE
Designation of Crystal Springs Watershed Special Resources Management Unit and Crystal Springs Zone of Contribution
Dog River Pipeline Replacement
Dog River Trail Relocation CE
Designation of the Tilly Jane Wilderness Addition
Cloudcap RAWS station

3.1 Vegetation Resources

3.1.1 Analysis Assumptions and Methodology

The intent of this report is to analyze how the vegetation resources would be affected by the management actions proposed by the U.S. Forest Service. Professional judgment and stand level data were utilized in determining the project's potential effects. Effects analyses were based on several components outlined in the following sections.

Landscape Scale

Information regarding the vegetative conditions of the larger landscape within the planning area is largely provided by East Fork Hood River and Middle Fork Hood River Watershed Analysis (EMHRWA), which was conducted in the recent past by the Mt. Hood National Forest.

The EMHRWA characterizes resource conditions at their respective scales, identifies issues, discusses trends and changes in conditions over time, defines desired conditions, and identifies possible management opportunities to be pursued at both the landscape and at the project planning level. Only the elements from these analyses most pertinent to the proposal are discussed in this section.

Site-Specific Scale

The analysis area boundary for disclosing effects at the site-specific level is comprised of the East Fork subwatershed (including the Lower and Middle East Fork Hood River sixth field watersheds). This analysis area totals 7,330 acres and represents the area where stands were evaluated for possible treatment actions as part of the Polallie Cooper Hazardous Fuels Reduction (PCHFR) project. The project record provides detailed documentation on individual stand conditions and the selection process. Additional information sources including stand records and field surveys conducted in the 1980s, 1990s, as well as field reviews conducted in 2013 and 2014 are also available in the project record, located at the Hood River Ranger District in Parkdale, Oregon.

Common Stand Exams

As part of the initial data gathering for this project, Common stand exams (CSE) were conducted within the planning area. CSE provides one set of national data collection protocols, data codes, portable data recorder software, forms, reports, and export programs. All stand examination data is stored in a common database structure, Field Sampled Vegetation (FSVeg). Data from multiple Districts, Forests, Regions, and participating Agencies can be analyzed with ease. The CSE protocols are used to collect stand, plot, tree, surface cover, vegetation, and down woody data. This data is stored in FSVeg along with strategic grid data, insect and disease study data, Forest Inventory and Analysis (FIA), and re-measured growth plot data.

Forest Service Vegetation (FSVeg) Module

FSVeg module contains data that has been collected in the field. FSVeg contains plot vegetation data from field surveys such as FIA data, stand exams, inventories, and regeneration surveys. It includes data on trees, surface cover, understory vegetation, and down woody material.

Forest Vegetation Simulator

The Forest Vegetation Simulator (FVS) was used to interpret data collected utilizing the CSE. FVS is a growth and yield model used for predicting forest stand dynamics that is used extensively in the United States. FVS is the standard model used by various government agencies, including the U.S. Forest

Service. Forest managers have used FVS extensively to summarize current stand conditions, predict future stand conditions under various management alternatives, and update inventory statistics (USDA, 2008).

Plant Associations

Field Guide to the Forested Plant Associations of the Westside Central Cascades of Northwest Oregon was used to analyze the effects of proposed treatments. Plant association classification describes repeating patterns of plant communities that indicate different biophysical environments. This includes a combination of factors, such as moisture and temperature regimes, light, and soil nutrients, provide habitat for a group of plant species. There are few distinct boundaries along the environmental continua. However, categorizing discrete plant associations provides a means to track and predict vegetation composition, structure, and response to disturbance. Plant association classification of forested lands has been a forest management tool for many years. Ecosystem management and concerns with biodiversity also require understanding the plant and animal habitats that occur across our landscapes.

Stand Structure Types

Stand structure types as described by Larsen and Oliver (1996) were used to describe landscape and stand conditions. Table 16 describes the potential stand types. Stand patterns is the spatial and temporal distribution of trees and other plants within a given stand. Both distributions can be described by species present, vertical or horizontal spatial patterns, size of plants (or their parts), age, or by any combination of the above. Stand development is the part of stand dynamics concerned with change in stand structure over time (Larson, 1996).

Table 16. Stand type and descriptions

Stand Type	Description	Percent of Planning Area
Sparce	Less than 10% cover	15%
Stand Initiation	Young, single cohort stands whose canopy has not yet closed; seedlings and small saplings; remnant of previous stand may be present.	6%
Stem Exclusion	Relatively young, single cohort stand whose canopy has closed and thinning has begun; saplings and poles; remnants of previous stand may be present	18%
Understory Reinitiation	Middle-aged, medium sized trees with variable canopy closure; second cohort of young trees present in the understory; scattered mortality in all size classes; remnant of previous stand may still be visible	30%
Mature Stem Exclusion	Middle-aged medium sized to large trees with closed canopy; crowns of second cohort intermingled with crowns of first cohort such that a second canopy layer is not readily distinguished’ scattered mortality; some small clumps of snags may be present	23%
Late Seral Multistory	Main canopy dominated by older, large trees; canopy closure variable; 2-3 canopy layers distinguishable; mortality both scattered and clumped and in higher proportion of stand than other stages	3%

Unknown	5%

3.1.2 Existing Condition

Landscape Scale

The EMHRWA describes the landscape on the northeast side of Mt. Hood and along the Cascade crest. The East fork watershed is dominated by several vegetative zones including but not limited to Douglas-fir (*Pseudotsuga menziesii*), grand fir, (*Abies grandis*), Pacific silver fir (*Abies amabilis*) and western hemlock (*Tsuga heterophylla)*.

The analyses completed at the larger landscape scale noted that there have been some marked changes in the nature and condition of the vegetation across the landscape from historical conditions (the period prior to Euro-American occupation). Most of these changes reflect the consequences of European settlement of the area and timber harvest beginning in the earliest years of the 20th century. The lumber industry began its development in the area in the 1850s, although the Hudson Bay Company constructed the first sawmill on Mill Creek in the 1820s. By the end of the 1800's, much of the timber was being cut from public lands at what was perceived as an alarming rate.

Before 1900, very large patches of similar type stands as mentioned above dominated the uplands. The species mix is similar today in both the understory and overstory. Due to the disturbance regimes on the uplands, only three structure types tended to dominant the watershed at any one point in time. Major disturbance is rare. Some diversity did exist as the result of smaller scale disturbances, creating scattered smaller patches of a different stand structure within the larger landscape.

The current vegetation differs from the typical pre-1900 vegetation primarily in terms of landscape patterns. Instead of a large continuous area dominated by one or two stand types, the landscape currently has a mosaic of stand types. The watersheds are dominant by a forests structure of small diameter trees within the stem exclusion stage. The watersheds do have small pockets of Understory Reinitiation and Mature Stem Exclusion but they are not a dominate stand condition on the landscape like they would have been prior to 1900.

Site-Specific Scale

The proposed treatment area is dominated by four plant associations, Grand fir/vanilla leaf (*Achlys triphylla*) (A1), Grand fir/vine maple (*Acer Circinatum*)/vanilla leaf (A2), Grand fir/oceanspray (*Holodiscus discolor*) (A3), and Pacific silver fir/vanilla leaf (A4). Common to the drier mix conifer plant associations (A1, A2, and A3) the overstory would be dominated by Douglas-fir and ponderosa pine (*Pinus ponderosa*) and the understory would be dominated by a variety of shrubs like Oregongrape (Berberis nervosa), serviceberry (*Amelanchier alnifolia*), oceanspray, vine maple, greenleaf manzanita (*Arctostaphylos patula*).

Currently ponderosa pine is only representing less than 20% of the overstory component and very little to no shrub component is present in the stands due to high stand densities. Common to the moist and wet plant associations (A4) the overstory would be dominated by Douglas-fir, Pacific silver fir and Western hemlock. There is a wide range of site productivity with in the planning area with site indices between 85 to 95 feet on low productive sites and 95 to 120 feet on the higher productive sites. They are usually found on moderate slopes with an average elevation between 3,200 to 4,800 feet. There are other plant associations in proposed treatment areas within the planning area (refer to

Table 17)

Table 17. Existing Acres by Plant Association within Proposed Treatment Stands

STAND Group	Plant Association	Acres within proposed treatment areas
A1	Grand fir/vanilla leaf	850
A2	Grand fir/vine maple/vanilla leaf	708
A3	Grand fir/oceanspray	566
A4	Pacific silver fir/ vanilla leaf	283
A5	Mt. Hemlock(*Tsuga mertensiana*)/queencup(*Clintonia uniflora*)	198
A6	Western Hemlock (*Tsuga heterophylla*)/vanilla leaf	85
	Others	140
TOTALS		**2,830**

Acreages are rounded and may not agree with overall acreage due to approximations from GIS. Units may be comprised of more than one plant association.

A1 should have an overstory dominated by Douglas-fir and ponderosa pine with minor components of grand fir throughout the stand. Regeneration should be found throughout the stand and dominated by Douglas-fir and grand fir. Understory should be sparse and dominated by vanilla leaf, Oregongrape, and common prince's pine (*Chimaphila umbellate*). These areas tend to be very productive sites for timber with generally deep, non-rocky soils that good moisture –holding capacity (see soils Report for me details).

A2 should have an overstory dominated by Douglas-fir and ponderosa pine with minor components of grand fir throughout the stand. Regeneration should be found throughout the stand and dominated by Douglas-fir and grand fir. Understory should be sparse and dominated by vine maple and snowberry (*Symphoricarpos albus*). These areas also tend to be very productive sites for timber with soils that tend to be rocky with good moisture –holding capacity (see soils Report for me details).

A3 should have an overstory dominated by and ponderosa pine with minor components of grand fir throughout the stand. Regeneration should be found throughout the stand and dominated by Douglas-fir and grand fir. Understory should be sparse and dominated by oceanspray, and snowberry. These areas tend to be moderately productive sites for timber with fine sandy soils (see soils Report for me details).

A4 should have an overstory dominated by Douglas-fir, Pacific silver fir and western hemlock. Regeneration should be found throughout the stand and dominated by Pacific silver fir and western hemlock. There should be a diverse understory dominated by vanilla leaf, prince's pine, Oregongrape, and big leaf huckleberry (*Vaccinium membranaccum*). These areas tend to be low to moderately productive sites for timber with moderately deep soils (see soils Report for me details).

A5 should have an overstory dominated by Mt. hemlock and Pacific silver fir with minor component of nobel fir (*Abies procera*) and Douglas-fir. Regeneration should be found throughout the stand and dominated by Pacific silver fir and Mt. hemlock. There should be a diverse understory dominated by big leaf huckleberry, and queencup beadily. These areas tend to be moderately productive sites for timber with moderately deep soils (see soils Report for me details).

A6 should have an overstory dominated by Douglas-fir and western hemlock with a minor component of grand fir. Regeneration should be found throughout the stand and dominated by western hemlock and

Douglas-fir. There should be a diverse understory dominated by big leaf huckleberry, prince pine, vine maple, Oregongrape. These areas tend to be very productive sites for timber with moderately deep soils (see soils Report for me details).

Currently, the planning area contains stands of immature plantations less than 80 years old in moist mix conifer plant communities and recently unmanaged stands (RUS) over 80 years old in both moist and dry mix conifer plant communities. The majority of the plantations are in the stem exclusion stage (see Table 16 and Table 18) dominated by small to medium size material with a quadratic mean diameter (QMD) ranging from 3 to 8 inches and an average height of 65 feet. The recently unmanaged stands range in age from 90-180 years old and are dominated by stands in the reinitiation stage in both the moist and dry mix conifer plant communities. The QMD within the RUS range from 5-9 inches in the moist mix conifer and 5-10 in the dry mix conifer with an average height range in both of 70-100 feet. Regeneration in the RUS is dominated by shade tolerant species like grand fir and western hemlock and is averaging around 800 trees per acre. Stands have an abundance of ladder fuel built up in the understory with very little to no shrub component (Figure 15). On average the proposed treatment units are below Mt. Hood Land and Resource Management Plan standards for snags. Currently, there are roughly 1 snags per acre in the moist mix conifer and 2 snags per acre in the dry mix conifer 20 inches DBH and larger. On average the proposed treatment areas (excluding the Dollar Lake fire) averages an estimated 6 snags per acre in the moist mix conifer and 7 snags per acre in the dry mix conifer 11 inch DBH trees and larger.

Furthermore, riparian corridors have similar conditions to the uplands within both dry and moist mix conifer stands. The majority of the riparian corridors are highly stocked with a single to two storied canopy. The corridors have very little growth, lack snags and downed wood suitable for riparian and wildlife needs, and have moderate species diversity dominated by fire intolerant species and minor components of hardwood species.

Figure 13. Understory Re-initiation Stage Photos

Figure 14. Stem Exclusion Stage Photo

Figure 15. Ladder fuel build up

Table 18. Current percent of age class within the planning area

Age Class	Percent
< 20 Years	20%
21-40 Years	4%
41-60 Years	6%
61-80 Years	14%
81-100 Years	10%
101-120 Years	10%
121-140 Years	8%
141-160 Years	5%
161-180 Years	4%
181-200 Years	6%
200 + Years	13%

Ecological Processes and Disturbances

Ecological processes and disturbances directly affect the diversity of plant and animal communities within an area over space and time. Ecological processes and disturbances include nutrient and biomass cycling, forest succession (the change in vegetation over time), weather events (i.e., windstorms), insects, pathogens, fire, and human influences (i.e. timber harvest).

Over the last century, there have been broad changes in vegetative conditions in the Cascade Range, as summarized in the landscape analysis referenced earlier. The disturbances or factors of change, influencing vegetation in the planning area include diseases, insects, timber harvest, and fire both associated with timber harvest activities and wildfire events. These replacement forests also tend to be overstocked with vertical structure (Carlson et al. 1995).

Insects and diseases can be natural elements of the ecosystem that can exert equal, if not greater, influence on forest development and conditions as fire. Most of these organisms have co-evolved with their host species over thousands of years. The balance between forests and their major pathogens is dynamic and fluctuates through time. In the past, with regular small scale disturbances like floods or avalanches, they probably existed most commonly at endemic levels. Population fluctuations were normal with epidemic conditions of some insects or diseases developing periodically and causing high levels of tree mortality over short periods (Harvey et al. 1995). In addition to native species there are also non-native insects present in the planning area including the balsam woolly adelgid (Adelges piceae) species, which has the potential to slowly eliminate true fir species from the ecosystem.

There have been no known recent Douglas-fir beetle insect outbreaks in the proposed treatment areas, but with the existing conditions of highly stocked Douglas-fir plantations, the planning area is at a higher risk for outbreak.

For western pine beetle beetle , when abundant favorable breeding habitat (weakened trees, moist conditions, etc.) becomes available, usually as density related competition or drought, beetle populations can rise to epidemic levels creating mortality in apparently vigorous host trees over large areas. Outbreaks are most commonly associated with large old growth and overcrowded second growth stands. There have been no known recent large scale insect outbreaks in the proposed treatment areas, but with the existing conditions of highly stocked mix conifer stands with large remnant ponderosa pine present, the planning area is at a higher risk for western pine beetle beetle outbreak.

Presently, throughout the planning area there are minor occurrences of western hemlock dwarf mistletoe (*Arceuthobium campylopodum tsugense)* and western larch (*Larix occidentalis*)(*Arceuthobium laricis*) in the overstory. The potential for mistletoe spread to younger western hemlock and western larch regeneration would increase as the understory begins to differentiate and become established as a second and third layers.

The dense, single-canopied Douglas-fir dominated forests in the planning area are perfect conditions for the proliferation of root disease. Most of the stands in the watershed have some level of root disease present as laminated and/or Armillaria root rot (*Phellinus weirri*) and (*Armillaria ostoyae*). It is recognized that root decay and stem decay are natural processes, which contribute downed wood thus creating a variety of structural components in the forest. Though these organisms themselves are a natural and integral part of the ecosystem, the condition of the vegetation across the landscape and within individual stands is in many cases not natural. When there is an abundance of a susceptible species in a stand, root disease centers continue to grow. When there is a wide variety of species in a stand, including some less susceptible species, it may be slowed. Current stand conditions have provided an abundance of susceptible species and available habitat for these organisms (dense, single-canopied Douglas-fir and grand fir stands) and therefore may cause more severe effects to the forests than has typically occurred in the past. Stands previously entered for selection harvest had the larger trees removed, mostly Douglas-fir and western hemlock.

Timber harvesting has been a major contributor to the change in vegetative conditions that have occurred across the planning area as well as the rest of the East Fork of Hood River watershed. This has altered the normal functioning of ecosystem processes. Past practices of regeneration harvest have impacted stand structure and species diversity within the planning area. In the planning area, records show about 1,247 acres that have previously been treated during the period from 1960 to 2010 (see Table 19 below) on federal lands. The Forest does not have records of historical harvest for private or federal lands between 1880 and 1960, only information from field observations.

Table 19. Acres by Harvest Type in Polallie Cooper Fuels Reduction Planning area

Decade	Regeneration Activities	Thinning
1960-1969	168	184
1970-1979	9	305
1980-1989	186	172
1990-1999	22	0
2000-2010	0	21
Unknown Time	0	180
Total	**384**	**862**

3.1.3 Effects Analysis

The baseline condition against which changes to the vegetation, after thinning treatments, would be measured is the existing condition. Criteria used to determine effects on vegetation include:

1. Total acres treated and acres treated within each affected plant association;
2. Changes in forest structure and composition;
3. Effects on residual trees; and
4. Effects on insect and disease processes and forest vulnerability to these elements.

No Action – Direct and Indirect Effects

No acres are treated under this alternative, and thus there are no direct effects to the vegetation at the landscape or site-specific scale in the short-term. Existing condition, as described above, would be maintained with little change in the current condition relative to forest structure and composition, residual tree densities or insect and disease processes.

Due to the limited size of the planning area there would be little to no effect at the landscape scale to stand structure and composition, residual trees, and insect and disease processes. The landscape would still have under-represented or lack necessary stand types vital to maintaining and sustaining properly functioning plant communities and disturbance regimes.

In the long-term, the stand structure and composition would be dominated by grand fir in the overstory, and the understory would remain under-developed with low occurrences of ecologically important tree and shrub species. The stand structure would remain in a multi-story dominant stem exclusion type stand Young stands would continue to grow in densely stocked conditions with little regeneration. What regeneration does occur would be dominated by shade tolerant less fire resistance tree and shrub species. Densely stocked stands would continue to have large amounts of small patches with increasing crown closure with little shade intolerant species and minimal structural diversity.

Ultimately, with no vegetation treatments, the stand would remain in dense overstocked conditions with no mosaic reinitiation of understory; risk of insect and disease levels and vulnerability of the stands to infestations would remain high; and stand density would continue to increase (Refer to Table 20 and Table 21 for treatment area densities). By maintaining high tree competition, stems would continue to grow in height but diameter growth would continually slow. These trees would become more dependent on neighboring trees for support. When trees develop in this manner they are more likely to blow down in large groups or if drought conditions persist. By maintaining a high blowdown risk, the risk of bark beetle infestation remains high.

Quadratic mean diameter (QMD) is the diameter corresponding to the tree of arithmetic mean basal area, or average diameter by basal area (BA). The QMD slowly increases over time with little fluctuation. This is indicative of stands that had little regeneration occurring through time. Stands QMD should fluctuate over time to reflect the ingrowth of smaller diameter trees that contribute to the BA. The stand heights also continue to grow, but level out over time due to lack of growing space.

Table 20. Resulting density levels from FVS modeling of the No Action Alternative within the moist mix conifer plant communities

Time After Treatment	[1]Basal Area (BA)	[2] Stand Density Index (SDI)	[3]Trees per Acre (TPA)	[4]Quadratic Mean Diameter	[5]Average Stand Height (feet)
2014	170	387	1089	6.0	80
2054	293	627	1236	6.9	113
2114	374	670	634	10.7	124

1. *Basal Area is the cross-sectional area of all stems of a species or all stems measured at breast height and expressed per unit of land area.*

2. *Stand Density Index is an expression of relative stand density in terms of the relationship of a number of trees to stand quadratic mean diameter*
3. *Trees per acre is the average number of stems within an acre.*
4. *Quadratic mean diameter is the diameter corresponding to the tree of arithmetic mean basal area, or average diameter by basal area. The use of the quadratic mean gives greater weight to larger trees and is equal to or greater than the arithmetic mean.*
5. *Average stand height is the height of the dominant and co-dominant trees within the stand.*

The stands currently occupied by densely stocked grand fir would experience the continuing spread of root disease and resultant mortality over the long-term. Without the reinitiation of the understory to a more typical species composition characteristic of the plant association, the spread of dwarf mistletoe would be limited due largely to the lack of western hemlock and western larch regenerating, but would remain high in with the Douglas-fir dwarf mistletoe. The risk of balsam wooly adelgid would remain moderate to low in stands dominated by Douglas-fir in the moist mix conifer but moderate to high in the dry mix conifer stands due to the availability of the highly susceptible grand fir. Any susceptible species that the adelgid does attack in the moist mix conifer stands would be at high risk due to poor growing conditions and stress from competing neighboring trees.

Table 21. Resulting density levels from FVS modeling of the No Action Alternative within the dry mix conifer plant communities

Time After Treatment	Basal Area (BA)	Stand Density Index (SDI)	Trees per Acre (TPA)	Quadratic Mean Diameter	Average Stand Height (feet)
2014	205	451	1052	6.7	95
2054	286	610	1172	6.9	112
2114	347	662	841	9.1	110

Table 20 and Table 21 provide modeled density measurements for the proposed treatment areas if no action was taken. The density measurement indicators used below can be used in determining stand health, and productivity. The density measurements mentioned below can also be used to evaluate the stands vulnerability to large scale insect disturbances and processes. These measurements are used to determine the stands response to thinning in both the long- and short-term. The amount of trees present, the species composition and the size of the trees present in the stand indicate the overall health and vigor of the stand. Stands that maintain higher than normal tree densities for their specific plant association have less growth and less species composition. With less growth the health and vigor of the trees decline, making them more vulnerable to insect and disease.

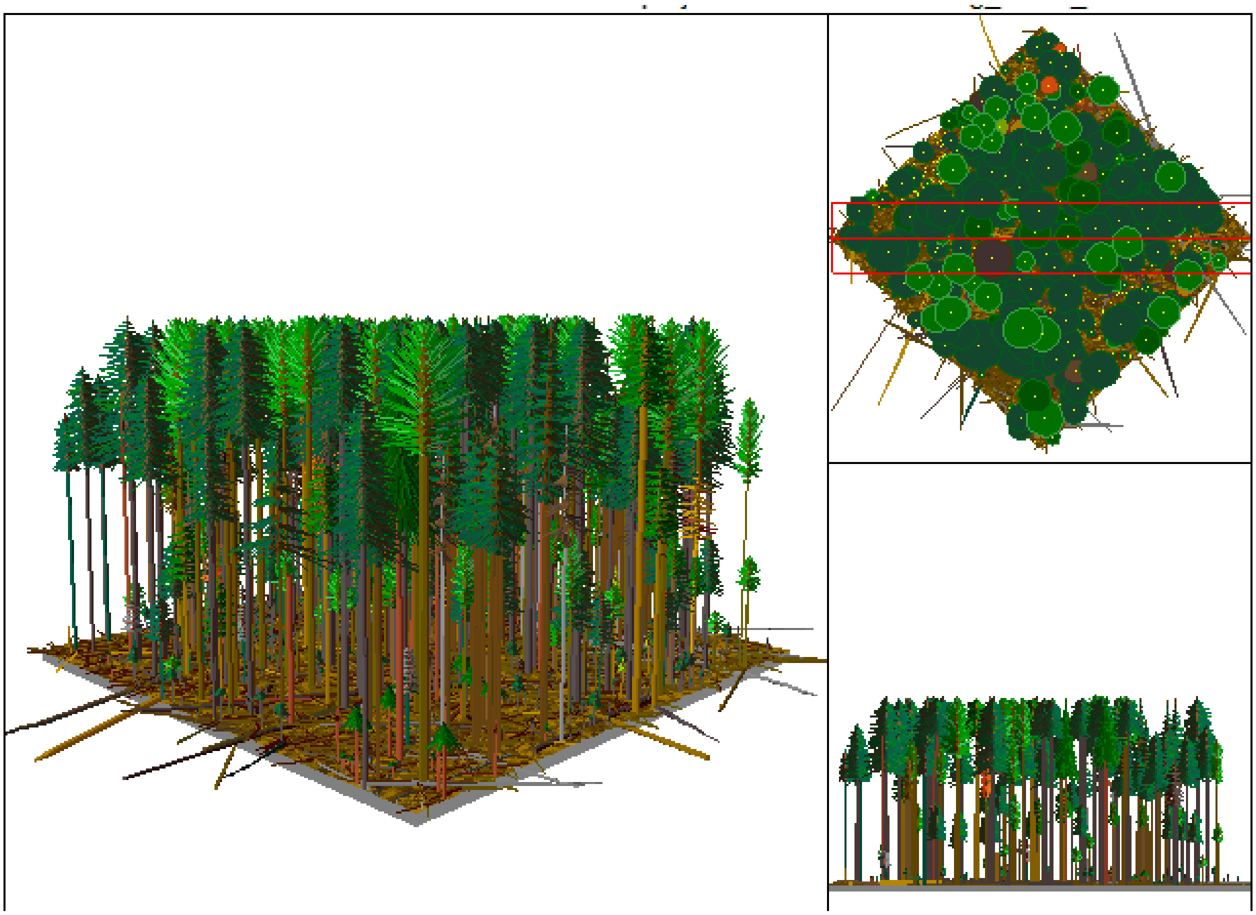


Figure 16. Projected stand structure 100 years after no treatment is applied with in the moist mix conifer plant communities

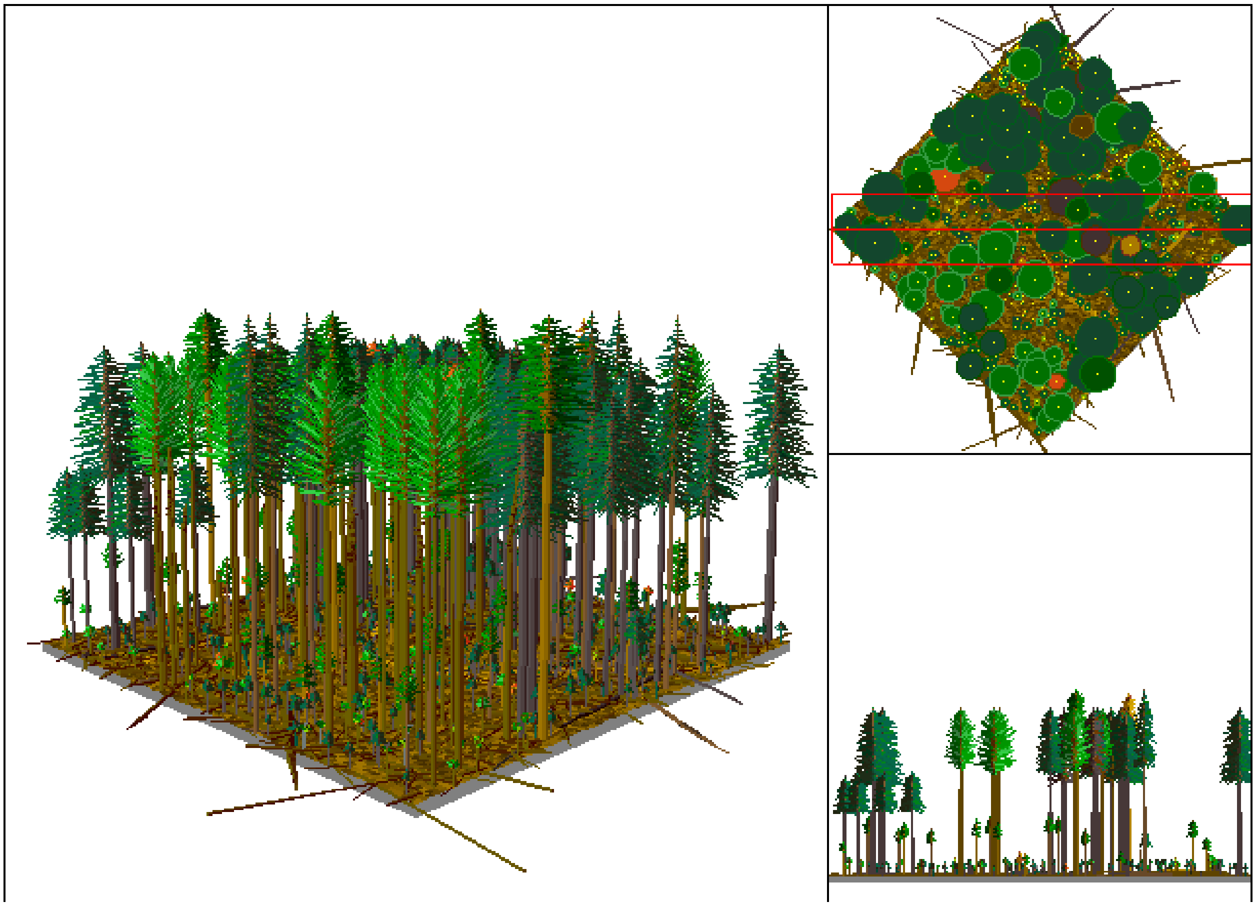


Figure 17. Projected stand structure 100 years after no treatment is applied with in the dry mix conifer plant communities

Proposed Action – Direct and Indirect Effects

Landscape Scale

The total acreage treated by thinning in the Proposed Action is approximately 2,830 acres. This is around 38% of the proposed planning area and represents less than 4% of the East Fork of Hood River watershed. Because the Proposed Action alternative treats a large portion of the dense dry mix conifer plant community within the planning area, it moves the overall landscape vegetation towards a condition that would have occurred under natural small and large scale disturbance regimes. Insect and disease intensity across the landscape would be decreased. Stands would be moved to more historic vegetation composition and stand structure, which would help ensure that key ecosystem elements and processes are sustained. The acres of late seral and mature stand classes would remain very similar after treatment, due to the fact that stands would be thinned and would retain the majority of the large overstory trees.

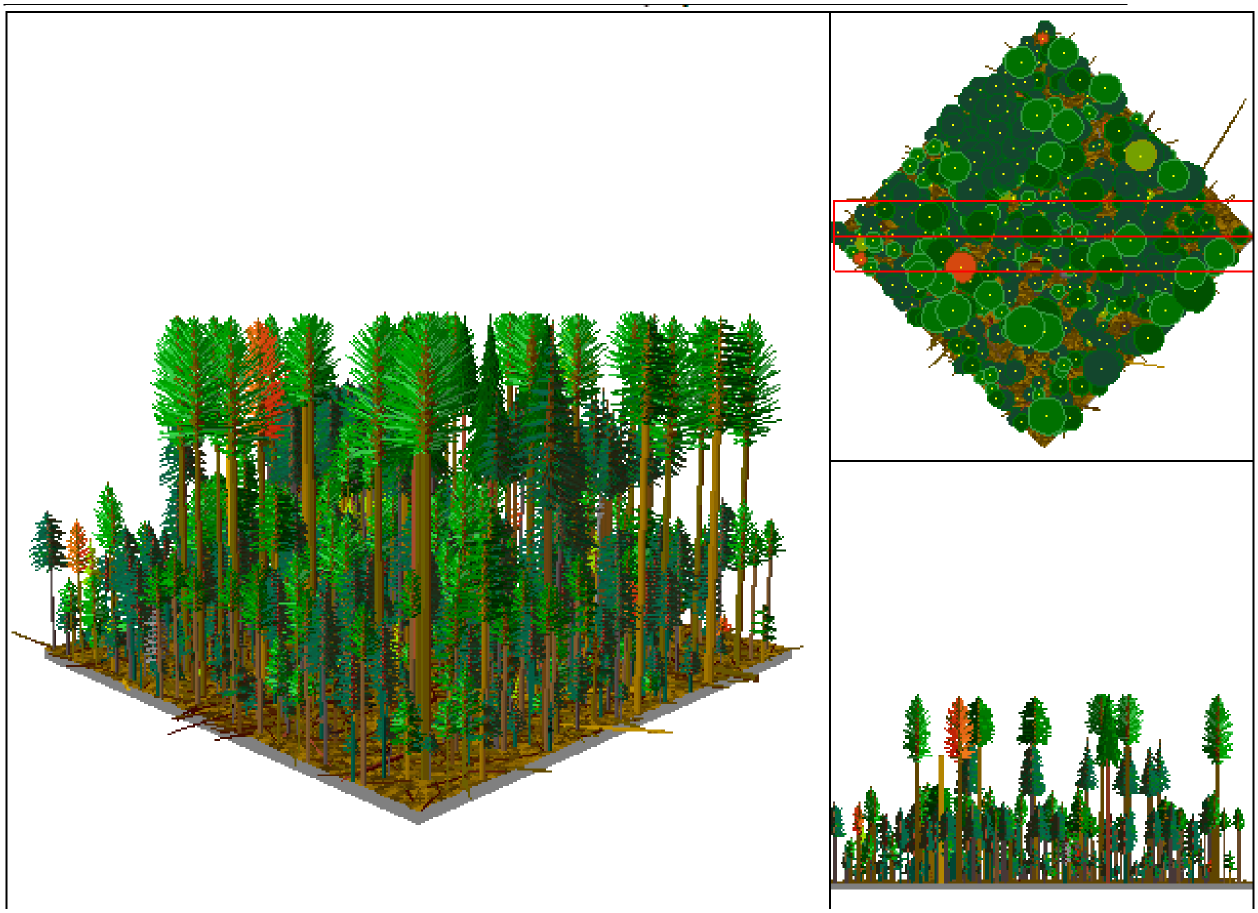
Site-Specific Scale

Approximately 2,830 acres of several forest types would be moved from mostly dense, closed canopy stem exclusion and mature stem exclusion stages towards a more open less dense conditions stand reinitiation or open mature stages. These conditions would have moderate to low canopy cover with large enough openings to stimulate natural regeneration of shade intolerant tree and shrub species within these types of plant associations. Species diversity in the overstory, seedlings and saplings and shrub layer is essential to the six plant associations mainly present in the treatment areas. In the short-term, overstory species diversity would remain limited. Over time as a diversity of species regenerates and gets established the overstory diversity would increase. With the use of larger (1 to 5 acre) openings, more shade-intolerant trees and shrubs species can become establish.

In variable density thinning, selected trees of all sizes down to saplings (i.e., 3-inches or less in diameter) would be removed. The focus would be on leaving the most vigorous, healthiest trees and favoring shade intolerant species. Thinning from below must retain some young trees of desired species if stands are to retain a healthy age structure. (Perry et al. 2004). Overall, the average stand diameters would be maintained or increased (Lindh and Muir 2004). In the long-term, the stand structure would be moved towards a multistory late seral stage.

Table 22. Resulting density levels from FVS modeling of the Proposed Action within moist mix conifer plant communities

Time After Treatment	Basal Area (BA)	Stand Density Index (SDI)	Trees per Acre (TPA)	Quadratic Mean Diameter	Average Stand Height (feet)
2014	171	387	1089	6.0	81
2054	170	344	525	7.7	110
2114	332	642	815	8.6	120



With vegetation treatments the stand would be less dense with a new mosaic of understory reinitiation (Refer to Table 22 and Table 23 for treatment area densities). By creating less dense stands with less tree competition, residual trees would benefit from the increased availability of sunlight, nutrients and water. Low stocking levels would result in less volume production, but larger average tree sizes (O'Hara et al. 1995).

Table 23. Resulting density levels from FVS modeling of the Proposed Action within dry mix conifer plant communities

Time After Treatment	Basal Area (BA)	Stand Density Index (SDI)	Trees per Acre (TPA)	Quadratic Mean Diameter	Average Stand Height (feet)
2014	205	451	1052	6.7	96
2054	175	375	823	6.4	115
2114	280	583	1042	7.3	118

With vegetation treatments, the QMD would increase over time from 6.0 to 8.6 inches DBH in moist mix conifer and 6.7 to 7.3 in dry mix conifer. This is indicative of stands that have regeneration occurring through time. Stands QMD is fluctuating to reflect the ingrowth of smaller diameter trees that begin to contribute to the stand BA. The stand heights continue to grow through time from an average of 81 feet to 120 feet in moist mix conifer and 96 to 118 feet in dry mix conifer. The stands TPA and BA also continue to increase indicative of stands with multiple regenerations (Refer to Table 22 and Table 23). What these density measurement indicators are used for is evaluating the stand health and productivity over time. The density measurements mentioned below can be used to evaluate the stands vulnerability to large scale insect disturbances and processes. These measurements are used to determine the stands response to the thinning in both the long- and short-term. The amount of trees present, the species composition, and the size of the trees present in the stand indicate the overall health and vigor of the stand. Stands that maintain higher than normal tree densities, for their specific plant association, have less growth, and less species composition. With less growth the health and vigor of the trees decline, making them more vulnerable to insect and disease. In the short term stand densities and species composition in both the moist mix conifer and dry mix conifer create defensible and move the stands towards more historic species composition and structure. To maintain this defensible space within the moist mix conifer plant communities a re-entry sapling thin would be every 20-30 years dependent on site conditions. Re-entry sapling thin would also be need in the dry mix conifer communities every 50-60 years depending on site conditions and frequency of low intensity fire occurrences.

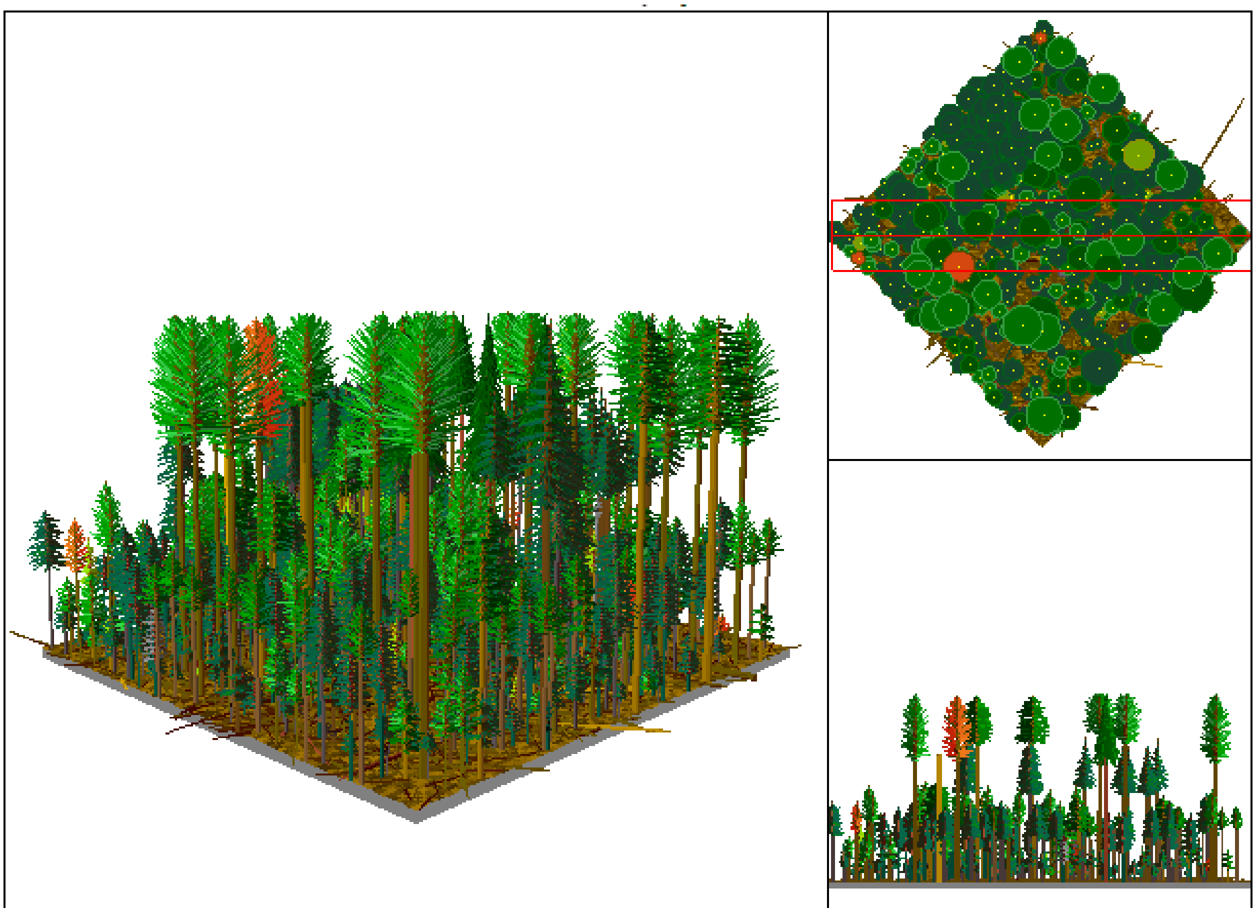


Figure 18. Projected stand structure 100 years after treatment is applied within moist mix conifer plant communities.

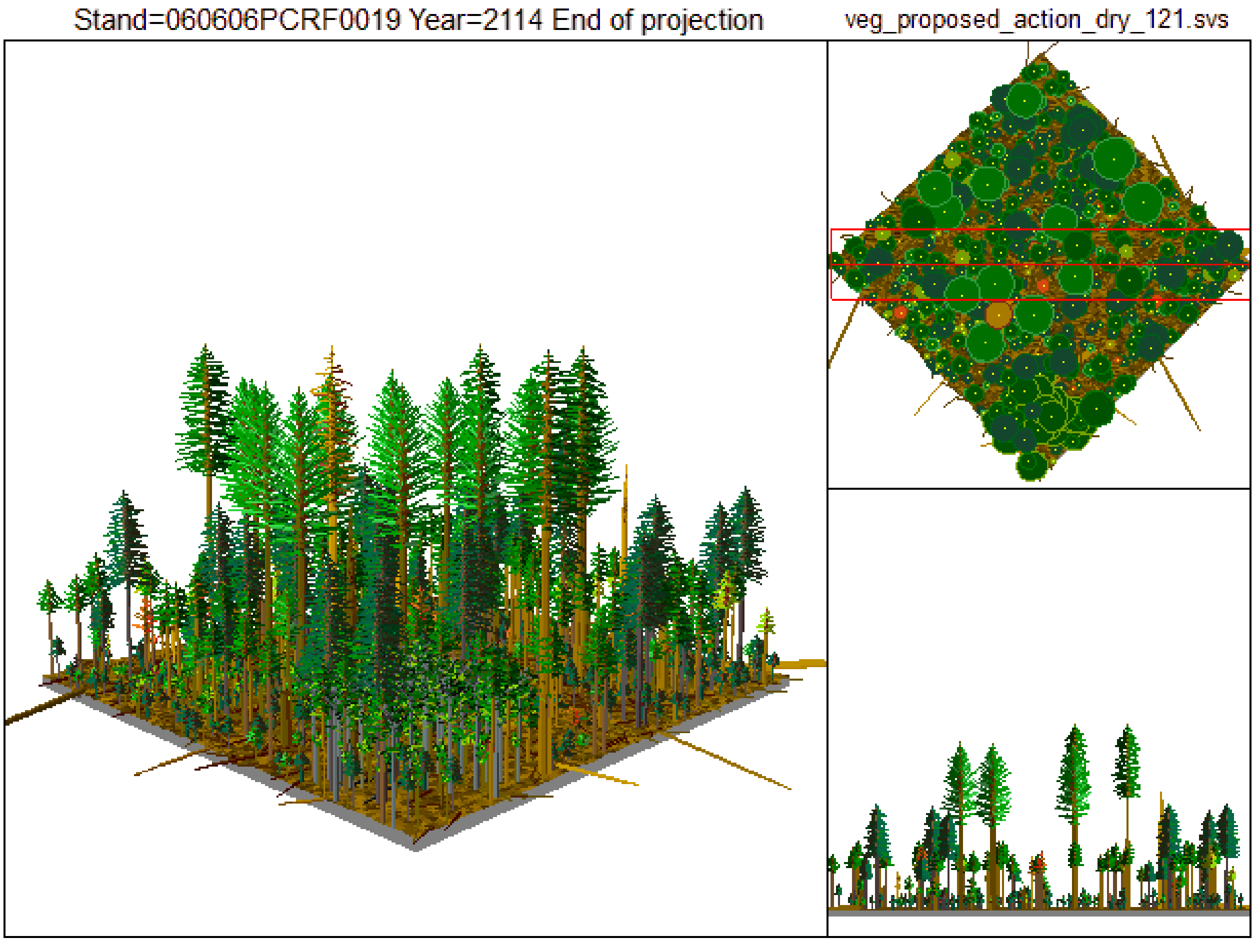


Figure 19. Projected stand structure 100 years after treatment is applied within dry mix conifer plant communities

There is a short-term increased risk of bending and breakage of the residual trees from snow loading or windthrow. Trees that have grown for many decades in densely stocked conditions and are relatively small in diameter as a result (i.e. <9-inches diameter at breast height) are often more vulnerable to these effects if a thinning occurs and the surrounding "supporting" trees are removed. However, it is not expected that these effects would be significant in this area. Tree diameters would vary, but many, if not most, trees would be of large enough diameter and strength to withstand the effects of winds and snow. In locations of higher blowdown potential (i.e. ridge tops) treatments may vary to reflect the need to provide support trees around our desired leave trees.

In utilizing mechanized equipment there is some risk of damage to residual trees from equipment strikes. However, residual tree spacing would be sufficient to allowing machinery adequate room to maneuver; and therefore, should be able to avoid any appreciable damage to residual trees.

Within thinning units there would be little direct effects on existing suitable snags (11-inch dbh and 10 feet tall) as snags would be maintained unless they pose a health and safety risk. In the long term, with the proposed treatments, stands would be provided a greater number of larger green retention trees for future snag recruitment. Snag densities of trees 20-inch DBH and greater would increase in the future moving the stands closer to Forest Plan snag density standards (FVS runs).

Ecological Processes and Disturbances

Within the proposed treatment areas the canopy closure would be reduced from 60% to 40% in the moist mix conifer and 64% to 38% in the dry mix conifer on average (FVS runs). By creating less dense stands with less tree competition, residual trees would benefit from the increased availability of sunlight, nutrients and water. With the increase of available nutrients, trees should be more vigorous and less susceptible to large scale insect out breaks. Small scale insect outbreaks would continue including the balsam wooly adelgid. The treatment areas are focused in stands were the balsam wooly adelgid is minor. Treatments would favor removal of susceptible species to the adelgid and other less fire resistant species to create stands that would help moderate the outbreak. Also, with healthier more vigorous trees, mortality would be more endemic to small scale disturbances.

A direct reduction in dwarf mistletoe populations would occur within treatments areas under this alternative. This would occur mostly because many of the trees parasitized by dwarf mistletoe would be removed from the site in the thinning treatment. Dwarf mistletoe would not be eradicated from the planning area due to the minimal acres being treated.

Thinning and small patch openings would reduce root to root contact and promote the growth of species in the stands that are resistant or have an increased tolerance to root disease. Trees with improved vigor would be more resistant to root disease, as well as the commonly associated insects. Root disease would still remain in the planning area, but small patches of forest would be restored to include a component of historical species with natural resistance (Carlson et al. 1995). Treating the rot pockets with patch cuts and encouraging the growth of root rot resistant species would improve species diversity, move the stand composition toward a more naturally occurring mix associated with the plant association while improving the stand resilience and forest health.

Cumulative Effects

Discussions of the cumulative effects are limited to those past, present and reasonably foreseeable activities that have been determined to have a potential cumulative effect on the vegetative resource. Refer to Table 15 at the beginning of Chapter 3 in the Polallie Cooper Fuels Reduction Project EA for a summary of all possible activities that were considered in this cumulative effects analysis for vegetative conditions.

Only the vegetation related proposed projects in the Polallie Cooper Fuels Reduction project that have direct or indirect effects are included in the cumulative effects analysis. The spatial context for the following cumulative effects analysis is the landscape and site-specific area as described previously in the existing conditions. The temporal context depends on the past, present or future project/activity and if there is an overlap in time from an effects perspective.

There are no direct or indirect effects that would cumulate from other projects due to the minimal amount of area being treated. The total acreage treated by thinning in the Proposed Action is approximately 2,830 acres. This is around 38% of the proposed planning area and represents with past and foreseeable future activities less than 10% of the East Fork of Hood River watershed as shown in Figure 30. Therefore, the total cumulative effects for this project would be nominal, and no cumulative effects are expected as a result the proposed projects to the vegetation resource.

3.1.4 Consistency Determination

NFMA Findings for Vegetation Manipulation

As required by regulations (FSH 1909.12 5.31a), “all proposals that involve vegetative manipulation of tree cover for any purpose must comply with the seven requirements found at 36 CFR 219.27(b).” All of these requirements are met by the project (refer to project record).

As a pre-cursor to the silvicultural diagnosis process, stand examinations are conducted to determine existing stand conditions, and a determination of suitability (in regard to management of the stand for timber production) is made for each stand. Stands proposed for harvest treatment were examined for suitability in accordance with 36 CFR 219.13, Timber resource land suitability. Stands were found to be suitable for timber management based upon the following:

- Meet the definition of forestland as described in 36 CFR 219.3.
- Technological feasibility exists to ensure soil productivity and watershed protection. All sites considered for treatment would use established harvesting and site preparation methods. In combination with resource protection standards in the Forest Plan and applicable Best Management Practices, these methods would be sufficient to protect soil and water resource values.
- There is reasonable assurance that lands could be restocked within 5 years of final harvest (this **generally** does not apply to the proposed harvest units, as they would be thinned. Small openings in root disease pockets would be regenerated with rot resistant species.).

Mt. Hood Forest Plan

Suitability for even-aged management

Even-aged management is the effective way to manage dwarf mistletoe and root disease, based on Forest Plan direction found in Forestwide Standards (FW) 316 and 317, C1-019 through C1-021, and C1-024. Project design criteria/mitigation measures, such as patch openings and risk of windthrow, are written into the design of the Proposed Action in order to meet Forest Plan direction.

Suitability for reforestation

Forest plan guidelines advise timber harvesting shall be completed in a fashion that reasonably assures each harvest area can be adequately restocked within 5 years after final harvest (FW-358). Replanting would occur to a minimum of 125 trees per acre (FW361-363) in root rot openings large enough to support resistant tree species establishment. Interplanting would be used to maintain genetic quality and desired species composition (FW-332). The proposed treatments would be consistent with all of the above mentioned standards for reforestation

3.1.5 Summary of Effects by Alternatives

Table 24 and Table 25 compare the Proposed Action and No Action alternatives for both the moist and dry mix conifer plant communities. Compared to the No Action alternative, the Proposed Action would in the short term reduce the trees per acre, basal area, and SDI while still increasing stand QMD. Lower TPA and BA result in stands that mimic more natural conditions for these plant associations and create defensible space around the WUI. Increased diameters and tree heights would move the stands towards late successional characteristics. The stands would also be less vulnerable to large insect and disease outbreaks.

With the use of variable density thinning, the stands would be moved towards a more sustainable vegetative condition in regards to species composition and stand structure. Larger openings would increase the regeneration of shade intolerant tree and shrub species. Within the openings, new age classes would be established moving the stand towards a multi-aged stand. Over time lower densities and larger tree heights are maintained in the Proposed Action versus No Action alternative. The QMD of the Proposed Action would drop, due to the variety of size classes thinned and because created openings would contribute to an increase in small tree establishment. These small trees would contribute to the stand BA thus lowering the overall QMD. Again, the use of the quadratic mean gives greater weight to larger trees.

Table 24. Differences between the Action and No Action Alternatives from FVS modeling within the moist mix conifer plant communities

Time After Treatment	BA		SDI		TPA		QMD		Average Height	
	No Action	Action	No Action	Action	No Action	Action	No Action	Action	No Action	Action
2014	170	104	387	161	1089	90	6.0	15.2	80	78
2054	293	170	627	344	1236	525	6.9	7.7	113	110
2114	374	332	670	642	634	815	10.7	8.6	124	120

Table 25. Differences between the Action and No Action Alternatives from FVS modeling within the dry mix conifer plant communities

Time After Treatment	BA		SDI		TPA		QMD		Average Height	
	No Action	Action	No Action	Action	No Action	Action	No Action	Action	No Action	Action
2014	205	117	451	175	1052	80	6.7	16.6	95	78
2054	286	175	610	375	1172	823	6.9	6.4	112	115
2114	347	280	662	583	841	1042	9.1	7.3	110	118

3.2 Fuels Management

3.2.1 Analysis Assumptions and Methodology

The intent of this report is to analyze how the vegetation resources would be affected by the management actions proposed by the U.S. Forest Service. Professional judgment and stand level data was utilized in determining the project's potential effects. Effects analyses were based on several components outlined in the following sections. Fire behavior for the existing condition of the PCHFR Planning area has been predicted by using a number of state of the art tools.

FOREST Service Vegetation module and FOFEM (First Order Fire Effects Module) and Behave Plus 5 were used to simulate thinning and fuel treatments for the forest strata within the planning area. The fire effects of no action and the action alternative were based data from the stand exams.

Although the (modeling) approach has limitations, model outputs yield useful information for planning, assessing, and prioritizing fuel treatments (Stratton, 2004). The data inputs necessary for FOFEM and behave Plus 5 include aspect, slope, elevation, fuel model, canopy height, canopy base height, crown bulk density, and crown class.

The fuel conditions used were those representing the 90th percentile weather. Historical weather from the Dollar Fire was used. The Dollar Fire borders the PCHFR Planning area on the west end of the planning area. The Data from this fire best represents summer fuel conditions for the planning area. The wind conditions used were conditions reported from the Dollar Fire.

The purpose of running the models was to compare the effects of the No Action and the Action Alternative on canopy base height, fire behavior and resulting mortality from a potential wildfire occurring under severe weather conditions. The action alternative was modeled by thinning to an SDI representing a fuel model 8. Fuel loadings were initialized from photo series data determined to represent the different strata.

Initial fuel models (Anderson 1982) were input based on local experience and fuel model data collected on the stand exams. Post treatment fuel models were input based on the expected change resulting from removal of trees, slash and brush.

Fire Regimes and Disturbance Processes

Disturbances are an intrinsic part of ecosystem development (Cooper, 1913; Raup, 1957; Oliver, 1981; Pickett and White, 1985). On the Mt. Hood National Forest, ecosystems developed in concert with, and are subject to, a variety of natural, introduced, and altered fire regimes. A fire regime refers to an integration of disturbance attributes including type, frequency, intensity, duration, and extent (Pickett and White, 1985). Natural disturbances include fires, insects, pathogens, wind throw, weather, avalanches, and earthquakes. Introduced disturbances include livestock grazing, mining, timber harvesting, fire suppression, road construction, insects and pathogens. Natural fire regimes have been altered by management activities including fire exclusion, livestock grazing, and timber harvesting. Potential global climate change may further impact fire regimes.

Ecosystem and landscape composition and structure both result from and influence fire regimes at different spatial and temporal scales. Disturbances and successional pathways interact, creating patterns of vegetation across landscapes (Bormann and Likens, 1979; Pickett and White, 1985; Oliver and Larson, 1990; Lehmkuhl and others, 1994). Landscape vegetation patterns can amplify (Turner and Bratton, 1987; Franklin and Forman, 1987) or impede (Knight, 1987; Rykiel and others, 1988) the spread of disturbances across landscapes.

Disturbances also create patterns at the stand level. Individual trees killed by lightning, root decay pathogens, or insects provide snags whose attributes are a function of the mortality agent and the species killed. Lightning striking a resinous ponderosa pine produces a hard snag that may endure for decades; grand fir killed by root and stem decaying fungi may form a soft snag that may topple within a decade (USDA, 2002b).

On the Mt. Hood NF, patterns of vegetation and their associated fire regimes are strongly influenced by topographic expression. Historically, this template acted as an environmental sieve or filter under which regional floral and faunal diversity developed. Altered vegetation patterns and their associated fire regimes create conditions beneficial to some species but adverse to others. More importantly, altered fire regimes potentially create conditions that may promote unprecedented catastrophic disturbance events. Altered fire regimes may seriously reduce ecosystem resiliency, i.e. the ability to return to prior levels of productivity. Loss of soil nutrients may take decades to replace; loss of the soil itself would likely take thousands of years (USDA, 2002b).

Some of the most altered vegetation patterns and fire regimes are within dry forest types: those in the ponderosa pine and Douglas-fir series, and in the warm, dry grand fir associations. Fire regime alterations are primarily a result of fire exclusion, and have been exacerbated by selective harvesting. Altered fire regimes in dry forests greatly affect the sustainability of adjacent, more mesic forest types.

Changes to other forest types, especially those further west than the planning area, are not as dramatic; however, fire exclusion and other management actions, coupled with native and introduced insect and pathogen dynamics, have put these ecosystems and landscapes at greater risk for unprecedented catastrophic disturbances. A forest stand at risk for catastrophic fire but embedded in a fire-resistant landscape is at a lower risk of loss than a fire-resistant stand embedded in a matrix prone to stand replacing fires (USDA, 2002b).

In some areas, past harvest practices have contributed to altered vegetation patterns and fire regimes. Harvesting within dry forest types, where fires were subsequently excluded, led to the establishment of dense stands dominated by a single age and size group. Because fire exclusion allowed shade-tolerant species to establish and grow, many of these stands developed multiple canopy layers. These stands are compositionally and structurally different from historical park-like stands that contained multiple age classes and one or two canopy layers. Excluding fire following harvest activities allowed stand density to be controlled by insects and diseases rather than fire. Density control did not begin until stands were well established, leading to increased fuel size and amount.

Fire Regime Condition Class

Fire Regime Condition Class (FRCC) is a function of the degree of departure from historical fire regimes that results from alterations of key ecosystem components such as composition, structural stage, stand age, and canopy closure. One or more of the following activities may have caused this departure: fire exclusion, timber harvesting, grazing, introduction and establishment of non-native plant species, insects or disease (introduced or native), or other past management activities (USDA, 2002b).

Table 26 describes the attributes of each FRCC. As with the Fire Regime information, the FRCC information is also typically programmatic in nature.

Table 26. Fire Regime Condition Class Attributes

Condition Class	Attributes
Condition Class 1	• Fire regimes are within or near their historical range. • The risk of losing key ecosystem components is low. • Fire frequencies have departed from historical frequencies (either increased or decreased) by no more than one return interval. • Vegetation attributes (species composition and structure) are intact and functioning within their historical range.
Condition Class 2	• Fire regimes have been moderately altered from their historical range. • The risk of losing key ecosystem components has increased to moderate. • Fire frequencies have departed from historical frequencies by more than one return interval resulting in moderate changes to one or more of the following: fire size, frequency, intensity, severity, or landscape pattern. • Vegetation attributes have been moderately altered from their historical ranges.
Condition Class 3	• Fire regimes have been substantially altered from their historical range. • The risk of losing key ecosystem components is high. • Fire frequencies have departed by multiple return intervals resulting in dramatic changes to one or more of the following: fire size, frequency, intensity, severity, or landscape pattern.

Fuel Models

For purposes of this project, fuels have been classified into four groups; grass (fuel models 2) and timber (fuel models 8, 9, 10). The differences in fire behavior among these groups are related to fuel load and its distribution among the fuel particle size classes, e.g. fuel size, arrangement and continuity (Anderson, 1982). Fuel models are used to describe the “primary carrier” of fire. For example, in fuel model 9, there is a canopy of ponderosa pine with needle cast, grass, and dead material on the ground. Even though trees are present, the primary carrier of the fire would be the fuel on the ground. Fuel models and fire behavior are described below in Table 27.

The following fuel models represent conditions analyzed for the proposed treatment areas. Specifically they have been used in the First Order Fire Effects Model (FOFEM) model to derive temperature in degrees centigrade at the soil surface and generally for fire suppression capabilities.

Table 27. Fuel Models, Associated Fire Behavior

Fuel Model	Fire Behavior
2 – open shrub or grass under timber	Fire spread is primarily through the fine herbaceous fuels, either curing or dead. These are surface fires where the herbaceous material and litter and dead-down stemwood from the open shrub or timber overstory contribute to the fire intensity. Flame length is approximately six feet.

8 – timber	Slow burning surface fires with low flame lengths (less than one foot) are typical, although fire may encounter an occasional “jackpot” or heavy fuel concentration and can flare up. Flame length is approximately one foot.
9 – timber	Fires run through the surface litter faster than model 8 and have greater flame height. Concentrations of dead and down woody material will contribute to possible torching of trees, spotting, and crowning. Flame length is approximately 2.6 feet.
10 – timber	Fires burn in the surface and ground fuels with greater fire intensity than the other timber litter models. Dead-down fuels on the forest floor are found in greater quantities. Crown fire, spotting and torching are more frequent in this fuel type leading to potential fire control difficulties. Flame length is approximately 4.8 feet.

Fire Severity

Fire severity for this project will be measured via two fire behavior characteristics: crown fire potential and flame length. The fuel conditions used were those representing the 90th percentile weather. Historical weather from the Dollar Fire was used. The Dollar Fire borders the PCHFR Planning area on the west end of the planning area. The Data from this fire best represents summer fuel conditions for the planning area. The wind conditions used were conditions reported from the Dollar Fire.

This analysis has some assumptions that must be considered for interpreting the results. First, the fuel moistures are the same for all fuel models for each model run. This is useful for comparison of the fire behavior but is not particularly realistic for any given day (fuel moistures change day by day). The fuel moistures at each site would be affected by their local topography, shading, wind exposure, and wetting and drying. In the early part of the fire season, the fuels in the open would likely dry at a faster rate than fuels in the shaded areas, or understory, because of their increased exposure to sunlight and wind. Thus, the FlamMap analysis described here might be expected to under or over predict the fire behavior that is likely to occur, depending on the actual impacts of these variables. FlamMap does a good job of comparing the fire behavior characteristics based on a given set of moisture conditions. This provides a snapshot in time and maintains these variables in a constant condition so that fire behavior changes in FlamMap results are based on changes in vegetation.

Crown Fire Potential

As the name implies, a crown fire is a fire carried through the crowns of living forests. Before reaching this condition, a fire can go through several stages of development. Typically, a fire may spread for some time in surface fuels without interacting with the overstory. It may even smolder in forest duff for days or weeks until burning conditions improve and the fire becomes active and begins to spread.

Conditions that are potentially conducive to a crown fire are: dry fuel moisture, low humidity, high temperatures, heavy fuel accumulation, presence of ladder fuels, steep slopes, strong winds, unstable atmosphere, and a continuity of coniferous trees (Rothermel, 1991). Depending on the degree that some or all of the above conditions are encountered, the intensity of a fire in surface fuels would increase and flames would begin to reach into the crowns or climb ladder fuels into the crowns where the needle foliage would ignite and “torching” of one or more crowns would occur.

For a crown fire to occur, tree crowns need to be able to be ignited and carry the fire. There are two assumptions on which this approach is based. First, the surface fire intensity must be sufficient to ignite the crowns. Second, the rate of spread must allow direct surface-to-crown fire spread through ladder fuels.

The development and maintenance of a forest relatively free of crown fire potential is primarily dependent on management of the structure (including crown spacing) of crown fuels. Management of surface fuels is a corollary activity that can constrain surface fire intensity and reduce chances of crown fire activity and damage to the residual stand. The regulation of crown fire potential can be approached from two complementary perspectives:

- Prevention of conditions that initiate crown fire
- Prevention of conditions that allow crown fire to spread

This project focuses on reducing the potential for crown fire by reducing surface and ladder fuels, crown bulk density, raising the base of the live tree crown and opening stand canopy.

It should be emphasized that a “crown-fire-safe” forest is neither fireproof nor likely to escape free of wildfire damage at the stand level. It is a stand that is unlikely to generate or allow the spread of crown fire. Wildfire damage would clearly be less in managed stands than in unmanaged stands, but would not necessarily be low or absent (Agee, 1996). Also, it is not necessary or feasible to manage all stands across the landscape to eliminate the potential for crown fire. Treating key locations can serve to isolate areas and reduce the potential for crown fire spreading into untreated stands.

Flame Length

Flame length is one of several fire behavior characteristics that relates not only to fire intensity and severity, but can also be used as a measure of effectiveness for firefighting resources. A term commonly used in the firefighting arena is “resistance to control.” Resistance to control or the resistance of a wildland fire to suppression efforts (the difficulty of fireline construction and the frequency of spot fires) is dependent on the amount of large diameter fuels. Given previous fire experience within this project area, we know that fires tend to spread rapidly through grass and brush generating flame lengths that are often beyond hand crew capabilities, especially fires pushed by high winds. Also, where areas of larger fuels or heavier fuel loading exist, suppression action takes more time. Flame length interpretations are listed below (NWCG 1998):

- 0-4 feet: Fires can generally be attacked at the head or flanks by persons using handtools.
- 4-8 feet: Fires are too intense for direct attack on the head by persons using handtools. Handline cannot be relied on to hold fire. Equipment such as dozers, engines, and retardant aircraft can be effective.
- 8-11 feet: Fires may present serious control problems; torching, spotting and crown fire. Control efforts at the head of the fire would probably be ineffective.
- 11+ feet: Crown fire, spotting, and major runs are common. Control efforts at the head of the fire are ineffective

3.2.2 Existing Conditions

Historically, fires would have burned in this area every 35 to 200 years. Fire suppression activities in the past 100 years have altered the historical development of the vegetation. However, the different land management practices such as timber harvest and the associated road development after 1855 have increased the risk in human caused fire. Both natural and human caused fires have changed the landscape and increased the risk of ignitions occurring.

Lightning strikes do occur in this planning area but are often accompanied by rain that puts many fire starts out. Fire suppression efforts have been used to put out small fires that were held over from lighting storms. In areas where high fuel loadings and ladder fuel are present extreme fire behavior would still occur as a result of an uncontrolled fire. This may pose a safety problem for fire suppression crews as well as the public.

The current road system provides adequate access for fire suppression. The PCHFR Planning area had 15 wildfires in the past ten years. The causes of ignition included: lighting, smoking, equipment, abandoned campfires and arson.

Since 2006 there have been there have been four large project fires south and north-east of the planning area. Blue Ridge Fire (2006), Gnarl Fire (2008), Gnarl II (2008) and Dollar Fire (2011). All of these fires were natural fires starts by lighting. The main ignition source for these fires was in down bug kill pockets. These fires were strongly influenced by local weather patterns coming off Mt Hood. The fire behavior on the Dollar Fire was strongly influenced by high winds, which made it transition into a crown fire. Gnarl II was the only large wildfire within the PCHFR planning area. It threatened the Cooper Spur Wildland Urban Interface (WUI) area which is listed as a high risk and priority for treatment within the Hood River Community Wildfire Protection Plan (CWPP). It was observed once the fire reached managed stands fire behavior dropped off. In unmanaged areas where the Gnarl II fire burned flame lengths and burn intensities were high and unable to be suppressed by hand crews. Mechanical equipment had been utilized to suppress the fire (Figure 25 and Figure 26)

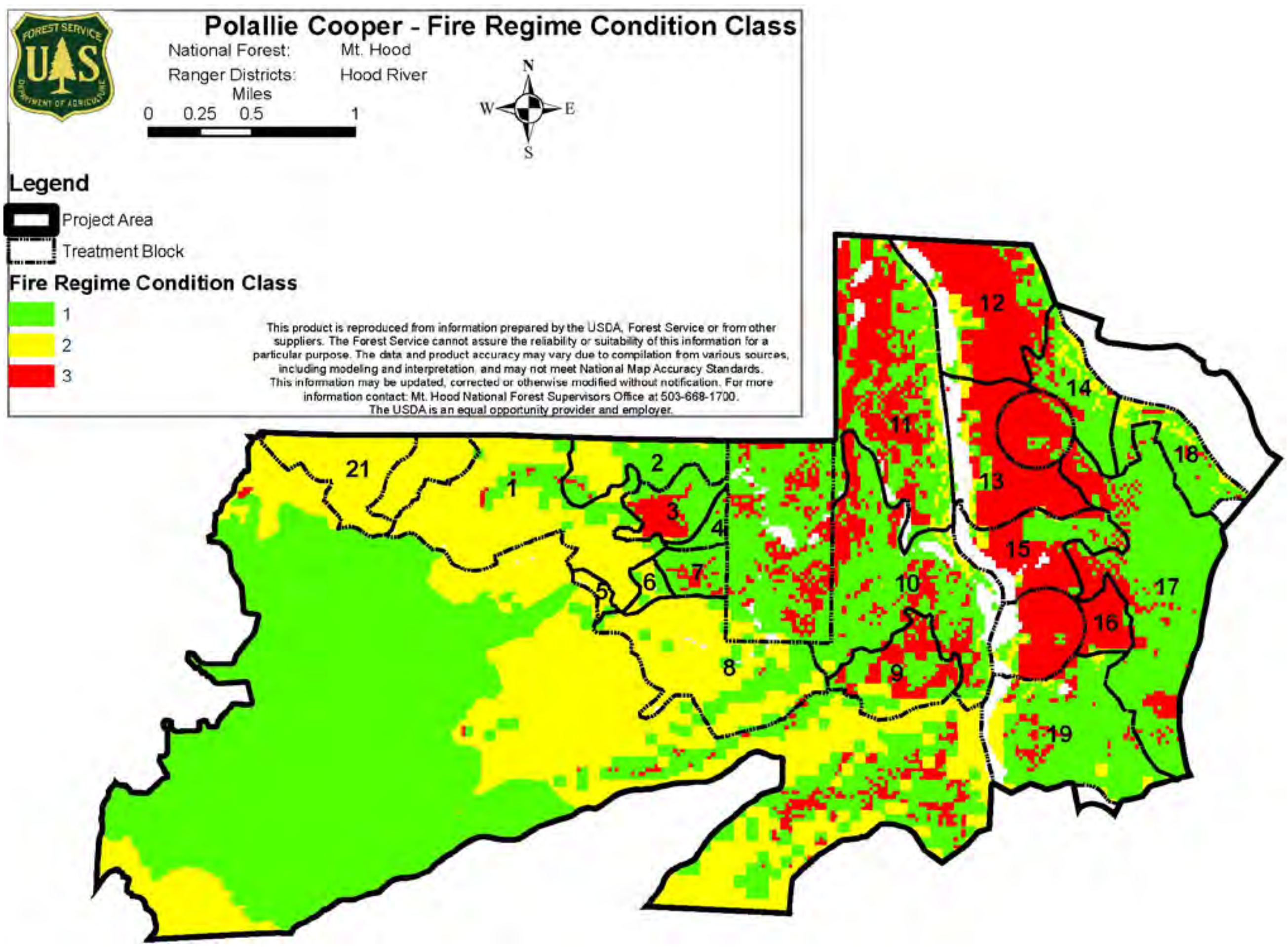


Figure 20. Map of Condition Classes in the Planning Area

Table 28. Condition Class by percentage in the PCHFR Planning Area

Condition Class	Percentage in the Planning Area	Percentage in Proposed Treatment Area
Condition Class 1	55%	50%
Condition Class 2	29%	23%
Condition Class 3	16%	27%

Fuel models currently found in the PCHFR planning are fuel models 2, 8, 9, and fuel model 10. Fuel model 10 is the predominant existing fuel model found in the planning area. For comparison purposes, FOFEM (First Order Fire Effects Module) and Fire Behavior runs were done using Behave Plus 5.0.5 .0.0. The following tables illustrate the rate of spread, flame length and probability of mortality.

Table 29. Fuel Model 10 Rate of Spread

Mid flame wind speed	Surface Rate of Spread (maximum) (chains*/hour)				
	10 % slope steepness	20 % slope steepness	30 % slope steepness	40 % slope steepness	50 % slope steepness
2.0	1.4	1.8	2.5	3.6	4.9
4.0	2.0	2.5	3.2	4.2	5.5
6.0	2.8	3.3	4.0	5.0	6.4
8.0	3.8	4.2	5.0	6.0	7.3
10.0	4.8	5.3	6.0	7.0	8.4
12.0	6.0	6.4	7.2	8.2	9.5
14.0	7.2	7.7	8.4	9.4	10.8
16.0	8.6	9.0	9.7	10.8	**12.1**
18.0	9.9	10.4	11.1	**12.1**	**13.5**
20.0	11.4	11.8	**12.6**	**13.6**	**14.9**

Rate of Spread: A three person engine crew could build fire hand line 12 chains per hour with hand tools. The areas underlined are outside the capability of a three person engine for handline production.

**One Chain is 66 feet*

Table 30. Fuel Model 10 Flame Lengths

Mid flame wind speed	Flame Length (ft)				
	10 % slope steepness	20 % slope steepness	30 % slope steepness	40 % slope steepness	50 % slope steepness
2.0	2.2	2.5	3.0	3.5	**4.0**
4.0	2.7	2.9	3.3	3.8	**4.3**
6.0	3.1	3.4	3.7	**4.1**	**4.6**

Mid flame wind speed	Flame Length (ft)				
	10 % slope steepness	20 % slope steepness	30 % slope steepness	40 % slope steepness	50 % slope steepness
8.0	3.6	3.8	4.1	**4.4**	**4.9**
10.0	4.0	4.2	4.4	**4.8**	**5.2**
12.0	4.4	4.6	4.8	**5.1**	**5.5**
14.0	4.8	5.0	5.2	**5.5**	**5.8**
16.0	5.2	5.3	5.5	**5.8**	**6.1**
18.0	5.6	5.7	5.9	**6.1**	**6.4**
20.0	6.0	6.1	6.2	**6.5**	**6.7**

Fuel Model 10 Flame Length: Four foot flame lengths are the limit fire line personal could safely and efficiently construct hand lines near a fire with hand tools. The areas underlined are over four foot flame lengths, and are too intense for direct attack by fire line personal.

Table 31. Fuel Model 10 Probability of Mortality

Mid flame wind speed	Probability of Mortality				
	10 % slope steepness	**20 % slope steepness**	**30 % slope steepness**	**40 % slope steepness**	**50 % slope steepness**
2.0	8 %	9 %	11 %	16 %	25 %
4.0	19 %	22 %	27 %	37 %	51 %
6.0	41 %	45 %	5 %	61 %	72 %
8.0	62 %	66 %	71 %	77 %	82 %
10.0	76 %	78 %	81 %	84 %	88 %
12.0	84 %	85 %	86 %	88 %	90 %
14.0	88 %	88 %	89 %	91 %	92 %
16.0	90 %	90 %	91 %	92 %	93 %
18.0	92 %	92 %	92 %	93 %	93 %
20.0	92 %	93 %	93 %	93 %	94 %

Figure 21. Example of a fuel model 10

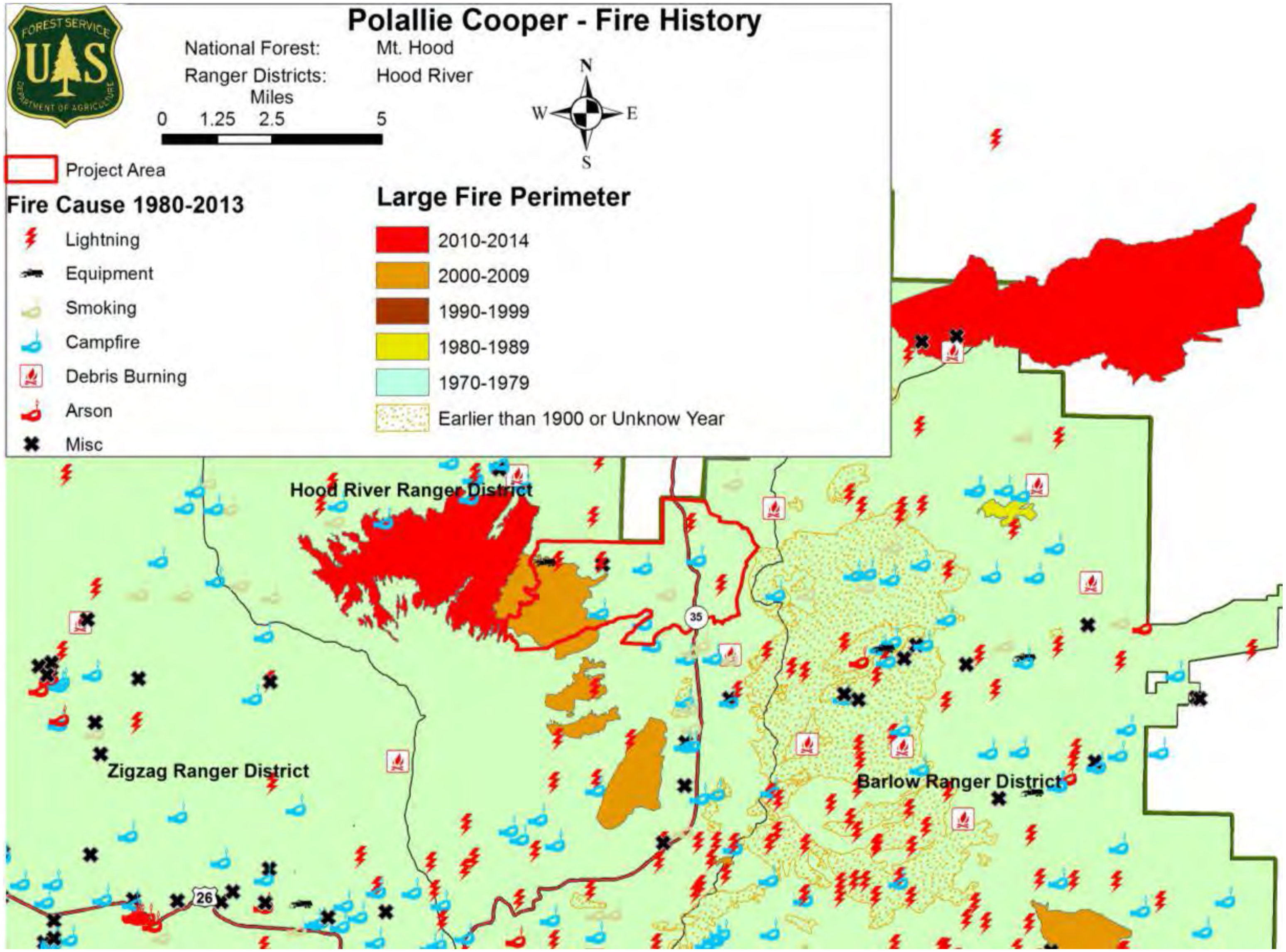


Figure 22. Fire History surrounding the Polallie Cooper Planning Area

3.2.3 Effects Analysis

No Action Alternative

The No Action Alternative proposes no projects and fire suppression would continue to occur. In the short term (one to five years), the fire hazard would remain constant, at a high risk. In the future, dead or dying trees would fall down increasing the fire hazard. Natural fuels (pine needles and other dead vegetation) would continue to accumulate. Natural processes of decay are not likely to remove the down and dead woody debris before the next fire cycle. As the available fuel increases, so would the potential for a large stand replacing wildfire event.

The risk of injury to the public and firefighters would increase as the fuel loadings and fire hazards increase. Larger, fast moving, higher intensity fires would put the public and firefighters at an increased risk to injury or death. Suppression costs would increase due to larger fires and the increased need for mechanized equipment and aircraft. Resource damage caused by fire suppression efforts would increase. There would be an increased threat of damage to the PCHFR Planning Area.

When large amounts of dead and down debris increase and there is an increase in ladder fuel, a fire would burn very hot and exhibit extreme fire behavior. Such fire behavior could result in loss of productivity and biodiversity in the stands, surface soils could be severely damaged, and it could take many years to restore the ecosystem.

Air quality would remain unaffected, until a large fire event occurred. Parkdale and/or Hood River Valley would be impacted by an uncontrolled large scale wildfire, with very high particulate matter imparted into the local air sheds, with potential health effects.

Fire Regime & Fire Regime Condition Class

Alternative 1 (No-Action) would not modify any fuels in the project area. No direct effect would occur within Fire Regime I, II and IV in FRCC 1, 2 or 3. Currently 50%, 23%, and 27% exist within FRCC 1, 2, and 3 respectively. The amount of acres present in FRCC I would gradually decrease over time, and those in FRCC 2 and 3 would gradually increase over time. No action would cause conditions to be further out of sync with the historical disturbance regimes.

Fire Severity

Crown Fire Potential

Passive and active crown fire would tend to occur in dense stands or small thickets of ponderosa pine, Douglas fir and lodgepole pine. In addition, stands that have some of the very limited large tree characteristics would also be susceptible to passive and active crown fire originating in adjacent areas. The level of mortality would likely be higher than desired on these sites. Historically, crown fires (either passive or active) were limited within these fire regimes.

Rate of Spread and Flame Lengths

Roughly 25% of current situations in the planning area would generate flame lengths that would allow direct attack by handcrews, while the remaining 75% would exceed handcrew capabilities (Table 30Table 29). Additionally, the rate of spread would not change from its existing condition. The existing rate of spread for the majority of the planning area exceeds initial attack capacity. As experienced during the recent large fires on the Hood River Ranger District, extremely limited opportunities were available for handcrew suppression operations. This was primarily due to rapid rates of spread and flame lengths. Under all alternatives, it is not a matter of “if,” but rather “when,” another large fire event occurs. For Alternative 1, when a fire event does occur, it would likely follow the pattern of previous large fire growth and continue to challenge firefighting resource capabilities. The resistance of a wildland fire to suppression efforts in fuel model 10 (the difficulty of fire line construction and the frequency of spot fires) is due to the amount of large diameter fuels. Under the No-Action Alternative, fire control efforts would be difficult for handcrews as well as dozers, engines, and aerial retardant where fuel model 10 exists.

Proposed Action

Proposed action would treat a total of 2830 acres, 1805 acres of recently unmanaged stand thinning, 420 acres of plantation thinning, and 605 acres of sapling thinning. This is about 40 percent of the planning area. This would reduce overall fuel loadings, thereby decreasing the Flame Length (FL) and Rate of Spread (ROS) in the event of a fire start in these areas, allowing suppression forces to safely and effectively contain and control a fire in the area of the Planning area. Much of the planning area would be reduced from a Fuel Model 10 to a Fuel Model 8.

Figure 23. Example of a fuel model 8

Fire Regime & Fire Regime Condition Class

Under Alternative 2 proposed fuel modification treatments would occur on approximately 2,830 acres. Across the planning area, this would cause a shift in FRCCs, resulting in a 9% increase of area in FRCC 1, 1% increase in FRCC 2, and 10% decrease in FRCC 3. In the Treatment Areas, this would result in a 23% increase of area in FRCC 1, 4% increase in FRCC 2, and 27% decrease in FRCC 3 as shown in Figure 24 and Table 32 below.

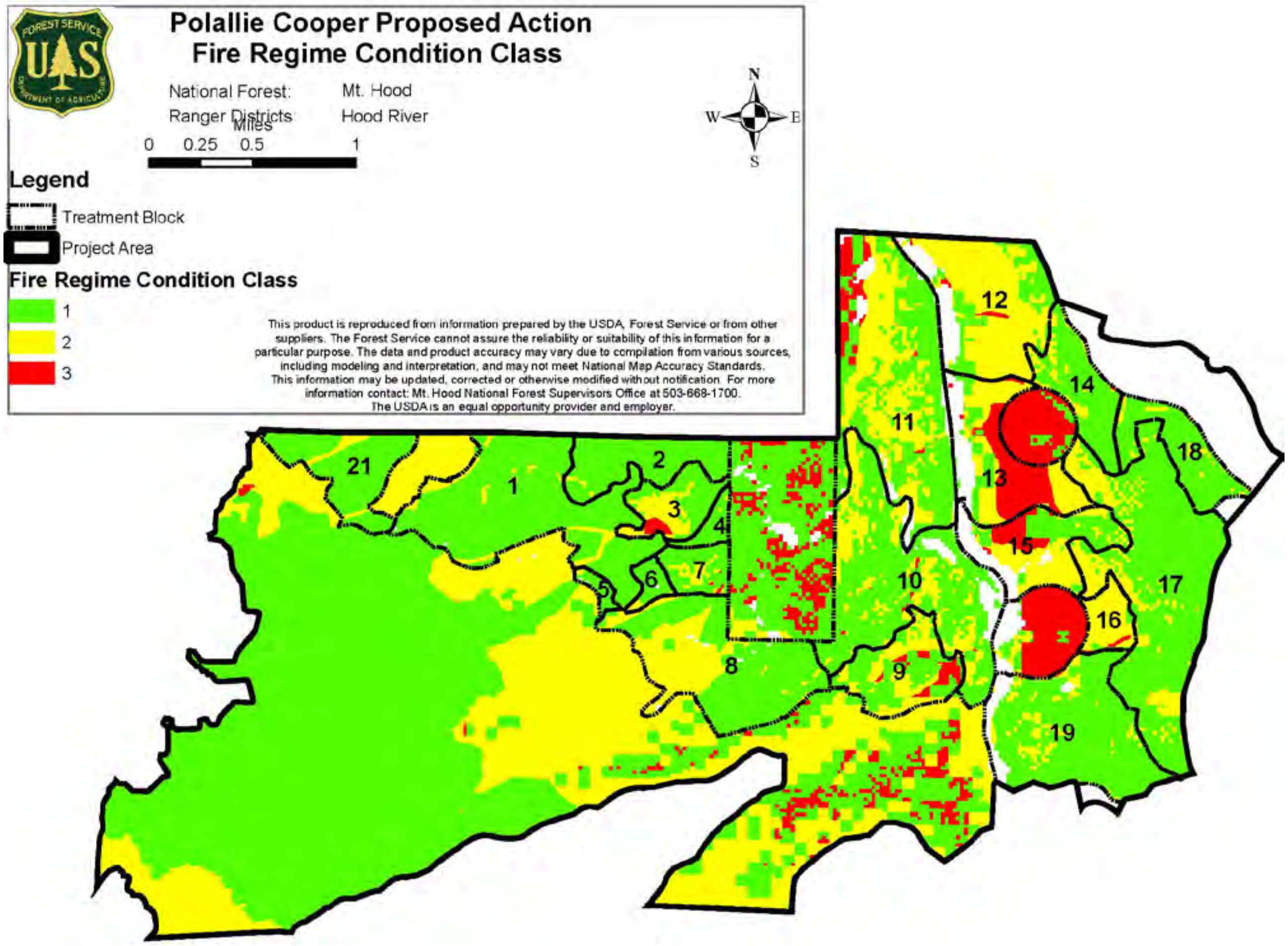


Figure 24. Map of the Fire Regime Condition Class after implementation of the Proposed Action

Table 32. Condition Class by percentage in the PCHFR Planning Area

Condition Class	Percentage in the Planning Area (Percent Change from No Action)	Percentage in Proposed Treatment Area (Percent Change from No Action)
Condition Class 1	64% (+9%)	73% (+23%)
Condition Class 2	30%% (+1%)	27% (+4%)
Condition Class 3	6% (-10%)	0 (-27%)

Fire Severity

The most pronounced decrease in fire intensity would occur as a result of fuel model 10 changing to fuel model 8. Higher fuel models have the potential to increase fire intensity as shown in Table 27. By moving much of the project area to Fuel Model 8, temperatures above 200 C causing nutrient capital reduction, organic matter charring, and amino acid loss, in addition to causing hydrophobic soil conditions would occur to a lesser degree when compared to the No Action Alternative.

Table 33. Fuel Model 8 Probability of Mortality after Implementation of the Proposed Action

Mid flame wind speed	Probability of Morality (%)				
	10 % slope steepness	20 % slope steepness	30 % slope steepness	40 % slope steepness	50 % slope steepness
2.0	7 %	7 %	7 %	7 %	7 %
4.0	7 %	7 %	7 %	7 %	7 %
6.0	7 %	7 %	7 %	7 %	7 %
8.0	7 %	7 %	7 %	7 %	7 %
10.0	7 %	7 %	7 %	7 %	7 %
12.0	7 %	7 %	7 %	7 %	7 %
14.0	7 %	7 %	7 %	7 %	7 %
16.0	7 %	7 %	7 %	7 %	7 %
18.0	7 %	7 %	7 %	7 %	7 %
20.0	7 %	7 %	7 %	7 %	7 %

Probability of Mortality is the likelihood that a tree would be killed by a fire.

Crown Fire Potential

Thinning would reduce the ladder fuel component in stands that are overstocked, allowing for suppression forces to contain and control future fire starts more efficiently and safely, thus reducing the risk to private property. Opening crown spacing to reduce the probability of a wildland fire transition from a surface fire to a crown fire has some tradeoffs. For example, thinning opens up stands to greater solar radiation and wind movement, resulting in warmer temperatures and drier fuels throughout the fire season. Also, activity fuels from thinning or pruning may result in increased fuel load, unless mitigated as an integral part of the treatment. These side effects of canopy fuel treatment must be considered when determining the overall effect of a treatment on potential fire behavior. Although opening the crown spacing could increase surface rates of spread, it also makes the fire easier to control and even under severe weather conditions an open stand is less likely to support a crown fire (Graham & McCaffery, 2003). Even though there is an increase in the rates of spread, flame lengths and fire line intensities are reduced to a level that could allow for initial attack by fire line personnel. When surface fires frequently burn they tend to minimize surface and ladder fuel accumulations, which in turn decrease the likelihood that crown fires would develop.

Rate of Spread and Flame Lengths

Wildfire accounted for 75% of the disturbances caused loss of spotted owl habit between 1994 and 2003. Decades of fire suppression and selective timber harvesting have led to a buildup of ladder and surface fuel and the potential for severe stand replacing wildfires. There is a broad consensus among forest managers and scientists the fuel treatment including mechanical thinning and prescribed fire may improve the long term protection of old growth stands from wildfire losses. Substantial reduction in wildfire risk as measured by probabilities or expected habitat loss can be realized by strategically locating treatments to reduce fire spread to spotted owl habitat stands. Not allowing fuel treatments within spotted owl habit could incur the loss of habit. Allowing treatments within spotted owl habitat in the planning can decrease the expected habitat loss at a given treatment intensity.(Alan A Ager, Mark A Finney, Becky K Kerns, Helen Maffei)

Low severity surface fires were relatively common (generally occurring every 4 to 25 years) in dry ponderosa pine and Douglas-fir forests prior to the 20th century (Agee 1993, Hann and others 1997). An appropriate fuel treatment would be a strategy of thinning (removing ladder fuels and decreasing tree crown density) followed by prescribed fire, piling and burning of fuels or other mechanical treatments that reduce surface fuel amounts. This approach would reduce canopy ladder and surface fuels, thereby reducing both fire line intensity and rates of spread severity and severity of potential wildfires (RMRS-GTR-120). Fuel models currently found in the PCHFR planning are fuel models 2, 8, 9, and fuel model 10. Fuel models 9 and 10 are the predominant fuel models found in the planning area.

Thinning followed by slash treatment at the Haymen fire and Davis fire sites produced the most impressive results, with less than 80 percent canopy scorch while adjacent untreated areas were nearly completely consumed (Chong, Martinson, and Omi 2007). For example modifying a fuel model profile from a fuel model 10 (currently found in the PCHFR planning area) to a fuel model 8 would alter rates of spread and flame lengths to a more manageable condition. This would allow land managers to conduct prescribed burns with less difficulty, less smoke and less risk of the fire escaping. For comparison purposes, FOFEM (First Order Fire Effects Module) and Fire Behavior runs were done using Behave Plus. The following tables illustrate the differences in rate of spread, flame length and probability of mortality

Table 34. Fuel Model 8 Estimated Rate of Spread after Implementation of the Proposed Action

Mid flame wind speed	Surface Rate of Spread (maximum) (*chains/hour)				
	10 % slope steepness	20 % slope steepness	30 % slope steepness	40 % slope steepness	50 % slope steepness
2.0	0.4	0.5	0.7	0.9	1.3
4.0	0.5	0.6	0.8	1.1	1.4
6.0	0.7	0.8	1.0	1.3	1.6
8.0	0.9	1.1	1.2	1.5	1.8
10.0	1.2	1.3	1.5	1.8	2.1
12.0	1.5	1.3	1.5	1.8	2.1
14.0	1.8	1.9	2.1	2.3	2.7
16.0	2.1	2.2	2.4	2.7	3.0
18.0	2.5	2.6	2.8	3.0	3.4
20.0	2.8	2.9	3.1	3.4	3.7

Rate of Spread: A three person engine crew could build fire hand line 12 chains per hour with hand tools.

**One Chain is 66 feet*

Table 35. Fuel Model 8 Estimated Flame Lengths after Implementation of the Proposed Action

	Flame Length (ft.)

Mid flame wind speed	10 % slope steepness	20 % slope steepness	30 % slope steepness	40 % slope steepness	50 % slope steepness
2.0	0.5	0.6	0.7	0.8	0.9
4.0	0.6	0.7	0.7	0.8	1.0
6.0	0.7	0.7	0.8	0.9	1.0
8.0	0.8	0.8	0.9	1.0	1.1
10.0	0.9	0.9	1.0	1.1	1.1
12.0	1.0	1.0	1.1	1.1	1.2
14.0	1.1	1.1	1.1	1.2	1.3
16.0	1.2	1.3	1.3	1.4	1.4
18.0	1.3	1.3	1.4	1.4	1.5
20.0	2.6	2.6	2.6	2.6	2.6

Flame Length: Four foot flame lengths are the limit fire line personal could safely and efficiently construct hand lines near a fire with hand tools.

Treatments of underburning would be done over two entries around 5 years apart to reduce surface fuel while maintaining visual objectives. To achieve the level of surface fuel reduction needed, prescribed fire intensities could have the potential to heavily scorch and/or torch individual and small groups of trees. These effects could be lessened by utilizing a lower intensity initial underburn that would consume a good portion of the fine fuel while avoiding stark changes in visual quality.

Future fire suppression costs have the potential to be reduced within the next 15 to 25 years because of anticipated reduction in future fire intensity. These reduced intensities would give more options to fire suppression managers and resources during suppression actions.

Surface fuel would be reduced to from approximately 25-55 (Figure 27 and Figure 28) tons per acre to 15 tons on the dry plant communities of the planning area and from 45 – 60 tons per acre to 25 tons in the moist plant communities within the planning area.

Ladder fuels are reduced as a result of the piling of brush and small trees. The fuel loading is reduced by the piling of the down dead woody material. The piles are burned in the fall season. Effects of this treatment on the stand are possible damage to residual trees, vegetation or soil when the pile is burned. Scorch of residual trees could occur if the pile is located too close to the dripline of residual trees.

Burning the pile eliminates the high concentrations (fuel loading) of woody material when the pile was created. Scorching of tree crowns is possible where landing piles are located close to residual leave trees. This scorching could result in tree mortality or reduced vigor. Trees killed by scorch could be left as future snags for wildlife benefits if not felled for public safety.

Escaped fires resulting from unexpected weather may occur and cause damage to the surrounding vegetation. Piles would need to be monitored and extinguished if weather conditions show that damage from escape would occur.

The treatment reduces the total fuel accumulation and fuel ladders. The effects on trees vary by species, size and bark thickness. Ponderosa pine is a fire tolerant species that has evolved with fire and is able to withstand low to moderate intensity fires. Other tree species such as Douglas-fir and grand fir are less fire tolerant then ponderosa pines and are susceptible to more damage and higher mortality rates, particularly in the smaller size classes. Some trees would die due to crown scorch, ladder fuel carrying the fires through the tree crown, and large fuel accumulations around the tree base could cause cambium damage. Root damage and tree mortality could occur if soil moistures are too high or residual heat created by large fuel accumulations occurs. During any burning operation, a possibility exists that a burn may escape control and become a wildfire. All firelines would be completed by hand, mechanical equipment, or small all-terrain vehicles (ATV) pulling a fireline plow. Firelines should be rehabilitated after burning if there is a possibility of resource damage.

Cumulative Effects

Cumulative effects examine the effects of the alternatives taken in combination with past, present and reasonably foreseeable actions. The cumulative effects analysis includes the area bordered on the south by The Dalles Watershed Fuelbreak Project as well and past harvest activities, and other activities included in Table 15.

No Action Alternative

Under the No Action Alternative, impacts to the current fuel profile in the projects area would be negligible in the short-term and moderate to high in the long term. The No Action Alternative implies continuance of current conditions and current management and exacerbation of the currently overstocked fuel conditions. Ignitions would continue to occur. Under the No Action Alternative, fuel conditions would continue to move to a dense high dead to live ratio situation. Resistance to control would increase while the ability to provide for firefighter and public safety would continue to decrease. Ignitions can be anticipated to move both on to and out of The PCHFR Planning Area in the absence of human made or natural barrier to fire.

Proposed Action Alternative

Past actions affecting the planning area under this alternative are past timber harvesting and insect infected trees. Additional past, connected reasonable foreseeable future actions that could affect the fuel profile include fuel reduction projects, including 2000 debris flow in the east fork hood river, Dollar Lake Fire, including burn area rehabilitation, 1980 debris flow in Polallie creek, Gnarl Ridge Fire, including burn area rehabilitation, Timber harvest on federal, county and private lands (including associated road/landing congestion), road decommissioning and road closures and aquatic restoration projects

The Proposed Action would enhance the effectiveness of the neighboring fuel reduction projects by reducing the likelihood of an intense wildfire starting in either The Dalles Watershed or in the North Fork Mill Drainage in treated areas. This would be done by breaking up continuous blocks of high fuel hazard areas. There is a possibility of smoke intrusion in the communities of the Hood River Valley, Mosier, The Dalles, Dufur, and areas within the Columbia River Gorge National Scenic Area. All prescribed burning would be scheduled in conjunction with the State of Oregon to comply with the Oregon Smoke Implementation Plan (FW-040) and to minimize the adverse effects on air quality. Burning prescriptions would be developed to minimize the potential for adverse effects. Implementation of these measures would ensure compliance with the Clean Air Act. See the Air Quality/Smoke Management section for more details.

3.2.4 Consistency Determination

The Proposed Action alternative is consistent with the Mt. Hood Forest Plan as amended, as well as the Hood River County Community Wildfire Protection Plan, including all applicable standards and guidelines.

3.2.5 Summary of Effects

This would reduce overall fuel loadings, thereby decreasing the Flame Length (FL) and Rate of Spread (ROS) in the event of a fire start in these areas, allowing suppression forces to safely and effectively contain and control a fire in the area of the Planning area.

Figure 25. Unmanaged areas where the Gnarl II fire burned flame lengths and burn intensities were high and unable to be suppressed by hand crews

Figure 26. Unmanaged areas where the Gnarl II fire burned flame lengths and burn intensities were high and unable to be suppressed by hand crews

Figure 27. Existing fuel loading in the Polallie Cooper planning area

Figure 28. Existing fuel loading in the Polallie Cooper planning area

3.3 Air Quality/Smoke Management

3.3.1 Analysis Assumptions and Methodology

Air quality is of particular concern on the Mt. Hood National Forest Airsheds. Airshed is defined as a geographical area that, because of topography, meteorology, and climate, share the same air (Boutcher 94; MHFP, Glossary-1). Portions of the Mt. Hood Wilderness are federally designated as a Class I Airshed (MHFP, FW-046, and FW-047). The Mt. Hood Wilderness is adjacent to the PCHFR Planning area on western and south western border of the planning area. The Badger Creek Wilderness, a Class II Airshed is approximately four miles south of The PCHFR Planning area. The city of the Dalles is a state receptor site is approximately 19 miles northeast of the planning area. Management activities shall comply with all applicable air quality laws and regulations, including the Clean Air Act and the Oregon State Implementation Plan (MHFP, FW-040). Also, in compliance with the Clean Air Act, the Forest Service is operating under the Oregon Administrative Rule OAR 629-43-043. The Forest Service is complying and would continue to comply with the requirements of the OSMP (Oregon Smoke Management Plan), which is administered by the Oregon Department of Forestry.

Smoke management is defined as: The management of fuel treatments from forest activities so that there is no or reduced effect to local areas surrounding the project. This primarily deals with impacts to people or air quality.

The effects of smoke management from activity created fuel on the surrounding area are described below and the procedures and guidelines followed when utilizing prescribed fire as a management tool. All Forestwide Standards and Guidelines for Air Quality FW-039 thru FW-053 (LRMP-MTF, 4:51-52) would be followed to minimize problems of Forest burns affecting air quality in local communities. All prescribed burning activities would comply with Forest Service Manual direction (FSM 5100, Chapter 5140). Currently, and in the future, all planned ignitions are and would be conducted according to the Operational Guidance for the Oregon Smoke Management Program (OSMP). The Operational Guidance contains the direction for meeting the terms of the OSMP. The Environmental Protection Agency has approved the OSMP as meeting the requirements of the Clean Air Act, as amended.

The OSMP, which is administered by the Oregon State Forester, regulates the amount of forestry related burning that could be done at any one time. The amount of burning that could occur on any one day depends upon the specific type of burning, the tons of material to be burned, and the atmospheric conditions available to promote mixing and transportation of smoke away from sensitive areas.

The size class distribution for wood smoke particles is such that 82 percent of the particles range between 0.01 and .099 microns, 10 percent range between 1.0 and 4.99 microns, and 8 percent range between 5.0 and 15.0 microns. The most efficient particle size for scattering light (and thus reducing visibility) ranges between 0.3 and 0.7 microns. The majority (82 percent) of particulate emissions from wood combustion are in the size range that reduces visibility.

The PM (Particulate Matter) 10 (microns) and PM 2.5 (microns) have been established as primary air quality parameters because of potential adverse human health effects. These small particulates could be inhaled and cause respiratory problems, especially in smoke sensitive portions of the population, such as the young, elderly, or those predisposed to respiratory ailments. Coarse particles could accumulate in the respiratory system and aggravate health problems such as asthma. Fine particles, which penetrate deeply into the lungs, are more likely than coarse particles to contribute to the health effects associated with hospital admissions.

Smoke sensitive areas near the PCHFR planning area also include: the communities of the Hood River Valley, Moiser, The Dalles, Dufur, and areas within the Columbia River Gorge National Scenic Area.

Burning would only be conducted when actual and predicted atmospheric conditions would minimize the possibility of smoke affecting these areas.

3.3.2 Effects Analysis

No Action Alternative

Because the no action alternative does not prescribe any use of fire, there would be no direct effects to air quality from taking no action. However, because there is an increased risk of large scale wildfire from taking no action, there is the potential for an indirect effect of a reduction in air quality from this alternative.

No action would have the least immediate impact on air quality, as there is no prescribed burning or pile burning. All biomass remain available for consumption by wildfires and it would continue to accumulate, increasing the potential for large amounts of smoke during the summer months, when diurnal inversions can concentrate smoke at low elevations. Wildfires tend to occur at the driest time of the year, and fuel are more completely consumed and typically produce three to five times more emissions than early or late season prescribed fires. These smoke concentrations can have high particulate levels that can cause health problems, or violate summertime Class I and Class II air quality visibility standards for Wilderness areas. The surrounding communities of the Hood River Valley, Moiser, The Dalles, Dufur, and areas within the Columbia River Gorge National Scenic Area would be impacted by smoke from a wildfire in this area. Any biomass that has accumulated is prone to be released back into the atmosphere by either combustion in a wild fire or by decomposition.

Proposed Action Alternative

Because of preventative measures and compliance with OSMP, there would be no long-term effects from prescribed burning or smoke from the proposed activities.

To avoid impacting smoke sensitive areas, units would be burned when smoke management forecasts predict mixing heights and transport winds that would carry smoke away from or over these areas. If intrusions occur, no additional areas that could contribute to the intrusion would be ignited and extinguishing burning material may be necessary. Signs would be posted on roads that are near burning operations when visibility could be affected, for public safety if visibility on State or Federal Highways is reduced to less than 750 feet, traffic flaggers and pilot cars would be required. Any particulate emission from prescribed burning would be substantially less per acre than a wildfire.

Smoke management concerns may require that some stands that have proposed underburning be treated by hand and/or machine piling. Pile burning could be accomplished during the passage of weather fronts that move smoke out of the area very quickly, whereas underburning requires very specific environmental condition to implement.

3.3.3 Consistency Determination

The Proposed Action alternative is consistent with the Mt. Hood Forest Plan as amended, as well as the Hood River County Community Wildfire Protection Plan, including all applicable standards and guidelines.

3.3.4 Summary of Effects of the Proposed Action

The direct effect of prescribed smoke for the Proposed Action alternative would be directly related to the volume of timber to be removed. The direct effects of prescribed burning smoke are reduced visibility and increased level of small diameter particulates specifically PM 2.5 and PM 10, of concern for human health reason.

The indirect effects of prescribed burning smoke produced as a result of the implementation of the Proposed Action alternative would be directly related to the amount of timber volume to be removed. Indirect effects are limited to the air quality degradation, as a result of PM 2.5 and PM 10 particulates, and increased haze. PM 2.5 and PM 10 levels would rapidly disperse as they are carried by local and general winds.

The cumulative effects on air quality of prescribed burning smoke, produced as a result of implementation of the proposed alternatives, would result in an incremental decrease in air quality as PM 2.5 and PM 10 particles from this source combine with other particles produced both by the implementation of other aspects of this project, as well as other local and regional sources located upwind. Prescribed burning of logging slash, on other federal, state or private lands, would also contribute particulates, as would agricultural burning. Particulates from industrial and automotive sources also contribute to regional particulate loading. Other vehicle traffic agricultural and industrial sources within the planning area would also contribute to the cumulative particulate loading. It is not possible to predict the amount of particulates contributed by these sources.

3.4 Transportation Resources

3.4.1 Analysis Assumptions and Methodology

A Roads Analysis has been developed at the Forest scale (USDA Forest Service, 2003) titled Roads Analysis: Mt. Hood National Forest (Roads Analysis). This document conducted a full analysis of the transportation system at the Forest level and considered the effect of the National Forest System Roads on riparian areas and flood plains, impediment to fish passage at road stream crossings, slope stability, surface erosion and sediment delivery, water quality of municipal water supplies, threatened or endangered species, special habitat connectivity, invasive species and noxious weeds, and operational budgetary constraints. The 2003 Roads Analysis has in turn been utilized to inform the development of road Access and Travel Management Guidelines (ATMs) and to develop Road Management Objectives (RMOs) for each segment of road on the Mt. Hood National Forest.

In addition to the Forest Roads Analysis, this project takes into consideration the effects and recommendations documented in the East Fork Hood River and Middle Fork Hood River Watershed Analysis and is further focused by project specific information obtained by observations and measurements taken in the field during the 2013 field season.

Road reconstruction and maintenance for stewardship and timber sales are limited to the proportionate share of the total traffic on a road (Commensurate Share Policy). The Commensurate Share Policy (Forest Service policy) is used to determine maintenance and reconstruction responsibilities for any project that has commercial haul. Under this policy, all competing users would be assessed their commensurate share of responsibility for maintenance and reconstruction. The commensurate share of responsibility for any given commercial haul is determined by examining typical structural degradation of roads under heavy haul.

For considering structural design of the subgrade, base, and surfacing of roads, the weight-per-axel loading of typical log haul trucks over the life of the timber sale is calculated using an estimated volume of timber passed over each segment of roadway [critical design vehicle per AASHTO's "Policy on Geometric Design of Highways and Streets" (AASHTO, 2004) and "Geometric Design of Very Low-Volume Local Roads; ADT < 400" (AASHTO, 2001)]. The result of this calculation is used to determine structural degradation and maintenance needs of the road system. The calculation is based on the Normal Operating Season, generally from June 1st through October 31st, and excepts unusual conditions which may occur, such as higher than normal moisture content or frozen subgrade (USDA Forest Service Mt. Hood National Forest, 1989).

Determination of road reconstruction needed to safely conduct operations associated with the Proposed Action was made utilizing the standards and guidelines set forth in the following documents with authority under 36 CFR Parts 212, 251, 261, and 295:

- Roads Analysis: Mt. Hood National Forest;
- Forest Service Manual (FSM) 7700 – Travel Management;
- FSM 7710 – Travel Planning;
- FSM 7730 – Transportation System Road Operation and Maintenance
- Highway Safety Act of 1966 (P.L. 89-564) in compliance with applicable Highway
- Safety Program Guidelines, as specified in the Memorandum of Understanding found
- in FSM 1535.11;
- Forest Service Handbook (FSH) 7709.55 – Travel Analysis Handbook;
- FSH 7709.58 – Transportation System Maintenance Handbook; and,
- FSH 7709.59 – Transportation System Operations Handbook.

All of these documents are available in the project record, located at the Hood River Ranger District in Parkdale, Oregon.

Costs associated with needed road reconstruction were estimated by utilizing the process and format outlined in “Cost Estimating Guide for Road Construction: Cost Guide Zone 5, Davis Bacon Area 5” (USDA Forest Service Region 6, April 2002) and by applying equipment and labor costs from updated tables of the same cost guide.

Quantities shown in this report were compiled using data from the Region 6, Mt. Hood National Forest, INFRA database, the Transportation GIS Geodatabase, the Hood River Ranger District Roads and Topography Map, and measurements and observations taken in the field.

3.4.2 Existing Conditions

Table 36 presents existing motorized route designation information as it exists in the field within the Polallie Cooper Hazardous Fuels Reduction planning area.

Table 36. Existing Motorized Route Designations

Route Miles, Stream Crossings, and Routes in RHCAs	Existing Condition
Proposed Action Area - (Acres)	2,830
Action Area Open to Motorized Cross-country Travel (Acres)	0
Grand Total Motorized Route: System Miles	32.03
Total Miles of Roads	32.03
a. Miles designated as open yearlong	29.47
b. Miles designated as open seasonally	0
c. Miles designated as closed yearlong (ML1)	2.56
Total Miles of Motorized Trails	0
a. Miles of designated roads open year round for use of OHV‟s	0
b. Miles of designated road open seasonally for use of OHV‟s	0
c. Miles of trail available for use by OHVs < 50 in wide	0
d. Miles of trail available for use by OHVs > 50 in wide	0
e. Miles of trail designated for motorcycle use	0
Total Miles of Routes in Riparian Reserves	5.77
a. Total miles of designated open OHV trails in Riparian	0
b. Total miles of designated open roads in Riparian	5.14
c. Total miles of designated closed OHV trails in Riparian	0
d. Total miles of designated closed roads in Riparian (ML 1)	0.63
Total Stream Crossings by Designated Route	44
a. Total number of open OHV trail stream crossings	0
b. Total number of open road stream crossings	38
c. Total number of closed OHV trail stream crossings	0
d. Total number of closed road (ML1) stream crossings	6
Total Miles of Designated Routes Available to OHVs	0

The Forest’s transportation system provides multi-use access for trans-forest travelers, the recreating public, commercial users, and administrative users. System roads within the Forest range from Maintenance Level to Maintenance Level 1. Maintenance for these roads is conducted utilizing appropriated funding, which is prioritized to focus on maintenance for those roads which accommodate higher levels of traffic and are commonly used by passenger vehicles.

However, across the Forest funding for road maintenance is lower than the level needed to properly maintain the open roads on the Forest. System roads within the planning area include Maintenance Level 4 to Maintenance Level 1 and include asphalt paved roads, aggregate surfaced roads, improved roads, and native surface roads. Maintenance Levels are defined as follows:

> 4 – Higher consideration than level 3 is given to comfort and convenience of the passenger car and commercial user at prudent driving speeds above 25 mph with positive surface drainage and surface that is cross sloped or crowned.
>
> 3 – Minimum conditions are provided for passenger car use. Surface provides moderately convenient travel at prudent driving speeds between 15 and 25 mph with corresponding surface roughness tolerated.
>
> 2 – Conditions are suitable for high clearance vehicle travel at prudent driving speeds less than 15 mph.
>
> 1 – Road is treated for hydrologic stability and placed in storage for administrative use at a future time. Road is not maintained for public use.

Due to decrease in budgets, appropriated funding tends to be allocated to maintaining the higher volume roads designated as Maintenance levels 3, 4, and 5. Consequently roads with lower level maintenance designations have been largely neglected in spite of the volume of traffic that they receive.

Roads such as National Forest System Road (NFSR) 3512 and NFSR 3512-620, which access the popular Cooper Spur Winter Sports Area, Cloud Cap Inn, Cloud Cap Campground, hiking trails, and several historical sites, and which receive relatively large amounts of traffic compared to other roads with the same maintenance level designations, are in need of maintenance that has not been funded.

Most other Forest Roads within or accessing the planning area have vegetative growth along the roadside which has begun to encroach upon the road prism, limiting sight distances around horizontal curves and creating a hazardous condition for road users. A few other roads such as NFSRs 3511, 3511-631, 4400-015, and 4400-620 have ditch lines and drainage structures along the roadway that are blocked by trees which have grown in excess of 4 inches in diameter, causing these drainage features to operate inadequately or fail, resulting in ponding and surface erosion that increases the delivery of sediments and contaminants to streams and degrades water quality. In a more extreme case, NFSR 3512-640, which is a native surface road, has eroded and degraded to a point where the road is difficult to navigate even in a high clearance vehicle. This is a steeply graded road with at least one perennial stream crossing that has road surface drainage being controlled only by multiple water bars.

Lack of funding for road maintenance activities has also resulted in the failure to treat many dead trees near the roadway that remain standing, but can be expected to fail and fall in the near future. Given the height of the hazard trees in the area and the slopes of the ground that they stand on relative to roadways, potential roadway hazards exist up to 200 feet or more away from the roadway itself. NFSRs 3511, 4400-015, and 4400-622 are the open roads most severely impacted by existing hazard trees and represent the highest risk to public traffic. NFSRs 3511-631 and 3512-012 are Maintenance Level 1 roads that are currently closed to the public, but are severely affected by this type of hazard and present a risk to administrative personnel and commercial operators that would use these roads during treatment operations.

As well as reduced maintenance resulting from budgetary constraints, the historic practice of conducting commercial haul during wet weather and under freeze/thaw conditions has had substantial detrimental effects on the transportation system and structural integrity. Heavy haul of materials is the most impactful action regularly applied to the transportation resource. Past commercial haul over the roadway during these conditions has weakened the load bearing capacity of aggregate surfaced as well as asphalt surfaced roads. Once compromised, even normal traffic during wet weather conditions is likely to cause further damage.

The 4400-621 road is unique in the planning area. Official documents and records indicate that this is an existing system road, currently Maintenance Level 2, that is 0.72 miles long. However, in actuality this road exists only as a hiking trail (#688) commonly known as the Clinger Springs Trail. The entrance is signed only as a trail and the character of this alignment is such that the common observer would not recognize it as ever having been a road in the past. Because of this existing condition the road mileage is not included in System Road miles in Table 36.

3.4.3 Effects Analysis

No Action Alternative

The No Action Alternative would involve no haul of commercial wood fiber. Since heavy haul of materials is the most impactful action regularly applied to the transportation resource, the No Action Alternative would result in no additional wear and tear on the roads within the planning area. The only wear and tear that would occur would come from trans-forest travel, recreation, and administrative use; normally in passenger vehicles. This would benefit the transportation resource to a certain degree, but would not be able to address current maintenance and reconstruction needs on this portion of the Forest.

Due to current budget prioritizations, no action on this proposed project would mean that none of the road maintenance and reconstruction planned under this proposal would occur. Lack of road maintenance exhibits a strong adverse effect with respect to both safety and the environment. Road surface, road subgrade, and road base failures present physical hazards to drivers, reduce a driver's ability to maintain positive control of a vehicle, and increase the potential for the development of erosion hazards on road slopes including soil slumps and slides due to pooling of water and increased soil saturation in the road bed (USDA Forest Service Engineering Staff Washington D.C., 1994). Failed or poorly functioning drainage systems increase sedimentation in streams and waterways due to their failure to properly mitigate erosion. They also increase the likelihood of waterway contamination from vehicular fluids due to water being forced onto the traveled way of roads prior to draining into natural stream courses. Unbrushed roadways also present an additional safety hazard to road users due to decreased sight/stopping distance (AASHTO, 2001). Fire suppression activities, search and rescue operations, and utility infrastructure maintenance/repair activities would be hindered to varying degrees. Road reconstruction issues, such as current road failures, drainage failures, and erosion control problems that have been identified within this road system, would not be addressed within the same time frame as the Proposed Action (issues would become or continue to be Deferred Maintenance).

Since this alternative would not include cutting of wood fiber, there would be no need for the construction or reconstruction of temporary roads. Since there would be no need for access to proposed units, the absence of temporary roads would have no direct impact to the transportation resource.

This alternative would not include system road status changes such as road closures, and consequently there would be no displacement with respect to the transportation system users. The current use pattern of roads within the planning area would not change. Volume of public use on this system would not change over the near term, but could decrease slightly over time due to decreased navigability of the roads. Administrative use on this system would not change, although access would become increasing difficult due to lack of road maintenance and lack of funding sources with the capability of appropriately addressing road reconstruction issues.

Road densities and road use designations would both remain unchanged with no action. As demonstrated with our existing conditions data, there are no designated OHV use roads or trails within the planning area. So, in these respects, the no action alternative has no substantial effect at all, neither beneficial nor detrimental.

Proposed Action Alternative

The Proposed Action would involve log haul. The roads within the planning area were designed for hauling timber during the Normal Operating Season. Moisture content in the materials of the road base and road subgrade must remain below the soil plasticity limit (AASHTO, 2006; T-87, T-89, T-90, T-99) to remain within design parameters.

For the purpose of this analysis, in order to quantify expected stresses, we can expect weather during the Normal Operating Season to behave within measured norms for the local area (http://www.weatherbase.com/weather/weather.php3?s=664853&refer=&cityname=Mount-Hood-National-Forest-Oregon-United-States-of-America). Then the moisture content of materials within the subgrade of the roadways remains within design parameters. Since commercial haul under this proposal would be limited to the Normal Operating Season to the extent practical, we can expect stresses produced by heavy haul to result in relatively normal wear and tear that does not create undo cost and damage to resources. The Forest Service can also regulate the cause of these types of negative effects through timely enforcement of contract provisions that require log haul to be suspended when wet weather conditions make continued haul unsafe, would contribute to stream sedimentation, or would threaten the integrity of the road's surface or subgrade. The Project Design Criteria/Mitigation Measures in Section 2.3 would further mitigate the adverse effects of wet weather or winter condition haul.

A cost analysis for reconstructing main haul roads to withstand winter haul shows that such an undertaking is economically prohibitive and unfeasible for any currently available source of road maintenance or reconstruction funding. As such, the PDCs provide restrictions to the road use outside the normal operating season (See Project Design Criteria Section 2.3).

Table 37 presents a list of roads that would be utilized for commercial haul on this project and presents a general maintenance/reconstruction regime that would occur for each, along with estimated costs associated with that work.

Table 37. System Road Reconstruction and Maintenance

Road	Road Length	Required Road Maint. Cost	Description
3511-000	2.09	$15,761	**Maintenance:** Blading, Brushing, 150cy Spot Rock, 0.52mi Ditch Cleaning
3511-000	1.78	$13,809	**Maintenance:** Blading, 0.11mi Brushing, Clean 14 Inlets, 120cy Spot Rock; * Snowmobile Route - No Plowing **Reconstruction:** Specified Road Clearing MP 2.20 - 3.87 Treat 60 DTs MP 3.02 - 3.87
3511-014	0.60	$1,032	**Maintenance:** Blading, Brushing; * Snowmobile Route - No Plowing
3511-015	0.40	$4,660	**Maintenance:** Remove & Replace Berm, Blading, Clearing
3511-016	0.30	$582	**Maintenance:** Blading, Brushing
3511-630	0.72	$16,919	**Maintenance:** Blading, Brushing, Clean 4 Inlets, 0.31mi Ditch Cleaning * Snowmobile Route - No Plowing beyond MP 0.46 **Reconstruction:** Add new Gate @ MP 0.03

Road	Road Length	Required Road Maint. Cost	Description
3511-631	0.70	$15,520	**Maintenance:** Blading, 20cy Spot Rock, Treat 10 DTs * Snowmobile Route - No Plowing beyond MP 0.26 **Reconstruction:** Specified Road Clearing Full Length Replace Gate at MP 0.29
3511-632	0.30	$970	**Maintenance:** Blading, Brushing, Log-Out, Clean 2 Inlets
3511-633	0.10	$430	**Maintenance:** Blading, Brushing, Log-Out, Clean 2 Inlets
3511-640	0.50	$9,410	**Maintenance:** Blading, Brushing, Ditch Cleaning Full Length **Reconstruction:** Construct Closure Berm, Add 12 WBs
3512-000	0.56	$7,430	**Maintenance:** Brushing, Ditch Cleaning Full Length, Clean 3 Inlets, Road Maintenance Deposit
3512-000	0.87	$8,884	**Maintenance:** Brushing, Ditch Cleaning 0.3mi, Clean 5 Inlets, Treat 3 DTs/mi, Road Maintenance Deposit
3512-000	1.15	$11,956	**Maintenance:** Blading, Brushing, Ditch Cleaning 0.36mi, 140cy Spot Rock **Reconstruction:** Specified Ditch Reconditioning MP 1.53-1.73
3512-000	1.10	$12,412	**Maintenance:** Blading, Brushing, Ditch Cleaning 0.6mi, Clean 3 Inlets, 100cy Spot Rock, Maintain 3 DDs
3512-011	0.20	$432	**Maintenance:** Blading, Clearing
3512-012	0.60	$2,640	**Maintenance:** Brushing, Blading, 20cy Pit Run, Maintain 2 WBs, Treat 12 DTs
3512-640	0.72	$4,124	**Maintenance:** Blading, Brushing, Clean 1 Inlet, Maintain 10 WBs **Reconstruction:** Construct Closure Berm, Add 1 WB
4400-000	3.59	$27,191	**Maintenance:** Brushing, 60cy Ditch Cleaning, Clean 4 Inlets, Road Maintenance Deposit
4400-015	0.90	$3,945	**Maintenance:** Blading, Treat 33 DTs **Reconstruction:** Specified Road Clearing Full Length
4400-620	2.50	$10,861	**Maintenance:** Blading, 0.3mi. Brushing, 10cy Spot Rock, 0.3mi Ditch Cleaning, Treat 5 DTs/mi **Reconstruction:** Specified Road Clearing 2.2mi.
4400-622	0.60	$4,455	**Maintenance:** Blading, Brushing, 10cy Spot Rock, Treat 21 DTs **Reconstruction:** Specified Ditch Reconditioning Full Length; Construct Closure Berm
4400-624	0.10	$3,085	**Maintenance:** Blading, Brushing, Treat 5 DTs/mi **Reconstruction:** Construct Closure Berm
Total	20.4	$176,508	

cy = *Cubic Yards*
DD = *Drivable Dip / Drain Dip*
DT = *Danger Tree*
mi = *Miles*
ML = *Maintenance Level*
MP = *Mile Post*
WB = *Water Bar*

In addition to National Forest System Roads, the project intends to utilize temporary roads. Temporary roads are constructed upon stable native soils and are intended for project use only. These temporary access roads are built or reconstructed in order to access landings needed for logging, and are rehabilitated upon completion of logging in each unit.

To minimize impacts to the environment and natural resources, pre-existing temporary road alignments and alignments of previously decommissioned system roads are utilized wherever practical. There are cases where it is not feasible or it is undesirable to use the same alignments or landings. In some places, in order to protect residual trees, soil, and water, new temporary roads are proposed to access landings where existing system roads and old alignments are not adequate for accessing strategic locations on the ground.

After use, temporary roads would be bermed at the entrance, water barred, decompacted, and roughened as needed with the jaws of a loader or excavator and outlined in the PDCs. Debris such as root wads, slash, logs, or boulders would be placed near the entrance and along the first portion of the road. Table 38 presents the proposed temporary roads to be utilized by timber unit (road lengths are approximate).

Table 38. Temporary Road Construction

Temporary Road Number	Type	Unit	Length (miles)
3	New	19	0.60
4	New	19	0.38
8	Existing	17	0.35
9	New	16	0.41
18	New	17, 18	0.22
21	New	8	0.50
23	Existing	8	0.41
25	New	10	0.57
26	New	9, 10	0.85
29	Existing	7, 8	0.27
30	New	10	0.04
31	Existing	5	0.20
32	Existing	5	0.20
35	New	10	0.63
36	New	10	0.54
37	Existing	1	0.08
38	Existing	1	0.05
39	Existing	1	0.14
40	New	1	0.08
41	New	1	0.10
42	Existing	4, 7	0.68
45	Existing	21	0.08
46	Existing	1	0.05
48	Existing	1	0.24
49	New	2, 3	0.55
53	Existing	2	0.40
54	Existing	2	0.10
55	New	2, 3	0.28
56	Existing	2	0.49
61	Existing	2	0.06

62	New	11	0.71
62	Existing	11	0.10
63	New	11	0.54
64	Existing	11	0.03
65	New	11	0.15
67	New	10	0.46
68	Existing	4	0.10
69	New	4	0.05
70	New	9	0.20
19 Roads	**Total Existing Temp Roads**	---	**4.0 mi.**
20 Roads	**Total New Temp Roads**	---	**7.9 mi.**
39 Roads	**Total All Temporary Roads**	---	**11.9 mi.**

The proposed project would close a number of system roads within the planning area. Site-specific treatments would be tailored to site-specific conditions using one or more of the following treatments:

1. Seasonal Closure – Install a gate to provide seasonal access or closure as needed (remains a system road at current maintenance level).
2. Administrative Closure – Install a gate to provide intermittent administrative access as needed, becomes closed to public use year-round (remains a system road at current maintenance level).
3. Maintenance Level 1 Closure – Install a berm or barrier (remains a system road at maintenance level 1).
4. Stormproofing – Install waterbars or other structures to provide drainage (remains a system road); Retain culverts unless specified; Reduce the depth of fill material over culverts, where appropriate.

Table 39. Year Round Road Closures Road Treatments within Planning area

Road Number	Miles	Current Maintenance Level	Proposed Maintenance Level
3511-015	0.4	2	1
3511-640	0.5	2	1
3512-640	0.7	2	1
Total	**1.6**		

These road closures, as informed by the ATM guidelines, the RMOs, the Forest Plan, and the Watershed Analysis, are intended to produce direct beneficial effects in terms of erosion prevention, aquatic and terrestrial habitat connectivity, and reduced road maintenance liability.

With regard to access and displacement, these status changes affect roads that generally receive no use by trans-forest travelers and low use by the recreating public. When considering the volume and frequency of road use on closures overall by use category, access to management areas by commercial and administrative users would be the categories most heavily affected by the changes. The recreational traffic on these roads is very low. Hunters and campers in the area would still be permitted access to their traditional recreational grounds, but would need to access those grounds by means other than motorized vehicles. This implements limited displacement of winter recreation users such as snowmobilers, and limits potential winter haul of commercial products. Since these roads are only closed to motorized traffic, other winter recreational users such as cross-country skiers and dogsledders would not be displaced.

Cumulative Effects

The spatial scale analyzed for cumulative effects is the planning area, and the time scale is five to ten years based on the anticipated effects associated with road maintenance activities. Roads require regular maintenance to function effectively because maintenance work, by definition, has a limited effect over time. The duration of these effects would vary case-by-case depending on the road surface, geologic stability of the site, type and volume of traffic, and weather conditions, but road maintenance work conducted at any given time can be expected to contribute to the effective functionality of a road prism for an average of about two to three years, in this area, before some road functions begin to deteriorate appreciably.

No future harvest activities are expected to take place on federal land over the next five to ten years. Road status changes such as decommissioning or closure of these roads, which has been analyzed under this Proposed Action would be delayed until completion of operations to avoid waste and inefficient use of government funds.

Given the spatial and temporal boundaries, it is expected that private wood harvest activities would take place on the adjacent lands and inholdings. These activities would conduct haul over roads within the planning area that may overlap in time and space with the haul associated with this project. While the Forest Service does not have enough data to accurately measure the effects of these private industry activities, the Forest Service utilizes Road Use Permits issued to these private companies to implement similar requirements for road maintenance and road use regulations that mimic the transportation Project Design Criteria. Because permitted private haul on Forest roads is mostly limited to collector routes and primary haul routes, the maintenance work that would be conducted under this Proposed Action and maintenance work conducted by private parties would have very limited overlap in time and space and any cumulative effects produced by maintenance work is expected to be negligible. Therefore, it is assumed this type of haul would have similar or identical effects as the Proposed Action with respect to the transportation resource.

3.4.4 Consistency Determination

The Proposed Action plan, with respect to the transportation resource, has been reviewed for consistency with the Forest Plan. All Proposed Actions related to the Forest Transportation System are consistent with the Forestwide Transportation Standards and Guidelines; A2-102 through A2-104, A4-036, 038, 042, and 044, B1-008, B1-077 through B1-079, B2-053 through 055, B2-058 though B2-062, B3-035, B5-032, 033, and 035, FW-407 through FW-411, FW-413 through FW-416, FW-419 through FW-434, and FW-436.

The Forest-wide Roads Analysis (2003) and the project specific transportation analysis documented in this report implements guideline FW-416.

All temporary roads constructed for project use under the Proposed Action would be obliterated and/or blocked and treated to meet or exceed the standards of FW-433 and FW-436.

All other standards and guidelines under the Forest Plan are specifically addressed and enforced through contract provisions included with each individual timber sale, stewardship project, or public works contract and/or the stated Project Design Criteria.

The Project Design Criteria (PDCs) for this project have incorporated the requirements of the Fisheries Biological Assessment (with regard to sediment and erosion control and protection of natural resources where road maintenance and road reconstruction is concerned) and implement the guidance of the Northwest Forest Plan. The Best Management Practices (BMPs) associated with this project together with the applicable road maintenance specifications (USDAFS, 2008) meet or exceed all requirements set forth by the State of Oregon for mitigating and minimizing environmental impacts of road maintenance and road reconstruction under OAR 629-625-0000 and per “Oregon Department of Forestry, State Forests Program, Forest Roads Manual”, 2000.

3.4.5 Summary of Effects by Alternative

No Action Alternative

The No Action alternative for this project would have no heavy haul of materials, no road reconstruction or maintenance, no construction of temporary roads, and no road closures.

Lack of road maintenance would have several measurable detrimental effects on the Forest’s transportation resource. As deferred maintenance would continue to increase while funding for road maintenance continues to decrease, the condition of system roads within the planning area would begin to deteriorate over time, resulting in increased cost to the taxpayer. Road maintenance issues are likely to become road reconstruction issues in times of immediate need. Fire suppression activities, search and rescue operations, and utility infrastructure maintenance/repair activities would be hindered to varying degrees. Forest access for travel, tourism, recreation, and research in the local area is already being negatively impacted by reduced safety and navigability of the roadways and would continue to decline in the absence of road maintenance and road maintenance funding that is typically provided for by timber purchasers or stewardship contractors.

Unused or little used aggregate and native surface roads that are proposed for closure would be overtaken by vegetation in time, and effectively decommission themselves.

Proposed Action Alternative

The Proposed Action would result in increased effectiveness and overall value of the Forest’s transportation system with minimal effect on other resources. Road maintenance and reconstruction work increases the safety and navigability of open system roads for administrative users, commercial users, recreational users, and trans-forest travelers, while decreasing the potential for contamination and sediment delivery to streams and waterways. However, the long term impacts of commercial haul and the incremental impacts of public and administrative use would eventually necessitate the reconstruction or decommissioning of any given system road, with the road’s life span extended by regular maintenance. The costs associated with road reconstruction are substantially higher than that which could be supported by traditional levels of appropriated road maintenance funding at the District level, and continue to require additional funding sources to complete.

3.5 Soil Productivity

3.5.1 Analysis Assumptions and Methodology

Regional soil productivity protection standards were originally implemented in 1976, and have been revised several times since then, including incorporation into the Forest Plan as part of the soil productivity chapter.

Methodology

Soil distribution across this planning area is complicated with several soil types mapped on two distinctively different geographic landscapes on the west and east sides of Highway 35. Each type of soil has been given a soil map unit (number) to show where they occur on the soil map (Figure 29). Each soil type was then assessed for many risks and hazards and assigned management ratings (e.g. erosion risk, compaction hazard), which are located in the Mt. Hood National Forest Soil Resource Inventory (SRI, Howes, 1979). The scale at which the mapping was produced in the SRI is one inch to the mile, which makes it useful as an initial broad-scale planning tool to identify and display maps of possible soil concerns or sensitive areas. The SRI map and overlay of proposed treatment areas was taken to the field and validated, and no changes were needed to reflect what was observed on the ground.

The methodology used to gather data needed for this effects analysis include field visits as well as previous field experience, including monitoring of activities on these and similar soils. Personal observation and knowledge of how soils respond to the proposed types of management actions was used to predict impacts. It is important to note that the previous Polallie/Cooper planning effort information has substantial overlap with this plan, and as much of that information was used as possible. Furthermore, wildland fires in this area and subsequent repair of fire suppression impacts has allowed for additional reconnaissance and observed soil disturbance and recovery.

Analysis Approach

The analysis area for soil resources in this Environmental Assessment (EA) are the proposed treatment blocks. A comparison of alternatives will be conducted using applicable Forest Plan standards and guidelines in

Table 40 as the method of measure to answer the following questions:

- If the Proposed Action is implemented, what assessable changes occur to the soil, and of the changes, which do we use in the analysis to describe the effect?
- What are the risks to the soil and related/associated values from the Proposed Action?
- Is it possible to reduce risks through mitigations or project design criteria?
- What are the consequences of taking no action?

Table 40. Summary of Forest Plan Soil Standards guiding the soils analysis. Full texts of these standards are on pages 4-49 and 4-50 of the Forest Plan

FW – 025 (Page 4-49)	In the first year following surface disturbing activities, the percent effective groundcover by soil erosion hazard class should achieve at least the following levels: **Soil Erosion Hazard Class** – **Effective Groundcover** **Slight to Moderate** – **60%** **Severe** – **75%** **Very Severe** – **85%**
FW – 022, 023 (Page 4-49)	The combined cumulative detrimental soil impacts occurring from both past and planned activities should not exceed 15% of an activity area (paraphrased).
FW – 032, 033, 034 (Page 4-50)	Favorable habitat conditions for soil organisms should be maintained for short and long-term soil productivity. At least 15 tons per acre should be maintained and evenly distributed across managed sites (paraphrased).

For this analysis and project type, the following three criteria will be used to assess impacts and answer these questions.

1. The risk of erosion and subsequent sedimentation of watercourses.

   - **Determined by: Erosion Hazard.** The possible impact of concern stemming directly from soil erosion is runoff from bare areas carrying sediment that could affect watercourses. This hazard rating is based upon a particular soils' texture, slope, etc. for bare soil. Effective groundcover is key to reduce a soils erosion risk. Although surface soils across most of the area are similar, slopes range from 0% to greater than 60%, thus driving variable risk ratings.

2. The risk of causing detrimental soil conditions such as heavy compaction, displacement, and intense burning that alter water movement through the soil and reduce site productivity.

   - **Determined by: Detrimental Soil Condition.** The Forest Plan standard (FW-022, 023) of no more than 15 percent detrimental soil condition in an activity area following project completion would protect site productivity, maintain water movement into and through the soil, reduce erosion risks and associated sedimentation, and protect organic matter. All soils within the planned treatment areas have a low to moderate compaction risk (SRI validated) due to inherent soil properties.

3. The risk of altering the soil biological ecosystem because of insufficient amounts of down woody debris to feed forest carbon and nutrient cycles in the less frequent fire plant communities or the burning of uncharacteristically high amount of organic matter in more frequent fire plant communities.

   - **Determined by: Soil Biology (organic matter levels).** Poor or non-functioning soil biological systems may lead to difficulties in revegetation efforts, or decline in existing desirable vegetation. In and of itself, soil biology is extremely difficult to evaluate because of infinitely complex interactions occurring between organisms and their soil habitats, including physical and chemical characteristics. It is assumed that soil biological systems would properly function given certain habitat components are present, such as non-compacted soils, appropriate levels of organic matter, and types of native vegetation under which the soil developed.

Management actions that displace, severely burn or compact soil or that remove ground cover are considered to result in a greater risk to soil productivity. The analysis will also consider restorative actions as well as the Project Design Criteria/Mitigation Measures (PDC) and best management practices that minimize impact. These actions would include: landing use (some existing landings would be reused and some new landings would be created); skidding with ground based equipment (some would use existing skid trails and some areas would have new skid trails); the use of low impact (low ground pressure) harvester felling equipment; skyline lateral yarding and corridors; temporary road use (some roads are existing, some would be built on top of already disturbed ground and some would be on previously undisturbed ground); post-harvest temporary road and landing rehabilitation; post-harvest erosion control activities; post-harvest landing slash burning; and road maintenance activities that reduce erosion risk. Other aspects of the Proposed Action would not have a meaningful or measurable effect on soil productivity.

Assumptions

The analysis within this report is based on the following assumptions:

- It is assumed damage on skid trails would not exceed 12 feet in width;
- The conceptual layout of logging system patterns have been designed to ensure less than 15 percent of the area is impacted (ground disturbance) within each proposed treatment that uses ground-based equipment;
- This project is designed such that no ground based harvest systems would be used on slopes greater than 30 percent;
- Undisturbed soils meet the Forest Plan groundcover standards; and,
- It is assumed ground impacts would take place during the normal operating season, when soil damage risk is lower than for the same activities occurring in winter.

3.5.2 Existing Condition

European influence in this area began with settlement, some small scale logging, and recreation activities in the first half of the 1900’s. Soils across the planning area have been derived from numerous ashfall deposits, primarily from Mt. Hood eruptions. Prevailing winds have a south or west component to them and as the mountain would erupt, ash clouds would be carried downwind and deposited across the entire planning area. Even today, dust continues to blow off the mountain across the area. Wind, precipitation events, and landslides continue to alter the original depositional pattern by removing ash completely in some places exposing bedrock, and depositing it in others resulting in very thick deposits. Although soil characteristics are generally similar under the forested terrain across the planning area, the landscape on the west side of Highway 35 is very different from the landscape on the east side due to geology, vegetation patterns and species, precipitation pattern, fire, and the human influences of management. There are also some major differences in soil development characteristics from west to east that can be used to help understand vegetation and fire patterns across the planning area. These differences are summarized in

Table 41 and explained in detail in the sections below.

West of Highway 35

The geologic deposits present on the west side include a 500,000 year old series of lava flows overlain by a roughly 20,000 year old series of volcanic pyroclastics and debris flows that were a result of what is commonly referred to as the Polallie volcanic event. These deposits are relatively young compared to those on the east side due primarily to the Hood River fault that trends from north to south through the planning area. A number of smaller faults that trend west to east are responsible for the location of the tributaries that feed the East Fork Hood River. The downthrown side of the Hood River Fault lies to the west of Highway 35, resulting in a landform characteristic consisting of gently rolling ridges with slopes generally less than 50% (the majority less than 30%). There are a few localized areas of rock outcrop where slopes can be very steep, occurring adjacent to Tilly Jane and Polallie Creeks. These drainages are identified as having a high susceptibility to landslides (debris flows), which can be large in size, occur infrequently, and are usually produced by rain on snow events (Middle and East Fork Hood River Watershed Analysis, 1996).

Most of the landscape on the west side is sloping radially away from the Mt. Hood peak, resulting in cool northwest to easterly aspects. Major climax plant communities include western hemlock, pacific silver fir, and mountain hemlock zones with western hemlock on the warmer sites and mountain hemlock on the coldest. Other seral tree species present include lodgepole pine, Douglas fir, ponderosa pine, western white pine, grand fir, noble fir, western larch, and western red cedar.

Soil types occurring where activities are proposed include 380, 333, 169, and 168 in the Mt. Hood National Forest (NF) Soil Resource Inventory (SRI) (Howes, 1979). These are deep, loamy, well-drained, productive soils, and are less rocky than described in the SRI. Rock contents from soils examined in the field were rarely more than 5%. The deep, loamy nature of the soils allows them to store adequate moisture for the growing season. Factors limiting growth here include cool soil temperatures and nutrient availability. These soils are beginning to develop what is called a spodic horizon. They develop over time where organic matter persists on the soil surface long enough to for organic acids to leach out of the duff and bleach out the surface mineral soil. Spodic development is fairly widespread in the west (map units 380 and 333), but becomes very spotty toward the east, occurring only where large amounts of older, well-rotted organic matter is present. Nutrients on these sites are stored in the duff layer, woody debris, and a very thin light brown topsoil that is found just above the thin (an inch or less), developing spodic horizon. The light gray soil below the topsoil (commonly referred to as subsoil) is relatively nutrient poor.

Taking into account field conditions that differ from the SRI, the surface erosion potentials are estimated as slight to moderate. Erosion ratings are based upon bare soil (no vegetative or duff cover). The compaction hazard is estimated as low to moderate, and the susceptibility to soil displacement is moderate. Soil ratings are summarized below in Table 42.

East of Highway 35

Just across the East Fork Hood River and Highway 35 the landform and vegetation change drastically. The geologic deposits on the east side include the East Fork, Tumble Creek, and Dog River lava flows that are approximately 80 to 600 feet thick and are nine million to 700,000 years old (Sherrod, D.R., and Scott, W.E., 1995). The upthrown side of the Hood River Fault forms the fault escarpment east of Highway 35 and is responsible for the long steep slopes we see today. Slopes from 40-60% are common with areas of rockslides adjacent to the East Fork. Many of the smaller east to west faults in the area route groundwater flow and are responsible for the headwater springs that eventually join to concentrate water that has eroded channels over many centuries, thus forming a number of small tributary drainages on the escarpment. These drainages are identified as having a high susceptibility to shallow landslides (debris flows), which are usually small in size, but more frequent than the west side due to the steeper slopes and thin soils (Figure 29). Historically, landslides on the east side were probably instigated by severe wildfire that would kill the large trees that provided root strength and acted as pumps to remove groundwater. Once dead a few years, roots would decompose. As root strength would decrease so would soil stability and cohesion, followed by landslides that would deliver sediment, rocks and logs to the East Fork.

The landscape on the east side faces west for the most part, except in the draws where there is a slight north or south aspect, and where the landscape rolls over into Dog River. Major climax vegetation zones on these hot south and west slopes include ponderosa pine, Douglas fir, and grand fir, with ponderosa pine being the warmest and grand fir the coolest. Other seral tree species present include lodgepole pine, western white pine, western larch, Engelmann spruce, and western red cedar.

Soil types occurring where activities are proposed include 168, 210, 211, 212, 213, and 211-7 as defined in the SRI. These soils differ from those on the west side in the following ways: they are generally not as deep due to eons of erosion on steep terrain; there are more frequent, larger patches of exposed rock (especially map unit 211-7) and thin soils that become droughty during the summer months because of aspect, rock content, shallow depth and lack of precipitation; they have evolved under a more frequent fire regime, which has resulted in stands of large diameter fire resistant tree species and supports more of a grass/forb understory where the canopy is not closed; and they store more nutrients in the mineral soil itself, rather than just a thin topsoil, duff, and old logs. These soils have a dark, well-structured surface horizon evident of high organic matter content referred to as a mollic horizon. They develop where perennial grasses and forbs dominate (or used to dominate) the understory. The decay of fine roots from grasses and forbs leads to an accumulation of organic matter in the topsoil. Soil types 168, 210, 212, and 213 are transitional, and exhibit both spodic and mollic characteristics within the same map unit (but not at the same time). This area is a mosaic, where organic matter would come and go with fire, yet remain shady enough in pockets to deter the growth of an understory. Fire exclusion has brought about a domino effect of broad scale changes to vegetation species composition and structure, which has allowed fire sensitive species to encroach resulting in denser stands of trees, thus affecting soil properties. As more open stands have closed in, understories of grasses, forbs, and shrubs have been increasingly shaded out, changing the soil development pathway from mollic to spodic. Sites then begin to store their nutrients more in duff, coarse woody debris, and additional trees, rather than in the topsoil. This is not a desirable situation because if fire should occur under these conditions the results could be severe. One older shelterwood stand (Thorhead sale, logged in 1991) supports a very dense understory of native grasses and forbs not present in adjacent shady stands, indicating the potential for sites to reverse this trend by replacing unvegetated duff layers with a more stable network of fine roots. This is a more desirable situation because if fire does occur, the fine roots hold soil in place and plants usually resprout the following year.

In the most productive areas on the east side, soils were found to be sufficiently deep and loamy to support either dense stands of trees or more spaced out larger trees (sometimes both in the same stand). Factors limiting growth on the east side include hot summer temperatures and availability of water and nutrients.

The soil erosion potentials and compaction hazards are moderate. As explained above, erosion ratings are based upon bare soil (no vegetative or duff cover). The susceptibility to soil displacement is moderate to high.

Table 41. Summary of soil distribution with associated landscape factors across the planning area.

	West *East*
SRI map unit	380 → 333 → 169 → 168 → 212 → 213 → 211-7
Soil characteristics	Widespread Spodic → Spotty → Transition → Low Mollic → High Mollic Development
Upland Veg.	Mt. Hemlock → Silver fir → W.Hemlock → Doug fir/Grand fir → Pond. Pine → Grassland
Climate	Cooler, wetter → Warmer, dryer
Organic matter	Average ≥25 tons and six logs per acre → Average 10 tons and one log per acre*
Fire frequency/type	Less frequent/stand replacing → More frequent/underburn
Landslides	Less frequent, larger → More frequent, smaller

** From Managing Coarse Woody Debris in Forests of the Rocky Mountains (Graham, et.al., 1994)*

Table 42. Summary of soil types in the analysis area where actions are proposed, and associated management interpretations from Mt Hood Soil Resource Inventory, adjusted based upon field observations.

SRI Soil Map Units Underlying Proposed Treatment Blocks	Compaction Hazard on Proposed Ground Based Harvest	Erosion Potential (bare surface soil) on all Proposed Treatment Blocks	Susceptibility to Displacement on Proposed Aerial Harvest Methods
168	Moderate	Moderate	N/A
169	N/A	Moderate	Moderate
210	N/A	Moderate	Moderate
211	N/A	Moderate	Mod-High
212	N/A	Moderate	Mod-High
213	N/A	Moderate	Mod-High
333	Low-Mod	Slight	N/A
380	Moderate	Slight	N/A

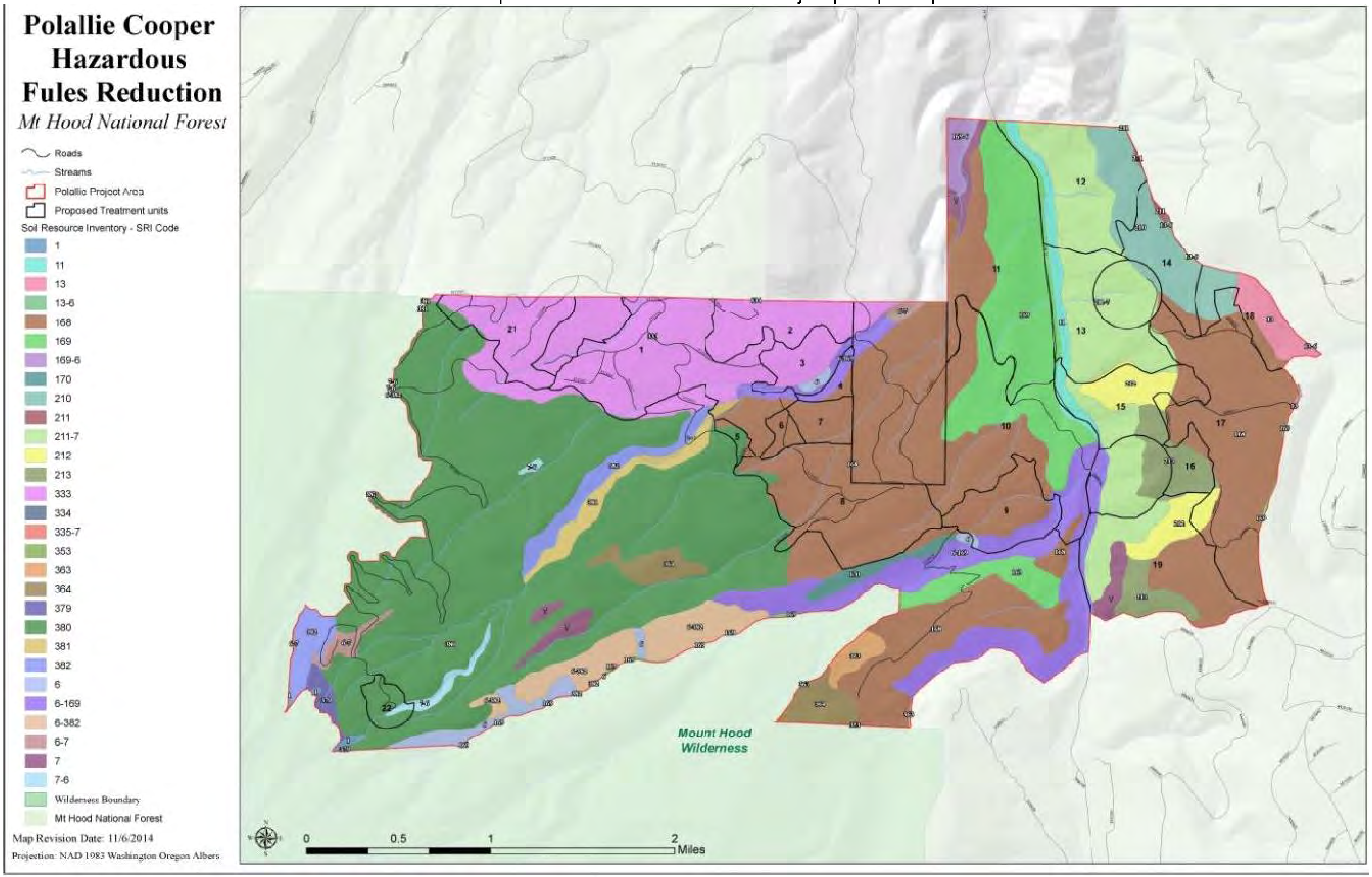

Polallie Cooper Hazardous Fules Reduction
Mt Hood National Forest
Roads
Streams
Polallie Project Area
Proposed Treatment units
Soil Resource Inventory - SRI Code
1
11
13
13-6
168
169
169-6
170
210
211
211-7
212
213
333
334
335-7
353
363
364
379
380
381
382
6
6-169
6-382
6-7
7
7-6
Wilderness Boundary
Mt Hood National Forest
Map Revision Date: 11/6/2014
Projection: NAD 1983 Washington Oregon Albers
Mount Hood Wilderness
0
0.5
1
2
Miles

Figure 29. Soil map and proposed draft treatment blocks across the planning area.

3.5.3 Effects Analysis

No Action Alternative

Soil Erosion Risk: The risk of erosion within the analysis area would remain unchanged because the amount of groundcover protecting the soil surface from erosional influences is common and widespread. The expected effect is the landscape would respond and change proportionate to the severity of natural events, such as storms or wildfire.

Detrimental Soil Conditions: It is assumed that soils damaged by previous activities would continue to recover and change at an unknown rate as roots, animals, and other influences slowly break up existing compaction. The effect of soil recovery is a gradual increase in available soil (therefore nutrients and water) for all normally expected soil biological, chemical, and physical functions to occur.

Organic Matter Levels: Soil organic matter and corresponding soil functions would continue without much change. Similar to erosion risk, the expected effect is that the soils at landscape and site scales would respond and change proportionate to the severity of natural events, such as storms or wildfire. In addition, organic matter decomposition is influenced substantially by temperature, moisture, and fire, thus the rate of decay and cycling would continue accordingly.

It is possible, under certain wildfire scenarios, that erosion risk, soil damage from high intensity burning, and loss of organic matter could be substantial. It is not possible to predict with any certainty however, and taken as a whole in the big picture, the existing condition puts soils at a potentially higher risk overall than the Proposed Actions that reduce fuel and return the landscape to a fire type and return interval under which they developed prior to fire suppression.

Proposed Action Alternative

Current and Predicted Changed Conditions Caused by the Proposed Action

Soil erosion risk: No active erosion from previous vegetation management was observed during the field reconnaissance for this project. All blocks proposed for treatments are expected to meet the effective groundcover standard following ground disturbing activities.

Detrimental soil conditions: The results of soil quality field surveys performed over several years are shown in

Table 43 below. Monitoring occurred on glacial soil types that exist within the planning area, or on soil types expected to respond in a similar fashion. All areas listed as proposed were either been clearcut many years ago, or have had some kind of on-the-ground impacts from scattered tree removal. All areas monitored post logging were within the 15 percent detrimental soil condition standard. The Forest has seen a steady trend of improvement in meeting this standard, which was commonly exceeded from the 1980's through the mid-1990's (Mt. Hood Forest Plan Monitoring Report, 2006). Reduced impacts may be attributed primarily to the following: major changes in practices, such as the elimination of machine (dozer) piling of logging slash; lower ground pressure machinery that reduce compactive forces; and an awareness that soil damage was exceeding acceptable levels with a conscious effort to reduce damage. The one major change in operations that led to the greatest decrease in soil damage was moving away from dozer piling to more grapple piling of slash.

Table 43. Summary of stands monitored with shovel probe transects.

Sale Name and Unit Number or Planning Unit Number	Year Monitored	Silvculture Treatment	Logging System	Fuel Treat-ment	% Monitored Detrimental Soil Impacts
BS Thin 43	2009	Proposed Thinning	N/A	N/A	Less than 2
BS Thin 58	2009	Proposed Thinning	N/A	N/A	Less than 2
BS Thin 59	2009	Proposed Thinning	N/A	N/A	Less than 3
BS Thin 64	2009	Proposed Thinning	N/A	N/A	Less than 2
BS Thin 70	2009	Proposed Thinning	N/A	N/A	Less than 3
BS Thin 76	2009	Proposed Thinning	N/A	N/A	Less than 3
Bear Knoll 145	1999	Proposed Thinning	N/A	N/A	1
Bear Knoll 169	1999	Proposed Thinning	N/A	N/A	1
Juncrock 8	1999	Proposed Thinning	N/A	N/A	3
Hi-Thin 1	2009	Thinned	Processor	MP	3
Hi-Thin 2	2009	Thinned	Processor	MP	Less than 3
Chee 18	2003	Thinned	Feller Buncher, Rubber tired skidder	MP	13
Yaka 21	2000	Thinned	Feller Buncher, Rubber tired skidder	MP	6

MP = Fuel concentrations were machine piled with small excavator.

The conceptual layout of logging system patterns for the proposed treatment areas have been designed to ensure less than 15 percent of the area is impacted (ground disturbance) within each individual stand that uses ground-based equipment. Since ground disturbance does not equate with detrimental soil condition, and design already has impact area below 15 percent, it is not expected that any of the proposed treatment areas would exceed the Forest Plan standard. Soils underlying skid trails nearest landings are most likely to incur detrimental damage because they receive the most trips with equipment. Further away from landings, soils are impacted less and less as fewer trips occur over them. The past several years of Forest Plan monitoring results indicate a clear trend in the reduction of detrimental impacts due to the increasing use of low ground impact machinery. Observations during monitoring indicate obvious detrimental impacts on main skid trails and landings that receive numerous trips with higher impact machinery (such as skidders) with much less impact on lateral trails, and within the unit where harvester equipment typically works. As an example, in July 2006, a thinning unit in the West Fork Hood River watershed was yarded with a large log loader. Random shovel probes occurring right behind the machine as it moved through the unit showed no detrimental damage at all, and barely an imprint on the ground.

Organic matter levels: Given the amount of material left standing on site, as well as expected slash loading, it is likely additional organic matter levels (tonnage) would be left on the ground verses up in the canopy for site productivity purposes.

Effects Resulting From Changing Conditions

Soil Erosion Risk: Soil erosion risk would increase with the Proposed Action because bare soil would be exposed during implementation. As the amount of bare, bare/compacted soil increases, so does the risk of soil movement. Actual resource damage (erosion and/or sedimentation) is dependent on weather events that provide the energy to move soil material from one location to another. In order to diminish this risk while soils are exposed, certain erosion control techniques are practiced to lessen erosive energies. The effectiveness of these 'Best Management Practices', or BMP's, is discussed by Rashin et.al. (2006) in an applicable publication of the Journal of the American Water Resources Association. Comparing the Proposed Action to their application of studied BMP's would indicate that the proposed buffers and logging system design criteria would substantially reduce the risk of resource damage should a storm event occur while the ground is exposed. For example, the study showed an assessment of surface erosion and sediment routing during the first two years following harvest indicated a 10 meter (approximately 30 feet) setback from ground disturbance can be expected to prevent sediment delivery to streams from about 95 percent of harvest related erosion features. The PDC's in this project uses setbacks from nearly double to 10 times that distance, in addition to directional felling and hand treatments (i.e., no machinery) that would further reduce erosion features and disturbance. In conclusion, by maintaining proper amounts of protective groundcover along with BMP's and PDC's, the risk of erosion and subsequent sediment delivery caused by the Proposed Action is extremely small.

Detrimental Soil Conditions: Impacts caused by heavy equipment would increase the amount of detrimental soil damage within the treatment areas. This increase is not expected to exceed Forest Plan standards. Therefore, there would be no accompanying measurable decrease in site productivity in the units. The Changed Condition section above explains how logging systems are expected to impact the ground based treatment areas.

Organic Matter Levels: Sufficient tonnage is expected to remain on site to provide for organic matter input to the ecosystem once all activities are complete. In thinning areas there would be substantial future organic matter left standing in addition to material on the ground, although there is a slight possibility localized acreage would be lower than Forest Plan standards for organic matter in the higher fire frequency areas within the thinning project on south and west facing slopes. When this occurs, it is not expected to be a substantial impact to nutrient cycling because these are ecosystems where fire typically moved through very quickly, thus retaining substantial organic matter reserves in the mineral topsoil due the way in which they have developed.

The same conclusion applies for the underburning treatments.

Cumulative Effects

The cumulative effects project list in Chapter 3 has been reviewed and no activities overlap in either time or space within the soils analysis areas. Therefore, no adverse cumulative effects are expected. The method of soils analysis is cumulative by nature as explained in the Mt Hood Forest Plan (specifically FW-22). More clearly stated, an area (proposed unit) is evaluated by considering previous damage (if any) that still meets the detrimental condition definition, plus any expected detrimental soil impacts caused by the Proposed Action.

3.5.4 Consistency Determination

The Proposed Action is consistent with all applicable laws, regulations, and Forest Plan guidance with the exception of the Soil Organic Matter standard in small, localized locations.

3.6 Water Quality

3.6.1 Analysis Assumptions and Methodology

The following effects analysis utilizes research, relevant monitoring, field data and modeling to provide a context, amount and duration of effects for each of the alternatives.

GIS analysis and additional modeling were completed for a variety of site conditions and parameters in the planning area. The Aggregate Recovery Percentage (ARP) model was used to determine whether watersheds in the planning area would meet the Mt. Hood National Forest Land and Resource Management Plan (Forest Plan) standard FW-064 dealing with Watershed Impact Areas. The ARP model is a standard tool used by many Forest Service resource specialists throughout the Pacific Northwest. The model calculates the "hydrologic recovery" of a watershed, which is based on the amount of human and natural caused vegetation disturbance. This disturbance usually results from timber harvest, wildfire and road building. In addition, some representative sediment erosion and transport concentrations are derived from the Forest Service Watershed Erosion Prediction Project (WEPP) Model. Documentation of the model, assumptions and limitations can be found on the website: http://forest.moscowfsl.wsu.edu/fswepp, and available in the project record located at the Hood River Ranger District in Parkdale, Oregon.

Some considerations about strengths and weaknesses associated with the analysis approach discussed above include the following.

Table 44. Strengths and Weaknesses of the Water Quality Analysis Approach

Analysis Method	Strength	Weakness
Aggregate Recovery Percentage (ARP) Model	Gives a good general idea about potential hydrologic recovery in a basin. Model works well when followed up with field data such as stream surveys.	Model utilizes a number of GIS results and a growth simulation model to determine recovery. These may differ somewhat from what is actually on the ground due to mapping inaccuracies and actual site conditions.
GIS Generated Site Data	Provided more site-specific data for effects analysis. This led to a more accurate effects analysis.	Since layers in GIS are updated as new, more accurate data becomes available, there may be some inaccuracies in current mapping. Accuracy depends on the level of field verification and ownership.
Effectiveness of Aquatic Best Management Practices (BMP) and Project Design Criteria (PDC)	Effectiveness of various erosion control measures in reducing erosion is well documented. General effectiveness of buffers in reducing sediment and other impacts is well documented.	Effectiveness of various buffer widths on reduction of effects to surface water is not extensively documented in a wide variety of physical settings.
WEPP Model	Some of the model input parameters can be adjusted to reflect site conditions. This resulted in more	Not able to adjust all of the variables that reflect all of the actual physical conditions in the planning area.

Analysis Method	Strength	Weakness
	accurate representations of potential erosion and sediment delivery	
	Model results give an actual value for erosion and sediment delivery.	Model results have been documented to underestimate actual amounts of erosion and sediment delivery (Welsh, 2008). The model documentation states that results can be up to + or – 50% of actual amounts.
Stream Inventories	Provide more site-specific data for effects analysis. This data has been collected in a Nationally standardized protocol by trained resource professionals.	Some of the inventories are older and some conditions may have changed between the time the data was collected and the present time.

The following assumptions are utilized in the Water Quality Analysis:

- All Best Management Practices (BMP) and Project Design Criteria (PDC) listed in Environmental Assessment (EA), Chapter 2 Section 2.3 would be implemented and effective as described in the BMP Table in Appendix 2.
- The areas of impact outlined in EA, Chapter 2 are actual areas of disturbance.
- Monitoring implementation and effectiveness of BMP and PDC would be a component of project implementation.
- All surface water areas have been identified through field work.

3.6.2 Existing Condition

The Polallie Cooper Hazardous Fuels Reduction project is located primarily within portions of seven 7th field watersheds, 13F (Crystal Springs), 13E (Dog River), 13P (East Fork Hood River), 13Z (East Fork Hood River, Lower Reach), 13B (Evans Creek), 13H (Polallie Creek) and 13G (Tilly Jane Creek). The 7th field watersheds are located in the Upper, Middle and Lower East Fork Hood River 6th field sub-watersheds and the East Fork Hood River 5th field watershed. These 7th field watersheds were used as the basis for the site-specific analysis, while the 6th field sub-watershed was used for other, larger scale cumulative effects analysis and compliance with the Northwest Forest Plan (NWFP) Aquatic Conservation Strategy Objectives. A portion of one treatment block (11 acres) is located in the 25F (Eliot Branch) 7th field watersheds, but the treatment block comprises 0.4 percent of the total watershed area. The affected area of the project is only anticipated to include portions of 13B (Evans Creek) and 13Z (East Fork Hood River, Lower Reach) 7th field watersheds; therefore these portions were used to analyze direct/indirect effects from the project. To address cumulative effects to estimate the change in watershed impact areas, the entire 7th field and 6th field watersheds were assessed. Effects are expected to be limited due to the small amount of disturbance and would not be included in the analysis for this document. All of the activities for the restoration project are subject to all applicable BMP and PDC regardless of their location.

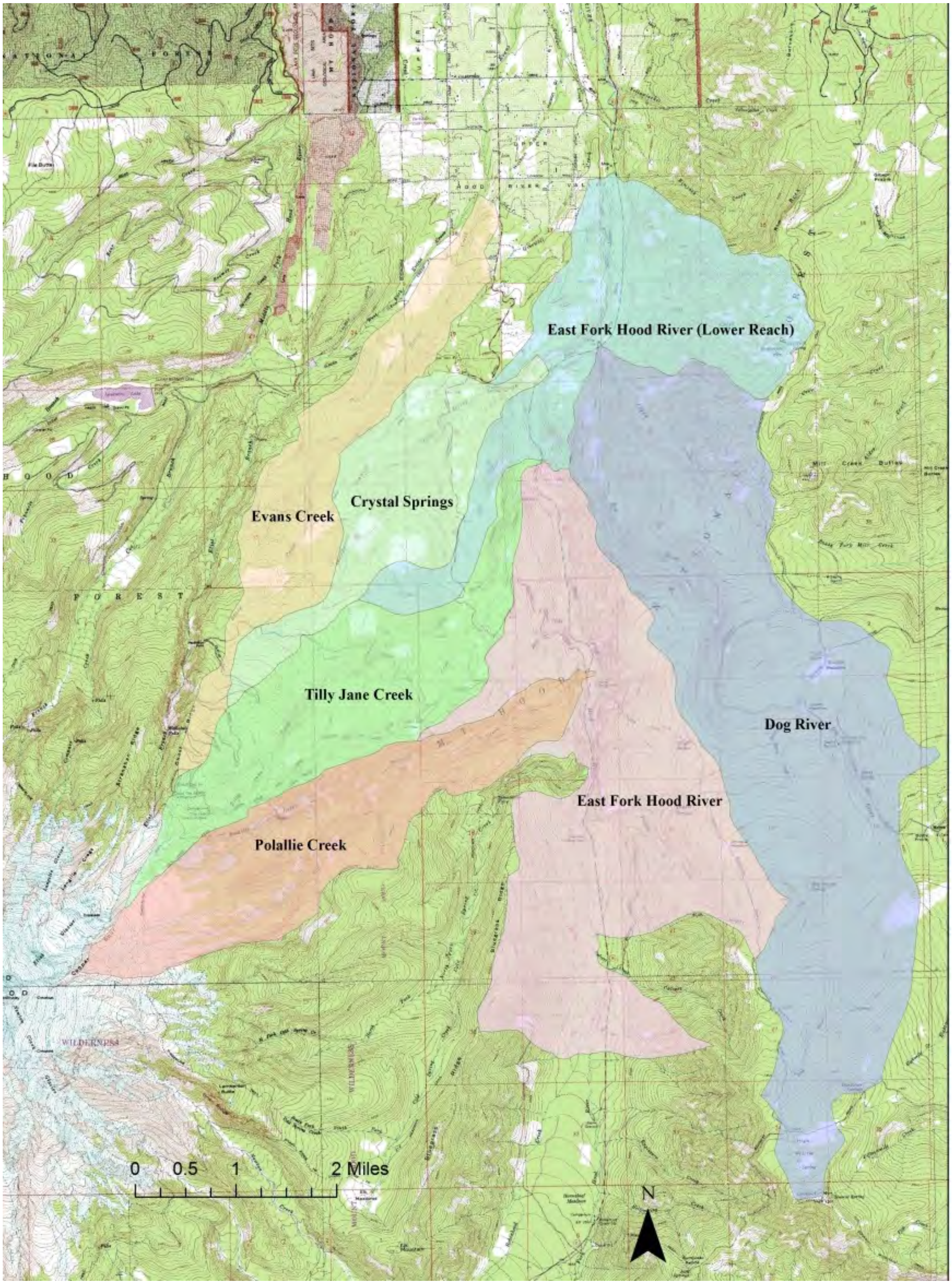


Figure 30: Map of the Water Quality Analysis Area showing 7th field watersheds

There are many streams, springs and wetlands located within these watersheds. The primary streams include East Fork Hood River, Polallie Creek, Dog River, Evans Creek, and Tilly Jane Creek. There are approximately 119 miles of stream in the National Forest portion of these 7th field watersheds in the following categories: 55 miles of perennial streams (flow year around) and 64 miles of intermittent streams (streams that dry up for part of the year).

Water Quality

Rivers, streams, and lakes within and downstream of the treatment areas are used for boating, fishing, swimming, and other water sports. Additionally, the Forest streams provide habitat and clean water for fish and other aquatic biota, each with specific water quality requirements. The Clean Water Act (CWA) protects water quality for all of these uses.

The CWA requires States to set water quality standards to support the beneficial uses of water. The Act also requires States to identify the status of all waters and prioritize water bodies whose water quality is limited or impaired. For Oregon, the Department of Environmental Quality (DEQ) develops water quality standards and lists water quality limited waters. In addition, Region 6 of the Forest Service has entered into a Memorandum of Agreement (MOA) with the Oregon State DEQ to acknowledge the Forest Service as the Designated Management Agency for implementation of the CWA on National Forest System (NFS) lands. In an effort to support the CWA, the Forest conducts a variety of monitoring and inventory programs to determine status of meeting state water quality standards as well as other regulatory and agency requirements. In an average year, approximately 50 sites are monitored for water temperature throughout the Forest. In addition, other water quality monitoring occurs at various locations depending on the year. This could be turbidity monitoring, instream sediment sampling, water chemical sampling, or surveys of physical stream conditions. Currently, approximately 25 miles of physical stream habitat is surveyed every year and to date approximately 1300 miles of stream have been surveyed. Some of the information collected during these surveys includes the number of pools and riffles, amount of large wood, riparian area condition and types, and numbers of fish and other aquatic organisms.

By direction of the CWA, where water quality is limited, DEQ develops Total Maximum Daily Load (TMDL) plans to improve water quality to support the beneficial uses of water. For water quality limited streams on NFS lands, the US Forest Service provides information, analysis, and site-specific planning to support state processes to protect and restore water quality. The TMDL plan for water temperature for streams in the planning area (West Hood Sub-basin) was completed and accepted by the EPA in 2002. In this document, DEQ concluded that standard and guidelines in the Forest Plan and the Northwest Forest Plan “meet the requirements of a TMDL management plan” (ODEQ 2001). In addition to stream temperature, Polallie Creek, East Fork Hood River and Polallie Creek Tributary are all listed as Category 5 – Water Quality Limited for Biological Criteria in the 2010 Oregon State Water Quality Integrated Report. Polallie Creek and East Fork Hood River are listed as “Category 3 – Insufficient Data” on the same report for sedimentation.

Stream Temperature

Water temperature data has been collected by the Forest Service on the above mentioned stream systems for several years. Data has been collected on continuous temperature recording dataloggers in five locations within or directly adjacent to the planning area (Figure 31).

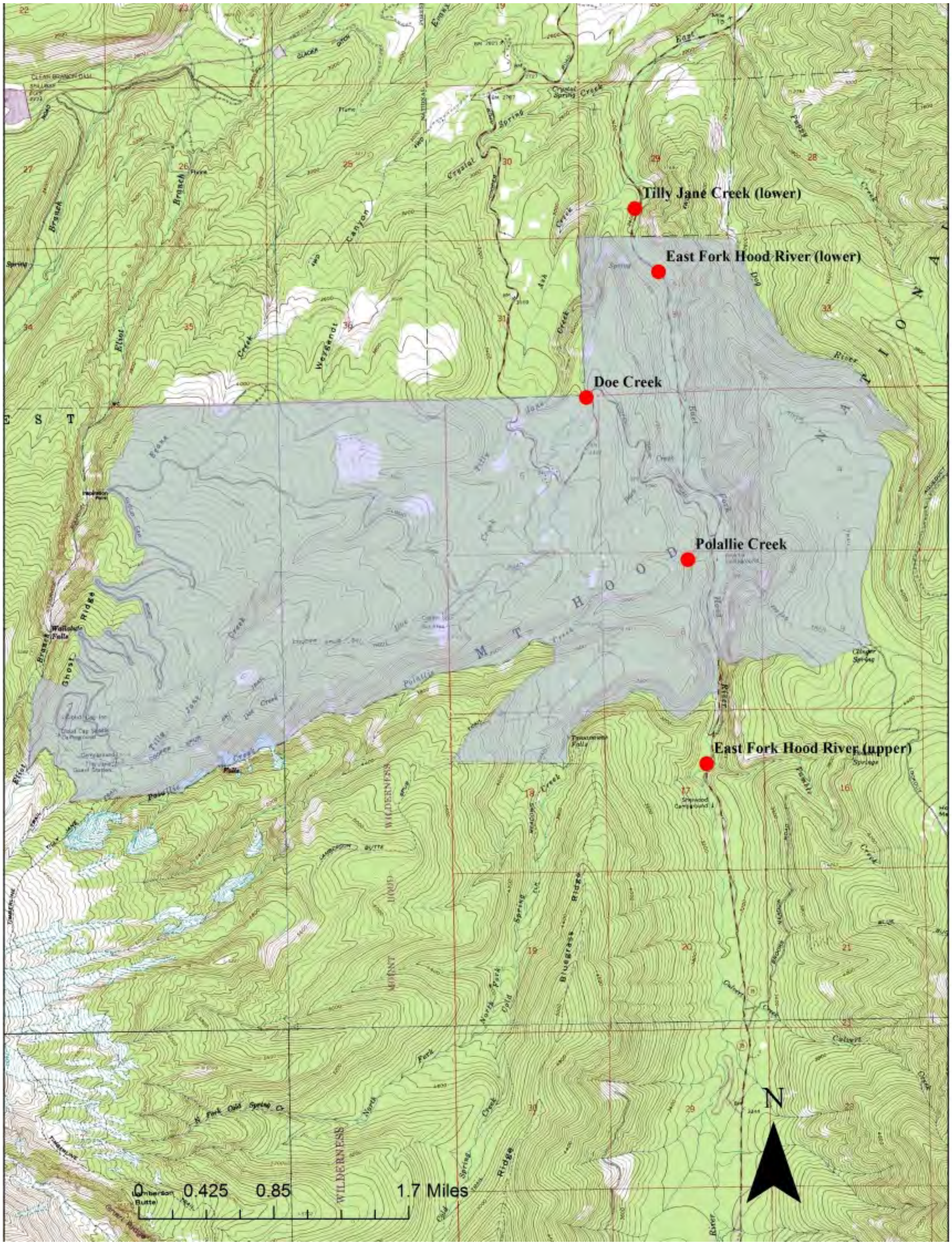


Figure 31. US Forest Service Water Temperature Monitoring Sites. Sites are red circles and the Polallie Cooper Hazardous Fuels Reduction Planning area is shown in blue.

The highest 7-day average maximum stream temperatures for the years deployed ranged as follows.

Table 45. Highest 7-Day Average Maximum Stream Temperatures in the Analysis Area (Celsius)

Stream	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Dog River	14.1	10.9	11.8	12.1	12.8	11.7	12.7	13.5	13.0	ND	ND	ND	ND	ND
Doe Creek	ND	ND	ND	ND	10.5	10.0	10.3	12.3	10.4	ND	11.9	11.6	ND	ND
E. Fk. Hood River - Lower	15.9	12.7	13.3	13.0	ND	13.2	14.6	17.1	14.5	16.6	16.5	17.3	15.5	16.4
E. Fk. Hood River - Upper	ND	ND	ND	ND	ND	ND	13.6	15.8	15.5	15.5	15.6	16.4	ND	ND
Tilly Jane Creek - Lower	ND	ND	ND	ND	8.6	10.0	10.0	10.6	10.5	10.4	10.8	10.2	ND	ND
Polallie Creek	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	17.8	17.5	ND	ND
ND = Not Deployed for that Year														

Table 45 illustrates some cold water temperatures within the planning area, due primarily to a contribution of flow from groundwater and glacial sources. Tilly Jane Creek has groundwater influence while East Fork Hood River water temperatures are somewhat influenced by glacial meltwater. Stream surveys also noted cool water temperatures in Crystal Springs Creek, Dog River and Doe Creek suggesting these streams also have a moderate to strong groundwater influence.

Stream Channel Condition and Sediment

Streams on the east side of the planning area are characterized by high channel gradient headwaters and moderate gradient, confined middle sections. They typically start out as Rosgen "A" channel types in the extreme upper portions of the streams and grade into "B3" and "B4" channel types throughout the rest of the planning area as shown in Figure 32 (HRRD stream surveys, 1997, 2000 and 2003). The "B" channels are generally stable and Rosgen (1996) identified this channel type as having "low to moderate" sensitivity to human disturbance. He also identified riparian vegetation as having a "negligible to moderate" controlling influence on the stability of "B" channels. These channel types are generally not a large source of sediment resulting from channel bed and bank erosion. "A" channels are high gradient channel types that have a very low to extreme sensitivity to disturbance depending on the type of material it has cut down through. They are generally a high source of sediment naturally, due to the steep surrounding terrain. Riparian vegetation has a negligible influence on channel stability.

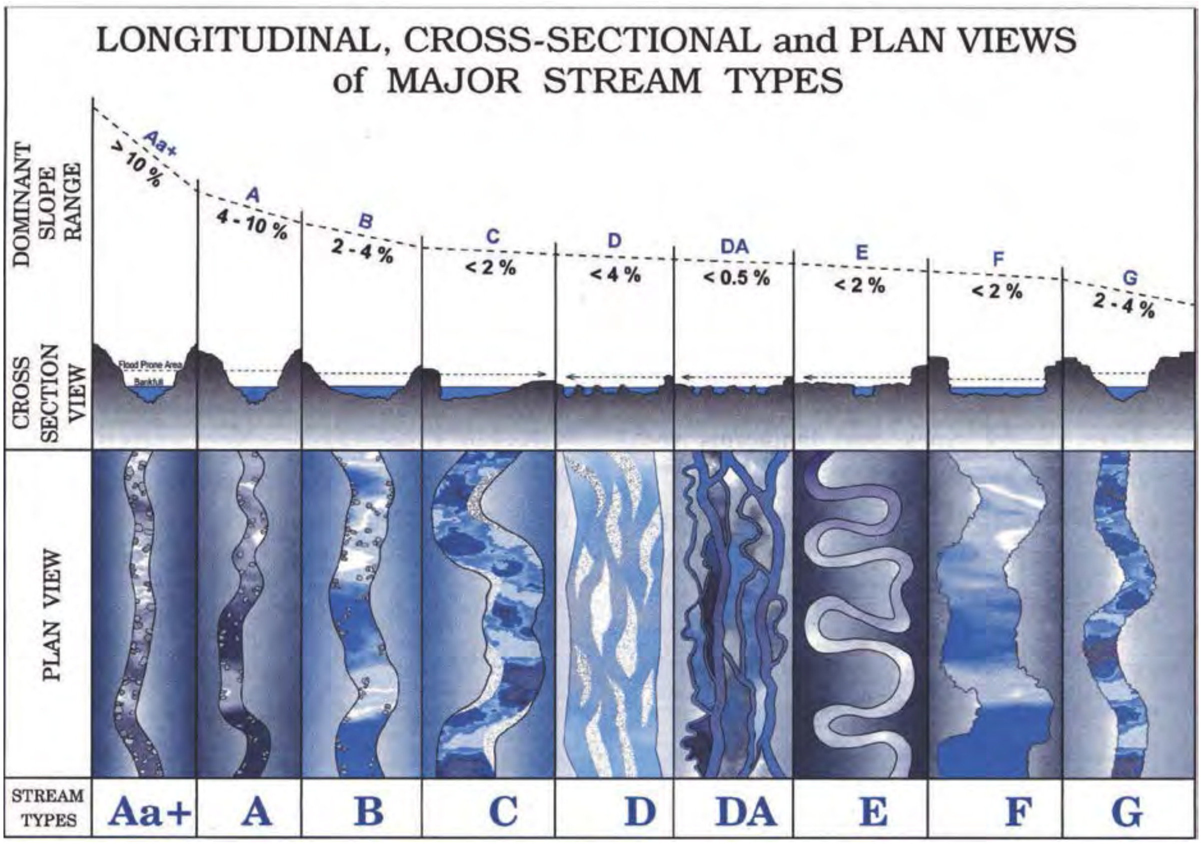


Figure 32. Illustration of the Rosgen classification of major stream types (A-G), delineated based on entrenchment, sinuosity and slope ranges

Stream surveys conducted in Doe Creek and Dog River support the characterization of stable stream banks and channel bed in "B" type channels and fairly stable "A" type channels. No bank erosion was noted in the Dog River stream survey. The stream survey for Doe Creek stated "bank stability and erosion are not problems in Doe Creek or the tributary. It appears some downcutting was occurring with some slumping banks and undercut banks present. Reaches 1 and 3 had 0 percent unstable banks while Reach 2 had 1.5 percent unstable banks. These are well within the properly functioning conditions…" The East Fork Hood River stream survey noted "moderate bank erosion" primarily from undercut banks. Bank instability ranged from 1.1 percent to 5 percent in the 14.3 mile survey area. The survey states "Much of the unstable bank in the East Fork Hood River is occurring naturally due to the unstable nature of the stream and also the bank material." A possible explanation for the unstable streambanks below the Polallie Creek confluence is that these river terraces represent deposits from the 1980 Polallie Creek debris flow and dam break flood. This debris flow deposited approximately 100,000 yards of saturated, poorly sorted debris to a maximum thickness of 35 feet in the East Fork Hood River. Subsequent stream erosion has left numerous unstable, eroding banks. Additionally, natural debris flows originating from the Newton Creek and Clark Creek drainages deposited large amounts of bedload and suspended sediment in the East Fork Hood River. Several events in the 2000 to 2006 period scoured and deposited material for at least 10 miles downstream from the source area. This sediment continues to be transported and deposited down the river and would continue to do so for many years. It should also be noted that a portion of the upper Tilly Jane basin burned with a moderate to high severity in the 2008 Gnarl Ridge Fire. This may result in higher levels of sedimentation in the area but those levels should be decreasing as vegetation recovers in the basin.

Natural turbidity in the form of glacial meltwater is present in one stream in the analysis area. East Fork Hood River has glacial influence and higher natural turbidity rates. Turbidity is the measure of the ability of light to pass through water, and is influenced by the amount of suspended sediment and other material in the water sample (MacDonald et al., 1991).

Another potential source of coarse and fine sediment to surface water in the area is roads. Sediment can wash off road surfaces into adjacent streams. The potential for erosion is highest on native surface (dirt) roads and lowest on paved or asphalt roads. Road density (miles of road per square mile of basin) can be used as a general indicator of potential problems associated with roads. Road densities within a watershed that exceed 3.0 miles per square mile indicate areas that should be examined more closely for specific sediment related problems, although it is possible to have isolated areas of road instability even in areas of low road density. This value is based on professional judgment by local Forest Service hydrologists, fish biologists, and earth scientists. Table 46 displaying total specified road densities for 7th field watersheds within the planning area.

Table 46. Watershed Road Density

Watershed	Road Density (mi/mi^2)
Crystal Springs Creek	3.4
Dog River	2.3
E. Fk. Hood River	2.5
E. Fk. Hood River (Lower Reach)	0.8
Evans Creek	2.2
Polallie Creek	0.1
Tilly Jane Creek	2.5

All but one of the 7th field watershed road densities are below 3 mi/mi^2 (miles per square mile) due in part to past road decommissioning efforts. The Crystal Springs Creek stream survey (2003) was examined to determine if indications of degradation related to high road densities were detected. These may include a high percentage of fine substrate, channel bank erosion, high width to depth ratio or general comments relating to sediment accumulations observed. The Crystal Springs Creek Stream Survey did not note concerns associated with of any of these attributes.

Gnarl Ridge Fire

A wildfire burned across a portion of the analysis area in the late summer/early fall of 2008. The Gnarl Ridge Fire burned approximately 1984 acres in portions of Crystal Springs, Evans Creek, Polallie Creek and Tilly Jane Creek 7th field watersheds. Burn severity ranged from low/unburned to high severity, with a majority of the high severity burn occurring in Tilly Jane Creek 7th field watershed. Burned Area Emergency Response (BAER) treatments including aerial straw mulch application on some high severity burn areas, erosion control measures on the Wagon Road in the Historic District and hydromulch and erosion control measures on the 3512 road were completed in the fall of 2008. These measures were focused on reducing fire related erosion, sedimentation and runoff and located primarily in the Tilly Jane Creek watershed. The burn area is currently recovering and ground cover has returned to most of the area.

Figure 33. 2015 photo showing a high severity burned area in the Tilly Jane watershed. Note the returning ground cover vegetation and trees. Down wood in background is providing natural erosion control, sediment and water flow storage.

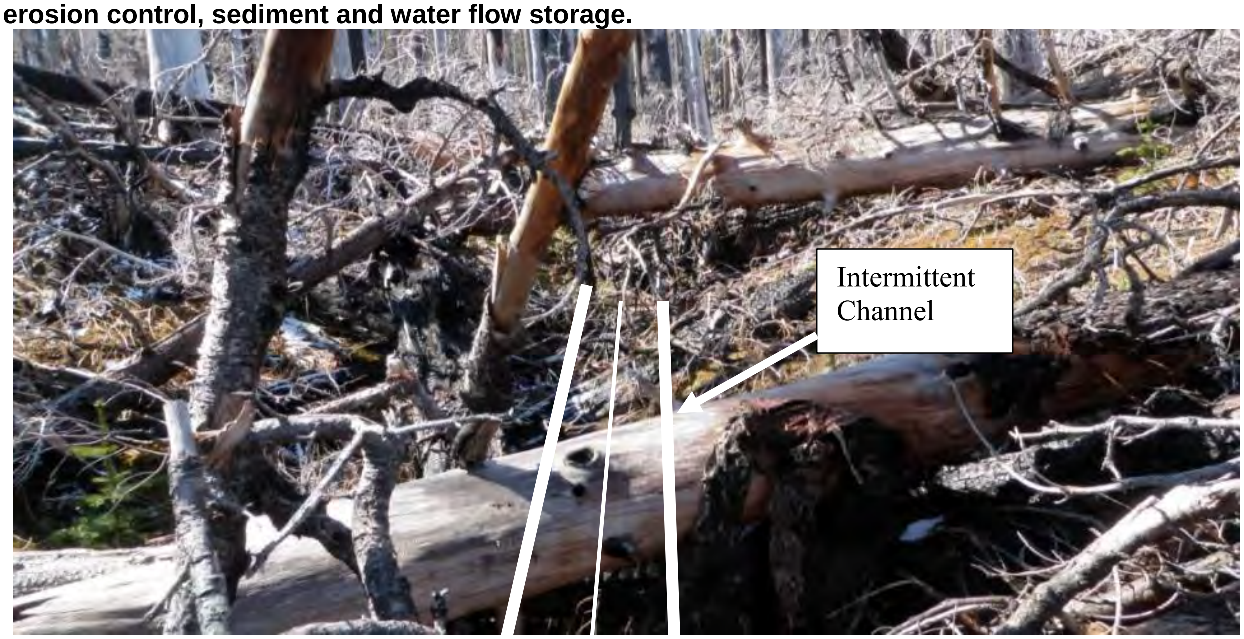


Figure 34. Wood loading in a high severity burned intermittent stream channel in the Evans Creek watershed. This wood is providing sediment storage and flow regulation in this channel.

BAER treatments in conjunction with natural recovery of the area have minimized negative wildfire effects on area streams. Tilly Jane Creek drains the watershed that was the most severely burned by the Gnarl Ridge fire. Major negative effects from higher runoff and high sediment loading were not readily apparent in a 2015 field visit. The most noticeable effect was the increased amount of small limbs in the channel, likely from the wood loading transported from the burned area just upstream, similar to the previous photograph.

Figure 35. Tilly Jane Creek just above the 3512 road crossing. This area is just downstream of the fire. Note moss still on rocks and small limbs.

Crystal Springs Drinking Water Protection Area

Surface and groundwater drinking water protection areas were delineated by the Oregon Department of Environmental Quality (DEQ) and Oregon Health Division (OHD) in response to source water assessments required by the 1996 Amendments to the federal Safe Drinking Water Act (SDWA). DEQ and OHD were required to delineate the groundwater and surface water source areas which supply public water systems, inventory each of those areas to determine potential sources of contamination, and determine the most susceptible areas at risk for contamination. Public water systems with greater than 3 hook-ups or serving more than 10 people, year-round are regulated by the requirements in the SDWA.

A portion of the planning area is located on the Crystal Springs Water District Drinking Water Protection Area (DWPA). The drinking water protection area is approximately 4,284 acres in size and the planning area intersects approximately 2,267 acres in the southwest portion of the DWPA. The groundwater source comes from a single spring that is approximately 2 miles away from the closest activity proposed in the Polallie Cooper Hazardous Fuel Reduction project. A source water assessment report was prepared by Oregon Department of Human Services and DEQ in June 2005. The report delineated the DWPA and identified potential risks by risk type and location. The only potential contaminant source associated with this project is Partial Harvest (greater than 10 years old). This is listed as a “Moderate” relative risk level due to potential turbidity in the shallow, unconfined aquifer.

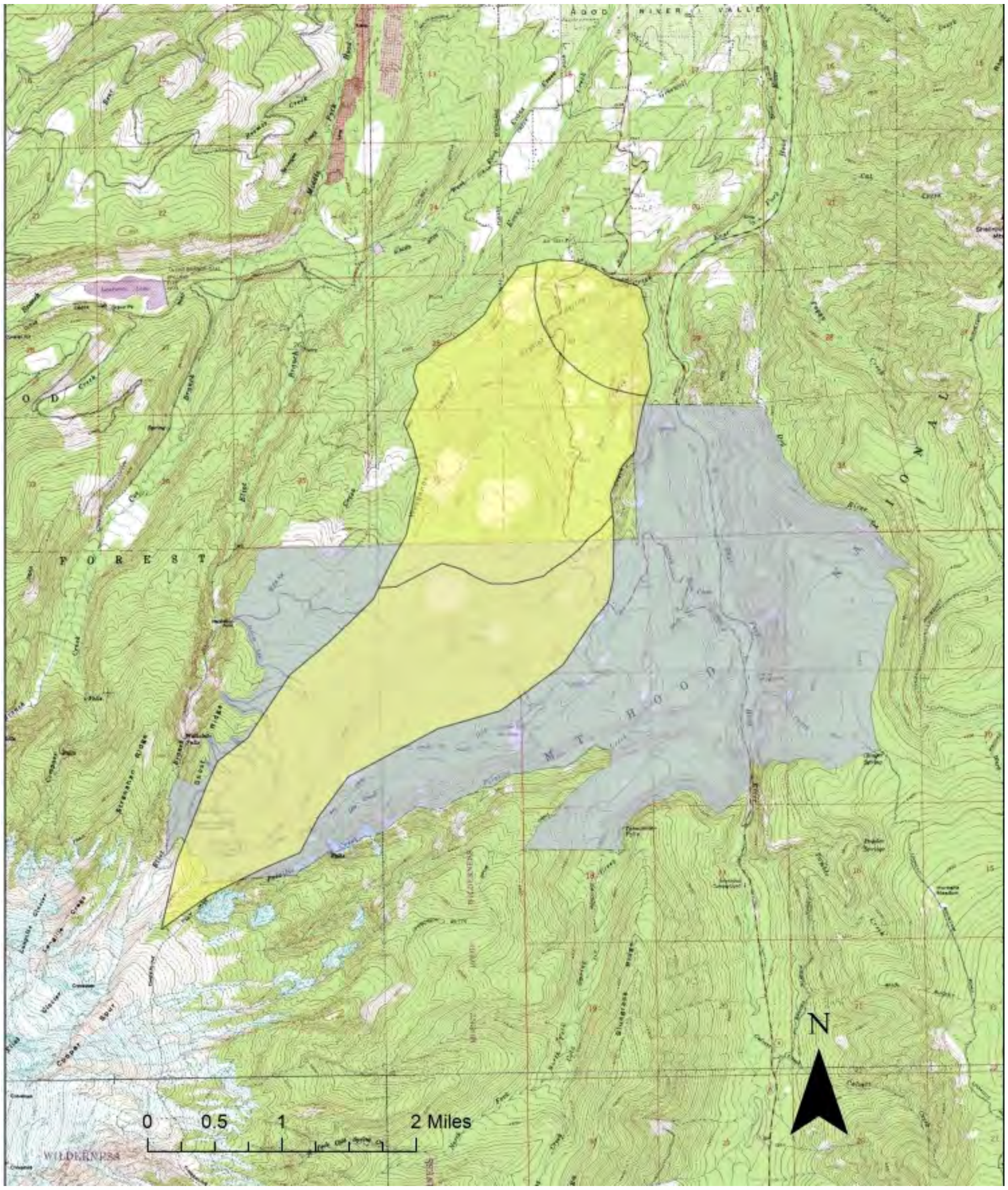


Figure 36. Map showing the location of the Crystal Springs Zone of Contribution (outlined in yellow) and the Polallie Cooper Hazardous Fuels Reduction planning area boundary (shown in blue).

3.6.3 Effects Analysis

No Action Alternative

In general, conditions described above in the existing conditions section would be maintained.

Stream Temperature

Stream temperatures would remain at current levels in the watershed due to no reduction in streamside shading. Primary shade zones (areas of riparian vegetation directly adjacent to streams) along perennial streams would continue to fill in with understory vegetation. Since most areas are already densely vegetated, it is not anticipated that this component would reduce stream temperatures any great degree within the planning area. The exception would be the Gnarl Ridge burn area. Approximately 202 acres of Riparian Reserve burned moderate to high severity so it would take time for the primary shade zone to recover with vegetation of sufficient height to supply shade.

These densely vegetated riparian areas are more susceptible to high severity burns due to excess fuel loading from fire exclusion. In the event a wildfire burned in this watershed, riparian areas have the potential to burn hot in areas that have high fuel loading. Research by Tollefson and others (2004) on 33 burned watersheds in the central, western Cascades of Oregon indicates that fire severity in intense events may be similar between intermittent stream channels and adjacent upland areas. It had been thought that the riparian areas may burn with a lower severity due to the presence water and other fire resistant features. Rhoades and others (2011) found that stream temperatures in burned areas increased by an average of 4 degrees C compared to unburned areas in the Hayman Fire Complex in Colorado. Research on the effects of wildfire on stream temperature is limited, but there is quite a bit of research on burning after clear-cut logging. In the central Oregon Cascades, clear-cut harvesting along a stream increased summertime maximum stream temperatures by 4° F. This same area was burned the following year and stream temperatures increased 14° F when compared to an undisturbed forest watershed (Levno and Rothacher 1969). In the central Oregon Coast Range, clear-cut harvesting along a stream increased maximum stream temperatures by 17° F; after a hot slash burn, an additional increase of 10° F was measured the following summer (Brown 1972). The above mentioned studies indicate that riparian vegetation can experience a high severity burn that has the potential to increase water temperature.

Sediment

Sediment delivery to streams in the planning area is expected to remain at current levels. Vegetation that impedes erosion and sediment delivery would be maintained. In the event a wildfire burned in this watershed, areas that have high fuel loading have the potential to experience high severity burns. These areas have the potential to have high sediment input to adjacent surface water through increased landslides and surface erosion, increased stream channel and bank erosion from increased runoff and sediment bulking from ash deposits. Sediment yields for the Wilson River watershed in Oregon were 252 tons per square mile per year or 5.7 times higher than for a comparable unburned watershed, after the 1933 Tillamook Fire. The number of days that the river experienced very high turbidity (sediment concentrations greater than 27 mg. per liter) increased from 18 to 102 days per year (Anderson 1976). It is not known to what extent salvage operations in the burned area contributed to this sediment increase. Increased sediment yields were found after a wildfire burned three relatively steep watersheds (average slopes of 50%) in the central Washington Cascades (Helvey 1980, Helvey et. al. 1985). An increased susceptibility to debris torrents was noted following the fire and was an important factor in causing increased sediment yields.

While much of the sediment increase can occur within the first year after the fire (Agee 1993, Debano et. al. 1998), it may take many years for sediment levels to reach pre-fire levels depending on fire severity. DeBano et al. (1996) demonstrated that following a wildfire in ponderosa pine, sediment yields from a low severity fire recovered to normal levels after three years, but moderate and severely burned watersheds took 7 and 14 years, respectively. Robichaud and Brown (1999) reported first year erosion rates after a wildfire from 9 to 22 tons per acre decreasing by one to two orders of magnitude by the second year and to no sediment by the fourth in an unmanaged forest stand in eastern Oregon. Erosion rate reduction was due to recovery of natural vegetation. First year growing season shrubs, forbs and grasses accounted for 28 percent of the total ground cover whereas after the second growing season, total ground cover was 82 percent. Rhoades and others (2011) found that basins that burned at high severity on greater than 45 percent of their area had four times the turbidity as basins burned to a lower extent and these values remained elevated through 5 years post-fire. The researchers concluded that due to the slow pace of tree colonization and forest regrowth, recovery of the watersheds burned by the Hayman Fire will continue for decades. Based on the research above and personal observations from over 23 years as a professional hydrologist involved with assessing risks and monitoring damage of large wildfires on water quality, it is reasonable to conclude that in the event of a high severity burn, especially on the steep, eastern portion of the planning area water quality could be severely impaired due to high turbidity levels. It may take many years (5 – 10) for turbidity levels to decrease to background levels.

Crystal Springs Drinking Water Protection Area

In 2006, the Crystal Springs Water District requested Ed Salminen to prepare a memo on the possible impacts of a catastrophic wildfire within the Crystal Springs zone of contribution (ZOC) which is the same area outlined as the Drinking Water Protection Area by the state. The April 27, 2006 memo identified the following "most likely significant impacts to water quality and quantity at Crystal Spring" as a result of a wildfire.

- Loss of groundwater to surface water pathways: A wildfire may create hydrophobic soils that repel infiltration, thus diverting flow that might recharge the Crystal Spring aquifer. This flow would remain on the surface instead of infiltrating into the aquifer. According to Salminen, in the most extreme case where all water was diverted to surface pathways, the ZOC "would be reduced by approximately ¼ its current size." According to the memo, "The duration of this effect would…be unknown; recovery periods reported in the literature range from months to years."
- Physical damage to spring infrastructure: Increased peak flows from a wildfire may damage the structures around Crystal Spring.
- Short-term increases in Nitrate Nitrogen in spring water: According to the memo, "The available literature indicates that it is very rare for post-fire N levels to exceed water quality standards…however any increase in N levels will probably be undesirable…" to the Crystal Springs water users. Any change in N levels is expected to be short-lived.

The memo concludes that "the likelihood for wildland fires in the ZOC is probably higher than it historically has been." The memo also identifies fuel spills in the ZOC as a greater threat than wildfires although the memo does not present any background information to substantiate this conclusion.

The 2008 Gnarl Ridge fire burned across approximately 24 percent of the Crystal Springs DWPA. All of the burned area is located within the long-term recharge area known as zone 3. It is not known whether any of the effects identified in the 2006 memo have been observed at Crystal Spring, but since the burn is located in the long-term recharge area, it might take quite some time for any effects to appear.

In summary, water quality parameters such as stream temperature and sediment are not expected to appreciably change in the planning area. Current riparian areas are overstocked with shrubs and small trees due primarily to fire exclusion creating ample stream shading. If a wildfire does occur in this planning area, it would likely lead to seriously impaired water quality conditions for quite some time in certain portions of the area. The overstocked riparian areas would encourage higher intensity fires due to high fuel loading that could lead to higher burn severities. As described above, these high severity burn areas have the potential for high turbidity and increased stream temperatures.

Proposed Action Alternative

Stream Temperature

This alternative proposes to thin vegetation within Riparian Reserves. Vegetation removal near water bodies has the potential of increasing solar radiation to surface water which in turn may increase water temperature. This analysis utilized tools contained within the *Northwest Forest Plan Temperature TMDL Implementation Strategy* (USDA and BLM 2012) document to identify necessary shade so that stream temperatures within treatment areas would not increase as a result of vegetation treatments. The document was the result of work between the U.S. Forest Service and the Bureau of Land Management (BLM) and identifies how to maintain sufficient stream shading to meet the Clean Water Act while providing the opportunity to treat Riparian Reserve vegetation to improve riparian conditions.

The concept of the sufficiency analysis is to maintain a primary shade zone of vegetation next to the stream and identify a secondary shade zone and other areas within the Riparian Reserves further away from the stream that can be treated to reach Riparian Reserve objectives while maintaining stream temperatures. In order to maintain sufficient shade next to the stream, the primary shade zone is untreated. The size of this zone is dependent on the height of the trees that would be removed and the hill slope adjacent the stream (Table 47). The zones were developed by calculating the width of the riparian area adjacent to perennial stream channels that provides stream shade for the period of greatest solar loading (between 1000 and 1400 hours), known as the primary shade zone, and the width of the riparian area that provides shade in the morning and afternoon (0600-1000 hours; 1400-1800 hours), considered the secondary shade zone. In dense riparian stands, optimum shade can be provided by the primary shade zone alone, and the secondary shade zone may contribute little to no shade since trees in the primary shade zone are already blocking the sun's solar radiation.

Table 47. Width of Primary Shade Zone

Height of Tree	Hill slope <30%	Hill slope 30% – 60%	Hill slope >60%
Trees < 20 feet	12 feet	14 feet	15 feet
Trees 20 to 60 feet	28 feet	33 feet	55 feet
Trees > 60 feet to 100 feet	50 feet	55 feet	60 feet
Trees > 100 feet to 140 feet	70 feet	75 feet	85 feet

As an example, if the heights of trees in the riparian area are predominately greater than 20 feet tall, the primary shade zone would be 14 feet wide for an area that had 30 percent to 60 percent hill slopes next to the stream. Based on field observations in proposed treatment blocks, most of the hill slopes are between 30 percent and 60 percent and the majority of existing tree heights range from greater than 60 feet to 100 feet. Trees within sapling thinning blocks are generally less than 20 feet tall. The proposed prescription for riparian area treatments would thin vegetation that would, for the most part be greater than 60 feet and less than 100 feet tall, which translates into a maximum primary shade zone of 60 feet for the planning area. Some blocks would treat vegetation less than 60 feet tall but would still retain a primary shade zone of 60 feet according to the treatment prescription. This area would be left untreated next to perennial streams to maintain current stream shading and water temperatures.

A recent literature review done by Czarnomski and Hale (2013) for the State of Oregon, examined the ability of seven different riparian vegetation treatments to meet Oregon State Water Temperature Standards. The major review question was "For small and medium streams in the western Pacific Northwest, in or adjacent to forest harvest operations, what are the effects of near-stream forest management on stream temperature and/or riparian shade?" They defined small and medium streams as having average annual flows that are 10 cubic feet per second (CFS) or less. The review also evaluated the relevance of the publications to each riparian management scenario and the confidence in each study to provide reliable information.

Of the seven treatment alternatives evaluated in the report, the alternative identified as State Forest Management Plan (FMP) is most similar to the riparian prescription for the Polallie Cooper Hazardous Fuel Reduction Project. Both of these prescriptions have a no-cut area adjacent to the stream, and then have treatments that retain some of the residual riparian canopy out to a certain distance away from the stream. The FMP prescription defines a 25 foot no-cut area adjacent to the stream while the Polallie Cooper Hazardous Fuel Reduction Project riparian prescription has a minimum 60 foot protection buffer that ranges up to 130 feet in some cases, exceeding the buffer width by at least 190 percent. The Polallie Cooper Hazardous Fuel Reduction project riparian prescription either meets or exceeds protection provided by the other elements identified for the riparian management zone in the FMP prescription.

The 2013 literature review found that three publications examining the FMP prescription “contained highly relevant results of temperature and/or shade using buffer rules from the…FMP”. According to the studies “Shade comparisons were made pre- and post-harvest and there was no detectable change in shade post-harvest from pre-harvest conditions.” The chance of exceeding the Oregon Protecting Cold Water (PCW) criterion” was found to be 9 percent and not statistically different from zero”. The Final Report concluded that “The evidence from this suite of studies only supports two classes of rule alternatives as effective in meeting” the PCW criterion. One of two alternatives is the FMP prescription of which the Polallie Cooper Hazardous Fuel Reduction Project riparian prescription meets or exceeds the protection provided for stream temperature.

Table 48 shows treatment blocks where treatment is proposed within one site potential tree (130 feet) adjacent to a perennial stream. Factors that may influence stream temperature other than those discussed in the Sufficiency Analysis are shown for each treatment block. Values that are underlined indicate an extra factor of safety for protection of existing stream temperatures than what is recommended by the Sufficiency Analysis. These include the following:

- Primary Shade Zone Width Recommendation from the Sufficiency Analysis. As stated above, perennial streams in treatment blocks would have a minimum 60 foot protection buffer next to them. The actual protection buffer would usually extend to a slope break if the slope break is greater than 60 feet. The value in Table 48 shows what is recommended according to the Sufficiency Analysis. For example, the Block 10 recommendation is a 33 foot primary shade zone. The actual protection buffer would extend to a slope break which is approximately 100 feet from the stream which is 67 feet greater than what is recommended by the Sufficiency Analysis.
- Side of the Channel to be Thinned. The orientation of a stream and ultimately the orientation of the strip of riparian vegetation next to the stream has an influence on the effectiveness of stream shading. Stream shading from the south side is more important than shading from the north side due to the sun angle. Streams that would only have vegetation removed on the north side of a stream are shown as having an extra factor of safety.
- Spring/Glacial Influence. Natural groundwater and glacial meltwater play a role in cooling water temperatures and reducing the influence streamside shading has on these temperatures. This relationship has been acknowledged in numerous scientific papers and studies. Streams where seeps, springs or glacial melt influence were noted in field surveys are shown as having an extra factor of safety.

Table 48. Factors that may influence stream temperature on perennial streams are shown for each treatment block. Values that are underlined indicate an extra factor of safety for protection of existing stream temperatures.

Treatment Blocks	Primary Shade Zone Width from Sufficiency Analysis (ft)	Side of Channel to be Thinned	Spring/Glacial Influence
1	**55**	N,S	**Yes**
3	**55**	**NW**	**Yes**
4	**55**	SE	**Yes**

Treatment Blocks	Primary Shade Zone Width from Sufficiency Analysis (ft)	Side of Channel to be Thinned	Spring/Glacial Influence
8	**28-33**	NW, SE	No
10	**33**	NW, SE	**Yes**
11	**33**	N,S	**Yes**
12	**55**	E	**Yes**
13	**55**	E	**Yes**
14	**55**	SW	**Yes**
15	**55**	E	**Yes**
16	**55**	N,S	**Yes**
17	**28**	N, S	No
18	**33**	E, W	**Yes**
19	**33**	**N, E**	**Yes**

All blocks have at least one additional factor that helps protect stream temperature and most have at least two.

There is one helicopter landing proposed in the Riparian Reserve near the confluence of Polallie Creek and East Fork Hood River. The landing site is on a flat bench in a previously disturbed area. This activity is not expected to increase summer stream temperature due to the existence of other factors of safety described above, maintaining the existing primary shade zone and the small number of trees that are expected to be felled since the site has been previously disturbed.

Some jackpot or swamper burning may take place in the Riparian Reserves. The fire may back down into the very outer portions of the protection buffer but lighting is not allowed within the protection buffer itself. According to the fuel specialist, none of the larger, shade producing vegetation would be killed so stream shading would be maintained within the primary shade zone.

Due to meeting or exceeding primary shade width recommendations in the Sufficiency Analysis, plus the existence of additional factors that help protect stream temperature, treatments associated with the Polallie Cooper Hazardous Fuels Reduction Project are expected to have an immeasurable effect to existing stream temperatures.

Sediment

Some ground disturbing activities in this alternative have the potential to dislodge soil particles which in turn may increase erosion. These activities include construction or reopening of temporary roads, landings, skid trails, yarding corridors, burn piles and areas of road maintenance and repair. A detailed discussion of soil erosion and sedimentation is contained in the soils section of the EA. According to the soils analysis, risks of erosion and potential sediment delivery are expected to be small due to maintaining protective groundcover along with implementation of Best Management Practices (BMP) or Project Design Criteria (PDC) as they are referred to in the EA.

The Proposed Action would re-open approximately 4 miles of old existing temporary and would construct approximately 7.9 miles of new temporary roads. The reopened temporary roads re-trace the alignment of older overgrown roads. These temporary roads can be reopened with minimal earth movement, without side casting material and would be rehabilitated after project completion. Re-opening these roads and the construction of new temporary roads would pose an overall low risk of introducing sediment to streams because almost all of these roads would be outside of the Riparian Reserves and away from streams. Of the approximately 4 miles of old existing temporary roads that would be reopened, only approximately 804 feet are within Riparian Reserves. None of the new temporary road construction would be within Riparian Reserves.

The 804 feet of temporary road proposed to be reopened represents 2 different incursions into Riparian Reserves that are approximately 315 feet to 489 feet in length. No new or existing stream crossings would need to be constructed or reconstructed for this project. The photograph below shows the condition of a portion of the 489 foot section of reopened temporary road accessing block 11. The first 350 feet are already open and would need little work to reuse the road. The road is approximately 200 feet from Doe Creek at its closest point and is located on a flat bench with a well vegetated buffer between the road alignment and the creek. The final 139 feet of road in the Riparian Reserve is more overgrown with trees. The center of the road is still void of trees, but conifers mostly ranging from 3 inches to 8 inches dbh are occupying the edges of the road. These trees would have to be removed to reopen this 139 foot section of road.

Figure 37. Photograph taken April 30, 2015 showing the condition of the first 350 feet of temporary road that would be reopened to access block 11. This section is in the outer edge of the Doe Creek Riparian Reserve.

The other section of temporary road that is proposed to be reopened in a Riparian Reserve accesses blocks 4 and 7. Approximately 315 feet of road are in the Riparian Reserve and is approximately 60 feet at its closest point to an unnamed perennial tributary to the East Fork Hood River. The East Fork Hood River is approximately 2 miles downstream from this section of road. The road is currently open and being maintained as a trail. The roadbed is still compacted and void of vegetation. There is no sign of recent erosion or sedimentation from this road and there is an intact vegetated buffer between the road and the unnamed stream.

Figure 38. Photograph of a portion of the proposed temporary road accessing blocks 4 and 7 that is within a Riparian Reserve. The road is currently open and being used as a trail.

Figure 39. Photograph taken April 30, 2015 showing the existing vegetative buffer between the temporary road accessing blocks 4 and 7 and the unnamed perennial stream. The photo is taken from the temporary road looking down to the stream.

Road density within the analysis area would change in some areas for the short period of time that temporary roads would be in use. These temporary roads would be decommissioned immediately following vegetation treatment operations. Table 49 displays the short-term change in road density.

Table 49. Watershed Road Density

Watershed	Existing Road Density (mi/mi^2)	Proposed Action Road Density During Operations (mi/mi2)*	Proposed Action Road Density After Operations (mi/mi2)
Crystal Springs Creek	3.4	3.4	3.4
Dog River	2.3	2.4	2.3
E. Fk. Hood River	2.5	3.1	2.5
E. Fk. Hood River (Lower Reach)	0.8	1.1	0.8
Evans Creek	2.2	2.3	2.2
Polallie Creek	0.1	0.2	0.1
Tilly Jane Creek	2.5	3.2	2.5
** Includes temporary roads*			

Since there would be no new stream crossings constructed or reconstructed and incursions into Riparian Reserves are limited to approximately 804 feet of existing, reopen roads, it is expected that there would be no sediment introduction from construction and reconstruction of temporary roads for the Polallie Cooper Hazardous Fuels Reduction Project. In addition, erosion control measures described in the PDC section would be employed to reduce and/or eliminate erosion and potential sedimentation. The new temporary roads and re-opened temporary roads would be decommissioned and re-vegetated immediately following completion of vegetation treatment operations to help reduce compaction, increase infiltration rates, minimize surface erosion, and re-establish natural drainage patterns.

Road maintenance prior to log haul would help maintain the design drainage of the road surface which reduces the potential for larger sediment inputs that eventually may enter stream courses. This includes the placement of new aggregate surfacing where necessary, blading, removing debris, brushing out encroaching vegetation, removing berms, stabilizing failing road shoulders and cleaning out ditch and culvert inlets where needed. Aggregate road surfacing can minimize the amount of fine sediment from road surfaces entering streams following log haul, especially during and following rainfall events. The following WEPP model runs show the difference in erosion between a 200 foot section of native surface road (road is made from native soil) and a 200 foot section of gravel surface road. All of the model inputs stayed the same except surface material, which was changed from native to gravel surface.

Table 50. WEPP model run showing the difference in erosion between a gravel surface road and a native surface road.

Road Surface	Road Prism Erosion
Native Surface Road	136 lbs.
Gravel Surface Road	86 lbs.

Results from the WEPP model runs show that in this situation, the native surface road produced 136 pounds of eroded soil while the gravel surface road produced 86 pounds of eroded soil which is a 37 percent reduction in eroded soil. It should be noted that under some circumstances, gravel surfaced roads may produce more runoff and erosion than native surface roads (WEPP manual).

Some road maintenance activities have the potential to increase short-term road related erosion and sediment during rainfall events. This increase is associated primarily with blading, ditch cleaning and culvert cleaning on aggregate and native surface roads although ditch cleaning and culvert cleaning associated with paved roads is a potential sediment source as well. Most of the road maintenance work would be brushing out existing vegetation, hazard tree removal, cleaning culvert inlets and minor blading and spot rocking of the road surface. Three roads that would require the most maintenance work include the 3511, 3512 and 4400 roads. These would require brushing, blading, culvert cleaning and ditch cleaning. Any fine sediment created by road maintenance activities would most likely be washed from the road surface in the first few precipitation events immediately after work has been completed. Personal observations through more than 27 years as a professional hydrologist and field work completed for this project indicate that most road-related sediment would be trapped and stored in the ditches or on the forest floor below cross drains. Implementation of PDC and BMP that include installation of erosion control measures to minimize or eliminate sediment introduction into streams would further reduce the risk of sediment introduction. Any sediment delivered to streams during these activities would be minimal, short-term duration, and undetectable at a sub-watershed (6th field) or watershed (5th field) scale. The probability of any degradation to water quality or fisheries resources caused by sedimentation due to road construction, reconstruction and maintenance is extremely low. These activities would provide an overall long term benefit by restoring proper function of the road drainage which would reduce erosion and sedimentation. Sections of road identified for maintenance are currently rutted and forcing runoff from precipitation to flow down the road surface causing long term erosion and sedimentation from the road. Maintenance would correct these problems.

Log hauling has a low risk of increasing the amount of fine sediment in streams due to the following conditions:

- The roads along the haul route have for the most part, well vegetated road ditchlines that allow eroded soil to be stored adjacent to the roads.
- Eighty seven percent of the road system is either asphalt or gravel surface which has a lower surface erosion potential than native surface roads.
- Sale administration personnel would restrict log hauling when necessary to minimize water quality degradation. Haul would be stopped if there is rutting of the road surface or a noticeable increase in the turbidity of water draining to the road ditches or at stream crossings.
- Log haul outside the normal operating season (June through October) would not be permitted on native surface roads that are hydrologically connected to any streams. If log haul occurs outside the normal operating season, then it is restricted to asphalt surface roads, gravel surface roads that do not cross streams within 1000 feet of listed fish habitat, and/or native surface or temporary roads that are not hydrologically connected to streams. An additional PDC that only allows haul outside the normal operating season when precipitation amounts are similar to amounts occurring during the normal operating season would further insure that log haul would only occur during dry periods. In summary, haul outside of the normal operating season would not occur on road segments that have a higher risk of soil erosion and sediment delivery to stream systems in the area. Haul outside the normal operating season can occur in certain areas if precipitation amounts are similar to those found during the normal operating season (see Chapter 2, PDC for more details).

Fuel treatment activities that utilize fire are not expected to introduce additional sediment into surface water. A literature review by Beschta (1990) states that "Management practices that prevent the occurrence of hot slash burns and encourage rapid re-vegetation would help minimize potential increases in fire-related sedimentation from upslope source. Relatively "cool" burns" (such as the swamper or jackpot burn blocks in this project) "should have little impact on erosion and sedimentation, regardless of general watershed slope." Some jackpot or swamper burning may take place in the Riparian Reserves. The fire may back down into the very outer portions of the protection buffer but lighting is not allowed within the protection buffer itself. Additional PDC that limit burn severity in Riparian Reserves to primarily low severity with some moderate severity and using non-ground disturbing types of fire line such as wet line would minimize the potential for sediment introduction related to burning activities.

Other fuel treatment activities may increase surface erosion in the harvest blocks along temporary roads, landings, skid trails and yarding corridors. The amount of erosion is expected to be low and short lived due to PDC such as ground based logging restrictions on ground over 30 percent side-slope, ripping and water barring disturbed areas and seeding disturbed areas. It is unlikely that any material would reach the aquatic system due to buffering by the Riparian Reserves and the other required PDC such as ripping and water barring skid trails and keeping mechanized equipment away from streams.

Best Management Practices and Project Design Criteria

A complete list of BMPs and PDC are included in Chapter 2 of the EA. BMPs and PDC were developed for the Polallie Cooper Hazardous Fuels Reduction EA using the National Core BMP Technical Guide (USDA Forest Service 2012), monitoring, field verification, professional judgment, and the best available science. An additional resource for BMP was utilized for this project due to the presence of the Crystal Springs DWPA. This resource was the draft “EPA Region 10 Source Water Protection Best Management Practices for USFS, BLM” (EPA, 2005). BMPs and PDC are discussed throughout the effects analysis of this report and are the primary mechanism to mitigate potential effects to water quality and quantity from the project.

BMP implementation and effectiveness has been systematically monitored across National Forest Lands in California since 1992. From 2008-2010, randomized monitoring showed 91 percent of BMPs were implemented, and 80 percent of implemented BMPs were rated effective. BMPs for timber harvests, fuel treatments, and vegetation management were consistently highly effective, while BMPs for other activities, including roads, range management, recreation, and mining, were less effective (USDA Forest Service 2013). At sites where BMPs were not implemented or effective the monitoring program includes a strong feedback loop to take corrective action on non- compliance scenarios.

At the national scale, a consistent program to monitor BMP implementation and effectiveness has been in development for several years. A publication outlining potential BMP was published April 2012 and monitoring protocols as well as a database with an associated scoring system is now fully in place. Monitoring of BMP implementation and effectiveness using the national BMP protocols has taken place on the Mt. Hood National Forest (MHNF) since 2012. A Forest wide monitoring report was produced in 2014, summarizing BMP monitoring results from 2013 (U.S. Forest Service 2014). “Of the 36 Core BMPs monitored for implementation on all projects, 89 percent were implemented fully as prescribed.” Twenty one Core BMPs specifically pertaining to ground based vegetation management were monitored and found to have 95 percent of the measures fully implemented. “Of the 38 Core BMPs monitored for effectiveness, 87 percent were fully effective at preventing or minimizing the effects of activities to aquatic and water resources as prescribed.” Twenty one Core BMPs specifically pertaining to ground based vegetation management were monitored and found to have 95 percent of the measures fully effective. The one measure that was not implemented (temporary road rehabilitation) “resulted in some observable surface erosion, but transport of sediment off-site to a water body had not occurred and because of its location there was no potential for it to do so.” An executive summary detailing the results of the 2014 BMP monitoring on the Mt. Hood National Forest (U.S. Forest Service 2015) indicate that two vegetation treatment projects were monitored and all BMP were fully implemented and fully effective. Additional project-level BMP monitoring by hydrologists and soil scientists has occurred as part of project implementation on the MHNF and is incorporated in professional judgment. Select BMPs, PDC, and project design elements are shown in Table 51. The full list of BMP can be found in Appendix 2.

Table 51. Select project design considerations, BMPs, and PDC for the Polallie Cooper Hazardous Fuels Reduction Project.

Practice	Initial Project Design Element	BMP/PDC
Maintaining a protection buffer adjacent to perennial and intermittent streams.	X	X
Keeping mechanized equipment at least 100 feet away from streams.	X	X
No new temporary road construction within Riparian Reserves	X	X
No stream crossings on new or existing temporary roads.	X	
Timber haul only during the Normal Operating Season on native surface roads that have a hydrologic connection to a stream.		X
Fuel storage and refueling activities only allowed if they are greater than 150 feet from streams or wetlands.		X
Installation of waterbars on skid trails		X
No ground-based harvest on slopes over 30%	X	
Limit burns within Riparian Reserves to mostly low severity.	X	X

Initial project design elements were included in the development of the Proposed Action, BMPs were developed using recommendations in the National Core BMP Technical Guide (USDA Forest Service 2012), and the draft "EPA Region 10 Source Water Protection Best Management Practices for USFS, BLM" (EPA, 2005), and site-specific analysis of the planning area.

The ability of PDC and BMP to reduce erosion and sediment delivery is documented in a study referenced in the Soil Productivity section (Rashin et. al. 2006). In this study, the authors looked at 21 harvest sites that had a variety of treatments ranging from no buffers to buffers up to 66 meters (216.5 feet) wide. They found that "Of 157 individual erosion features determined to deliver sediment to streams during either the first or second year following timber harvest, 94 percent were located within 10 meters (33 feet) of the stream. Conversely, 74 percent of the 248 erosion features with no evidence of sediment delivery were greater than 10 m from streams. The sediment routing survey results indicate that when erosion is initiated by ground disturbing activities within 10 meters (slope distance) of a stream, delivery of sediment was more likely than not." Other studies also support the effectiveness of mitigating sediment delivery by maintaining a buffered area adjacent to surface water. Lakel and others (2010) looked at the effectiveness of a variety of treated and untreated buffers in trapping sediment adjacent to timber harvest units. They concluded that streamside management zones (buffers) between 25 feet and 100 feet were effective in trapping sediment before it could enter streams. These streamside management zones consisted of both treated and untreated areas. The study also found that thinning within buffers was an appropriate forest management tool, "because the practice did not significantly increase erosion".

Other studies also support the effectiveness of mitigating sediment delivery by maintaining a buffered area adjacent to surface water. Burroughs and King (1989) found that 80 percent of sediment reaching streams from roads in the first year after construction came from the fill slope of the road. They also found that transport distances and obstructions between the fill slopes and streams influenced the amount and likelihood of eroded material reaching these streams. Burroughs and King found that windrowed fill slopes, which would act very similar to unharvested Riparian Reserves in that there would be obstructions to flow, had an average travel distance of 3.8 feet for eroded material, and a maximum travel distance of 33 feet. Similar results were documented by Packer (1967). He found that "the most important factors that affect the distance that sediment moves are the spacing between down slope obstructions and an interaction between this spacing and the kind of obstruction”. He found that logs, rocks, and trees or stumps were the second, third, and fourth most effective materials in reducing sediment movement distances below roads. Travel distances were similar to those reported by Burroughs and King.

PDC that include protection buffers of at least 60 feet along perennial streams and at least 30 feet along intermittent streams, keeping large mechanized equipment away from surface water, use of erosion control (e.g., ditchline sediment traps, straw wattles, waterbars) where necessary, controlling burn severity near surface water and lower impact road maintenance techniques (leaving vegetated buffer strips in ditchlines near streams) would substantially reduce the amount of sediment reaching the streams from this work. Burroughs and King (1989) reported that measures, such as erosion control blankets, could reduce sediment production by 80 to 90 percent. This in conjunction with other measures, such as minimizing the amount of ground disturbance and seeding these areas, would further decrease the chance of short-term direct and indirect sediment production. With the implementation of above-mentioned PDC and BMP new temporary roads, landings, skid trails, yarding corridors, road maintenance, log hauling and road repair work are expected to have minimal effect on sedimentation.

Crystal Springs Drinking Water Protection Area

As mentioned in the Existing Condition section, a portion of the planning area is in the Crystal Springs Drinking Water Protection Area (DWPA). Activities proposed in the DWPA are shown in Table 52.

Table 52. Polallie Cooper Hazardous Fuels Reduction Project treatments within the Crystal Springs Drinking Water Protection Area.

Recharge Area within the DWPA	Sapling Thinning (acres)	Plantation Thinning (acres)	Recently Unmanaged Stand Thinning (acres)	New Temporary Road Construction (miles)	Existing Temporary Road Reopening (miles)	Ground Based Treatment (acres)	Skyline Treatment (acres)	Hand Treatment (acres)
Intermediate Recharge Area (Zone 2)	72	122	0	0.5	1.0	143	51	0
Long Recharge Area (Zone 3)	94	183	113	0.6	1.8	287	42	60

Turbidity was identified in the source water report as a potential threat to the protection area. As described above, sediment amount is anticipated to be minimal due to PDC and inclusion of BMP identified in the USFS National Core BMP Technical Guide and the draft “EPA Region 10 Source Water Protection Best Management Practices for USFS, BLM”. BMP focused on reducing or eliminating the chance of biological or chemical contamination in the DWPA are included in this project. Some of those measures include requiring toilet facilities during operations, utilizing absorbent pads under stationary mechanized equipment, preparation of a Spill Prevention Control and Countermeasures Plan by the contractor, spill kits on board ground based mechanized equipment and refueling at least 150 feet away from all surface water. In addition, all of the project activities are proposed outside of the most sensitive zone of the drinking water protection area, zone 1 or the short term recharge area. The closest activity to Crystal Springs associated with this project would be vehicle traffic along Highway 35 which is approximately 1600 feet below the spring source.

Peak Flow Analysis

Forest Plan Standard FW-064 states that "Watershed impact areas at the subbasin or area analysis level should not exceed 35 percent" (pg. Four-53) as part of a cumulative watershed effects analysis. This value is set to disperse activities in time and space to "minimize cumulative watershed effects" which in this case is primarily increased peak flow (Forest Plan Standard FW-061, pg. Four-53). These increased peak flows can cause stream channel damage in the form of increased bank erosion, channel bed scour, channel widening, and sedimentation. Pre- and post-project implementation watershed impact areas for The Polallie Cooper Hazardous Fuels Reduction Project do not exceed the watershed impact area standards and guidelines (FW-061, FW-062, FW-064 and FW-065). This analysis was conducted at the 7th field HUC level; therefore change in watershed impact area at a larger size watershed, such as the "major drainages" as defined in the LRMP, would result in a lesser change from pre- to post-project (FW-063).

Table 53. Pre and Post Watershed Impact Areas for the Analysis Area. For all watersheds except Dog River, any value greater than 35 percent is exceeding Forest Plan Standard FW-064. Upper Dog River has a threshold of concern of 25 percent.

7th Field Watershed	Current Watershed Impact Area (percent)	Post Project Watershed Impact Area (percent)
Crystal Springs Creek	9	9
Dog River	2	3
East Fork Hood River	3	7
East Fork Hood River (lower reach)	6	7
Evans Creek	7	7
Polallie Creek	10	10
Tilly Jane Creek	28	31

Tilly Jane Creek watershed is approaching the 35 percent value due to vegetation loss from the Gnarl Ridge fire. Indications of major increased peak flows such as channel bed instability or scour and channel bank erosion were not noted during field visits to Tilly Jane Creek just below the burned area. All other values are well below the maximum Watershed Impact Area percentage of 35 percent after implementation, so this project is consistent with this standard.

Another component of the peak flow analysis is the extension of the stream channel network by roads and ditch lines in roads. These factors may increase peak flows through the road cut-slope interception of subsurface flow and routing it to surface waters using ditch lines as pseudo-channels (Jones, et al 1996 and Wemple, et al 1996). The road surface also collects rainfall due to surface compaction, and routes this water to adjacent channels. See Table 54 for extension of stream channel network.

Table 54. Percent increase of stream channel miles by roads for the Analysis Area. Values are based on 200 foot and 500 foot spacing of relief culverts

7th Field Watershed	Current Increase in the miles of stream channel due to roads (percent)
Crystal Springs Creek	4-10

Dog River	5-13
East Fork Hood River	7-17
East Fork Hood River (lower reach)	3-7
Evans Creek	5-14
Polallie Creek	1-2
Tilly Jane Creek	7-18

Since no new stream crossings are proposed in the Polallie Cooper Hazardous Fuels Reduction Project, the values shown in Table 54 would not change with project implementation.

Summary of Indirect/Direct Effects

Detrimental effects to water quality and quantity would be reduced or eliminated through implementation of PDC and BMP in the Proposed Action and following Standards and Guidlines. These PDC and BMP are displayed in Chapter 2 and Appendix 2 of the EA and pertinent ones are described in this analysis.

Cumulative Effects

Table 55 provides a qualitative summary of potential cumulative watershed effects. It shows existing and potential projects, effects from those projects that may result in cumulative effects with the Polallie Cooper Hazardous Fuels Reduction Project, whether these projects overlap in time and space and an assessment if a measureable cumulative effect is expected. Only projects that overlap in either time or space with the Polallie Cooper Hazardous Fuels Reduction Project or have a potential cumulative effect are included in the table. Findings in this summary are supported by the analysis above which utilizes pertinent research, PDC and applicable management standards and guidelines. Water Quantity is included in this section, as potential increased peak flow from vegetation removal is primarily a cumulative effect. To assess potential increases in peak flow, watershed impact areas and the changes pre- and post-project were estimated at the full 7th field HUC level for cumulative effects purposes for all ownerships; as well as qualitatively analyzed at the subwatershed scale.

Table 55. Cumulative Effects for Water Quality and Water Quantity

Project	Potential Effects	Overlap in Time	Overlap in Space	Measurable Cumulative Effect?	Extent, Detectable?
Existing Old Forest Service Timber Harvest Units	Coarse and Fine Sediment	No	Yes	No	Projects are completed. No remaining sediment or stream temperature and water quantity effects due to project design criteria implementation on the original projects, natural recovery, and conformance with existing standards and guidelines on the Polallie Cooper Hazardous Fuels Reduction Project. For each entire 7th field HUC, post-project watershed impact area never exceeded a threshold of concern (Table 53) or immeasurable cumulative increases from pre- to post-project were estimated. Immeasurable and minor increases in watershed impact area would also be further reduced at the 6th field HUC, resulting in immeasurable cumulative effects to peak flows.
	Stream Temperature	No	Yes	No	
	Water Quantity	Yes	Yes	No	
Forest Service Vegetation Treatment Activities Planned or Underway (Tilly Jane Hazardous Fuels Reduction and other general Pre-commercial treatments)	Coarse and Fine Sediment	Yes	Yes	No	There may be an overlap in timing of these projects with the Polallie Cooper Hazardous Fuels Reduction Project; any minor suspended sediment would not be measurable due to implementation of PDC, conformance with existing standards and guidelines on both the existing projects and the Polallie Cooper Hazardous Fuels Reduction project.
	Stream Temperature	Yes	Yes	No	Some projects are completed so there are no remaining stream temperature effects due to natural recovery. The more recent vegetation

					treatment projects conform to the Northwest Forest Plan Stream Temperature Sufficiency document. The Polallie Cooper Hazardous Fuels Reduction project would maintain the primary shade zone so there is a low risk of increase in stream temperature from this project.
	Water Quantity	Yes	Yes	No	No cumulative water quantity effects due to project design criteria implementation, conformance with existing standards and guidelines and natural recovery on both the existing projects and the Polallie Cooper Hazardous Fuels Reduction Project. For each entire 7th field HUC (including orchards and crop-lands), post-project watershed impact area never exceeded a threshold of concern (Table 53) or immeasurable cumulative increases from pre- to post-project were estimated. Immeasurable and minor increases in watershed impact area would also be further reduced at the 6th field HUC, resulting in immeasurable cumulative effects to peak flows.
Private Land activities (past timber harvest and agricultural activities)	Coarse and Fine Sediment	Yes	Yes	No	Some projects are completed so there are no remaining sediment effects due to natural recovery. Other ongoing projects on adjacent private such as road maintenance and vegetation manipulation have a chance of some short-term introduction of fine sediment. The primary fine sediment producing activity in the Polallie Cooper Hazardous Fuels Reduction project is road maintenance activities, specifically ditch and culvert cleaning and blading. The highest potential location for sediment mixing is in Tilly Jane Creek and the East Fork Hood River. It is highly unlikely there would be a measurable cumulative effect due to implementation of PDC and conformance with

					existing standards and guidelines in the Polallie Cooper Hazardous Fuels Reduction project
	Stream Temperature	Yes	Yes	No	Some projects are completed so there are no remaining stream temperature effects due to natural recovery. The Polallie Cooper Hazardous Fuels Reduction project would maintain the primary shade zone so there is a low risk of increase in stream temperature.
	Water Quantity	Yes	Yes	No	No cumulative water quantity effects due to project design criteria implementation, conformance with existing standards and guidelines on the Polallie Cooper Hazardous Fuels Reduction Project and natural recovery for some of the projects on private land.
Gnarl Ridge Fire (including Burned Area Rehabilitation projects)	Coarse and Fine Sediment	Yes	Yes - Evans Creek, Tilly Jane Creek and Polallie Creek 7th field HUC only	No	There may be an overlap in timing of effects from the Gnarl Ridge Fire and the Polallie Cooper Hazardous Fuels Reduction project. The primary fine sediment producing activity in the Polallie Cooper Hazardous Fuels Reduction project is project is road maintenance activities, specifically ditch and culvert cleaning and blading. The closest sediment mixing opportunity is Tilly Jane Creek and maintenance activities on the 3512 road. It is highly unlikely there would be a measurable cumulative effect due to implementation of PDC and conformance with existing standards and guidelines in the Polallie Cooper Hazardous Fuels Reduction project.
	Stream Temperature	Yes	Yes - Evans Creek, Tilly Jane Creek and Polallie Creek 7th	No	Except for dropping some trees for the Polallie Cooper Hazardous Fuels Reduction project would maintain the primary shade zone so there is a low risk of increase in stream temperature.

			field HUC only		
	Water Quantity	Yes	Yes - Evans Creek, Tilly Jane Creek and Polallie Creek 7th field HUC only	No	No cumulative water quantity effects due to project design criteria implementation, conformance with existing standards and guidelines and natural recovery in the Gnarl Ridge fire area. There would be some vegetation removal in the Tilly Jane Creek watershed which has the highest amount of burned area from the fire, but any increase would not be measurable due to project design criteria implementation, conformance with existing standards and guidelines on the Polallie Cooper Hazardous Fuels Reduction Project.
Past Aquatic Restoration Projects (Road Decommissioning, East Fork Stream Channel Projects)	Coarse and Fine Sediment	No	Yes	No	Projects are completed. No remaining sediment, stream temperature and water quantity effects due to project design criteria implementation on the original projects, natural recovery, and conformance with existing standards and guidelines on the Polallie Cooper Hazardous Fuels Reduction project.
	Stream Temperature	No	Yes	No	
	Water Quantity	No	Yes	No	
2000 and 2006 Debris Flow in the East Fork Hood River and 1980 Debris Flow in Polallie Creek	Coarse and Fine Sediment	Yes	Yes	No	The 1980, 2000 and 2006 debris flows originating from Mt. Hood deposited large amounts of sediment in the East Fork Hood River. This sediment has increased background turbidity and would continue to do so for many years. Any sediment from the Polallie Cooper Hazardous Fuels Reduction project would not be detectable due to the high natural turbidity rate.
	Stream Temperature	Yes	Yes	No	The 1980, 2000 and 2006 debris flows originating from Mt. Hood deposited large amounts of sediment in the East Fork Hood River. This sediment widened the stream channel and opened

					it up for increased solar radiation and potential increased stream temperatures. The Polallie Cooper Hazardous Fuels Reduction project would maintain the primary shade zone so there is a low risk of increase in stream temperature.
Ongoing road maintenance, including snowplowing on both National Forest land and Highway 35.	Fine Sediment	Yes	No	No	It is expected that all road maintenance needs on National Forest land would be taken care of with the Polallie Cooper Hazardous Fuels Reduction Project. Road maintenance activities off National Forest land cannot be determined for the most part, as specific road maintenance projects have yet to be identified. Known recurring road operations off National Forest that may have a potential for cumulative effects would be sanding on Highway 35 during the winter. The timing of sanding has the potential to provide sediment that may mix with road maintenance activities in the Polallie Cooper Hazardous Fuels Reduction project but no measurable cumulative is expected due to the small amount of potential sediment from road maintenance and the distance between both activities.
Invasive Plant Treatments	Coarse and Fine Sediment	Yes	Yes	No	There may be an overlap in timing of this project with the Polallie Cooper Hazardous Fuels Reduction project; any minor suspended sediment would not be measurable due to implementation of project design criteria and conformance with existing standards and guidelines in both projects.
	Stream Temperature	Yes	Yes	No	The Polallie Cooper Hazardous Fuels Reduction project would maintain the primary shade zone so there is a low risk of increase in stream temperature.

Cooper Spur Ski Area and associated activities	Coarse and Fine Sediment	Yes	Yes	No	There may be an overlap in timing of these activities with the Polallie Cooper Hazardous Fuels Reduction project; any minor suspended sediment would not be measurable due to implementation of project design criteria and conformance with existing standards and guidelines in both projects.
	Water Quantity	Yes	Yes	No	No cumulative water quantity effects due to project design criteria implementation, conformance with existing standards and guidelines and natural recovery in the Gnarl Ridge fire area. Both the Cooper Spur Ski Area and the Gnarl Ridge burn area are located in the Tilly Jane Creek 7th field HUC and were included in the Watershed Impact Area calculations. There would be some vegetation removal in the Tilly Jane Creek 7th field HUC but any increase would not be measurable due to project design criteria implementation, conformance with existing standards and guidelines on the Polallie Cooper Hazardous Fuels Reduction Project.

Stream Temperature

No detrimental cumulative effects are expected as a result of increased water temperature due to PDC that maintain existing primary shade vegetation adjacent to perennial streams. Additionally, all blocks that propose Riparian Reserve treatments adjacent to perennial streams have additional conditions that protect existing water temperatures. As described in the direct and indirect effects section, this project is expected to have an immeasurable effect to existing water temperatures.

Sediment

Detrimental cumulative effects are not expected as a result of sediment introduction from activities associated with the Polallie Cooper Hazardous Fuels Reduction project. Sediment from road maintenance activities on the 3512 road may mix with sediment originating from the Gnarl Ridge burned area. This risk would be greatest the year following the road maintenance work associated with the Polallie Cooper Hazardous Fuels Reduction Project. The cumulative effect is not expected to be measurable and would be localized due to the small amount of sediment expected from the Polallie Cooper Hazardous Fuels Reduction Project.

Water Quantity

A peak flow analysis was completed for this project and is displayed in the Effects Section above. This project along with other projects on and off National Forest lands were included in the Watershed Impact Area calculation (Forest Plan Standard FW-067, pg. Four-55) and the analysis area was found to be in compliance with Forest Plan Standard FW-064 so no cumulative effects are anticipated for water quantity, indicating compliance with Forest Plan Standard FW-066..

3.6.4 Consistency Determination

Numerous existing plans provide guidance for projects in the form of Standards and Guidelines (S&G) and recommended Best Management Practices (BMP). These documents include the Mt. Hood National Forest Land and Resource Plan (Forest Plan), the Northwest Forest Plan (NWFP) and associated supporting documents and the Middle Columbia-Hood (Western Hood Subbasin) TMDL. A summary of applicable water quality S&G and BMP's from these documents are displayed below.

Forest Plan Standards and Guidelines (pages Four-53 through 63)

- Standards and Guidelines dealing with BMPs – FW-54,55,56,57,58,59,60
- Standards and Guidelines dealing with analysis considerations – FW-61,62,63,64,65,66,67
- Standards and Guidelines dealing with drinking water protection –FW-72,75,76
- Standards and Guidelines dealing with maintaining good water quality (temperature and sediment) - FW-109,110,111,112,113,114,127,128,129,132,133,134,135,136

Northwest Forest Plan (NWFP) Standards and Guidelines:

- Standards and Guidelines dealing with Riparian Reserves (NWFP ROD, pg. C-31 through C-38). The primary Standards and Guidelines that pertain to this project are Timber Management – TM1-C, Roads Management – RF-2 and Fire/Fuels Management – FM-1.
- Aquatic Conservation Strategy

The Clean Water Act of 1948 (as amended in 1972 and 1987) establishes as federal policy the control of point and non-point pollution and assigns the States the primary responsibility for control of water pollution. Compliance with the Clean Water Act by National Forests in Oregon is achieved under State Law.

West Hood Subbasin TMDL: Continue to follow Forest Plan and Northwest Forest Plan Standards and Guidelines as well as the *Northwest Forest Plan (NWFP) Temperature TMDL Implementation Strategies: Evaluation of the Northwest Forest Plan Aquatic Conservation Strategy (ACS) and Associated Tools* (2005).

In addition to the plans discussed above other documents such as the “Forest Service National Core Best Management Practices” (USDAFS, 2012) and the draft “EPA Region 10 Source Water Protection Best Management Practices for US Forest Service, BLM” provide guidance about potential BMP’s for this project. Those BMP’s would be incorporated where appropriate.

Summary - As outlined in the effects section this project is consistent with applicable law and direction. Major highlights include:

- The inclusion of Best Management Practices (BMP) to meet water quality standards and the Clean Water Act. These BMPs reduce or eliminate potential degradation from increased water temperature and sedimentation.
- Establishment of Riparian Reserves and protection buffers adjacent to all streams.
- Designing prescriptions within Riparian Reserves to contribute to attainment of Aquatic Conservation Strategy Objectives (see the Aquatic Conservation Strategy section for more information).

Executive Order 11990 – Protection of wetlands

As documented above, none of the proposed activities are located in wetlands. The Proposed Action does include some level of entry into Riparian Reserves adjacent to wetlands. As outlined in the Water Quality section, PDC and BMP aimed at reducing or eliminating potential detrimental effects to water quality are included with this project. In addition, vegetation treatment prescriptions are developed to improve and restore more natural tree stands within Riparian Reserves.

Executive Order 11988 – Protection of Floodplains

Due to the steepness of the topography, small stream size and confined nature of streams in this area, floodplain width is fairly limited. The 100-year floodplain on all first order tributaries is estimated to be less than 15 feet wide in general. On East Fork Hood River, the 100-year floodplain is estimated to be generally less than 50 feet wide but is unusually wide in some places due to the previous debris flows described in the Existing Conditions section of this report. Smaller streams such as Dog River, Polallie Creek and Tilly Jane Creek floodplains are generally about 20 to 30 feet wide. One activity proposed in floodplain areas of some of the smaller streams is falling wood into stream channels to improve aquatic organism habitat and stream channel function. This activity would improve aquatic and riparian habitat.

3.6.5 Summary of Effects by Alternative

Water temperature would be maintained under the No Action alternative. The risk of increased stream temperatures is low in the Proposed Action alternative due to the implementation of protection buffers and existence of several site conditions such as groundwater input and wider primary shade zones that reduce the chance of water temperature change. The short-term sedimentation risk would be low for the No Action alternative because sediment delivery to streams in the planning area is expected to remain at current levels. Lack of road maintenance in some areas would lead to increased sediment introduction due primarily to erosion of the road surface. The risk would also be low under the Proposed Action alternative with the highest risk associated with road maintenance activities. Risk for increased peak flow would be low under both alternatives due to meeting Forest Plan Standards and not increasing the stream channel network miles under the Proposed Action. Water quality in the Crystal Springs DWPA would be maintained due to implementation of PDC and BMP, some of which are specifically developed for protection of the DWPA.

3.7 Fisheries and Aquatic Fauna

3.7.1 Analysis Assumptions and Methodology

The analysis method utilized to determine potential impact to fish, aquatic invertebrates, and their associated habitat are listed below.

- Determine known and suspected locations of federally listed or proposed aquatic species, designated critical habitat, essential fish habitat, Region 6 Regional Forester's sensitive species, survey and manage species, and Mt. Hood National Forest management indicator species in relation to proposed project activities.
- Assess proposed project activities and determine the aquatic habitat elements potentially impacted and the geographic area where effects could occur (i.e., the action area).
- Overlap the species/habitat locations with the action area and determine which species/habitat could be affected by project activities.
- When species/habitat overlaps with the action area impacts are predicted from proposed project activities to individuals and their associated habitat. This analysis relies upon the Soil Productivity and Water Quality Specialist Reports to determine the potential effects to physical resources (i.e., habitat). These specialist reports are available in the project record located at the Hood River Ranger District in Mount Hood/Parkdale, Oregon.
- Potential effects to aquatic fauna and habitat were determined from the following:
    - Direct and/or indirect effects to individuals from proposed activities;
    - Potential reductions in stream shade and subsequent increases in water temperature compared to existing levels;
    - Potential increases in erosion and fine sediment input to streams and wetlands compared to existing levels;
    - Potential impacts to existing and future levels of large wood in stream channels and Riparian Reserves, including any impacts to large wood recruitment;
    - Potential impacts to the quantity and quality of pool habitat; and,
    - Cumulative effects associated with ongoing or proposed projects in the action area or close enough so that cumulative effects could occur.
- Where impacts to individuals or habitat parameters discussed above result from proposed project activities, the potential impacts to aquatic species/habitat were analyzed and then the effects to the biological resource were determined based on professional experience, applicable surveys/studies, and available literature/research.

Assumptions associated with this methodology are listed below.

- Aquatic faunal and habitat survey data utilized is the latest available and utilized standard survey protocols. It is assumed that this information is representative of current conditions unless otherwise noted.
- All Best Management Practices (BMP) and Project Design Criteria (PDC) listed in the EA, Chapter 2 would be fully implemented and effective.
- The areas of impact outlined in the EA, Chapter 2 are the actual areas of disturbance.
- A large chemical spill (gas, oil, or other material) would not occur during project implementation thus it will not be analyzed.

3.7.2 Existing Condition

The project area is located in the Mt. Hood National Forest (Forest), Hood River County, in the following seven 7th field watersheds: Dog River, Crystal Springs, East Fork Hood River, Lower East Fork Hood River, Evans Creek, Polallie Creek, and Tilly Jane Creek. The 7th field drainages are located in the Middle, Lower East Fork Hood River, and Dog River 6th field sub-watersheds within the East Fork Hood River 5th field watershed.

A portion of one treatment block (11 acres) is located in the Eliot Branch 7th field sub-watershed (Upper Middle Fork Hood River 6th field watershed), but the treatment block comprises 0.4 percent of the total sub-watershed area. Effects are expected to be immeasurable at the sub-watershed scale and no activities would occur within Riparian Reserves, thus any further discussion of this area would not be included in this analysis. All of the activities for the project are subject to all applicable BMP and PDC regardless of their location.

There are approximately 119 miles of stream in the National Forest portion of the above listed 7th field watersheds in the following categories: 55 miles of perennial stream (surface flow year around) and 64 miles of intermittent streams (streams are dry for part of the year). The hydrology in the planning area west of the East Fork Hood River is characterized by numerous ephemeral drainages[3] that eventually become intermittent streams and in a few cases perennial streams (examples include Evans Creek and Doe Creek). Tilly Jane Creek is the only stream in this area that is perennial from the source. The streams are small, spring fed, with relatively gentle gradients except some steeper sections depending on stream and location (Rosgen A and B channel types).

In the portion of the planning area west of Highway 35, especially in the headwaters of Doe Creek and some tributaries to the EFHR, the streams “pipe” water underground for varying distances, with occasional surface flow, before the water surfaces and the stream becomes perennial. These stream sections presented an unusual dilemma in terms of classification as per the NWFP because they did not fit either the perennial or intermittent stream channel definitions well. In the end we categorized them as intermittent streams (because of the lack of surface flow and definable channel) but in terms of protection these streams in blocks 7 and 8 were buffered wider than other intermittent streams in the planning area (see PDCs and Table 10).

East of the East Fork Hood River there are no stream channels on top of the ridge between Dog River and East Fork Hood River (as expected) but many channels form on the steep slopes leading down to both streams. These channels are quite steep, many over 20% gradient. Not all are perennial, in fact many are ephemeral, but all are small and confined. Dog River is the largest perennial stream in the eastern half of the planning area. It lies in a steep, confined valley (predominantly Rosgen A4a+, A3a or B4 channel types) within the action area. For reference, the water quality specialist report defines Rosgen channel types in detail.

The portion of the East Fork Hood River within the project area is contained in a large, confined V-shaped valley (Rosgen B3 channel type) which widens into a wider U-shaped valley to the north. Through most of the action area, the EFHR lies in a broad glaciated valley with streambanks composed of un-vegetated unconsolidated alluvial material (Rosgen C2 and C3 channel types). It is designated as a Wild and Scenic River. Well upstream of the planning area are two glacial streams that empty into the EFHR, Clark and Newton Creeks, as well as many spring-fed tributaries.

Water quality in streams within the project area is generally good, with water temperatures well within Oregon Department of Environmental Quality standards. Clark and Newton Creeks carry significant amounts of natural bedload and fine sediment that influences habitat conditions in the EFHR downstream from their respective confluences, including within the project area. Polallie Creek is in a steep drainage within naturally unstable areas which has high potential for landslides and debris torrents during high intensity precipitation events, especially those occurring on a snowpack (rain on snow events). Other streams in the project area are all spring fed and thus run clear and cold.

A 2011 USFS analysis of watershed condition conducted at the 6th field scale, under a National Program protocol, determined overall watershed condition in the Polallie Cooper project area was "Functioning Properly" for all three 6th field watersheds in the project area (the watershed condition rating was 1.4 or 1.6 for each sub-watershed, with scores <1.66 considered properly functioning, and above this figure considered functioning at-risk). The functioning properly rating does not necessarily mean every aspect or environmental condition is in excellent or good condition, only that overall natural processes are working at a high level. Functioning properly also doesn't mean that restoration is not needed in the watershed; on the contrary, these watersheds are the priority for restorative actions because less effort is needed to improve and/or maintain conditions.

Affected Environment / Action Area

The affected environment, also known as the action area, is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action [50 CFR §402.02]. For the purposes of this analysis, the action area is defined as the 7th field watersheds where ground disturbance would take place for all proposed activities, as well as aquatic habitat areas downstream where potential effects could occur.

The 7th field watersheds listed above were used as the basis for the site-specific analysis summarized herein, while the 6th field sub-watershed were used for other, larger scale cumulative effects analysis and compliance with the Northwest Forest Plan (NWFP) Aquatic Conservation Strategy Objectives. Although watershed boundaries make up the extent of the action area the actual expected effects may only be realized in a portion of the watershed. The action area also includes the proposed log haul route and associated stream crossings in a portion of the EFHR watershed south of the planning area: FSR 4400 to Highway 35.

The action area encompasses 27,582 acres. This is larger than the project area (7,300 acres) because the action area includes either the entire 7th field watershed or the watershed clipped at a 3-mile distance downstream of the project area, such as in the case with 2 watersheds that are dominated by residential or agricultural lands downstream of where proposed actions would occur. In contrast, the project area boundary does not extend far beyond specific treatment blocks that total 2,830 acres (Table 3).

Environmental Baseline

The environmental baseline discussion is divided into two main sections: aquatic species distribution and basic life history; and existing habitat conditions, particularly as they relate to designated critical habitat primary constituent elements (PCE) in the action area. Only those species and associated habitat that are found within the action area are discussed and analyzed since there would be no effect/impact to species/habitat outside the action area.

Presence of Proposed, Endangered, Threatened, and Sensitive Aquatic Species within the Action Area

Fish Species Presence / Absence

There are 13.1 miles of designated critical habitat for Lower Columbia River (LCR) steelhead (*Oncorhynchus mykiss*), 1.9 miles for LCR Chinook salmon (*O. tshawytscha*), and 11.9 miles of proposed critical habitat for LCR Coho salmon (*O. kisutch*) in the action area (Figure 40, Figure 41, Figure 42). All of the aforementioned species are listed as threatened under the Endangered Species Act (ESA). Not all critical habitat is occupied by the corresponding listed species – as discussed in more detail below. Other native fish species present in the action area include resident rainbow trout (*O. mykiss*) and resident cutthroat trout (*O. clarki*). Brook trout (*Salvelinus fontinalis*), a non-native salmonid, are found in Doe Creek and Tilly Jane Creek. When they were planted there, and by whom, is unknown.

Both LCR summer and winter steelhead runs are present in the Hood River Basin; however, only winter steelhead are present in the EFHR watershed; in the EFHR mainstem and possibly the lower reaches of Dog River and Polallie Creek (Figure 40). Adult winter steelhead typically enter the Hood River in early December to mid-June before spawning from mid-January to late June. Most juvenile steelhead emigrate as age-2 or age-3 smolts and spend 1-3 years rearing in the ocean before returning as adults.

LCR coho salmon presence in the action area is relatively limited. They are known to reside in the EFHR up to Dog River and based on limited observations in the past (MHNF, unpublished data) they inhabit the lower ¼ mile of Dog River (Figure 41). Proposed critical habitat, however, extends well beyond the upper limit of known distribution – up to the headwaters of the EFHR and about 1.2 miles above the mouth in Dog River (Figure 41). Coho adults arrive in the Hood River in late summer and fall and spawn that same fall. Most coho salmon incubate and rear in freshwater for a little over a year and then spend 1-2 years in the ocean before returning to spawn.

Chinook salmon are not currently known to be present in the action area (Figure 42). Known spring Chinook salmon upper distribution ends about three miles downstream of the action area in the EFHR, although they may potentially be able to utilize the EFHR up to the Tilly Jane Creek confluence near the Forest boundary (Rod French, personal communication October 16, 2015). Spring Chinook enter the Hood River from April to September, and spawn beginning in mid-August through late September. Juveniles emigrate in the fall or the following spring after emergence, and return generally at age 4 (range 1-5 years old). Fall Chinook salmon are found low in the Hood River Basin, a distance of over 10 miles downstream. Designated critical habitat for Chinook salmon extends into the lower (northern) end of the action area – located only in the EFHR up to the confluence with Dog River as well as into Dog River a few hundred feet upstream of the confluence.

No other ESA listed fish species that occur elsewhere on the Forest are found in the action area.

Figure 40. Map of known and suspected steelhead trout distribution and designated critical habitat within the Polallie Cooper Fuels Reduction Project action area.

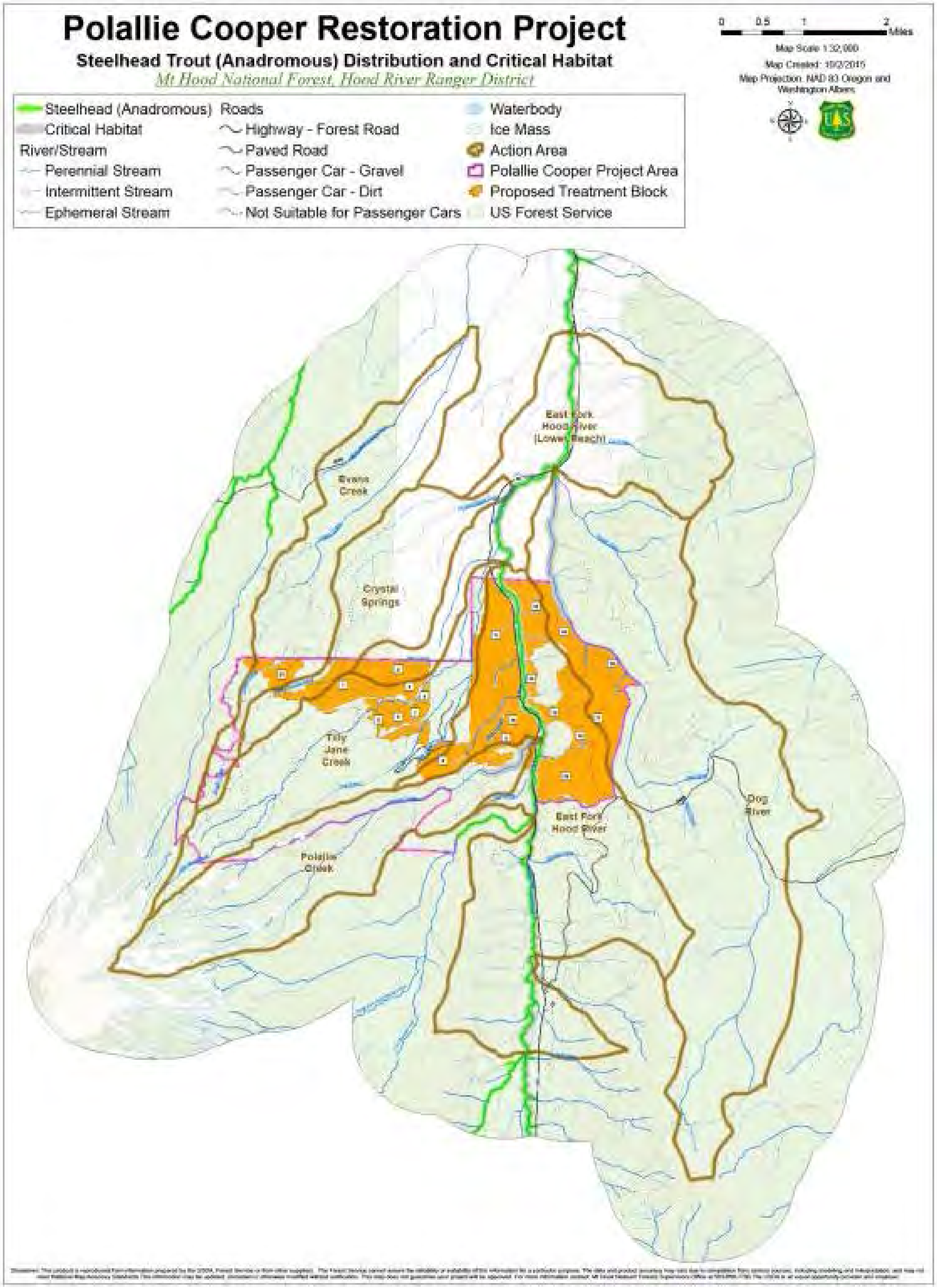


Figure 41. Map of known and suspected Coho salmon distribution and proposed critical habitat within the Polallie Cooper Fuels Reduction Project action area.

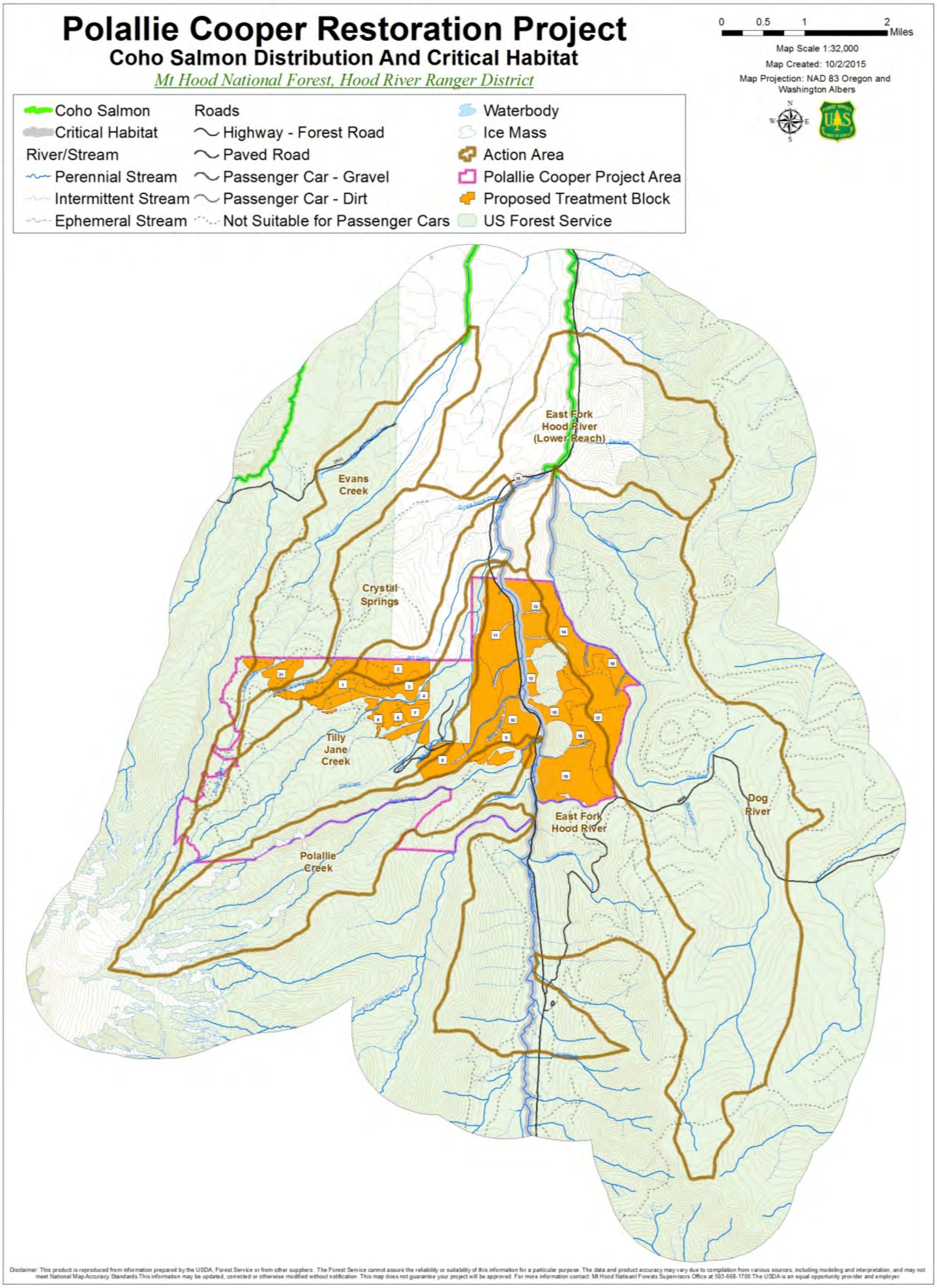
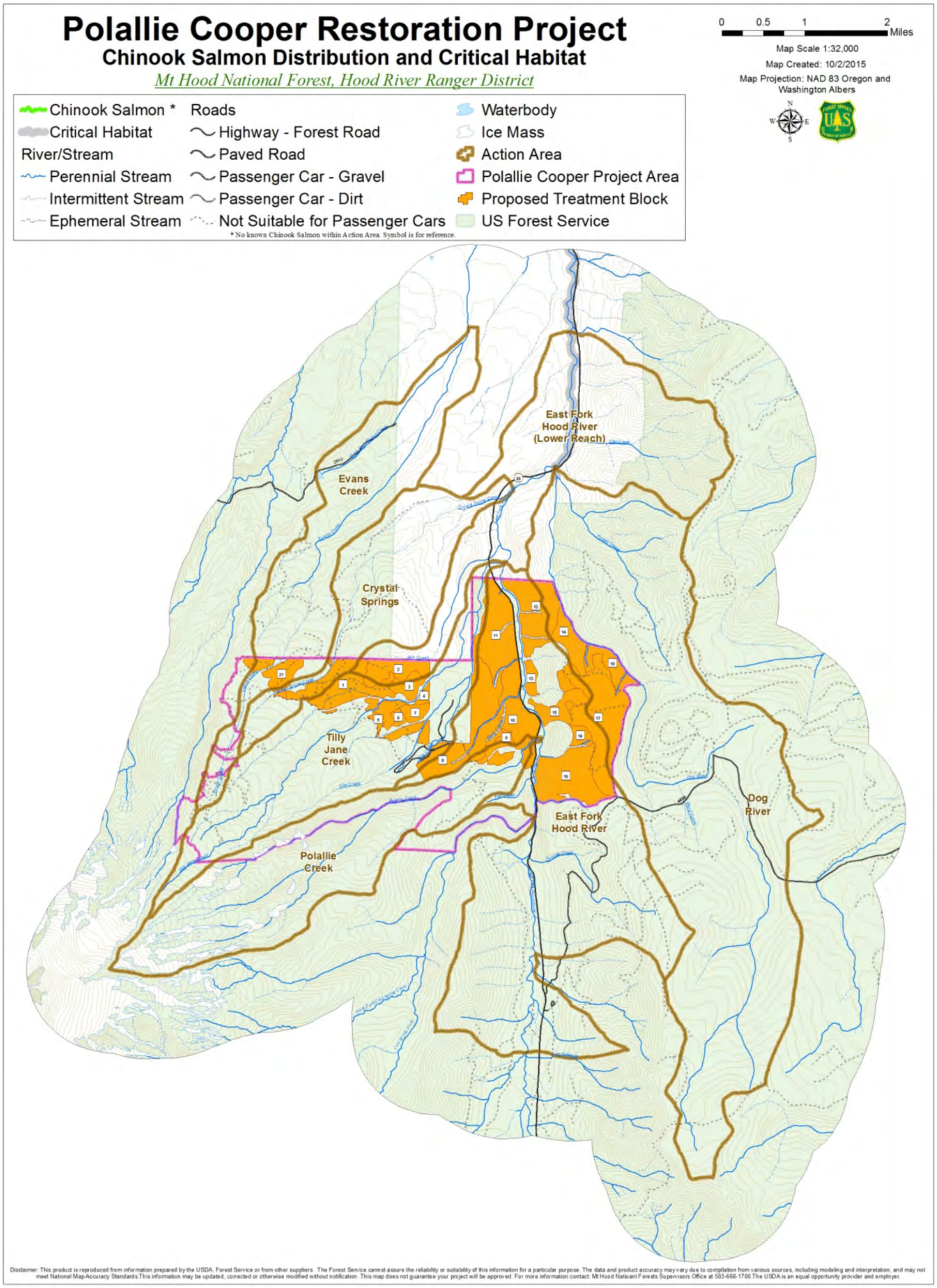


Figure 42. Map of Chinook salmon designated critical habitat within the Polallie Cooper Fuels Reduction Project action area.



Management Indicator Species

Because of their relative sensitivity to change, salmonids were selected as "an indicator species group" for aquatic habitats on the forest. This group of species is especially important for their commercial and game values and because they occupy the spectrum of aquatic habitats on the forest. Their habitat and water quality requirements are restricted enough that it is reasonable to assume that if the life history needs of salmonids are met, the needs of other fish species found on the Forest would be met (see FEIS, III-58). Management Indicator Species (MIS) for the Forest include ESA listed fish species (Chinook salmon, Coho salmon, steelhead trout, and bull trout), coastal cutthroat trout, and resident rainbow trout – all but bull trout are found in the Polallie Cooper Fuels Reduction Project action area. Of these species, resident trout (rainbow and cutthroat) are the most widespread in the action area (Figure 43).

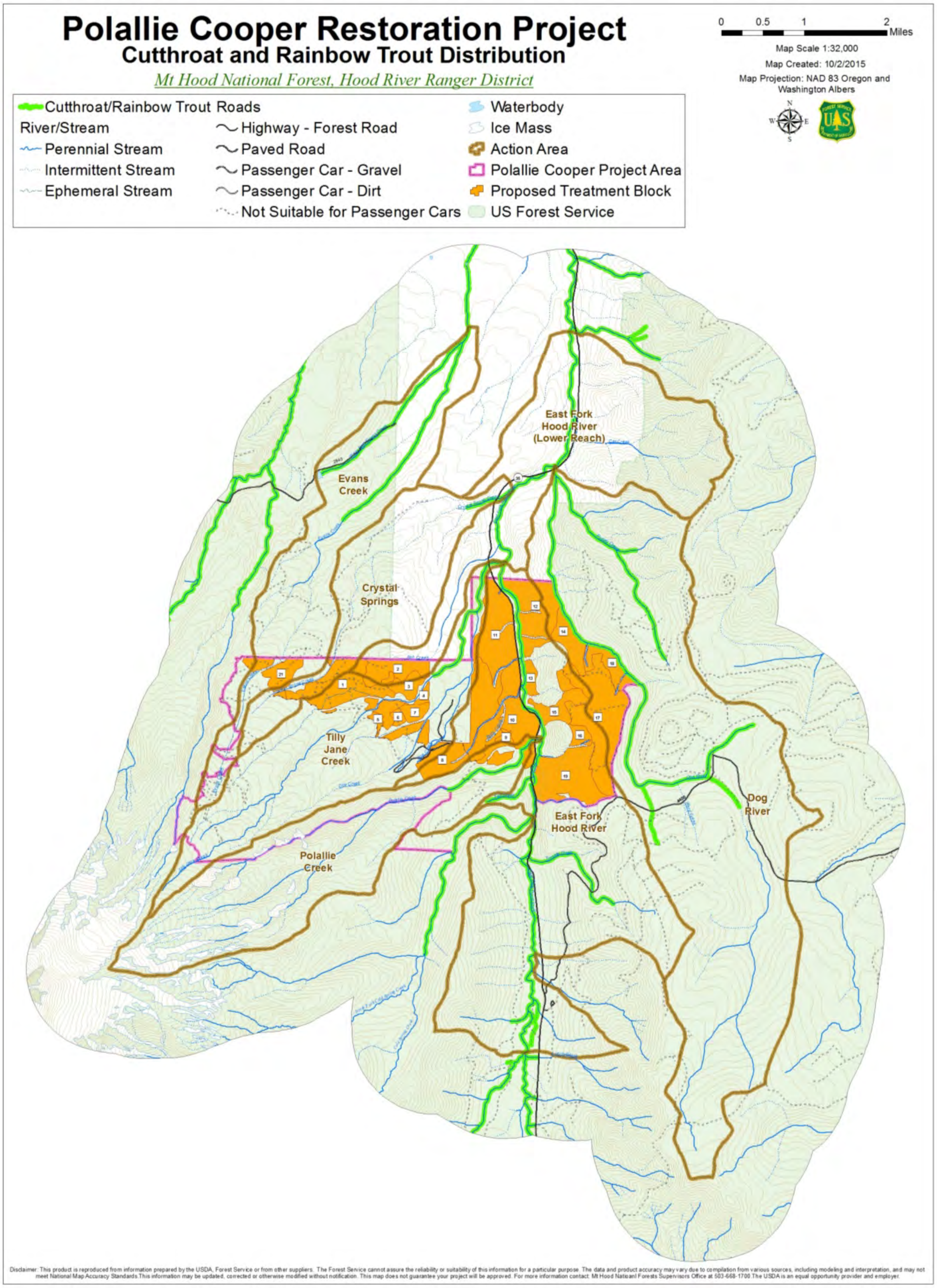
A forest-level analysis of the status of these species and their habitat was conducted in March 2011. The state of Oregon, in collaboration with the regulatory agencies, manages fish populations while the Forest manages the habitat. For a population to be viable, attributes such as species abundance, productivity, spatial structure, and genetic diversity are needed for the species to maintain its capacity to adapt to various environmental conditions and allow it to sustain itself in the natural environment. All of these attributes are affected by habitat and other environmental conditions that influence species behavior and survival.

The forest-wide analysis also assessed the quantity and quality of habitat available on the forest, and how much habitat was occupied, for each of the salmonid species. The analysis was performed by calculating the linear distance of stream miles of the intersect between widely available National Hydrography Dataset (NHD) and StreamNet fish distribution layers of the geo database on file at the Forest headquarters office. Fish distribution was determined by utilizing the Oregon Department of Fish & Wildlife (ODFW) 1:24000 data for anadromous fish (which matched StreamNet data), U.S. Fish and Wildlife Service data for bull trout, and Forest legacy fish distribution data for resident trout distribution. Results of this analysis are summarized below (Table 56).

Table 56. A comparison of salmonid management indicator species (MIS) occupied habitat within the Mt. Hood National Forest (total) and the occupied habitat within the action area. Private land wholly within the Mt. Hood National Forest boundary is included in the "Total Occupied Habitat" column. Steelhead trout is the winter run only.

MIS	Total Occupied Habitat in the Mt. Hood National Forest (mi)	Occupied Habitat in the Action Area (mi)	Percentage of Total Occupied Habitat in the Action Area
Coho salmon	193	2.3	1.2%
Steelhead trout	303	10.5	3.5%
Resident trout	1370	32.5	2.3%
Chinook salmon	143	0.0	0%
Bull trout	20.0	0.0	0%

Figure 43. Map of known and suspected resident trout distribution within the Polallie Cooper Fuels Reduction Project action area.



Aquatic Macroinvertebrate Presence/Absence

There are three aquatic mollusks and two caddisflies known or suspected to occur on the Forest included on the Region 6 Regional Forester's 2011 Sensitive Species list (Table 57). In addition, there are four mollusks and three caddisflies considered strategic species by the Regional Forester. Two of the strategic mollusks (Basalt Juga and Columbia duskysnail) were also listed as Survey and Manage Category A species requiring management of known sites and minimizing inadvertent loss of undiscovered sites (USFS and BLM 2001).

Only sensitive species are required to be addressed in a biological evaluation (Forest Service Manual 2670). Distribution, life history, etc. for many strategic species are poorly understood; thus when they are found while conducting surveys for other species, the Forest Service requires recording location(s) in corporate databases established by the agency. For the purposes of this report/biological evaluation, the only two strategic species discussed further are the Columbia duskysnail and Basalt Juga since they are Survey and Manage species as described above.

Table 57. Region 6 (R6) special status species either documented (D) or suspected (S) to occur within the Mt. Hood National Forest and within the Polallie Cooper Fuels Reduction Project action area (Yes, No, Unknown). The two species in bold are also Survey and Manage species as outlined in Forest Service et al. 2001.

Scientific Name	Common Name	Forest Presence	Action Area Presence
	Sensitive Species		
Juga hemphilli dallesensis	Dalles juga	S	No
Juga hemphilli hemphilli	Barren juga	D	No
Juga hemphilli maupinensis	Purple-lipped juga	S	No
Allomyia scotti	Scott's apatanian caddisfly	D	No
Namamyia plutonis	A caddisfly (no common name)	S	No*
	Strategic Species		
***Fluminicola* sp. nov. (Pinhead)**	Pinhead pebblesnail	S	No
***Juga* sp. nov. (Basalt)**	**Basalt juga**	**D**	No
***Juga* sp. nov. (Brown)**	Brown juga	S	No
***Lyogyrus (Colligyrus)* sp. nov.(Columbia)**	**Columbia duskysnail**	**D**	Yes
Pristinicola hemphilli	Pristine springsnail	S	No
Lepania cascada	A caddisfly (no common name)	S	Unknown
Moselyana comosa	A caddisfly (no common name)	S	Unknown
Rhyacophila unipunctata	One-spot rhyacophilan caddisfly	D	Unknown

***Not found during 2013 and 2014 surveys targeting suitable habitat. Based on survey results and known habitat preferences they are not present in the action area although not all streams in the action area were surveyed.**

Dalles Juga: The Dalles juga has been found in Mill Creek and the central and eastern Columbia River Gorge from Hood River to The Dalles, in Hood River and Wasco Counties, Oregon and Skamania

County, Washington (Frest and Johannes 1995). The Dalles juga is found at low elevation large springs and small-medium streams with a stable gravel substrate and fast-flowing, unpolluted, highly-oxygenated cold water. Relatively few macrophytes or epiphytic algal taxa are present, with Rorippa being the most frequently encountered. The species cannot survive long out of water (Frest and Johannes 1995). None of this species were found during surveys conducted in 2013 within streams in the project area.

Barren Juga: This species of aquatic mollusk is found in freshwater habitats in small to medium sized highly oxygenated cold water streams at low elevations. The species prefers streams that have moderate velocity level bottoms with stable gravel substrates. The known range of this species is the Columbia River Gorge in Oregon and Washington. None of this species were found during surveys conducted in 2013 within streams in the project area.

Purple-lipped Juga: The Purple-lipped juga snail is endemic to Oregon. It is found in large streams at low elevations. These snails prefer riffle habitat with stable gravel substrates, in cold well oxygenated water. It is more tolerant of silt and slack water than other Juga subspecies. The known range of the species is the Lower Deschutes River drainage, below Pelton Dam, and the Warm Springs River in Wasco and Sherman counties, Oregon. Sites where the species are known to occur are located on the Warm Springs Reservation and Prineville Bureau of Land Management (BLM) in the Deschutes Wild and Scenic River Area. There are few locations on the Forest that match the above preferred habitat description. None of this species were found during surveys conducted in 2013 within streams in the project area.

Scott's Apatanian Caddisfly: This species has been found in several streams around Mt. Hood but only within the 4,000-6,000 foot elevation band and not in streams in the action area (Wanner and Arendt 2015). Surveys were conducted in Tilly Jane Creek and Doe Creek, as well as in an unnamed tributary to Polallie Creek and no individuals were found. No other streams in the action area lie within this elevation band and thus are not suitable habitat.

Namamyia plutonis: Little is known about this caddisfly but they have been found in small streams in densely forested old growth or mature forest watersheds, and larvae have been found in core samples collected from areas composed of coarse gravel mixed with silt and organic sediments (Anderson 1976). They are known to reside in the Coastal and Cascade Ranges of Oregon and California, including documented occurrences in the Rogue River-Siskiyou, Siuslaw, and Willamette National Forests (Anderson 1976), and a recent occurrence in the Rogue River-Siskiyou National Forest (Borgias and Wisseman 1999).

Namamyia plutonis has never been documented in the Forest, including during surveys conducted in 2013 and 2014 in Tilly Jane Creek, Doe Creek, and the unnamed tributary to Polallie Creek. Suitable habitat, as described by Anderson (1976), is not prevalent in the action area; as such they are presumed not present in the action area.

Survey and Manage Aquatic Mollusks

Surveys for the two Survey and Manage aquatic mollusks known to reside in Forest streams (Table 57) were conducted throughout the project area in 2013 (MHNF, unpublished data). No Basalt juga individuals were found at any site surveyed and thus they are not believed to reside in any action area stream. However, the Columbia duskysnail was found at seven sites in the action area in the following streams/springs: Clinger Springs (2 sites, a tributary to the EFHR), EFHR (1 site below Polallie Creek), and Dog River (4 sites). Interestingly, no Columbia duskysnail individuals were found in the action area west of the EFHR. It is also noteworthy that the one specimen found in the EFHR is the first described in a glacially influenced stream on the eastside of the MHNF.

Upon review of the survey and manage direction in the *Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines* (USFS et al. 2001) all of the sapling thinning and commercial plantation thinning blocks fall within exemption "a" (thinning projects in stands younger than 80 years old) listed in the October 11, 2006, modified injunction Northwest Ecosystem Alliance v. Rey, Case No. 04-844-MJP.

This project complies with the court's survey and management direction in Northwest Ecosystem Alliance v. Rey and is consistent with the survey requirements in 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 BLM).

Existing Aquatic Habitat Conditions within the Action Area, Including Designated Critical Habitat and Essential Fish Habitat

The project area has been impacted over the past century by timber harvest, road building, floods, fires, fire suppression, irrigation, and recreational activities. All these activities have had an effect on the condition of the quality and quantity of habitat for fish and other aquatic species in the action area. Whereas a number of habitat parameters could be affected by proposed project activities, the primary processes that could be impacted by the project include sediment delivery, increased solar loading, and large wood recruitment.

Proposed treatments, unit boundaries, temporary road locations, and PDCs have all been designed to minimize impacts to aquatic habitat across the action area. Some impacts are possible, and the following habitat parameters are the most likely to be impacted: stream shade and subsequently water temperature; substrate fine sediment levels in streams and wetlands; pool quantity and quality; future large wood recruitment potential; and existing in-stream large wood levels. *Because other habitat parameters and/or fluvial processes are either analyzed in the Water Quality Specialist Report or proposed activities would not impact them, only those habitat parameters listed above will be discussed below and in the effects sections that follow.*

Stream Temperature

Stream temperatures have been collected by the Forest Service at six monitoring locations within or below the project area for several years (see Figure 2 in the Water Quality Specialist Report). Water temperature monitoring has focused on summer conditions since fall, winter, spring and early summer temperatures (spawning and incubation periods) in this watershed are quite cool. Water temperature recorders were generally placed in late spring or early summer, depending on snowmelt, and removed in early fall.

The lower EFHR (13 year of data) and Polallie Creek (only two years of data) had the warmest maximum 7-day average water temperatures (17.3°C and 17.8°C, respectively) of monitored streams in the action area during the 1994-2007 period of record (Table 4 in the Water Quality Specialist Report). The upper EFHR site, located just upstream of the project area, did not exceed 16.4 °C in six consecutive years of monitoring (2000-2005). Stream temperatures in the other 3 monitored locations (Dog River, Doe Creek and Tilly Jane) never exceeded 13.5 °C for maximum 7-day average temperatures. All recorded water temperatures met Oregon DEQ temperature standards of 13 °C during salmon/steelhead spawning (October 15-May 15 for Dog River and EFHR) and 18 °C for salmon/trout rearing & migration (all perennial streams). However, in some years, principally in July and August, water temperatures in the lower EFHR and Polallie Creek may approach the upper end of the preferred range for salmonids. As outlined in the Water Quality Specialist Report the EFHR is glacially influenced and Tilly Jane Creek is heavily influenced by multiple groundwater sources. Although not continuous or long term data, stream surveyors noted cold water temperatures in Dog River and Doe Creeks (USFS 1997 and 2000). In addition, water temperatures collected by fisheries and watershed personnel during field surveys for this project in multiple small unnamed streams were always cold; generally less than 6° C.

Stream Sediment

Fine sediment deposition in streams can adversely affect fish and fish habitat, particularly for salmonids, by reducing the quantity and/or quality of spawning habitat, reducing food supply by impacting invertebrate habitat, reducing interstitial habitat, thereby decreasing fry survival, and reducing pool quality and quantity. Both past and on-going land use activities can contribute fine sediment in streams. The Mt. Hood National Forest Land and Resource Management Plan (Forest Plan) states that spawning habitat shall maintain less than 20 percent fine sediments less than 1 mm (FW-096).

Dog River was the only surveyed stream in the action area with fine sediment levels below Forest Plan standards (Table 58). As per protocol, stream surveyors combine all sediment less than 2 mm in diameter into one category so comparing values directly with the Forest Plan standard is impossible, but given the relatively high levels of fine sediment on most stream reaches it is doubtful any reach met the standard. Due to the volcanic ash soils that are somewhat prone to erosion, recent fire activity that may have exacerbated erosion, and that fact that many of the streams are small with little capability to move the sediment downstream (Doe Creek and many unnamed tributaries to several streams fit this description) much of the existing fine sediment is likely naturally derived. In the EFHR, the level of fine sediment is naturally elevated due to glacial stream inputs in the headwaters. Polallie Creek is not glacial but it lies in a steep, confined valley where landslides are a common source of chronic fine sediment. Based on personal observation, the level of fines in the EFHR and Polallie Creek appears relatively high, at least in depositional reaches (not unexpected), but not above the range of natural variability given environmental conditions upstream.

All the streams in the action area are located near potential anthropogenic sources of fine sediment, including roads, the Cooper Spur Ski Area, and in some cases old timber harvest units. Those sources could contribute some fine sediment to stream channels depending on the location, site specific conditions, etc.

Table 58. The percent of surface fine sediment measured by Wolman pebble counts in streams within the Polallie Cooper Fuels Reduction Project action area. Pebble counts were not conducted in the East Fork Hood River or Polallie Creek.

Stream	Year Surveyed	River Miles	Percent fines <6mm	Percent fines <2mm
Crystal Springs Creek	2003	0.0 – 0.7	33	32
Dog River	2000	0.0 – 1.8	8	5
Dog River	2000	1.8 – 5.1	17	14
Doe Creek	1997	0.0 – 0.8	32	29
Doe Creek	1997	0.8 – 2.25	61	59
Doe Creek	1997	2.25 – 2.75	57	53
Tributary to Doe Creek	1997	0.0 – 0.75	68	61
Tributary to Doe Creek	1997	0.75 – 1.4	28	25
East Fork Hood River	2009	11.7 – 13.6	NA	NA
East Fork Hood River	2009	13.6 – 15.5	NA	NA
Polallie Creek	1994	0.0 – 3.0	NA	NA

Stream	Year Surveyed	River Miles	Percent fines <6mm	Percent fines <2mm
Tilly Jane Creek	1997	0.0 – 1.9	30	23
Tilly Jane Creek	1997	1.9 – 4.2	65	58
Tilly Jane Creek	1997	4.2 – 5.5	32	24

Pool Quantity and Quality

Pool habitat is a critical component of healthy stream habitat for salmonid populations. The Forest Plan requires that pool habitat be maintained or increased resulting from a given project (FW-088) and that streams contain one or more primary pools per 5 to7 channel widths in low gradient streams (less than 3 percent slope) and one per 3 channel widths in steeper channels (FW-090/091). A primary pool is defined as a pool at least 3 feet deep, which occupies at least half of the low water flow channel. Pool frequency is often related to the occurrence of large wood or other channel obstructions (Montgomery et al. 1995) and pool depth is a function of a variety of factors including sediment input and the ability of the stream at that site to scour, and maintain, a pool. Fine sediment above natural background levels can fill pools and increase bed mobility, resulting in shallower scour depths (Buffington et al. 2002).

Pool frequency in all streams within the action area is below Forest Plan standards (Table 59). Very few streams across the entire Forest meet the standard and those that do tend to be the larger rivers. This is because the pools per mile standard only applies to primary pools as defined above and pools of this size are not common in the smaller, steeper streams common across the Forest and in the action area. The fact that primary pools are not prevalent does not mean that pool habitat is absent in action area streams as can be seen in the “Total Pools per Mile” column in Table 59. Those streams and reaches with fewer pools (EFHR, Polallie Creek, headwaters of Doe Creek) are either transport reaches with little wood to form and maintain pools, and/or are in steeper canyons that are riffle dominated.

There are steam reaches that have been impacted by land management activities, including a reduction of pool forming large wood, across the action area that may have fewer pools now than in the past. All in all, although the Forest Plan standard is not met in any action area stream, most streams in the action area have at least some reaches within the range of natural conditions given stream size, gradient, and valley type in the action area.

Table 59. Pool habitat summary for surveyed streams found within the Polallie Cooper Fuels Reduction Project action area, including total pools per mile; primary pools (pools >=3ft. deep) per mile, and the Forest Plan standard (primary pools). The Forest Plan standard does not apply to stream reaches on private land.

Stream	Year Surveyed	River Miles	Total Pools per Mile	Primary Pools per Mile	Forest Plan Pools per Mile Standard
Crystal Springs Creek	2003	0.0 – 0.7	21	0	166
Dog River	2000	0.0 – 1.8	19	5	97
Dog River	2000	1.8 – 5.1	17	5	105
Doe Creek	1997	0.0 – 0.8	28	0	227
Doe Creek	1997	0.8 – 2.25	35	0	267

Stream	Year Surveyed	River Miles	Total Pools per Mile	Primary Pools per Mile	Forest Plan Pools per Mile Standard
Doe Creek	1997	2.25 – 2.75	10	0	503
Tributary to Doe Creek	1997	0.0 – 0.75	26	0	215
Tributary to Doe Creek	1997	0.75 – 1.4	13	0	293
East Fork Hood River	2009	11.7 – 13.6	5	5	14
East Fork Hood River	2009	13.6 – 15.5	7	7	20
Polallie Creek	1994	0.0 – 3.0	12	<1	141
Tilly Jane Creek	1997	0.0 – 1.9	33	3	163
Tilly Jane Creek	1997	1.9 – 4.2	55	0	260
Tilly Jane Creek	1997	4.2 – 5.5	23	0	357

Pool quality is a descriptive measure of their “attractiveness” and suitability for fish and other aquatic fauna. Pools of higher quality are deeper and contain some form of cover for fish (i.e. large wood, undercover bank, water turbulence bubbles). Pools of this type aren’t common but are present in all of the larger streams, even if the pool isn’t classified as a primary pool. Field observations conducted as part of this project indicated pools located in first order headwater streams in the action area had shallow pool depths with fine sediment, sand, or small gravel as the dominate substrate. Minimum diameter channel forming wood sizes were identified in the action area during field surveys and the majority of the first order headwater stream pools were created and maintained by 3 to 4 inch diameter wood (both alive and dead).

Large Wood Recruitment Potential

The ability of forested stream-side riparian areas to provide a continual source of large wood to the channel and floodplain is dependent on a variety of factors including tree species, tree sizes, stand health, and susceptibility to natural disturbance events such as windthrow, wildfires, or floods. Large wood recruitment potential is not a Forest Plan standard and there is no objective protocol to measure it. Despite the subjective nature surrounding this process the ability of forested riparian stands to provide down wood at present and in the future is an important component of this analysis because silvicultural treatments are proposed in riparian areas as part of this project. The following is a summary of known conditions in the action area.

The EFHR and MFHR Watershed Analysis (USFS 1996) suggested that silvicultural objectives for the two watersheds would “…focus on development of species diversity vertical structure and size class differentiation in the vast young stand components (generally less than 21” diameter) that presently make up the basic forest matrix.” In the Silviculture section of the watershed analysis the riparian reserve design cells and interim period management objectives were to “Implement stand maintenance to ensure quality habitat for aquatic and terrestrial species.”

The ability of riparian stands in the action area to provide large wood now and in the future varies depending on the stream and area. Many of the streamside stands, especially west of Highway 35, are dense and have an abundance of smaller trees (<15 inch dbh). In some areas these stands are beginning to decay and down wood, albeit smaller sized, is abundant. In other areas there is little down wood and the capacity of the stand to provide large wood in the immediate future is limited. Most streams have at least sections where relatively large trees are present that could provide down large wood in the future.

In short, riparian conditions and pathways for recruitment are at various stages of recovery in much of the action area; however, short-term large wood recruitment is limited because most trees are not yet of an age and/or size to fall in great numbers on their own.

In-stream Large Wood

Large wood plays an important role in stream ecosystems. Large wood modifies both hydrologic, sediment and nutrient transport by slowing, storing, and redirecting stream water, sediments, and particulate organic matter (Montgomery et al. 2003). Additionally, large wood creates and enhances stream habitat for fish, other vertebrates, and invertebrates by providing physical cover, pools, backwaters, secondary channels, and creating stream flow refugia. Having adequate levels of large woody debris is critical for healthy streams in forested ecosystems.

The Forest Plan has a standard of 106 pieces of suitable large wood per mile of stream (FW-095). To be counted towards this standard in eastside streams, all pieces of large wood shall be at least 35 feet long with 80 percent at least 12 inches in mean diameter, and at least 20 percent over 20 inches in mean diameter. None of the surveyed stream reaches in the action area met the standard based on MHNF stream survey data collected over the last 20 years (Table 60). However, during site specific surveys for this project conducted by fisheries and watershed personnel some streams may now have more wood than presented below (MHNF, unpublished data). For example, based on a count of wood in a representative reach in Tilly Jane Creek this stream likely has about a 100 pieces of large wood per mile and thus would meet the MHNF plan standard. Similar results were found in in many of the unnamed tributaries to larger streams across the planning area. Perhaps more importantly, most channels had numerous pieces of “channel forming” wood. Channel forming wood is smaller in length and diameter than pieces meeting the Forest plan, but is large enough to store sediment, reduce erosion, and maintain channel stability.

Table 60. The in stream large wood summary for surveyed streams in the Polallie Cooper Fuels Reduction Project action area. Wood was counted and summarized differently prior to 1995, thus in Polallie Creek only total pieces per mile is presented.

Stream	Year Surveyed	River Miles	Number of Pieces		Pieces per Mile		
			Medium	Large	Medium	Large	Total
Crystal Springs Creek	2003	0.0 – 0.7	7	6	10	9	19
Dog River	2000	0.0 – 1.8	40	78	17	27	44
Dog River	2000	1.8 – 5.1	47	55	19	22	41
Doe Creek	1997	0.0 – 0.8	17	10	19	11	30
Doe Creek	1997	0.8 – 2.25	33	14	24	10	34
Doe Creek	1997	2.25 – 2.75	9	1	30	3	33
Tributary to Doe Creek	1997	0.0 – 0.75	7	1	11	2	13
Tributary to Doe Creek	1997	0.75 – 1.4	39	8	56	12	68

East Fork Hood River	2009	11.7 – 13.6	9	4	5	2	7
East Fork Hood River	2009	13.6 – 15.5	4	0	2	0	2
Polallie Creek	1994	0.0 – 3.0				2	4
Tilly Jane Creek	1997	0.0 – 1.9	62	40	38	25	63
Tilly Jane Creek	1997	1.9 – 4.2	111	30	46	13	59
Tilly Jane Creek	1997	4.2 – 5.5	14	4	11	3	14

Designated Critical Habitat and Essential Fish Habitat

Critical habitat for steelhead trout and Chinook salmon was designated in 2005 by the National Marine Fisheries Service (NMFS) (70 Federal Register 52630, September 2, 2005) and proposed for Coho salmon in 2013 (78 Federal Register 2726, January 14, 2013). Designated steelhead critical habitat in the action includes the EFHR and the lower reaches of Dog River and Polallie Creek (Figure 40). Proposed Coho salmon critical habitat includes the EFHR and the lower reach of Dog River (Figure 41). Chinook salmon critical habitat does only lies within the northern portion of the action area (Figure 42).

Primary constituent elements (PCE) for steelhead trout and salmon are sites and habitat components that support one or more life stages. There are 6 PCEs that are designated for specific stream reaches, which are: freshwater spawning sites, freshwater rearing sites, freshwater migration corridors, estuarine areas, nearshore marine areas, and offshore marine areas. Streams in the action area are designated critical habitat for spawning and rearing only, thus only the following PCE pertain to this project and only conditions in the above mentioned streams are discussed.

1. Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development.

   Action Area conditions: Suitable spawning habitat for salmon and steelhead is limited in the action area due primarily to the natural geomorphic setting and resulting habitat conditions. The lower ¼ mile of Dog River, the lowest gradient reach, has suitable spawning habitat for the three species and coho salmon spawning has been documented there in the past (MHNF, unpublished data). Dog River steepens considerably above this point and is unsuitable for coho salmon spawning but some areas may provide limited spawning habitat for steelhead trout. Steelhead spawning has never been documented in Dog River despite the suitability of habitat.

   It is unlikely any anadromous species spawn in Polallie Creek due to the steep gradient, high level of fine sediment, and lack of large wood or other roughness elements to trap and sort substrate into suitable gravel beds for spawning. However, spawning surveys have not been conducted in this stream (largely because the habitat is unsuitable). Limited use by steelhead may occur.

   Suitable spawning habitat exists in the EFHR in the action area but it is not widespread. Due to the lack of roughness (e.g. large wood) to trap and sort spawning gravel the suitable spawning areas are discrete patches where smaller sized substrate can settle – behind larger boulders and along stream margins primarily. One excellent spawning habitat area does exist upstream of the confluence with Polallie Creek. Due to a lack of spawning survey information it is unknown whether salmon or steelhead spawn in this reach of the EFHR with any regularity but some spawning is believed to occur due to the presence of suitable habitat. Steelhead trout have been documented as high as Cold Springs Creek in the EFHR based on radio telemetry information collected in the 1990's. Coho presence is undocumented but suspected.

2. Freshwater rearing sites with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility.

   Action Area conditions: Water quantity and floodplain connectivity are within the range of natural variability in the action area but some alterations have occurred in some streams. Polallie Creek has experienced little impact from human development, primarily because of the steep, isolated canyon it lies in. Due to the conditions listed above resulting in a lack of spawning habitat it is not ideal rearing habitat for salmonids; however, resident trout are known to reside there and use by anadromous salmonids is possible. Through some of the action area the EFHR has been constrained by Highway 35 which lies parallel to the river. This has reduced, but not eliminated, the available floodplain area and the ability of the river to migrate laterally. Dog River has adequate floodplain connectivity given its geomorphology – it lies in a steep, confined canyon throughout much of the reach designated as critical habitat and thus has limited connectivity.

   Streams in the Western Cascades are often flashy and can have low base flows in the late summer and early fall, including streams in the action area. However, the spring and glacial fed streams in the headwaters of the action area provide relatively high discharge in the summer and ensure water quality and quantity is adequate for migration and rearing. A large diversion in the EFHR below the action area can result in difficult upstream migration for salmon into the action area. A diversion in the headwaters of Dog River, located 4 miles upstream of critical habitat, takes most of the flow during certain times of the year but springs and tributaries downstream of the diversion contribute considerable water for anadromous fish use. The amount of flow within critical habitat, although not matching historic levels, is adequate to support rearing and migration.

3. Freshwater rearing sites with water quality and forage supporting juvenile development. Freshwater rearing sites with natural cover such as shade, submerged and overhanging large wood, logjams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.

   Action Area conditions: Water quantity and quality is sufficient to support juvenile growth and development in streams within much of the action area. Natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks are available but appear limited compared to conditions historically (USDA 1996). Freshwater rearing habitat quantity and diversity, as caused by glacial silt load, were determined to be a key limiting factor for both steelhead and Chinook salmon juvenile life stages (Coccoli 2004).

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established procedures designed to identify, conserve, and enhance essential fish habitat (EFH) for those species regulated under a Federal fisheries management plan – in this case, Chinook and coho salmon. Section 305(b) of the MSA directs Federal agencies to consult with NMFS on all proposed actions that may adversely affect EFH. Adverse effects include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH.

Pacific salmon (Chinook, pink, and coho) EFH was designated in 1999, and includes all water bodies occupied or historically acessible by the these species within identified fourth-field hydrologic units in Oregon. Washington, Idaho and California [Federal Register Vol 23(200) October 15, 2008]. Pink salmon are not native to the Hood River watershed, thus within the action area, EFH is coincident with designated Chinook salmon and proposed coho salmon critical habitat.

3.7.3 Effects Analysis

No Action Alternative

None of the proposed activities would be implemented if this alternative were chosen. In the near term habitat conditions for aquatic fauna would remain essentially unchanged from existing conditions unless natural events, such as floods or fire, occurred. The risk, however, that these types of events could lead to degraded habitat conditions would increase.

Stream Temperature

As outlined in the Water Quality Specialist Report stream temperatures would remain at current levels due to no shade reduction. Water temperatures would remain cool and well within the preferred range for salmonids and other indigenous aquatic fauna, including macroinvertebrates.

Stream Sediment

Because no ground disturbing actions would occur, the existing condition in regards to fine sediment levels would remain. Current sources of fine sediment including roads, the Cooper Spur Ski Area and natural sources (most notably the Gnarl Ridge Fire area) would remain unchanged. Although road maintenance would occur as budgets and priorities allow the overall level of maintenance would be less than if the Proposed Action were implemented. In some areas, this could result in an increased risk of erosion and fine sediment input over time. The likelihood of this occurring is difficult to estimate because log hauling would not occur and the act of maintenance in and of itself can cause a spike in erosion and thus fine sediment introduction to streams.

In summary, the risk of increased erosion and thus sediment input to streams from roads would be increased under the No Action alternative. However, since other proposed activities that could also increase erosion, including road maintenance and log hauling, would not occur the overall impact in the action area from a sediment perspective under the No Action alternative would be negligible.

Pool Quantity and Quality

The amount and quality of pool habitat would be unaltered under the No Action alternative in the short-term (next 10 to 20 years). Beyond that time a slight decrease in pool quantity would be expected in the larger streams over time given reductions in larger down wood and reduced wood inputs. However, in smaller streams there could actually be an increase in wood created pool habitat as more small trees fall. These conditions would manifest themselves over decades given the anticipated riparian stand response without treatment.

Large Wood Recruitment Potential

If the proposed fuels reduction treatments did not occur, forested riparian stands would be maintained in an uneven aged mature stem exclusion stage. Little to no natural tree regeneration would occur to influence the stand basal area, resulting in high quadratic mean diameters (QMD) compared to the proposed action (Tables 8 and 9). Stands would still maintain high trees per acre with an interlocking canopy and ladder fuels. The snags per acre would remain low, but over time the untreated condition would produce slightly more snag habitat than the treated scenario.

Table 61. Modeled riparian stand characteristics comparing stand conditions in the moist mixed conifer thinning blocks (blocks 1, 2, 4, 5, 6, 7, 8, 14, 18, and 21) for the No Action (NA) and Proposed Action (PA) alternatives in the Polallie Cooper Fuels Reduction Project

Years After Treatment	Trees per Acre		Height (ft.)		QMD (in.)		Snags >20" dia.	
	NA	PA	NA	PA	NA	PA	NA	PA
0	1089	90	81	78	6	15.2	1	1
10	1235	300	91	88	5.9	8.4	1	2
20	1332	443	100	96	6	7.4	1	2
30	1251	435	107	104	6.6	7.9	1	1
40	1236	525	113	110	6.9	7.7	1	1
50	1247	659	117	114	7	7.4	1	2
60	1067	639	120	116	7.7	8	2	2
70	939	760	122	117	8.4	7.8	2	2
80	829	924	122	118	9.1	7.5	2	2
90	724	869	123	119	9.9	8.1	2	3
100	634	815	124	120	10.7	8.6	3	3

Table 62. Modeled riparian stand characteristics comparing stand conditions in the dry mixed conifer thinning blocks (blocks 3, 9, 10, 11, 12, 13, 15, 16, 17, and 19) for the No Action (NA) and Proposed Action (PA) alternatives in the Polallie Cooper Fuels Reduction Project

Years After Treatment	Trees per Acre		Height (ft.)		QMD (in.)		Snags >20" dia.	
	NA	PA	NA	PA	NA	PA	NA	PA
0	1052	80	95	88	6.7	16.6	2	3
10	1197	685	102	97	6.3	7.3	2	3
20	1267	766	107	104	6.3	6.8	2	3
30	1151	745	110	112	6.8	7.3	2	3
40	1172	823	112	115	6.9	7.1	2	3
50	1239	924	112	118	6.9	6.9	2	2
60	1132	900	112	119	7.3	7.3	3	2
70	1043	1021	113	119	7.8	7	3	2
80	964	1165	114	118	8.3	6.6	3	3
90	895	1103	115	118	8.7	7	4	3
100	841	1042	115	118	9.1	7.3	4	3

To summarize, without treatment there would be more trees in Riparian Reserves that could provide more down wood (at least for the first 70 years) and, over time, snags. However, this apparent benefit would be offset by increased susceptibility to disease, windthrow, fire, density related mortality, and other ecological change agents. Even though there could be an increase in the amount of down wood this wood would generally be smaller in diameter and thus would decay faster both in and out of stream channels. The down trees would increase fuel loading that would in turn increase the risk of stand replacing fire in riparian areas with the potential for hotter, more destructive burns as described in the Water Quality Specialist Report. There would also be a trade-off in the health of the riparian stand, as discussed in the Silviculture Specialist Report, which would increase the likelihood of disease, susceptibility to fire and other natural events, and result in stand composition and structure outside the desired future condition.

In-Stream Large Wood

There would be no change in the amount of in-stream and floodplain large wood if the No Action alternative were selected. No activities would occur that would directly reduce the amount of large wood. Based on riparian stand modeling conducted as part of this analysis (Tables 8 and 9) not treating the riparian stands would, over 50 years or so, result in slightly larger trees on average that would eventually fall into streams and/or floodplains. Before that time the number of trees in the stand would be greater and thus more wood could fall into streams during the next 50-70 years, albeit smaller wood than would be produced via proposed fuels treatment. Many streams in the action area are small and thus smaller sized wood provides habitat and channel stability benefits as described above. In larger streams within the action area, however, smaller wood would not provide the same benefit and would not remain in the system as long as larger wood.

Proposed Action

Direct Effects

Direct effects are those that occur during project implementation, in this case actions such as road maintenance, logging, log hauling, and fuel treatment. To directly impact aquatic species/habitat, the activity needs to be in close proximity to the water body where they reside, often within the water body itself. From an aquatic perspective, direct effects most often result in disturbance to aquatic organisms – forcing movement or a flight response. Depending on the activity, it is possible that individuals can be injured or killed; this is almost always a result of people or equipment working directly in water. Direct habitat effects are possible, but depend on the activity. For example, removal of vegetation directly adjacent to a stream can immediately reduce shade thus reducing available cover for fish. The only component of the Proposed Action that has a risk of direct effects on aquatic organisms or habitat is tree falling into perennial streams for skyline logging system access in blocks 18 and 19.

Minimum protection buffers of 60-feet for perennial streams and wetlands, as well as minimum protection buffers of 30-feet for intermittent streams are in place in part to protect aquatic organisms and habitat from the direct effects of logging activities. There are 20 proposed treatment blocks that encompass 2,830 acres in the Polallie Cooper Fuels Reduction Project. Three blocks (5, 6, and 9) do not enter any Riparian Reserves. In the remaining 17 blocks there are 658 Riparian Reserve acres, and treatment could occur in approximately 38% (247 acres) of that area (Table 63). Within the Action Area, approximately 5% of the Riparian Reserve acres would be treated by this project. Five blocks are directly adjacent to LFH but only those adjacent to the EFHR (12, 13, 15, and 19) are adjacent to occupied LFH. Although blocks 10 and 11 extend to the valley floor west of the EFHR Highway 35 runs between them and the floodplain thus they are not considered directly adjacent to the EFHR.

Table 63. Riparian Reserve treatment summary information for the Polallie Cooper Fuels Reduction project area. All heights and distances in the table are in feet unless otherwise noted. Distance to fish bearing stream and ESA-listed fish habitat (LFH) is the closest point of a block to a fish bearing stream reach and/or LFH via a stream channel. For those blocks adjacent to LFH (distance = 0) the minimum protection buffer would apply. Site potential tree heights varied significantly in the planning area (range from 95'- 130') but in an effort to simplify planning and ensure adequate resource protection the 130 foot height was selected as the default for all units.

Block	Total Acres	RR Acres	Treated RR Acres	Distance to Fish Bearing Stream (mi)	Distance to LFH (mi)	Primary Shade Height	Spring Influence	Minimum Protection Buffer Width (ft) - Perennial+	Minimum Protection Buffer Width (ft) - Intermittent+
1	311	14.2	7.0	1.2	2.6	55	Y	60 or slope break, whichever greater	
2	114	5.0	4.5	1.8	1.8	55	Y		30
3	56	13.3	1.0	0.7	2.1	55	Y	100	
4	16	8.1	2.1	0.7	2.1	55	Y	80	
5	15	0.0	0	NA	NA	NA	NA	NA	NA
6	17	1.3	0	NA	NA	NA	NA	NA	NA
7	37	8.5	1.2	0.3	2.5	33	Y		40
8	161	67.0	16.2	0.07	2.6	28-33	Y	60	40
9	60	23.9	0	NA	NA	NA	NA	NA	NA
10	356	85.9	47.5	0	0	33	Y	100	30
11	318	114.5	44.0	0.1	0.1	33	Y	60 or slope break, whichever greater	30 or slope break, whichever greater
12	206	76.2	27.7	0	0	55	Y	EFHR – 130 or slope break, whichever greater. Dog R. – 100 or slope break. Other perennial streams 60 or slope break	30 or slope break, whichever greater

Block	Total Acres	RR Acres	Treated RR Acres	Distance to Fish Bearing Stream (mi)	Distance to LFH (mi)	Primary Shade Height	Spring Influence	Minimum Protection Buffer Width (ft) - Perennial+	Minimum Protection Buffer Width (ft) - Intermittent+
13	81	65.9	16.1	0	0	55	Y	EFHR – 130 or slope break, whichever greater.	30 or slope break, whichever greater
14	94	22.0	15.1	0	0	55	Y	Dog R. – 100 or slope break. Other perennial streams – 60 or slope break	
15	89	36.2	5.9	0	0	55	Y	EFHR – 130 or slope break, whichever greater.	
16	31	7.8	4.2	0.5	0.5	55	Y	60 or slope break, whichever greater	60 or slope break, whichever greater
17	413	2.6	1.9	1.4	1.4	28	Y	60 or slope break, whichever greater	
18	81	44.5	26.2	0	0.5	33	Y	Dog R. – 100 or slope break, whichever greater. Other 2 perennial streams 60 and 80or slope break, whichever is greater.	80
19	266	50.6	23.5	0	0	33	Y	EFHR – 130 or slope break, whichever greater. Other perennial stream 60 or slope break, whichever greater	60 or slope break, whichever greater
21	109	10.9	2.9	2.2	4.6	28	L		80
TOTALS	**2831**	**658.4**	**247**						

+ Minimum distance from edge of stream channel. Actual treatment distance may be greater than listed.

Except at 2 locations, Project Design Criteria (PDC) includes no tree falling within protection buffers, and outside protection buffers, directional tree falling away from those buffers. If a tree is inadvertently felled within a protection buffer the portion of the tree within the buffer would not be removed. Blocks 18 and 19 would have skyline or tailhold cable corridors (logging system access) immediately adjacent to perennial streams. If any trees located within the protection buffer need to be felled, they would be felled toward the stream channel as this presents an opportunity to add habitat features within the Riparian Reserve. All felled trees would be left in place. Falling trees from the yarding corridors into the unnamed small perennial stream in block 19 would have no direct effect to fish or sensitive aquatic species as there are neither fish nor sensitive species present. This action is expected to have minor direct impacts to aquatic species in block 18 because:

- Very few trees per linear feet of stream would need to be felled to allow for tailhold cables to be strung across the stream (Dog River). At most, it is anticipated that up to 40 trees may need to be felled within the protection buffer (100’ on each side), which would average about 1 tree per 112’ of stream (or ~2 trees per acre) and,
- Since average tree height is 61’, in conjunction with the stream channel being deeply entrenched and confined (Rosgen type A4a+), few of the felled trees (if any) within the 100’ protection buffer would likely contact the wetted stream area.

Indirect Effects

Indirect effects are those that can result after project implementation and/or as a result of implementation. For example, in the vegetation removal scenario mentioned above in the Direct Effects section the indirect effect associated with shade reduction could be an increase in water temperature. The magnitude of such an effect, if it occurred, would depend on the amount of vegetation removed, location and elevation of the stream, amount of stream flow, etc.

Stream Temperature

Stream temperature plays a critical role in determining metabolic rates, physiological function, and life-history of aquatic organisms as well as ecological processes such as nutrient cycling and productivity (Allen and Castillo, 2007). Aquatic species are restricted to temperature ranges that limit their distribution and available habitat. For salmonid species, there is a well-established connection between temperature and growth rate. Warmer temperatures increase feeding activity and rates of digestion, but also increase respiratory rates and energetic costs (Allen and Castillo, 2007). The Ultimate Upper Incipient Lethal Temperature (UUILT) of most salmonids falls within the range 21 to 26°C; however, multiple exposures to sub-lethal temperatures can lead to mortality (McCollough 1999). However, growth and development can be limited long before temperature approach lethal conditions. For coho salmon, preferred temperatures range from 12 – 14 °C, which is close to optimal temperatures for maximum growth efficiency (Brett 1952 as cited in Groot and Margolis 1991).

Water temperatures recorded in streams within the action area were well below the UUILT for salmonids and were also within ideal growing conditions for coho salmon (Table 2, Water Quality Specialist Report), which is similar to ideal temperatures for most other salmonids. As explained in the Water Quality Specialist Report, the protection buffers stipulated for perennial streams are sufficient to maintain existing shade levels, and thus, no increase in water temperature is anticipated in any stream in the action area as a result of proposed silvicultural and fuels treatments.

Blocks 18 and 19 will have skyline or tailhold cable corridors (logging system access) immediately adjacent to perennial streams. Falling trees for the yarding corridors within the 60’ protection buffer in block 19 would have little impact to stream shading as trees would only need to be felled on the north side of the stream (there is an existing opening on the south side of the stream). The falling of trees for skyline cable corridors (not yarding corridors) in block 18 would reduce a minor amount of shade but would have no measurable impact to stream temperature as analyzed previously in the direct impact analysis above, as well as due to Dog River containing very cold spring inputs. In 9 years of monitoring Dog River within block 18 (1994 to 2002), the 7-day average maximum ranged from 10.9 to 14.1°C. Likewise, the unnamed tributary in block 19 was surveyed on August 27, 2014 and measured 6.5 °C at headwater springs, and 10.2 °C in areas immediately adjacent to the proposed skyline corridors.

Brushing along roads is part of the proposed road maintenance package. If brushing occurs near stream crossings, some shade producing vegetation could be removed. Brushing targets smaller vegetation (deciduous shrubs primarily and in some cases small coniferous trees) that provides little shade, and the larger trees that provide most of the shade would be untouched. Although shade could be slightly reduced at some stream crossings, particularly those where the stream is oriented more west to east, the actual shade reduction would be minimal. Hazard tree falling associated with road maintenance (Table 10 in Chapter 2) would occur on eight road segments totaling approximately 155 trees; however, only three of the road segments cross stream channels and only 2 segments cross perennial (non-fish bearing) channels. At most, 1-2 trees would be felled near stream crossings – this would have little effect on shade. Given existing cool water temperatures, abundant spring and groundwater sources, and the fact that larger shade producing trees would be retained, any shade reduction at road crossings would not measurably increase water temperatures over existing levels.

Stream Sediment

Fine sediment deposited on the stream bottom can impact aquatic organisms depending on the location of the sediment source in relation to aquatic life, amount of sedimentation, and timing of sedimentation. Indirect effects are possible if sediment fills pools and reduces interstitial living space in the substrates, decreases food availability, and covers fish spawning areas thereby reducing spawning success. All of these elements will be discussed below.

Turbidity

Increases in turbidity could affect fish by reducing feeding success, stimulating movement out of the area, respiratory impairment, increasing stress, and reducing tolerance to disease (Waters 1995). Sigler et al. (1984) found steelhead trout and Coho salmon growth rates decreased in turbid water with as little as 25 NTU (nephelometric turbidity units) measured turbidity over test periods ranging from 14 to 31 days. Visual impairment is likely the most common reason for reduced feeding rates and thus reduced growth rates. They also noted there was more fish emigration from tanks with turbid water compared to tanks with clear water. They speculated that salmonids emerging from the gravel would likely emigrate quickly if turbid conditions were encountered. In fact, Waters (1995) states that behavioral avoidance of turbid water may be one of the most important sub-lethal effects of turbidity. Direct mortality as a result of increased turbidity levels is possible but unlikely. Sigler et al. (1984) reported some mortality of very young Coho and steelhead fry and turbidities ranging from 500 to 1500 mg/L (milligrams per liter); however, McLeay et al. (1983) found little mortality of arctic grayling under yearlings subject to prolonged exposure to concentrations around 1000 mg/L.

The effect of increased turbidity on aquatic macroinvertebrates is likely similar to those described for fish, at least for aquatic insects, but most of the literature focused on fine sediment deposition rather than suspended sediment. Waters (1995) postulates that prolonged episodes of turbidity may result in insect drift stimulation (i.e., emigration) that can reduce food supplies. The level of turbidity would have to be very high for long periods of time however. Waters admits that in streams with such a high turbidity load there could be as much or more effect on macroinvertebrates from deposited sediment. Effects on mollusks are not well documented, but given that preferred habitat characteristics include clean water it is assumed that long periods of high turbidity could be detrimental. Aldridge et al. (1987) found that feeding was impaired for three species of clams in laboratory experiments when sediment was added frequently to simulate suspended solids churned up by dredging. Given their lack of mobility, it is conceivable that snails could respond in a similar manner.

With the exception of the EFHR, streams in the action area are spring fed and generally quite clear. Naturally turbid conditions would only occur during high water periods. Due to glacial tributaries in the headwaters the EFHR is naturally turbid in summer and fall, and it has a large impact on lower valley streams in this regard. Native aquatic animals have evolved around these conditions; altering distribution and habitat use if necessary. For example, Chinook salmon spawning has been documented in the MFHR and WFHR (also glacial) despite normal turbid conditions in the fall, and they likely spawn in the EFHR below the action area.

Increased turbidity resulting from the activities described above would be limited both in space and time because of the small amounts of disturbance and/or fine sediment introduced at each site. Foltz et al. (2008) found that turbidity decreased by an order of magnitude within 100 m of the source following culvert removal, and turbidity dropped to background (above disturbance) levels within ½ mile. Increased turbidity that could result from road maintenance would be much less because none of the activities would occur in a stream channel as in the study by Foltz et al. Turbidity also decreases more rapidly in larger streams as the sediment is diluted more readily. If any turbid water were to reach the EFHR the increase would be immeasurable against background levels due to the high sediment load originating from the two glacial tributaries in the headwaters during the in-water work window.

Few activities outlined in the Proposed Action would result in an increase in turbidity because actions would occur well away from water, including silvicultural treatments. Road maintenance, especially blading and ditch cleaning could increase turbidity in streams, but only after the first significant precipitation event as that is when disturbed soil would be mobilized downstream and potentially into stream channels. In any case, the turbid conditions would last a short period of time and would dissipate relatively quickly downstream as particulate matter settles (Rosetta 2005). As described in the Water Quality Specialist Report various PDC and BMPs are in place to minimize the amount of sediment entering surface water resulting from project activities. The first “flush” after the first precipitation event following road maintenance on native surface and aggregate surface roads could slightly increase turbidity in streams crossed by the road. In the action area this would only occur in those few places where such roads cross streams (Table 64), none of which are fish bearing. Most of these streams are intermittent or has extensive reaches that subsurface, and none, regardless of flow regime, have the capacity to transport large amounts of sediment quickly. As such, the impact to fish from increased turbidity would be negligible. The impact on aquatic invertebrates would be minimal although slightly impaired feeding and possibly respiration is possible.

Sedimentation

The soil erosion and delivery potential of proposed activities is detailed in the Soil Productivity and Water Quality Specialist Reports. PDC and BMPs are in place to greatly minimize, if not eliminate, the chance of increased sedimentation in action area streams and other water bodies resulting from proposed activities. Potential source of increased sedimentation in action area streams are centered around road maintenance but other potential sources also include timber harvest, log hauling, and tree falling into streams.

Summary of Potential Sediment Impacts to Aquatic Fauna

The deposition of fine sediment on the streambed could negatively impact habitat conditions and subsequent survival and/or production for both fish and aquatic macroinvertebrates (Waters 1995). The effect of fine sediment deposition on macroinvertebrate production, survival, and species composition is relatively well documented. Bjornn et al. (1974 and 1977) found riffles with the most sediment contained the lowest abundance of insects in Idaho streams, but small amounts of sediment added to riffles in streams did not greatly affect abundance or drift. In laboratory studies they concluded that embeddedness levels more than one third around cobbles decreased insect abundance by over 50 percent, especially riffle inhabiting taxa (e.g., stoneflies, mayflies, and caddisflies), which are most important as salmonid food. Other laboratory studies have supported these results (McCelland and Brusven 1980). The reduction in abundance associated with fine sediment appears to be related to respiration (Rutherford and Mackay 1986) and possibly the loss or reduction of organic detritus, which is a source of food for macroinvertebrates (Culp et al. 1983). Most studies have focused on aquatic insects as these are more important as fish food, but it is likely that impacts to aquatic mollusks are similar.

Table 64. Polallie Cooper Fuels Reduction Project proposed haul road maintenance and haul road distances to listed fish habitat (LFH)/essential fish habitat (EFH). Road surfaces are coded as follows: P – paved, A – aggregate, and N – native material. All haul segments will have associated road maintenance with the exception of haul road numbers that are bolded. Road numbers italicized (3 segments) would be closed post-project with a berm or gate, left in a hydrologically stable condition, and periodically maintained.

Haul Road Number	Miles Within Action Area	Road Surface Type	Danger Tree Treatment	Number of Crossings Over:				Closest Non-LFH Crossing to LFH/EFH (mi)	Notes
				LFH/EFH		Other Peren.	Inter.		
				Bridge	Culvert				
OR-35	10.5	P		3	3	9	8	<0.1 (~80’)	
3510000	10.5	P				3	4	0.4	
3510620	2.4	N				1		1.1	No winter haul
3511000	3.6	A	Y				3	4.6	
3511014	0.6	N							
3511015	0.4	A							
3511016	0.3	N							
3511630	1.1	A							
3511631	0.7	A	Y						
3511632	0.3	A							
3511633	0.1	A							
3511640	0.5	A							
3512000	1.4	P	Y			4		2.6	
3512000	9.0	A				2		2.9	
3512011	0.2	N							
3512012	0.6	N	Y						No winter haul
3512620	0.8	P				1		2.6	
3512640	0.7	N				1	2	2.6	
4400000	3.6	P				2	3	0.1	

4400015	0.9	N	Y		
4400620	2.5	A	Y	1	1.3
4400622	0.6	A	Y		
4400624	0.1	A	Y		

Indirect effects of fine sediment deposition on fish and fish habitat, particularly salmonids, relates primarily to the following: reduction in the quantity and/or quality of spawning habitat for fish, reduction in food supply, reduction in fry survival in riffles, and reductions in interstitial living space. The relationship between spawning success and fine sediment levels has been addressed in detail over the last 40+ years. Suffice it to say that the more fine sediment in spawning areas the lower the spawning success. Most research correlates the amount of fine sediment 0.84 mm or less with embryo survival (McNeil and Ahnell 1964; Hall 1986; Tagart 1984; Reiser and White 1988) and it is commonly accepted that when fines less than 0.8 mm exceed 20 percent then significant embryo mortality could be expected (Waters 1995). In many cases fine sediment increases are temporary, occur at times of the year other than spawning or egg incubation, and may be tempered by the act of spawning itself. When adults digs redds they clear much of the fine sediment from the area (Sheridan and McNeil 1968; Everest et al. 1987; Bjornn and Reiser 1991) and increase the chances for egg and embryo survival.

Reduction in food supply for salmonids, particularly riffle-dwelling insects, can be significantly impacted by surface and embedded sediment as described above. Reduction in food would lead to increases in competition, increased stress, decreased growth rates, and emigration from the area. The degree to which the above would occur depends on a variety of factors including the amount of sediment, overall productivity of a stream or reach and other water quality factors, such as temperature or pollution, fish species present, and fish abundance prior to the sediment disturbance.

Salmonid fry spend some time throughout the year, much of it during the winter, living in the interstitial spaces between rocks, primarily cobble. Their survival can be reduced if the spaces between cobbles are filled with fine sediment because the actual living space is reduced and they are unable to utilize this protective habitat. Bustard and Narver (1975) found that sedimented substrates reduced winter survival of juvenile cutthroat trout. Similarly, Hillman et al. (1987) observed that age-0 Chinook salmon moved in the fall from areas where summer habitat was heavily sedimented. Experimental additions of clean cobble the following year resulted in a fivefold increase in winter fry densities.

Potential Polallie Cooper Fuels Reduction Project Sediment Impacts

Timber harvest activities, including tree falling and log yarding, would have little impact on stream sediment levels due to protection buffers ranging from 30-130 feet (Table 63) that will maintain protective ground cover as outlined in the Water Quality Specialist report. Skyline corridors over streams in block 18 and 19 would maintain full suspension of logs within protection buffers. Because vegetated buffers would effectively trap any sediment generated from timber harvest activities there is no expected impact to aquatic species or habitat.

Roads where log hauling would occur in the action area are generally located outside Riparian Reserves and, with six exceptions, do not cross LFH/EFH (Table 64). All LFH/EFH crossings are on Oregon Highway 35, which is paved and has wide shoulders and very good drainage. Highway 35 crosses the EFHR twice, and then once on on 4 other streams: Polallie Creek, Dog River, Cat and Culvert Creek. The highway also crosses Tilly Jane Creek near its mouth and Crystal Springs Creek; both are fish bearing at this location but does not contain any listed sensitive fish species nor is it LFH/EFH. The only other fish bearing stream crossings are over Doe Creek and a fish bearing tributary to Doe Creek (non-native brook trout are the only salmonid residing in Doe Creek). Both crossings are by FSR 3510, which is paved. The possibility that log hauling on Highway 35 or FSR 3510 would result in enough sediment to impact aquatic species or habitat is negligible as they are both paved routes.

Other proposed haul routes are a mix of road surfaces but there are only three perennial stream crossings over aggregate surface roads and two native surface road crossings over perennial streams (Table 64). Paved haul routes cross perennial streams 20 times. There are five road crossings on intermittent streams; 3 are aggregate and 2 are native surface (Table 64). Restrictions to wet season haul, as listed in PDCs L1 and L2, would minimize any risk of road-related sediment reaching action area streams.

Road maintenance has a higher likelihood of some sediment contribution to nearby streams compared to log hauling. Large amounts of sediment input are unlikely (Water Quality Specialist Report), but some increase in fine sediment could occur, especially during the first few precipitation events following the maintenance. Of course the highest likelihood of erosion and sediment introduction would be associated with native surface roads, followed by aggregate roads and then paved roads. Ditch cleaning, culvert cleaning and blading are the activities most likely to result in some sediment introduction.

The roads, or road segments, where road maintenance could result in the highest risk of erosion and subsequent sediment introduction to area streams include aggregate and native surface roads that cross stream channels (6 and 4 stream crossings, respectively; Table 64). Paved roads have little risk of sediment introduction to area streams because the only maintenance activity that could produce sediment is ditch cleaning and the road segments with direct drainage into streams at crossings are few. The two native surface roads that cross streams has only one proposed for maintenance activities, and this road (3512-640) crosses non-fish bearing streams that are intermittent or has periodic intermittent sections (subsurfaces). Proposed maintenance activities on aggregate and native surface roads or road segments located outside Riparian Reserves would follow all PDC's to reduce fine sediment transport from the project work site. In all cases, PDCs would ensure that a minimal amount of sediment would reach streams and that the chance for such sediment introduction would be of a short duration.

Note that road maintenance would reduce erosion and potential sediment introduction as compared to unmaintained roads (see Table 9, Water Quality Specialist Report). Thus the overall effect of road maintenance is beneficial despite the potential short-term impacts.

Given the location of potential sediment producing activities in relation to aquatic macroinvertebrate populations, which are located in all perennial streams, there is much greater potential for impacts to macroinvertebrates than to fish. Stream reaches directly below sediment sources are the most susceptible to impact. Small amounts of fine sediment, such as is possible from road maintenance, would likely have little effect on macroinvertebrate abundance given the findings in natural streams described by Bjornn et al. (1974 and 1977).

The small amount of fine sediment making its way to fish bearing stream reaches and/or most LFH/EFH would be immeasurable against background levels, primarily due to the small amount of potential sediment expected and the distance between potential sediment producing activities and those stream areas. Short duration pulses of sediment directly following precipitation events could have a localized impact on some aquatic macroinvertebrate species, and thus the amount of forage for fish could be slightly reduced for a short time until upstream drift rebuilds the population. Similarly, there could be some sediment deposition on riffles and spawning habitat (pool tails) but the amount would be negligible and thus no negative effect to spawning is anticipated.

Pool Quantity and Quality

The Proposed Action would have little effect on pool habitat quantity and quality because proposed silvicultural treatments include protection buffers and all existing down large wood, the primary pool forming habitat feature in the action area, would remain. As explained below, a decrease in potential large wood resulting from silviculture treatments in Riparian Reserves is possible but the decrease would be quite small and thus have little effect on existing and future pool habitat. As existing pool forming wood decays there could be gap in time where relatively fewer trees are falling into channels to replace this wood in those areas where treatment occurs. Whether this potential decrease in large wood could result in less pool habitat depends on the site and local conditions; some decrease in pool habitat in these small, steep streams is possible.

Reductions in pool habitat quantity in fish bearing streams due to reductions in LWD input are not expected because much of the proposed riparian thinning would not occur near fish bearing streams and existing amounts of LWD would not change as a result of silviculture treatment. A decrease in large wood downstream from non-fish bearing stream reaches where silviculture treatment occurs is unlikely because the primary large wood contributing mechanism is tree fall from adjacent stands, not floods or debris flows. There could be more impact to aquatic macroinvertebrates but this impact is likely minimal for two reasons:

- Pools make up a low percentage of the total habitat in these streams already due to steep gradients and relatively confined of the streams, thus a slight decrease in pool habitat would not change existing conditions to a great degree; and,
- Most aquatic insects live in faster water habitats and thus pools are not their preferred habitat.

The exception could be aquatic mollusks, some decrease in suitable habitat for the Columbia duskysnail could result from a reduction in pool habitat, although this is unlikely due to their usual habitat found within slow-moving springs.

While large increases in fine sediment to a stream can reduce pool volume and thus pool quality, this is unexpected as described above in the Sediment section. Both the quantity and quality of pool habitat in the action area is expected to be maintained or improved in the future from the long-term improvements in large wood recruitment potential and erosion risk reduction.

Large Wood Recruitment Potential

Riparian silviculture has the greatest potential to affect large wood recruitment potential compared to any other proposed project element. Thinning removes standing wood volume from the recruitment zone and reduces exclusion-phase mortality, which can contribute wood to the stream. In small streams, relatively small diameter pieces of woody debris can contribute to pool formation (Beechie and Sibley 1997). In recovering riparian areas, small trees in close proximity to the stream can help provide geomorphic and biotic benefits in the short-term, especially during the stem-exclusion phase (Beechie et al. 2000). As the source distance increases, the likelihood of the tree entering the stream decreases and becomes dependent also on the size of the tree (Meleason et al. 2002; Spies et al. 2013). When all stand ages and types are considered then 95 percent of total instream wood comes from distances of 82 to 148 feet (Spies et al. 2013); shorter distances come from younger stands, longer distances from older stands.

The amount of wood recruitment potential to any stream varies greatly and depends on forest conditions and geomorphology. In all but the EFHR the major mechanism of LWD contribution to stream channels is stream adjacent recruitment, not debris torrents or other delivery mechanisms. Debris torrents and material migrating to stream reaches downstream are not a prevalent habitat forming process in most streams within the action area due to the low occurrence of slides and debris flows in the sub-watershed. This is true even in the steep tributaries to Dog River and the EFHR because those streams are so small and the slopes stable enough that slides rarely occur and the streams are not large enough to transport wood on their own. The exception is the EFHR which is glacially fed and subject to debris flows; however, no treatments are planned along this stream that would affect future LWD recruitment as protection buffers are a minimum of one site potential tree height from the channel.

The desired future condition for the unmanaged riparian stands proposed for treatment is to move them toward historical conditions so they are more resistant to large scale disturbances. To accomplish this tree density levels and fuel loadings must be reduced. Immediately after treatment the stands would be in a more open mature condition with the largest, most dominate trees retained creating favorable growing conditions by removing both above (light) and below (nutrient availability) ground competitions. Canopies would no longer interlock and fuel loading would be lowered to more historical conditions. These conditions would favor establishment of a third and/or forth age class that within 20 years would begin influencing stand densities (QMD and height). These younger age classes would continue to influence stand QMD and height throughout the projected time period (100 years, Tables 8 and 9) resulting in low QMD and tree heights as compared to the no action proposal. All in all, the difference between untreated and proposed treatment conditions, except in trees per acre, is relatively slight (Tables 8 and 9).

The proposed action would create healthier stand conditions that would not trigger density and disturbance related mortality such as a high intensity wildfire or western bark beetle outbreak. These treatments would not deter from the recruitment of large wood to streams because the favorable growing conditions that help establish the younger Cohort also provide optimal growing conditions for the large diameter retention trees. Diameter distributions in the stands would still be variable and large diameter trees would be available to provide large woody debris (Figure 44and Figure 45).

Six of the Riparian Reserve treatment areas are located adjacent to fish bearing streams, five of which are adjacent to LFH/EFH. Most of these blocks contain or border several streams but for the portions of the blocks adjacent to fish-bearing stream segments the protection buffers are 100 feet along Dog River and 130 feet along the EFHR. Along all other streams in all blocks the minimum protection buffers are 60 feet for perennial streams and 30 feet along intermittent streams, although these buffers are wider along some streams depending on site conditions (Table 63).

Proposed silvicultural treatment outside protection buffers in Riparian Reserve (Table 63) would significantly reduce the trees per acre and thus reduce the number of trees available as potential down large wood for a period of about 70 years compared to the No Action alternative (Tables 8 and 9). However, all larger trees would be retained and over time a diverse mix of tree sizes would be available for large wood recruitment (Figure 44 and Figure 45). There would be no effect on large wood recruitment to the EFHR due to protection buffers meeting or exceeding the height of site potential trees. There could be a slight decrease in large wood recruitment potential in other streams as a result of riparian silvicultural treatment, but the decrease would be slight if realized at all for several reasons:

- Protection buffers would maintain an untreated source of potential large wood.
- Treated areas would retain all of the largest size classes of existing trees (Figure 44 and Figure 45) and a good mix of other tree sizes that can provide large wood.
- Approximately 247 acres of the total 4,915 acres of riparian reserve within the action area would be treated, equating to five percent.

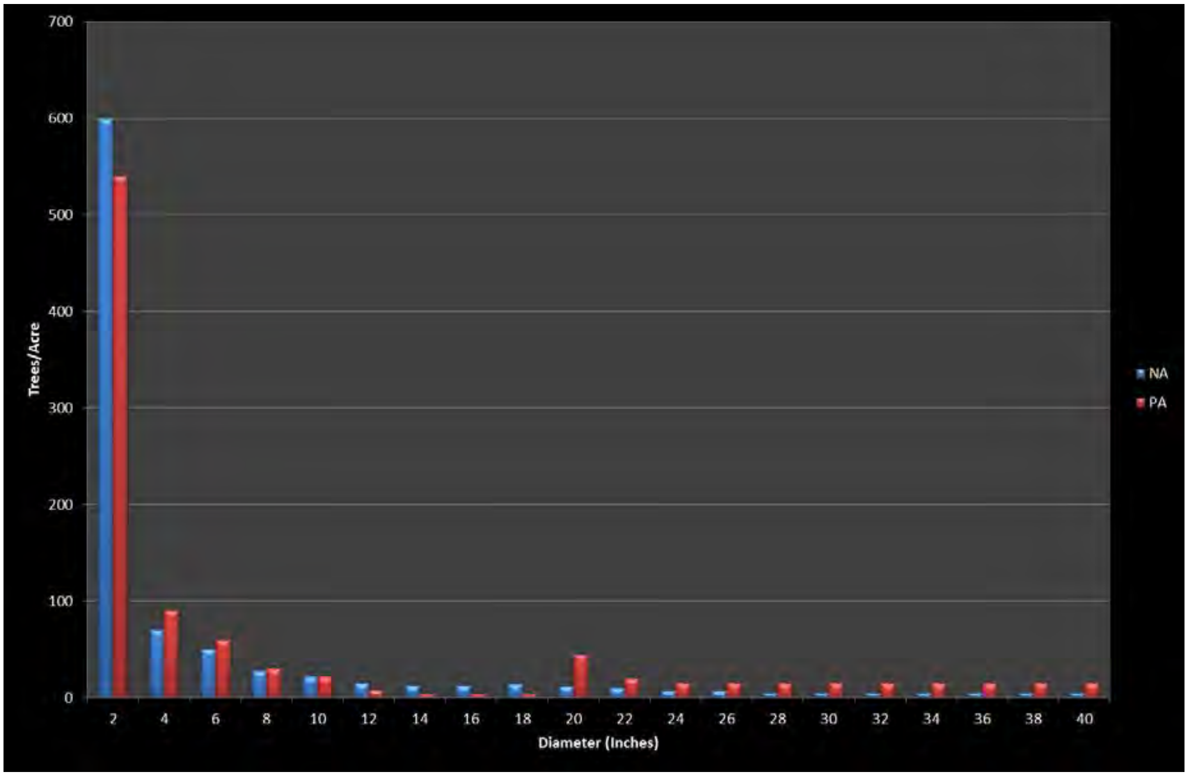
To summarize, a total of 658 Riparian Reserve acres lie within 17 out of the 20 blocks with proposed fuels reduction treatment (Table 63). Of the Riparian Reserve acres within proposed blocks only 247 acres would actually be treated. Riparian Reserve acres within blocks make up a small portion of the action area and proposed treatment area:

- Riparian Reserve acres (4,915) make up 17.8% of the entire action area (27,582 acres).
- Riparian Reserve acres proposed to be treated within blocks make up only 0.9% of the entire action area.

In-Stream Large Wood

Because large wood potential would be minimally affected across the action area, even in proposed treatment blocks adjacent to perennial streams, there would be little to no effect on in-stream large wood levels by proposed fuels treatment. In those units with silvicultural treatment proposed in Riparian Reserves there could be a slight reduction in the amount of instream and floodplain over time; however, the actual reduction in down large wood, if it occurs at all as described above, is difficult to predict. Natural events such as wind storms could result in large amounts of down large wood even in in streams along thinned areas due to protection buffers, which would provide a sustained source of large wood (Meleason et al. 2002; Spies et al. 2013) for the foreseeable future.

Figure 44. A comparison of trees per acre in the dry mix conifer ecotype grouped by diameter at breast height between the No Action and Proposed Action alternatives 50 years (top) and 100 years (bottom) after proposed treatment.



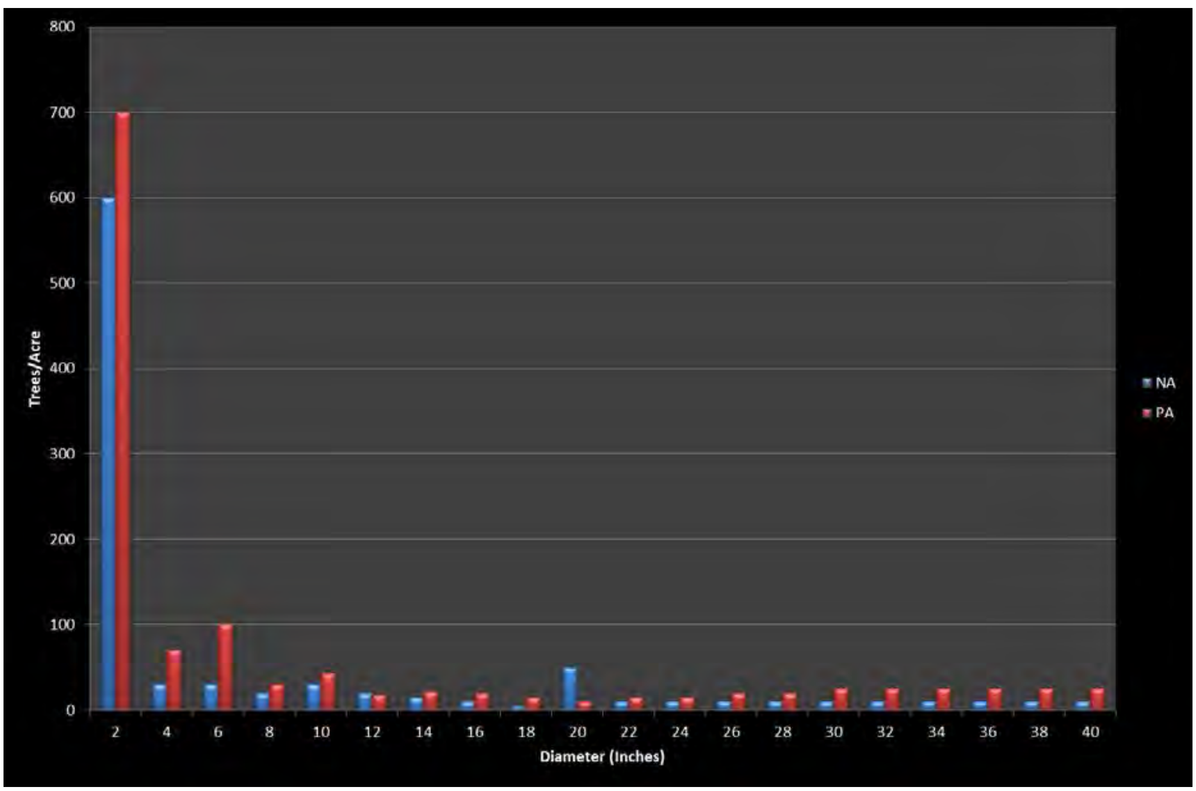
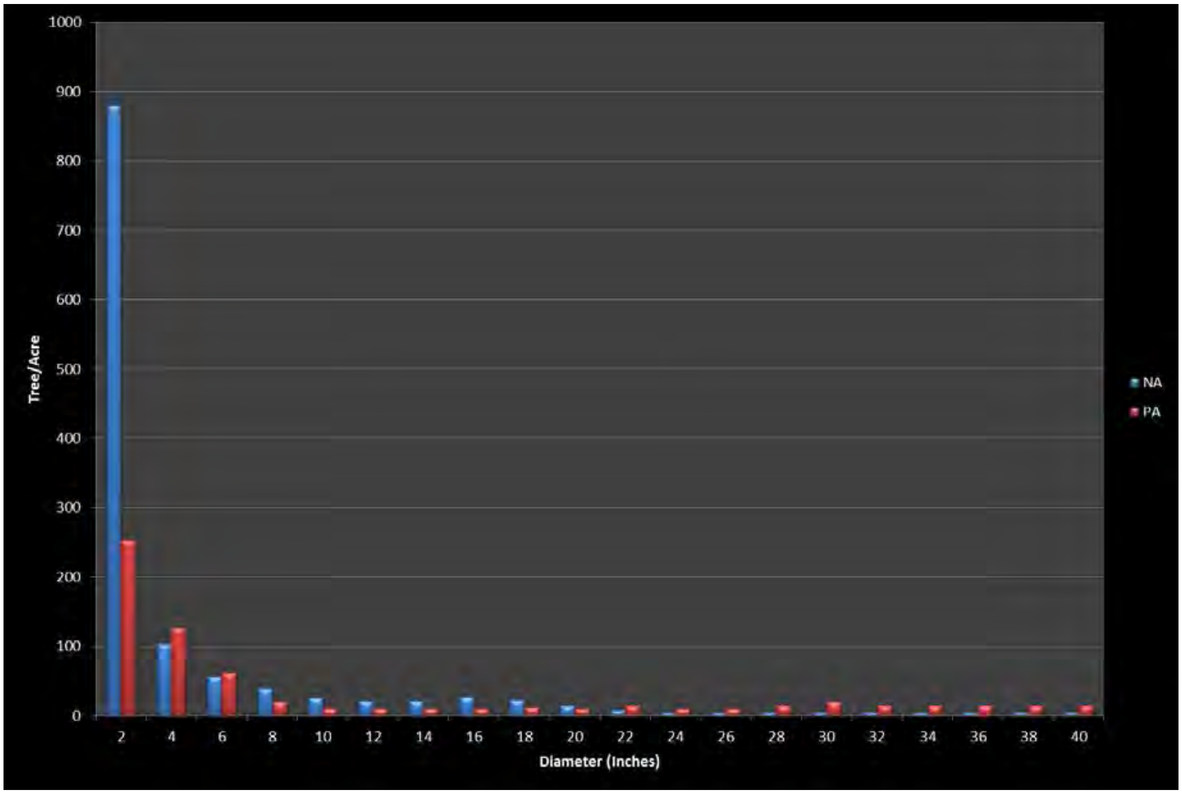
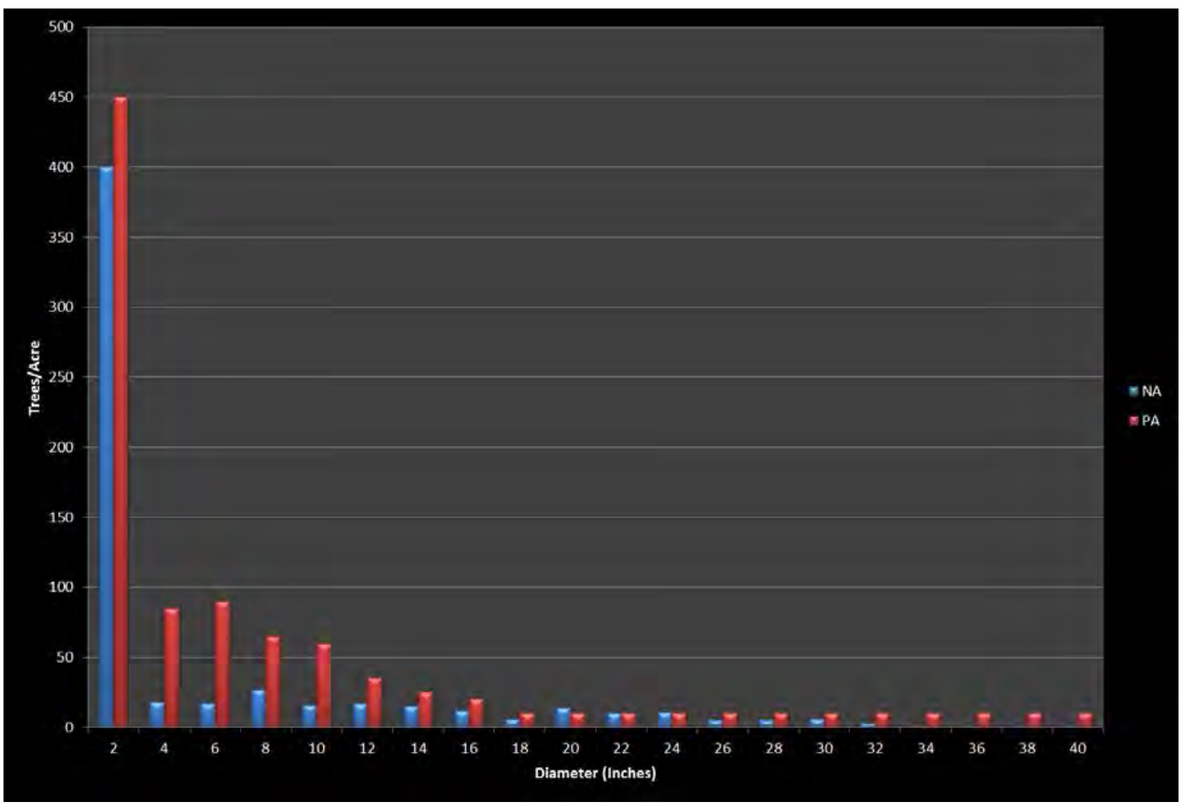


Figure 45. A comparison of trees per acre in the moist mix conifer ecotype grouped by diameter at breast height between the No Action and Proposed Action alternatives 50 years (top) and 100 years (bottom) after proposed treatment.





The slight reduction in large wood in upstream reaches is not expected to result in a reduction in large wood downstream in larger streams, including streams with LFH/EFH. Since debris flows are a very uncommon mechanism for large wood recruitment in all but the EFHR, wood transport to downstream reaches would only occur during infrequent floods or even less frequent debris flows. Therefore, reductions in large wood within LFH/EFH would be negligible because very few riparian acres would be treated in the action area and wood transport mechanisms are limited.

Cumulative Effects

Cumulative effects include the effects of past, present and reasonably foreseeable future State, tribal, local or private actions that overlap in time and space within the Action Area (i.e., affected environment) of the Federal action subject to consultations (50 CFR 402.02). The "reasonably foreseeable" clause is a key factor in assessing and applying cumulative effects and could include actions that are permitted, imminent, have an obligation of venture, or have initiated contracts (U.S. Fish and Wildlife Service and National Marine Fisheries Service 1998). Past and present impacts are incorporated as part of the environmental baseline and discussed here in the effects discussion.

Only those proposed projects in the Polallie Cooper Fuels Reduction Project that have direct or indirect effects are included in the cumulative effects analysis (if the action has no direct/indirect effects there is nothing to cumulate). The spatial context for the following cumulative effects analysis is the action area as described previously. Project/activities occurring outside this area may have an effect on aquatic species/habitat, but would not add to those effects from projects proposed in this EA. The temporal context depends on the existing or future project/activity. If there is an overlap in time from an effects perspective then it is included.

Cumulative effects from an aquatic species and habitat perspective overlap considerably with water quality cumulative effects because most of the attributes analyzed by the hydrologist are directly related to aquatic habitat conditions. As such, this analysis builds upon the Water Quality cumulative effects analysis with an attempt, in this summary, not to duplicate that analysis. Therefore, if there is no cumulative effect identified in the Water Quality Specialist Report then that attribute is not discussed here. For example, although existing Forest Service timber harvest units overlap in space with proposed activities outlined in this EA there is no measureable cumulative effect from a sediment, stream temperature, or water quantity perspective thus there is no effect on aquatic habitat or species and no further discussion is needed (see Table 12 in the Water Quality Specialist Report).

The analysis summary outlined in Table 65 below follows the same format as Table 12 in the Water Quality Specialist Report. The one addition is a column that describes potential effects to aquatic species and/or habitat. Those activities that were identified in the Water Quality Specialist Report as having a possible cumulative effect have been copied into the table below and a description of potential species/habitat effects has been added.

Table 65. A summary of cumulative effects on aquatic species and habitat resulting from proposed projects in the Polallie Cooper Fuels Reduction Projects EA, and known/expected projects elsewhere in or near the action area. Only those potential effects not discussed in the Water Quality Specialist Report, or those that have a potential cumulative effect, are addressed in this table.

Project	Potential Effects	Overlap in		Measurable Cumulative Effect?	Extent, Detectable?	Aquatic Species or Habitat Effect
		Time	Space			
Existing Old Forest Service Timber Harvest Units	Large Wood Recruitment Potential	No	Yes	Possible	Projects completed. Although most previous timber harvest occurred decades ago riparian stands were treated more aggressively in many areas than current practices and thus the amount of standing wood remaining was less than would be in proposed units. These areas are still recovering (trees are still growing) and those less 40 years old in particular have yet to grow to a size where they would contribute meaningfully to riparian/stream habitat even if they were to fall. The thinning proposed in this EA would increase the riparian area that could reduce the amount of available large wood compared to a non-treatment scenario.	Minimal cumulative effect throughout action area because the reduction in large wood recruitment potential resulting from proposed projects would be quite small due to relatively few Riparian Reserve acres affected. Given location of proposed units and lack of transport mechanisms downstream the effects would be localized. This reduction in large wood potential would not directly affect aquatic fauna or habitat; indirect effects could result in localized reductions in in-stream large wood and pool habitat quality and quantity.

Project	Potential Effects	Overlap in Time	Overlap in Space	Measurable Cumulative Effect?	Extent, Detectable?	Aquatic Species or Habitat Effect
	In-stream Large Wood	No	Yes	Possible	Projects completed. Removing large wood from stream channels was a common practice into the 1970's thus the amount of large wood in many streams within the action area may be less than historic conditions. None of the actions proposed in this EA would directly reduce existing levels of large wood in any stream. Indirect effects, associated with slight reductions on large wood recruitment potential, could result in localized areas with less large wood recruitment and thus less in-stream wood for the next 50 years or more.	Minimal cumulative effect due to relatively little thinning in Riparian Reserves proposed in the action area. In some streams, localized areas could have less in-stream large wood until trees in treated stands begin to fall. Transport capability in these streams is lacking so inputs of large wood from upstream are unlikely.
Forest Service Vegetation Treatment Activities Planned or Underway (Tilly Jane Hazardous Fuels Reduction and other general pre-commercial treatments)	Large Wood Recruitment Potential	Yes	Yes	No	There may be an overlap in timing of these projects with the Polallie Cooper Fuels Reduction Project; however, PDCs in pre-commercial thinning environmental analyses require that a no-cut buffer be established along all streams and that the buffer be site-specific based on local conditions. As such, any trees that could fall into the channel in the near future would not be cut. In most areas remaining trees outside the buffer would grow faster and contribute large wood sooner than if thinning did not occur. Since the potential for tree fall would remain the same, this pool habitat forming element would be unaffected and thus the amount of pool habitat would remain the same.	None
	In-stream Large Wood	Yes	Yes	No		
	Pool Quantity and Quality	Yes	Yes	No		

Project	Potential Effects	Overlap in Time	Overlap in Space	Measurable Cumulative Effect?	Extent, Detectable?	Aquatic Species or Habitat Effect
Private Land (past timber harvest and agricultural)	Pool Quantity and Quality	Yes	Yes	No	Some projects are completed, but others ongoing. Given the small amount of fine sediment expected resulting from Polallie Cooper Fuels Reduction project activities there is no cumulative impact expected to pool habitat from a sediment perspective. Past and ongoing timber harvest in many private land areas has reduced the amount of large wood, a key pool forming component in this area, so the slight reduction in pool habitat that could occur as a result of projects proposed in this EA would add to large wood dependent pool reduction elsewhere.	Minimal affect in the action area. Most impact would continue to be on private land where more intensive timber harvest has occurred with less large wood to form pools. Fewer pools results in less rearing area for salmonids that could result in localized areas of higher crowding and increased competition. This could lead to reduced fitness in some individuals. Rearing area reductions would be concentrated in reaches next to areas where intensive timber harvest has occurred. Impacts to aquatic macroinvertebrates negligible.

Project	Potential Effects	Overlap in Time	Overlap in Space	Measurable Cumulative Effect?	Extent, Detectable?	Aquatic Species or Habitat Effect
	Large Wood Recruitment Potential	Yes	Yes	Possible	Timber harvest on private land has occurred for decades and is ongoing. In general, stream protection buffers on private lands are relatively narrow and as such the potential large wood recruitment in these areas has been reduced. These areas are in various stages of recovery in terms of tree growth but in many areas the trees have yet to grow to a size where they would contribute meaningfully to riparian/stream habitat even if they were to fall. The thinning proposed in this EA would increase the SIZ area that would not contribute as much large wood compared to a non-treatment scenario.	Minimal cumulative effect throughout action area because the reduction in large wood recruitment potential resulting from proposed projects would be quite small. Given location of proposed units and lack of transport mechanisms downstream the effects would be localized. This reduction in large wood potential would not directly affect aquatic fauna or habitat; indirect effects could result in localized reductions in in-stream large wood and pool habitat quality and quantity.

Project	Potential Effects	Overlap in Time	Overlap in Space	Measurable Cumulative Effect?	Extent, Detectable?	Aquatic Species or Habitat Effect
	In-stream Large Wood	Yes	Yes	Possible	Removing large wood from stream channels was a common practice into the 1970's thus the amount of large wood in many streams within the action area have less large wood than historic conditions. None of the actions proposed in this EA would directly reduce existing levels of large wood in any stream. Indirect effects, associated with slight reductions on large wood recruitment potential, could result in localized areas with less large wood recruitment and thus less in-stream wood for the next 50 years or more.	Minimal cumulative effect due to relatively little thinning in Riparian Reserves proposed in the action area. In some streams, localized areas could have less in-stream large wood during a short time period between existing wood decay and the time when trees in treated stands begin to fall. Transport capability in these streams is lacking so inputs of large wood from upstream are unlikely. A reduction of in-stream large wood could result in fewer pools and some reduction in channel stability because one of the major roughness elements that forms and maintains habitat is large wood. Some impact possible to salmonids in terms of rearing habitat, as described above. A negligible impact to aquatic macroinvertebrate populations as a whole, but some localized habitat degradation possible.

Project	Potential Effects	Overlap in Time	Overlap in Space	Measurable Cumulative Effect?	Extent, Detectable?	Aquatic Species or Habitat Effect
Gnarl Ridge Fire (including Burned Area Rehabilitation projects	Pool Quantity and Quality	Yes	Yes	No	There may be an overlap in timing of effects from the Gnarl Ridge Fire and the Polallie Cooper Hazardous Fuels Reduction project. Since it is highly unlikely there would be a measurable cumulative effect from a fine sediment perspective, as well as from a large wood perspective in all but Polallie Creek (see below), the cumulative effect to pool quality and quantity would be negligible.	None
	Large Wood Recruitment Potential	Yes	Yes	Possible	At the 7th field watershed scale in Evans, Tilly Jane, and Polallie Creek watersheds the Gnarl Ridge fire increases large wood recruitment potential in the burned areas along stream channels for the foreseeable future because the burned and dead trees would be more prone to falling. However, in the longer term these same areas may be deficient in large wood recruitment potential for decades until the stands along creek grow large conifers again. Proposed thinning and fuels treatment in riparian stands could slightly reduce large wood recruitment potential and thus a small cumulative effect is possible.	Given the inability of these streams to transport wood, except Polallie Creek, the impact to fish bearing stream reaches downstream would be negligible in terms of wood supply. In Polallie Creek an increase in wood is possible although it would be minor because very few burned areas in the watershed are directly adjacent to the creek.
	In-stream Large Wood	Yes	Yes	Possible	See above.	See above

Project	Potential Effects	Overlap in Time	Overlap in Space	Measurable Cumulative Effect?	Extent, Detectable?	Aquatic Species or Habitat Effect
Past Aquatic Restoration Projects (Road Decommissioning, East Fork Hood River Stream Channel Projects)	Pool Quality and Quantity	No	Yes	No	Projects are completed. Some large wood placed in the EFHR in 1998 does make it way downstream during larger flow events and it is possible this wood could end up in the action area and create additional pool habitat in the EFHR in this reach. However, The EFHR in the action area is primarily a transport reach and the chance that a measurable increase in pool habitat due to large wood recruitment from upstream is low. Actions proposed in the Polallie Cooper Fuels Reduction project would not result in a cumulative effect in the EFHR in terms of pool quantity and quality due to protection buffers along the EFHR that would maintain existing and future recruitment rates and amounts of large wood.	None
	Large Wood Recruitment Potential	No	Yes	No	Projects are completed. No change in riparian wood recruitment potential is anticipated from upstream or in the action area due to protection buffers along the EFHR.	None
	In-stream Large Wood	No	Yes	No	See above.	None

Project	Potential Effects	Overlap in Time	Overlap in Space	Measurable Cumulative Effect?	Extent, Detectable?	Aquatic Species or Habitat Effect
2000 and 2006 Debris Flow in the East Fork Hood River and 1980 Debris Flow in Polallie Creek	Pool Quality and Quantity	No	Yes	No	The 1980, 2000 and 2006 debris flows originating from Mt. Hood deposited large amounts of sediment in the East Fork Hood River. This sediment has likely filled pools in some areas but as the channel has shifted in response other pools may have been created. Proposed project activities would generate little sediment that would add to existing background conditions and thus would have no cumulative effect on pool habitat. Likewise, the debris flows moved large amounts of large wood downstream, primarily out of the action area. Protection buffers along the EFHR would maintain existing large wood recruitment potential and amounts of in-channel large wood so no cumulative effect expected in regards to pool habitat in the EFHR related to LWD.	None
	Large Wood Recruitment Potential	No	Yes	No		
	In-stream Large Wood	No	Yes	No		

Project	Potential Effects	Overlap in Time	Overlap in Space	Measurable Cumulative Effect?	Extent, Detectable?	Aquatic Species or Habitat Effect
Ongoing road maintenance, including snowplowing on both National Forest land and Highway 35	Pool Quality and Quantity Large Wood Recruitment Potential In-stream Large Wood	Yes	Yes	No	It is expected that all road maintenance needs on National Forest land would be taken care of with the Polallie Cooper Hazardous Fuels Reduction Project. Road maintenance activities off National Forest land cannot be determined for the most part, as specific road maintenance projects have yet to be identified. Known recurring road operations off National Forest that may have a potential for cumulative effects would be sanding on Highway 35 during the winter. The timing of sanding has the potential to provide sediment that may mix with road maintenance activities in the Polallie Cooper Hazardous Fuels Reduction project but no measurable cumulative is expected due to the small amount of potential sediment from road maintenance and the distance between both activities.	There would be no effect to pools, large wood recruitment, or amounts of in-stream large wood
Invasive Plant Treatments	Pool Quality and Quantity Large Wood Recruitment Potential In-stream Large Wood	Yes	Yes	No	There may be an overlap in timing of this project with the Polallie Cooper Hazardous Fuels Reduction project; however, there would be no cumulative effect to pools or large wood amounts or recruitment potential in the action area	None

Project	Potential Effects	Overlap in		Measurable Cumulative Effect?	Extent, Detectable?	Aquatic Species or Habitat Effect
		Time	Space			
Cooper Spur Ski Area and associated activities	Pool Quality and Quantity Large Wood Recruitment Potential In-stream Large Wood	Yes	Yes	No	There may be an overlap in timing of this project with the Polallie Cooper Hazardous Fuels Reduction project; however, there are no activities planned that would decrease large wood recruitment or existing amounts, nor would any activities increase fine sediment that could fill pools in Doe Creek downstream.	None

Cumulative Effects Summary

Stream Temperature

No detrimental cumulative effects are expected regarding increased water temperatures due to PDC that maintain existing primary shade vegetation adjacent to streams. As described in the Water Quality Specialist Report, this project would maintain existing water temperatures. As such, there are no temperature related cumulative effects on aquatic species or habitat.

Sediment

Due to PDC designed to greatly minimize erosion and sedimentation detrimental cumulative effects are not expected from implementation of the Polallie Cooper Fuels Reduction project. Some sediment may be generated at road crossings where maintenance occurs, but this sediment would be localized and immeasurable against background levels.

Pool Quantity and Quality

The chance that there could be some reduction in pool volume resulting from increased fine sediment levels is negligible given the very small amount of sedimentation expected and the fact that relatively large amounts of sediment are required to measurably decrease pool volume. Slight reductions in pool quantity could occur in some areas resulting from decreased amounts of pool forming large wood resulting from Polallie Cooper Fuels Reduction Project thinning coupled with past timber harvest. The potential decrease in pool habitat over time would be minor, thus the potential impacts to aquatic species would be negligible.

Large Wood Recruitment Potential

Large wood recruitment potential has been reduced throughout the action area by past timber harvest, both on federal and private land. Actions proposed in the Polallie Cooper Fuels Reduction Project would slightly increase the area within Riparian Reserves where large wood recruitment potential would be reduced. Over time, increased tree growth of remaining trees, coupled with a return of trees per acre to pretreatment levels, would increase large wood recruitment potential.

In-Stream Large Wood

The amount of in-stream large wood is low in many streams and reaches, in part due to past land management including stream clean out, although existing levels are likely within the range of natural variability in many reaches. No proposed project actions would directly result in further reductions of in-stream large wood. The potential reduction in large wood potential could result in some reaches adjacent to treated stands to have less in-stream large wood until remaining trees begin to fall naturally.

Summary of Effects

Because there would be no federal action if No Action was chosen there would be no effect to PETS species or habitat, although some habitat conditions would continue to degrade under this scenario – particularly riparian forest stand health. Activities proposed in the Proposed Action could impact PETS species that reside in the action area, as well as habitat conditions (Table 66). Depending on the species and/or habitat direct, indirect, and cumulative effects are possible. PDCs would greatly minimize potential effects, but not eliminate them altogether.

Indirect and cumulative negative effects (there are no direct effects anticipated) center on slight increases in fine sediment and very slight reductions in future large wood recruitment potential. In localized areas associated with road maintenance there is the possibility of increased levels of fine sediment. In any given location, the increase is expected to be quite small. However, sediment deposition could impact aquatic macroinvertebrate feeding and survival in perennial streams. This, in turn, could lead to slight reductions in salmonid food supply. There would be no impact to salmonid survival or reproductive success resulting from fine sediment increases because the amount of sediment would be very low and localized.

Table 66. The Polallie Cooper Fuels Reduction Project effects determination summary for ESA listed species, designated critical habitat, and Region 6 Regional Forester's Sensitive Species.

	Listing & Critical Habitat Date	Suitable Habitat Present	Species Present	Effects of Actions	
				No Action	Proposed Action
Endangered Species Act Listing by ESU/DPS – All Threatened					
Lower Columbia River steelhead & CH (*Oncorhynchus mykiss*)	1/06 9/05	Y	Y	NE	NLAA
Lower Columbia River chinook & CH (*Oncorhynchus tshawytscha*)	6/05 9/05	Y	N	NE	NE
Columbia River Bull Trout & CH (*Salvelinus confluentus*)	6/98 11/10	N	N	NE	NE
Middle Columbia River steelhead & CH (*Oncorhynchus mykiss*)	1/06 9/05	N	N	NE	NE
Upper Willamette River chinook & CH (*Oncorhynchus tshawytscha*)	6/05 9/05	N	N	NE	NE
Lower Columbia River Coho[4] *(Oncorhynchus kisutch)*	6/05 1/14	Y	Y	NE	NLAA
Forest Service Region 6 Regional Forester's Sensitive Species					
Barren Juga *(Juga hemphilli hemphilli)*	1/08	N	N	NI	NI
Purple-lipped Juga *(Juga hemphilli maupinensis)*	1/08	N	N	NI	NI
Dalles Juga (*Juga hemphilli dallesensis*)	12/11	N	N	NI	NI
Scott's Apatanian Caddisfly *(Allomyia scotti)*	1/08	N	N	NI	NI
Caddisfly (*Namamyia plutonis*)	12/11	N	N	NI	NI

Endangered Species Act Abbreviations/ Acronyms:
NE No effect
NLAA May affect, not likely to adversely affect

Regional Forester's Sensitive Species List Abbreviations/ Acronyms:
NI No impact

[4] Critical habitat for this species was proposed on Federal lands on January 14, 2013. It has not yet been formally designated.

Proposed projects would have no immediate impact on in-stream levels of large wood. However, thinning conducted in Riparian Reserves may reduce the wood recruitment potential in adjacent stream segments until remaining trees begin to fall naturally and replace those that were harvested. This future reduction in down wood could locally reduce the amount of pool habitat. These impacts, if they occur, would occur primarily in small (<4' bankful width) spring-fed headwater streams where fuels treatment is proposed because large wood transport to downstream reaches, including those that contain ESA-listed fish, is not expected as wood transport mechanisms such as floods and debris flows are very infrequent.

The anticipated impacts summarized above could have some localized effects to habitat upstream of stream reaches containing ESA-listed fish. Potential reductions in large wood recruitment and small increases in fine sediment from road maintenance **may affect, but are not likely to adversely affect ESA-listed fish species and designated/proposed critical in the action area.** Essential Fish Habitat for Chinook and Coho salmon would **not be adversely affected**.

Proposed project activities would have **no impact** on any sensitive aquatic species as they are not present in the action area. There may be slight impacts to Columbia duskysnail, a survey and manage Category A species, individuals or habitat due to some increase in sediment associated with road maintenance. However, population viability would be maintained as potential impacts would be site-specific and the Columbia duskysnail has a wide distribution across the Forest.

Although MIS resident trout may be impacted by some project activities the impacts would be minimal and localized. This project potentially impacts less than 2.3 percent of occupied resident trout habitat across the forest (Table 56), thus impacts to habitat would be insignificant at the forest scale and therefore the EA is consistent with the Forest Plan. Given their limited distribution compared to resident trout, more steelhead trout habitat could be affected by project activities (Table 56). However, for all salmonid species the actual area of impact would be far less than the total occupied habitat within the action area due to proposed activity locations along with PDCs and BMPs. For all salmonid species the Proposed Action **may impact individuals or habitat, but would not threaten species viability**.

3.7.4 Consistency Determination

The Polallie Cooper Fuels Reduction Project is consistent with all applicable fish/aquatic related federal laws, plans, and guidelines as outlined below.

Law, Regulation & Policy

Numerous existing plans provide guidance for projects in the form of Standards and Guidelines and recommended Best Management Practices (BMP). These documents include the Forest Plan and the NWFP. There is significant overlap between aquatics and water quality in terms of applicable standards and guidelines; therefore, those listed below are directly related to fisheries, management indicator species, or other aquatic special status species. See the Water Quality Specialist Report for other pertinent standards and guidelines.

Forest Plan Standards and Guidelines (pages Four-64, Four-69, Four-257, 258):

- Fisheries: FW-137, 138, 139, 145, 147
- Threatened, Endangered and Sensitive Plants and Animals: FW-174, 175, 176
- B7 General Riparian Area: B7-028, 030, 031, 032, 033, 037, 038, 059

Northwest Forest Plan Standards and Guidelines:

- See Water Quality Specialist Report

In addition to the above, the Forest Service is required to assess and disclose the effects of any federal action on ESA listed species, candidate species, and Regional Forester's Special Status species, as outlined in the Endangered Species Act of 1973 and National Forest Management Act of 1976. Lastly, the Magnuson-Stevens Fishery Conservation and Management Act of 1976 requires the Forest Service to assess and disclose the affects to Essential Fish Habitat.

Desired Future Condition

The desired future condition for streams and associated riparian areas within the Polallie Cooper Fuels Reduction Projects Project Area is summarized in several sources as outlined below:

The NWFP Aquatic Conservation Strategy (ACS) was developed "…to restore and maintain the ecological health of watersheds and aquatic ecosystems contained within them on public lands." Within this strategy are nine ACS objectives that give direction regarding the maintenance and/or restoration of aquatic processes key to watershed health. These objectives can be considered desired future conditions from an aquatic perspective for the project area.

Finally, the Forest Plan presents desired future conditions for all management areas, including General Riparian Areas. The list of DFCs can be found on page Four-254 in the LMRP, and the General Riparian Area management goal is to:

> "Achieve and maintain riparian and aquatic habitat conditions for the sustained, long-term production of fish, selected wildlife and plant species, and high quality water for the full spectrum of the Forest's riparian and aquatic areas. A secondary goal is to maintain a healthy forest condition through a variety of timber management practices."

3.7.5 Summary of Effects by Alternative

In the No Action alternative, none of the proposed projects would be implemented and there would be no immediate effect to aquatic habitat or species. However, the risk that natural events such as flooding or wildfire would result in degraded habitat conditions is greater. An increased risk of increased fine sediment input to area streams would be due primarily to roads not maintained, and thus, the chance for erosion and subsequent sedimentation would be greater. Not thinning forest stands, including Riparian Reserve stands, would result in increased susceptibility to disease and wildfire due to overstocking and large amounts of small down wood over time that increases the fuel loading. Although increased levels of down wood in the short-term would likely occur, the small size of the down material would decay quickly and not provide the same habitat benefit as larger wood, especially in larger streams.

The Proposed Action would result in short-term disturbance that could result in localized increases in fine sediment due to road maintenance and localized decreases in large wood recruitment potential (Riparian Reserve fuels treatment). These effects would be minimal and not result in an irreversible or irretrievable loss of aquatic habitat or species. In fact, the amount of erosion and subsequent sedimentation into streams would be reduced overall due to road maintenance in the long term; Riparian Reserve forest conditions would improve leading to less susceptibility to disease and fire, and increase the amount of larger down wood over time compared to the No Action scenario. Due to the project design, including PDCs, cumulative effects would be negligible.

3.8 Aquatic Conservation Strategy

In order for a project to proceed, "a decision maker must find that the proposed management activity is consistent with the Aquatic Conservation Strategy objectives" (ROD B-10) from the Northwest Forest Plan Record of Decision. The nine objectives are listed on page B-11 of the ROD. Portions of the effects analysis in this document focus on key parameters or indicators that make up elements of the nine Aquatic Conservation Strategy objectives, to determine if the project would restore, maintain, or degrade these indicators. Once this determination is made, the indicators are examined together with the Range of Natural Variability to ascertain whether the project is consistent with the objectives. A description of the range of natural variability of the "important physical and biological components" (ROD B-10) is necessary for determining whether a project "meets" or "does not prevent attainment" of the Aquatic Conservation Strategy objectives (ROD B-10). Relevant portions of the range of natural variability from the Watershed Analysis are included in the Existing Conditions section of this report. In general, natural sediment loads are high in this area and sediment tends to move unevenly, in pulses through the aquatic system. These high sediment loads have several sources including the presence of highly erodible soils along the flanks of Mt. Hood, natural debris flows originating from glacial moraines on Mt. Hood and glacial influences from tributaries to East Fork Hood River. In addition, general stream temperatures are cool due to glacial meltwater and numerous groundwater inputs.

Table 67 displays specific indicators that comprise the Aquatic Conservation Strategy (ACS) objectives and the effects section that covers this indicator in the Environmental Assessment. Also, refer to the Fisheries and Aquatic Fauna Specialist Report for additional effects descriptions.

Table 67. ACS Objective Indicators in the EA

Indicators	Analysis Found in the Effects Section of the EA
Water Temperature	Water Quality, Fisheries
Sediment	Soil Productivity, Water Quality, Fisheries
Chem. Contaminants	Water Quality, Fisheries
Physical Barriers	Water Quality, Fisheries
Substrate	Fisheries
Large Woody Debris	Fisheries
Pool Frequency	Fisheries
Pool Quality	Fisheries
Off-Channel Habitat	Fisheries
Refugia	Fisheries
Width/Depth Ratio	Fisheries
Streambank Condition	Water Quality, Fisheries
Floodplain Connectivity	Water Quality, Fisheries
Peak/base Flows	Water Quality
Drainage Network Increase	Water Quality
Riparian Reserves	Water Quality, Fisheries

Table 68 displays the individual indicators and the effect the alternatives have on those indicators at the 5th, 6th and 7th field watershed scale. Fifth field watersheds are generally large in size (40,000 acres to 250,000 acres), while 6th and 7th field watersheds are smaller (5,000 acres to 40,000 acres and 2,000 acres to 5,000 acres respectively).

Table 68. ACS Objective Indicators for each Alternative.

Indicators	Effects of the Actions by Alternative	
	No Action	Proposed Action
Water Quality: Temperature	M	M
Sediment	M	M
Chemical Contamination	M	M
Habitat Access: Physical Barriers	M	M
Habitat Elements: Substrate	M	M
Large Woody Debris	M	M
Pool Frequency	M	M
Pool Quality	M	M
Off-channel Habitat	M	M
Refugia	M	M
Channel Conditions and Dynamics: Width/Depth Ratio	M	M
Streambank Condition	M	M
Floodplain Connectivity	M	M
Flow/Hydrology: Peak/Base Flows	M	M
Drainage Network Increase	M	M
Watershed Conditions: Riparian Reserves	M	Restore over Long-term

The abbreviations in the table are defined as: R="Restore" which means the action(s) would result in acceleration of the recovery rate of that indicator; M="Maintain" which means that the function of an indicator does not change by implementing the action(s) or recovery would continue at its current rate; and, D="Degrade" which means changing the function of an indicator for the worse.

The following summarizes the Individual Indicator Table and associated ACS Objectives:

- The proposed project would treat vegetation in Riparian Reserves to restore them to a more natural vegetation state. This would result in more natural function of the riparian area. Benefits from implementation of the Proposed Action would be noticeable at the site scale and possibly the 7th field watershed.

- Indicators other than those described in the bullet above would be maintained as outlined in the effects analysis above.

The following is a summary the Aquatic Conservation Strategy objectives (ROD B-10) and how the Polallie Cooper Hazardous Fuels Reduction Project action alternative would influence them. All changes described below would be evident at the 7th field watershed or smaller (site scale) scale:

1. Maintain The Distribution, Diversity And Complexity Of Watershed And Landscape-Scale Features

95.7 percent of the Riparian Reserves in the 6th field sub-watersheds comprising this project would be left untreated so their current condition would be maintained. A specific prescription for vegetation treatments in Riparian Reserves has been developed for this project and this prescription is intended to maintain or enhance the development of a diverse, healthy riparian area while protecting it with a variety of project design criteria. The prescription includes a protection buffer adjacent to each perennial and intermittent stream that would maintain existing vegetative conditions adjacent to these features. No new road crossings or reconstruction of existing crossings in perennial or intermittent streams or wetlands are proposed.

2. Maintain Spatial And Temporal Connectivity Within And Between Watersheds

95.7 percent of the Riparian Reserves in the 6th field sub-watersheds comprising the project would be left untreated so their current condition would be maintained. A specific prescription for vegetation treatments in Riparian Reserves has been developed for this project and this prescription is intended to maintain or enhance the development of a diverse, healthy riparian area while protecting it with a variety of project design criteria. The prescription includes a protection buffer adjacent to each perennial and intermittent stream that would maintain existing vegetative conditions adjacent to these features.

3. Maintain The Physical Integrity Of The Aquatic System, Including Streambanks, Side channels (Refugia), And Channel Bottom Configurations

This project would meet this objective through project design criteria aimed at reducing soil compaction and erosion, restricting near-stream ground disturbance and establishment of protection buffers next to perennial and intermittent streams which would maintain current levels of snags and wood input. A prescription for vegetation treatments in Riparian Reserves that is intended to maintain or enhance the development of a diverse, healthy riparian area and the lack of any new or reconstructed road crossings on perennial or intermittent streams would greatly reduce risks of sedimentation, increased peak flow, and resulting bank erosion and channel bed scour.

4. Maintain Water Quality Necessary To Support Healthy Ecosystems

This project would meet this objective through project design criteria and inclusion of a specific prescription for vegetation treatments in Riparian Reserves that includes a protection buffer adjacent to each perennial and intermittent stream. This protection buffer includes the primary shade zone along perennial streams that would maintain stream temperature. The protection buffer would also trap any eroded material prior to reaching surface water, thus reducing or eliminating the potential for sediment delivery. The protection buffers in conjunction with project design criteria aimed at reducing erosion would maintain the sediment levels in the long-term. Additional PDC for the Crystal Springs DWPA including on-site toilet facilities and limits to fuel storage would reduce the risk of water quality degradation. These measures are discussed in detail in the Soil Productivity, Water Quality, and Fisheries sections in Chapter 3.

5. Maintain Sediment Regimes

Project design criteria aimed at reducing soil compaction, erosion and sediment transport, restricting near stream ground disturbance and establishment of protection buffers next to perennial and intermittent streams would minimize sediment introduction in the short and long-term. Any sedimentation resulting from road maintenance activities would be short term and most evident at the site scale. Overall sediment production from roads is expected to be reduced since most maintenance activities are aimed at correcting areas that have existing erosion problems.

6. Maintain In-Stream Flows That Are Closer To Natural Regimes

As described in the watershed section of the EA, this project would maintain the Watershed Impact Area below the 35% Management Plan Standard and Guide which shouldn't result in any peak flow increase from this project. In addition, there would be no new road/stream crossings so there would not be any increase in the stream channel network by implementation of the Proposed Action.

7. Maintain The Timing, Variability, And Duration Of Floodplain Inundation

This project would meet this objective through project design criteria such as establishment of protection buffers next to perennial and intermittent streams which would maintain floodplain and channel roughness and ultimately the timing, variability and duration of floodplain inundation. Maintaining the Watershed Impact Area below the 35% Management Plan Standard and Guide would protect the integrity of the floodplains while minimizing the potential for increased peak flows. In general, floodplains are limited in this area due to the steep nature of the landscape.

8. Maintain The Species Composition And Structural Diversity Of Plant Communities In Riparian Areas And Wetlands

A specific prescription for vegetation treatments in Riparian Reserves has been developed for this project and the prescription is intended to maintain or enhance the development of a diverse, healthy riparian area while protecting it with a variety of project design criteria. Treatments within the Riparian Reserves are aimed at producing a more natural vegetative composition and density that has been lost through many decades of fire suppression.

9. Maintain And Restore Habitat To Support Well-Distributed Populations Of Native Plant And Riparian Dependent Species

The project would meet this objective with project design criteria and vegetative treatments that are designed to simulate a more natural disturbance regime within the area.

3.9 Wildlife

3.9.1 Analysis Assumptions and Methodology

Four species of wildlife and critical habitat that are classified as threatened, endangered or proposed may be found on or adjacent to the Hood River Ranger District. There are seventeen U.S. Forest Service Region 6 Sensitive species (2011), seven Survey and Manage species (2001), and seven Management Indicator species that may also be found on the District. The status of species in the project area is listed in Table 69. Species that are not present or do not have habitat within the project area will not be discussed further in this biological evaluation.

Table 69. The status of Threatened, Endangered, and Proposed Species; Forest Service Region 6 Sensitive Species; Survey and Manage Species; and Management Indicator Species in the Project Area

Species	Habitat Impacted	Presence
Federally Threatened, Endangered or Proposed		
Northern spotted owl (*Strix occidentalis caurina*)	yes	yes
Northern spotted owl critical habitat	yes	yes
Canada lynx (*Lynx canadensis*)	no	-
North American wolverine (*Gulo gulo luscus)*	no	-
R6 Sensitive Species		
Bald eagle (*Haliatus leucocephalus*)	no	-
Peregrine falcon (*Falco peregrinus anatum*)	yes	unknown
Bufflehead (*Bucephala albeola*)	no	-
Harlequin duck (*Histrionicus histrionicus*)	yes	yes
White-headed woodpecker (*Picoides albolarvatus*)	yes	unknown
Lewis' woodpecker (*Melanerpes lewis*)	no	-
Cope's giant salamander (*Dicomptodon copei*)	no	-
Cascade torrent salamander (*Rhyocotriton cascadae*)	no	-
Oregon spotted frog (*Rana pretiosa*)	no	-
Townsend's big-eared bat (*Corynorhinus townsendii*)	no	-
Fringed myotis (*Myotis thysanodes*)	yes	unknown
Pacific fisher (*Martes pennanti*)	no	-
Western bumblebee (*Bombus occidentalis*)	yes	unknown
Beller's ground beetle (*Agonum belleri*)	no	-
California Shield-backed bug (*Vanduzeenia borealis californica*)	no*	-
Johnson's hairstreak (*Callophyrs johnsoni*)	yes	unknown
Mardon skipper (*Polites mardon*)	no	-
Survey and Manage		
Great gray owl *(Strix nebulosa)*	no	-
Larch Mountain salamander *(Plethodon larselii)*	yes	no
Dalles sideband *(Monadenia fidelis minor)*	yes	no
Crater Lake tightcoil *(Pristiloma arcticum crateris)*	yes	yes
Evening fieldslug *(Deroceras hesperium)*	yes	no
Puget Oregonian *(Cryptomastix devia)*	yes	no
Columbia Oregonian *(Cryptomastix hendersoni)*	yes	no

Management Indicator Species		
Mule Deer (*Odocoileus hemionus*) and Elk (*Cervus elaphus nelsoni*)	yes	yes
Pileated Woodpecker *(Dryocopus pileatus)*	yes	yes
American Marten *(Martes americana)*	yes	
Wild Turkey *(Meleagris gallopavo)*	no	-
Western Gray Squirrel *(Sciurus griseus griseus)*	no	-
Other Speices of Interest		
Snag and Down Log Associated Species	yes	yes
Neotropical Migratory Birds	yes	yes
** Documented in 1927, however not ducmented since and the habitat is no longer present*		

Species that are listed as “no” for Habitat in Table 69 do not occur within the project area or would not be impacted by this project and will not be discussed further in this analysis. Surveys were completed for survey and manage species in accordance with the 2001 Survey and Manage ROD (Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and Other Mitigation Measures Standards and Guidelines) for the project. The following analysis includes a discussion for wildlife species for the components of the Polallie Cooper Hazardous fuels reduction project.

The California Shield Backed-Bug was starred in the table above due to a 1927 record documented at Homestead Inn off of Cooper Spur road inside the project area. It is a tall grass prairie, meadow, and bald butte obligate and habitat is not anticipated to be impacted. The habitat is no longer there and thus the species is not thought to be present to be impacted by proposed actions.

3.9.2 Threatened, Endangered and Proposed Species – Northern Spotted Owl

Methodology

Disturbance

The U.S. Fish and Wildlife Service (USFWS) has concluded that noise, smoke, and human presence can result in a disruption of breeding, feeding or sheltering behavior of the northern spotted owl (spotted owl) such that it creates the potential for injury to individuals (i.e., incidental take in the form of harassment). For a significant disruption of spotted owl behavior to occur as a result of disturbance caused by the Proposed Action, the disturbance and spotted owl(s) must be in close proximity to one another. Human presence on-the-ground is not expected to cause a significant disruption of behavior because spotted owls do not seem to be startled in those situations.

A spotted owl that may be disturbed at a roost site is presumably capable of moving away from the disturbance without a substantial disruption of its behavior. Since spotted owls forage primarily at night, projects that occur during the day are not likely to disrupt its foraging behavior. The potential for effects is mainly associated with breeding behavior at active nest sites.

In the late breeding period, potential effects from disturbance decline because juvenile spotted owls are increasingly more capable of moving as the nesting season progresses. To ensure that more than 86 percent of juvenile spotted owls in the Oregon Eastern Cascades Physiographic Province are able to move away from disturbance without increasing their risk of predation or harm, the critical breeding period is considered to be March 1 through July 15. After July 15, it is estimated that most fledgling spotted owls are capable of sustained flight and can move away from most harmful disturbances.

The USFWS has based disruption distances on interpretation of the best available information. The proposed actions for this project that generate noise above ambient levels would be the use of helicopter, heavy equipment and chainsaw use. Disruption by helicopters is based off of helicopter type (see PDC's). Disruption distances of 65 yards for heavy equipment and chainsaws use have been set by the USFWS.

Home Range, Core Area, and Nest Patches

Nest patches were removed from treatment areas and will have no management activities occurring within them, whether nest patches are occupied or not by spotted owls.

While it is usually the alteration or removal of suitable habitat that potentially results in adverse impacts to a territorial pair of spotted owls, the loss or degradation of dispersal habitat may also result in short-term impacts. The USFWS has guidelines for how much removal of suitable habitat would result in take. For the Willamette Province, the home range is a 1.2 mile radius circle (2,955 acres) centered on a historic nest site. Incidental take would be presumed to occur when suitable habitat is removed from a home range and if suitable habitat is less than 40 percent of the home range. A core area has been defined as the area within a home range that receives disproportionately high use (503 acres or 0.5 mile radius circle from the historic nest). Incidental take would be presumed to occur when suitable habitat is removed from a core area and if suitable habitat is less than 50 percent of the core area.

There are few recent surveys for spotted owls that show locations of active nest sites on the Forest. Historical nest sites, predicted nest sites, and modeled habitat were used to set the baseline for an intensive survey of all Suitable Habitat that could have management activities occurring. Following the USFWS Protocol for Surveying Proposed Management Activities That May Impact Northern Spotted Owls (Revised January 2012) surveys were also completed 1.2 miles from suitable habitat within the project area. Year one of surveys were completed in 2014, with year two occurring in 2015 to protocol.

Existing Condition

The spotted owl is listed as a threatened species under the Endangered Species Act, as a Regional Forester Sensitive Species for Region 6, and as a Management Indicator Species under the National Forest Management Act.

The analysis area for determining the effects to spotted owls is the project boundary and overlapping spotted owl territories to include 14,337 acres shown in blue below (Figure 46). There are 7 spotted owl home ranges that overlap proposed treatment units as identified by numeric values below.

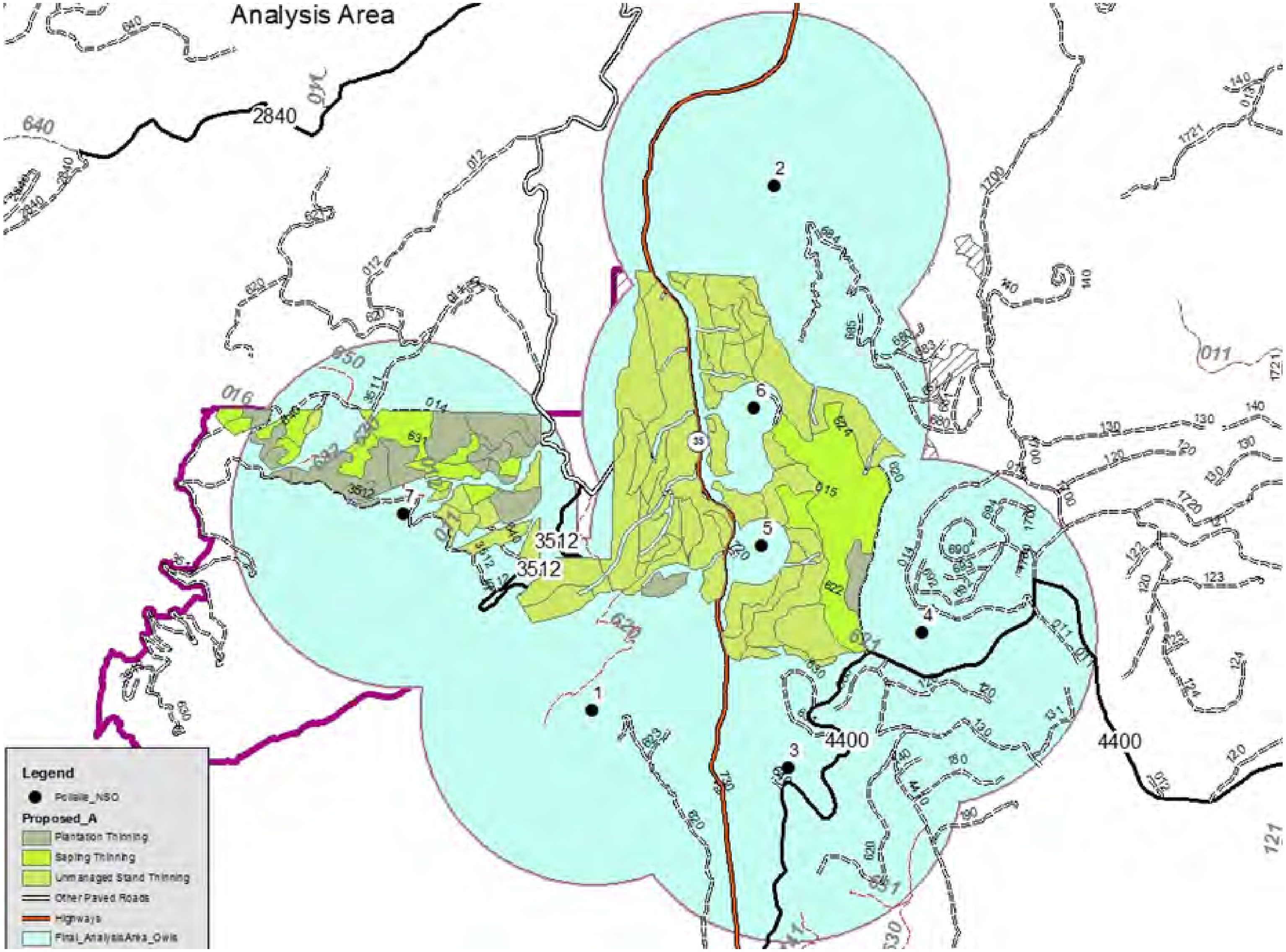


Figure 46. Analysis area for effects to Northern spotted owls

There are 2,830 acres proposed for treatments. Approximately 1,174 acres are providing dispersal, 311 acres of suitable, and 376 acres of foraging habitat for spotted owls. The remaining 969 acres are considered non-habitat for the spotted owl. The non-habitat stands are plantation or sapling thinning stands, while dispersal habitat has an average diameter of 11-inches, canopy closure of 40% and open enough for spotted owls to fly threw them. The sizes of trees in these stands are considered too small to support dispersing spotted owls. There are a total of 687 acres that are considered suitable (nesting, roosting, or foraging habitat). They have a multi-storied structure, large diameter trees and appropriate levels of snags and down wood required for suitable habitat.

The Forest Service extensively surveyed habitat for NSO's in the field season of 2014. Figure 47 shows habitat as mapped from field surveys for suitable and foraging habitat. Dispersal was mapped by analyzing what was left after suitable/foraging was mapped by analyzing the corporate layer of habitat and aerial photographs. Data identified as suitable and dispersal in the corporate layer was created into a layer showing dispersal habitat. An analysis was completed for non-habitat in the planning area (fire burned areas, sapling thinning areas etc) and left out of layers for habitat. See Table 70 for acres available to each pair in the current condition.

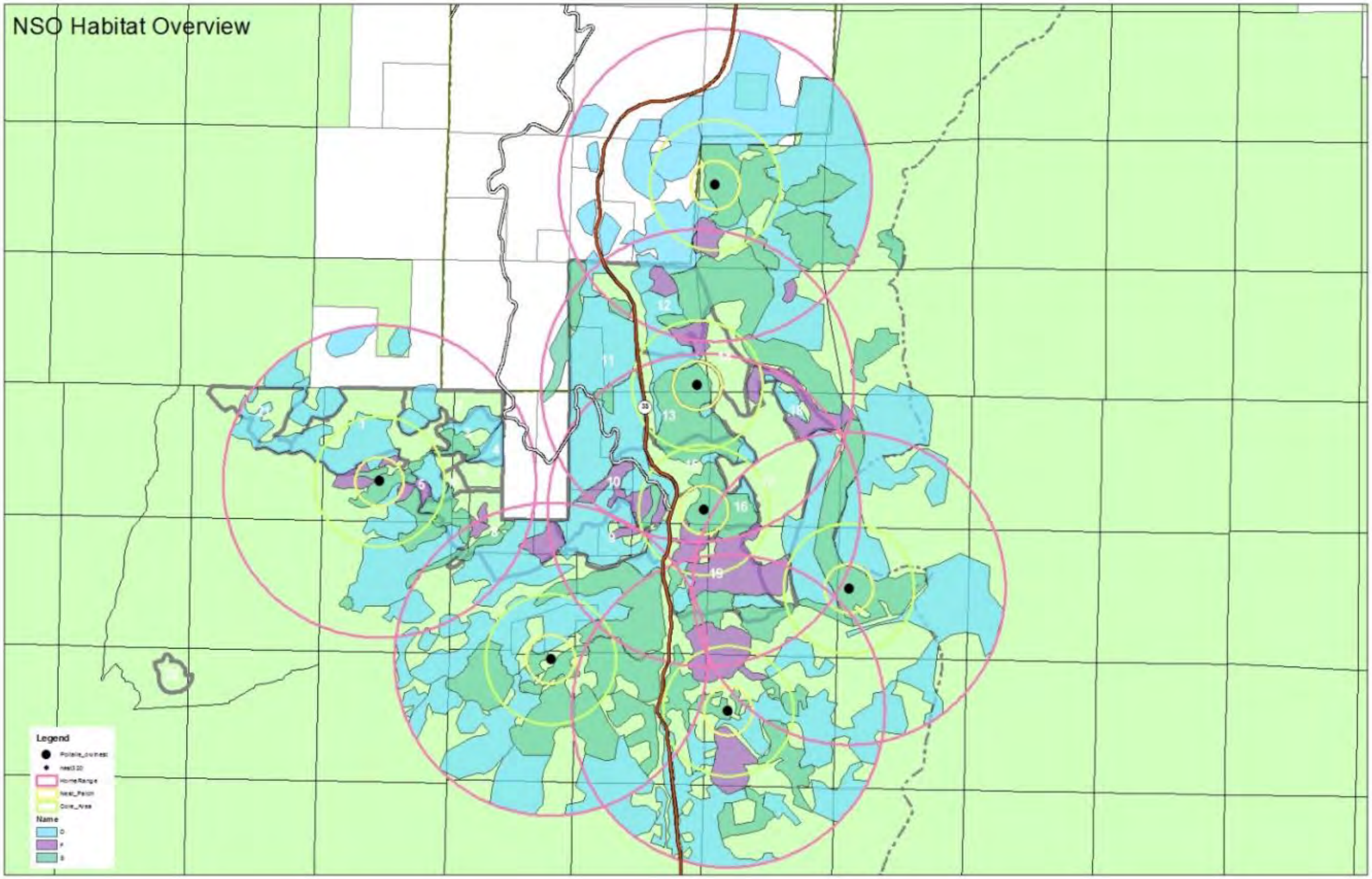


Figure 47. Mapped Habitat Overview for Northern Spotted Owls

Table 70. Acreage breakdown by nest number in current condition

Nest # 1	Non-Habitat		Dispersal		Foraging		Suitable		Suitable and Foraging Habitat	
	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
Nest Patch	18.8	27.1	15	21.5	0	0.0	36	51.5	36	51%
Core Area	82.6	16.4	184	36.6	0	0.0	236	47.0	236	47%
Home Range	790.3	27.3	1164	40.2	88	3.0	853	29.5	941	33%
Nest # 2	Non-Habitat		Dispersal		Foraging		Suitable		Suitable and Foraging Habitat	
	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
Nest Patch	15.8	22.7	5	7.2	0	0.0	49	70.2	49	70%
Core Area	96.6	19.2	207	41.2	27	5.4	172	34.2	199	40%
Home Range	1003.3	34.7	1239	42.8	84	2.9	569	19.7	653	23%
Nest # 3	Non-Habitat		Dispersal		Foraging		Suitable		Suitable and Foraging Habitat	
	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
Nest Patch	27.8	39.9	14	20.0	4	5.7	24	34.4	28	40%
Core Area	170.6	33.9	98	19.5	122	24.3	112	22.3	234	47%
Home Range	1004.3	34.7	808	27.9	320	11.1	763	26.4	1083	37%
Nest # 4	Non-Habitat		Dispersal		Foraging		Suitable		Suitable and Foraging Habitat	
	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
Nest Patch	1.8	2.6	10	14.3	0	0.0	58	83.0	58	83%
Core Area	164.6	32.7	158	31.4	3	0.6	177	35.2	180	36%
Home Range	1279.3	44.2	924	31.9	242	8.4	450	15.5	692	24%
Nest # 5	Non-Habitat		Dispersal		Foraging		Suitable		Suitable and Foraging Habitat	
	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
Nest Patch	14.8	21.2	0	0.0	1	1.4	54	77.3	55	79%
Core Area	162.6	32.4	59	11.7	114	22.7	167	33.2	281	56%
Home Range	846.3	29.2	852	29.4	429	14.8	768	26.5	1197	41%
Nest # 6	Non-Habitat		Dispersal		Foraging		Suitable		Suitable and Foraging Habitat	
	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
Nest Patch	15.8	22.7	4	5.7	0	0.0	50	71.4	50	71%
Core Area	192.6	38.3	85	16.9	48	9.6	177	35.2	225	45%
Home Range	937.3	32.4	943	32.6	249	8.6	766	26.5	1015	35%
Nest # 7	Non-Habitat		Dispersal		Foraging		Suitable		Suitable and Foraging Habitat	
	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
Nest Patch	4.8	6.9	13	18.6	16	22.9	36	51.5	52	74%
Core Area	170.6	33.9	193	38.4	47	9.4	92	18.3	139	28%
Home Range	1783.3	61.6	836	28.9	62	2.1	214	7.4	276	10%

For each pair an analysis was done on the basis of habitat available and threshold limits for take to spotted owl. This was derived by reviewing Table 70. All Nests except for Nest #5, are below thresholds for take in the Core area.

Effects Analysis

The existing condition gives the baseline conditions for which effects to NSO's are measured from. Alterations to habitat from vegetation management, fuels treatments, and tools used to accomplish the work are considered in determining the effects.

No Action Alternative

There would be no short-term effects to spotted owl under this alternative. The units that are providing suitable and dispersal habitat would continue to function as habitat and snag and down wood levels would remain essentially unchanged, as no treatments would occur.

In the long term, the quality of suitable habitat could be improved in areas, with the potential increase of larger snags and down wood recruited, and more areas with a multi-storied canopy. The quality of dispersal habitat would improve only slightly in some stands while improving much more in others. The stands that are currently considered non-habitat for the owls would likely become dispersal habitat. Some of the stands may eventually develop nesting habitat characteristics and become suitable spotted owl habitat.

However, with no action, it could take as much as 60-150 years for non-habitat and dispersal to develop into suitable habitat as stocking levels and high tree density would keep trees from growing in diameter and help with canopy closure. Refer to the Silviculture Specialist Report for further discussion of tree response under the No Action Alternative. Under this alternative, there would be no sound related disturbance/ disruption to owls and habitat would not be downgraded in areas of the project, and no effects from fuel treatments.

The long-term effects of the No Action alternative to spotted owls would include an increase in the potential for stand replacing fires within the planning area. This increase would also raise the likelihood of losing mature forest habitat which the owls depend on for nesting, roosting and foraging. Refer to fuels write up for further discussion of fire effects under the no action alternative.

Proposed Action Alternative

Habitat Impacts

The proposed treatments include a thinning prescription that would improve the growth rate for all of the stands. Larger trees would be retained, snags would be retained where snags don't pose a health and safety risk. In areas of non-habitat and dispersal, habitat would be provided in a faster timeframe than with no treatment. This would increase the rate that suitable habitat would be available for spotted owl. Many of the stands are lacking understory components due to the high stocking level of trees and lack of sunlight hitting the ground. After treatment there would be an increase in shrub components and small openings that spotted owls use for foraging. In some areas of the project, trees are stocked so closely that spotted owls are unable to fly through the stands. After treatment, it is believed that these areas would be dispersal habitat and would potentially provide new foraging areas.

Structural diversity is a combination of several stand characteristic which would include, but would not be limited to, number of canopy layers, down wood, and snags. About a third of the planning area consists of sapling and plantation stands that have very little growth and lack the snags and downed wood needed for nesting and foraging owl habitat. The remaining two thirds of the planning area are in recently unmanaged stands that have higher tree diversity, areas of multiple-canopies, some areas of even-aged stands, and have trees that are sufficient in size to provide quality snags or downed wood. Thinning in all stands can have immediate effects on forest diversity and long-term effects restoring native plant communities as understory species are released and provide a seed source for future recruitment. In suitable habitat structural diversity is present. However, some of these components are comprised of small areas of multiple canopy layers, and limited by the number of large snags and down wood.

Structural diversity would be improved in all habitats by creating openings, and in some areas initiating a new stand class. Thinning would also have an indirect impact by releasing the green retention trees. These retention trees would later become the large diameter snag and downed wood. Thinning and fuels treatments would have a short-term negative effect on snags and downed wood quantity, but tree response to variable density thinning is expected to result in increased growth which would provide for larger snags and down wood into the future. This could speed the ability of the stands to provide the size of snags and down wood needed to meet the Mt. Hood National Forest Land and Resource Management Plan (Forest Plan) standards (FW-215, FW-216, FW-219 through FW-223).

The proposed harvest treatments and fuels treatments would temporarily impact approximately 1,174 acres of dispersal habitat, 376 acres of foraging and 311 acres of suitable habitat would be downgraded, but have other habitat components of large snags and down wood persisting (See Figure 48). Suitable habitat would be downgraded and impacted by reducing the canopy cover from 60-70 percent to 35-40 percent or greater. There would also be a loss of some down wood, shrubs and snags, which provide habitat for prey species. Overall 96% of suitable habitat would be maintained as suitable in the proposed action, with only 120 acres of the 2686 acres of suitable in the Project Area being downgraded to dispersal. Although suitable habitat within these units would be reduced in quality, they would still function as dispersal habitat. It is estimated that these units would again provide quality suitable habitat approximately 20-30 years on the moist mixed conifer side, and 25-40 years on the dry mix conifer side after harvest.

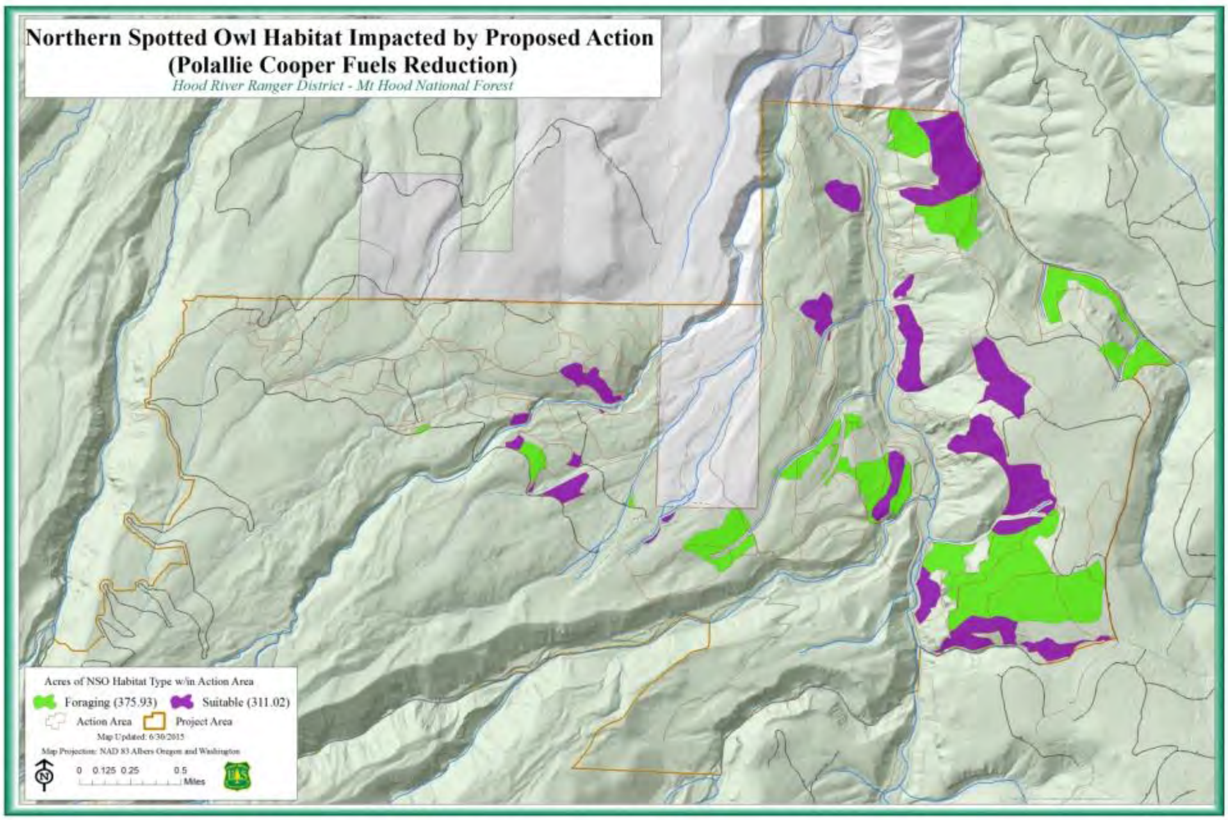


Figure 48. Spotted Owl Habitat Impacted by Proposed Action

The impacts to habitat are not anticipated to affect the ability of owls to move through these stands as dispersal is being maintained or enhanced in much of the project area, and suitable is present throughout the analysis area. Dispersal from East to West is not anticipated to be impacted by this project. Dispersal to the North is limited due to the amount of agriculture, private, and county lands. Dispersal to the South and West is limited due to past stand replacing wildfires and habitat is no longer persistent around the higher elevations of Mt. Hood. The project area and to the South habitat is present as identified through field verification.

Barred Owls

There is concern that timber harvest and other silvicultural activities may directly or indirectly affect the interaction between barred owls and spotted owls and increase the competitive advantage for barred owls. The main areas of concern related to the proposed action are: logging may expand the range of barred owls; and silvicultural treatments that thin forests and create early seral habitat, or create edge habitat, which may favor barred owls over spotted owls. Barred owls are documented on both the east and west side of the project area.

Barred owls were located in the planning area. Several (occurrences in 2014 and 2015) were found on the west-side of the planning area while only a few were located on the east-side. Based on these studies that showed the small mammal species that have been found to increase most after thinning are not one that are selectively favored by barred owls more than spotted owls, the silvicultural treatments proposed in the PCHFRA would not expand the range of barred owls and would not create habitat favored by barred owls over spotted owls.

Sound Disturbance

The sound from project activities would not adversely affect the breeding behavior of spotted owls during their critical breeding period because no heavy equipment, chainsaw use, or helicopter use would occur within the 65 to 120 yard disruption distances. Some activities would take place during the critical nesting season between March 1 and July 15, but these activities would be beyond the disruption distance of an actively nesting spotted owl pair or beyond the disruption distance from the nest patch of a predicted site.

ESA Effects Determination

Because many units are within the home range of a pair of owls, the impacts to habitat could reduce the birds nesting and foraging ability or shift the core area of a nesting pair away from the thinned stands for a time. The removal of suitable nesting habitat is **likely to adversely affect** northern spotted owl. The degradation of suitable and/or dispersal habitat **may affect, likely to adversely affect**, northern spotted owls.

Sound disturbance caused by thinning activity would not adversely affect the breeding behavior of spotted owls during their critical breeding period because no heavy equipment or chainsaw use would occur within the 65 yard disruption distances during the critical breeding period of March 1 to July 15. As well helicopter use would be below decibel levels to impact owls during the critical breeding period (see PDC's). Some activities would take place between March 1 and July 15, but they would be beyond the disruption distance from a spotted owl nest site. Therefore, harvesting of the proposed action **may affect, but are not likely to adversely affect**, nesting northern spotted owls due to disturbance

Cumulative Effects

The activities considered in the cumulative effects for spotted owls are those that impact habitat, dispersal, and cause disturbance/disruption as listed within Chapter 3 of the EA.

Based on the analysis above for barred owl, the cumulative effects to spotted owl would be the same as those discussed under the effects from the proposed project. Timber harvest would not expand the range of barred owls and would not create habitat favored by barred owls over spotted owls.

East to west and south migration is not anticipated to be negatively impacted by the proposed action, previous, or those in the foreseeable future. Migration to the North is limited due to private land ownership and the upper Hood River valley being made up of orchards. However, the Dog River LSR is in close proximity and movement to the NE is possible and likely.

Consistency Determination

The effects to spotted owls for this project will be covered under a formal consultation.
This project is consistent with the Northwest Forest Plan and with the Revised Northern Spotted Owl Recovery Plan (U.S. Fish and Wildlife Service 2011) for habitat management in dry forests:

- Known spotted owl activity centers within the project area would be protected (ROD Standards and Guidelines pp C-10). One hundred acres of the best spotted owl habitat would be retained as close to the nest site or owl activity center as possible for all known spotted owl activity centers (as of January 1, 1994) located on federal lands.

All applicable Mt. Hood National Forest Land and Resource Management Plan Standards and Guidelines that apply to the Proposed Action alternatives and would be met.

Summary of Effects

For northern spotted owls, there would be no short-term effects under the No Action alternative. Some of the stands may eventually develop nesting habitat characteristics and become suitable spotted owl habitat; however, it could take as much as 60 to150 years in portions of the project area. Suitable habitat would be maintained and habitat would continue to persist in the project area unaltered. The Proposed Action **may affect, likely to adversely affect**, northern spotted owls because suitable and foraging habitat would be impacted, while there would be no effect from noise disturbance because timing restrictions would reduce impacts from sound.

3.9.3 Northern Spotted Owl Critical Habitat

Analysis Assumptions and Methodology

Critical habitat (CH) includes those specific areas within the geographical area occupied by the species at the time it was listed and on which are found those physical or biological features essential to the conservation of the species, and which may require special management considerations or protection. For the spotted owl, these features are defined as primary constituent elements (PCEs) which include particular forest types that are used or likely to be used by spotted owls for nesting, roosting, foraging, or dispersing habitat. The effects to CH are analyzed based on the impacts to the individual PCEs. The PCEs for the spotted owl were defined in the Final Rule, Federal Register Vol. 77, No. 233 December 4, 2012. They are listed as:

1. Forest types that support the spotted owl across its geographic range. This PCE is essential to the conservation of the species because it provides the biotic communities that are known to be necessary for the spotted owl.
    a. Includes - Sitka spruce, western hemlock, mixed conifer, mixed evergreen, grand fir, Pacific silver fir, Douglas-fir, white fir, Shasta red fir, redwood/Douglas-fir, and the moist end of ponderosa pine.
    b. Coniferous zones at elevations up to 6000’.
    c. This PCE must be in concert with at least one other PCE to be critical habitat.
2. Habitat for nesting and roosting. Nesting habitat is essential to provide structural features for nesting, protection from adverse weather conditions, and cover to reduce predation risks. Roosting habitat is essential to provide for thermoregulation, shelter, and cover to reduce predation risk while resting or foraging.
    a. These habitats must provide:
        i. Sufficient foraging habitat to meet home range needs of territorial pairs throughout the year.
        ii. Nesting and roosting habitat (see definition above)
3. Foraging habitat is essential to provide a food supply for survival and reproduction.

   a. Varies widely across the range in accordance with ecological conditions and disturbance regimes that influence vegetation structure and prey species distributions
   b. East Cascades foraging habitat
      i. Stands of nesting or roosting habitat
      ii. Stands of Douglas-fir or white fir/Douglas-fir mix
      iii. Mean tree size >16.5"dbh
      iv. Increased density of large trees (>26" dbh) and increased basal area
      v. Large accumulations of fallen trees and other woody debris
      vi. Sufficient space below canopy to fly
4. Habitat to support the transience and colonization phases of dispersal.
   a. Would optimally be composed of nesting, roosting or foraging habitat but may also be composed of other forest types that occur between larger blocks of nesting, roosting, and foraging habitat
      i. Where nesting, roosting, and foraging habitat is insufficient to support dispersal, dispersal habitat may be provided by:
         1. Habitat supporting the transience phase of dispersal
            a. Stands with adequate tree size and canopy cover to provide protection from avian predators and minimal foraging opportunities
            b. May include but is not limited to trees at least 11" dbh and a minimum of 40% canopy cover AND
            c. Younger and less diverse forest stands than foraging habitat like even-aged, pole-sized stands if they contain some roosting structures and foraging habitat to allow for temporary resting and feeding during the transience phase
         2. Habitat supporting the colonization phase of dispersal
            a. Equivalent to nesting, roosting, and foraging habitat but may be smaller in area than that needed to support nesting pairs

The Final CH Rule has a section entitled "Determining Whether an Action is Likely to Adversely Affect CH" (77 FR 71939). For this analysis the stand scale was utilized to assess effects for all four PCEs. This scale of analysis is consistent with the current method recommended by the Willamette Province Level 1 Team for addressing effects to CH for consultation.

PCE 1 is the forest types that support spotted owls. This criterion was used to identify CH affected by the Proposed Action. PCEs 2, 3, and 4 (nesting/roosting, foraging, and dispersal habitat) were specifically considered with respect to the Proposed Action to determine if they were removed, reduced, maintained or enhanced at a stand level.

The analysis of impacts has both a temporal scale (would the actions delay or accelerate the development of the PCEs in the stand following treatment) and a qualitative scale (would the life history needs of the spotted owl be better or worse with respect to the PCEs as a result of the treatment).

In addition to the above scales, the effects to the PCEs are evaluated at the scales of the CH subunit, CH unit, and the range of the spotted owl. However, if the Proposed Action does not have significant effects at a smaller scale they would not have significant effects at increasingly larger scales and would therefore not be analyzed.

Existing Condition

A total of 9,577,969 acres in 11 units and 60 subunits have been designated as CH for the spotted owl. The proposed project falls within unit 7: East Cascades North (ECN) and includes a total of 1,345,523 acres in 9 subunits.

The East Cascades North (ECN-7) subunit consists of approximately 139,979 acres in Hood River and Wasco Counties, Oregon, and is comprised of only Federal lands managed by the U.S. Forest Service under the Northwest Forest Plan (USDA and USDI 1994). Special management considerations or protection are required in this subunit to address threats from current and past timber harvest, removal or modification of habitat by forest fires and the effects on vegetation from fire exclusion, and competition with barred owls. This subunit is expected to function primarily for demographic support to the overall population, as well as north-south and east-west connectivity between subunits and other CH units.

An evaluation of sites known to be occupied at the time of listing indicates that nearly 100 percent of the area of ECN-7 was covered by verified northern spotted owl home ranges. When combined with likely occupancy of suitable habitat and occupancy by nonterritorial owls and dispersing subadults, we consider this subunit to have been largely occupied at the time of listing. In addition, there may be some smaller areas of younger forest within the habitat mosaic of this subunit that were unoccupied at the time of listing.

The CH Rule determined that all of the unoccupied and likely occupied areas in this subunit are essential for the conservation of the species to meet the recovery criterion that calls for the continued maintenance and recruitment of northern spotted owl habitat (USFWS 2011). The increase and enhancement of northern spotted owl habitat is necessary to provide for viable populations of northern spotted owls over the long term by providing for population growth, successful dispersal, and buffering from competition with the barred owl.

Analysis Area

The analysis area for spotted owl CH is the ENC-7 subunit. The analysis for the effects to spotted owl CH relates the impacts of activities within the project area to the subunit (ENC-7) as described above. The impacts to the subunit are then related to impacts at the unit and range-wide scale.

There are 3,651 acres of CH in the planning area and 2,124 acres in the proposed action treatment units within CH. Of the 3,651 acres, approximately 955 acres are in suitable nesting habitat, 439 acres are in suitable foraging habitat, and 1,283 acres are in dispersal habitat, and 973 acres are considered non-habitat.

Effects Analysis

No Action Alternative

There would be no short-term effects to spotted owl critical habitat under this alternative. In the short-term, the units that are providing dispersal habitat would continue to function as dispersal habitat and snag levels would remain essentially unchanged. In 20 to 30 years, the stands could start to differentiate to varying degrees and show an increase in the levels of small snags and small down wood. Where these developments eventually occur, they would improve the dispersal habitat. The quality of dispersal habitat would improve only slightly in some stands while improving much more in others. Stands that are functioning as suitable habitat would continue to, while recruitment of larger trees, more defects, larger down wood, and potential foraging areas would be recruited and enhanced.

In the long-term, the stands that are currently considered non-habitat for spotted owls would likely become dispersal habitat. Some of the stands may eventually develop nesting habitat characteristics and become suitable spotted owl habitat. However, with no action, it could take as much as 60 to100 years for these stands to develop into suitable habitat. Refer to the Silviculture Specialist Report for further discussion of tree response under the No Action Alternative. Impacts to critical habitat by large scale wildfire would be increased as it is anticipated to be a stand replacing event, removing habitat for NSO's for the short and long- term. Refer to the Fuels Specialist Report for further discussion of wildfire impacts under the No Action Alternative.

Proposed Action Alternative

Special management considerations or protections may be required in the east Cascades to address the effects of past activities that have substantially altered the landscape, modifying the patterns of vegetation and fuels, and subsequent disturbance regimes to the degree that contemporary landscapes no longer function as they did historically (Hessburg *et al.* 2000, Hessburg and Agee 2003, Hessburg *et al.* 2005, Skinner *et al.* 2006, and Fontaine and Kennedy 2012). This has affected not only the existing forest and disturbance regimes, but the quality, amount, and distribution of spotted owl habitat on the landscape (Buchanan 2009, Healey *et al.* 2008).

In order to preserve the essential physical or biological features the CH Rule states that forests should be managed in a way that promotes spotted owl conservation, responds to climate change, and restores dry forest ecological structure, composition and processes, including wildfire and other disturbances (USFWS 2011). The following restoration principles apply to the management that may be required in this dry forest region:

1. Conserve older stands that contain the conditions to support spotted owl occupancy or high-value spotted owl habitat as described in Recovery Actions 10 and 32. On Federal lands this recommendation applies to all land-use allocations.
2. Emphasize vegetation management treatments outside of spotted owl territories or highly suitable habitat;
3. Design and implement restoration treatments at the landscape level;
4. Retain and restore key structural components, including large and old trees, large snags, and downed logs;
5. Retain and restore heterogeneity within stands;
6. Retain and restore heterogeneity among stands;
7. Manage roads to address fire risk; and
8. Consider vegetation management objectives when managing wildfires, where appropriate.

These principles may result in treatments that have a variety of effects on spotted owl habitat in the short and long term. Some restoration treatments may have an immediate neutral or beneficial effect on existing spotted owl habitat (e.g., roads management, some prescribed fire prescriptions). Other treatments, however, may involve reductions in stand densities, canopy cover, or ladder fuels (understory vegetation that has the potential to carry up into a crown fire) and thus affect the physical or biological features (PCEs) needed by the species.

There would be no effects to spotted owl CH from road closures or road maintenance. The proposed treatments include a thinning prescription that would improve the growth rate of the stands. Larger trees would ultimately be provided in the second-growth stands in a faster timeframe than they would with no thinning. This would increase the rate that dispersal and suitable habitat would be available for spotted owl.

At the temporal scale the Proposed Action would aid in the development of structural diversity as the treatments are designed to accelerate development of the PCEs in the stand and the life history needs of the spotted owl would be improved with respect to the PCEs. The average canopy retained in the proposed units would remain at or above 35% with the exception of the small gaps. These gaps along with skips (no trees cut) would provide greater horizontal and vertical diversity in the future stand.

The proposed harvest treatments would temporarily impact approximately 2,124 acres of CH within proposed units: 279 acres are suitable, 366 acres are foraging, and 883 acres are dispersal habitat, while the remaining 597 acres are non-habitat. This habitat would be impacted by reducing the canopy cover and the loss of some down wood, shrubs and snags, which provide habitat for prey species. Suitable and foraging habitat would be negatively impacted in the short term by a reduction in quality of habitat and downgraded to dispersal habitat based on canopy cover. However it is estimated that within 15-30 years downgraded suitable/foraging habitat on the moist mix conifer side would return to suitable/foraging habitat, and 25-40 years on the dry mix conifer side. Although the dispersal habitat within these units would be reduced in quality, it would still function as dispersal habitat. It is estimated that these units would remain as quality dispersal habitat after harvest.

The Proposed Action would maintain components of the PCE's in a manner that helps meet the life history needs of the spotted owl at the stand scale, however they would be negatively impacted in the short term. This impact when considered at the subunit and unit scales is minor, and the units would continue to function as demographic support for spotted owls. Therefore, the proposed treatments would also meet the life history needs of the spotted owl at the subunit and unit scale. The subunit and unit would continue to function as demographic support to the overall population, as well as connectivity between other CH units and subunits.

ESA Effects Determination

Because PCEs 1 through 4 would be removed on all action area acres, and PCEs 3 and 4 would be reduced in quality on 687 acres, the Proposed Action **may affect, likely to adversely affect** spotted owl critical habitat. The immediate impacts of reduced nesting and foraging habitat would be short-term, while treatments are expected to improve habitat components within the PCEs in the long-term and CH in the project area would continue to support the life history needs of spotted owls.

Consistency Determination

The Proposed Action is consistent with the Final Rule for CH which states that forests should be managed in a way that promotes spotted owl conservation, responds to climate change, and restores dry forest ecological structure, composition and processes by:

1. Emphasizing vegetation management treatments outside of spotted owl territories or highly suitable habitat.
2. Retaining and restoring key structural components, including large and old trees, large snags, and downed logs.
3. Retaining and restoring heterogeneity within stands.
4. Retaining and restoring heterogeneity among stands.

The Proposed Action alternative is consistent with the following Standards and Guidelines for threatened species: (1) FW-174: Threatened, endangered and sensitive plants and animals shall be identified and managed in accordance with the Endangered Species Act (1973), the Oregon Endangered Species Act (1987), and FSM 2670; and, (2) FW-175: habitat for threatened, endangered and sensitive plants and animals shall be protected or improved.

The special management considerations or protections required in ENC-7 subunit to address threats from competition with barred owls are discussed above (See Direct and Indirect Effects to Spotted Owl).

Consultation

A formal BA will be submitted to US Fish and Wildlife Service for the effects to northern spotted owls and northern spotted owl critical habitat. A signed Letter of Concurrence would be received before a final decision is signed for this project.

Summary of Effects

For northern spotted owl critical habitat, there would be no short-term effects under the No Action alternative. Some of the stands may eventually develop nesting habitat characteristics and become suitable spotted owl habitat; however, it could take as much as 60 to150 years in portions of the project area. Because the impacts to PCEs would be short-term; treatments are expected to improve habitat components within the PCEs in the long-term; and because CH in the project area would continue to support the life history needs of dispersing spotted owls, the Proposed Action **may affect, likely to adversely affect**, spotted owl CH.

3.9.4 Region 6 Sensitive Species

Analysis Assumptions and Methodology

All Region 6 sensitive species within the project area must be analyzed in a biological evaluation. Sensitive species within the project area are identified in Table 69. Information on these species from the Interagency Special Status / Sensitive Species Program (ISSSSP) as well as other research was reviewed and summarized below to determine how sensitive species use the project area and the impacts this project would have on these species.

Peregrine Falcon

Existing Condition

In Oregon, peregrines occur as resident and migratory populations. They nest on cliffs ranging from 75 to 1,500 feet in height, and within 1 mile of some form of water. The average occupied cliff size in the Cascade Mountains is 229 feet (Marshall, et al. 2003). Cliff nests are on ledges as well as potholes and stick nests originally constructed by other raptors are common. Peregrines often use the same nest in consecutive years but some pairs also may use a different nest site each year. Nesting occurs in xeric areas of eastern Oregon, montane habitats that extend to over 6,000 feet elevation, small riparian corridors statewide, and more recently in urban habitats of the lower Willamette and Columbia rivers (Marshall, et al. 2003).

Surveys were conducted on the Forest in the 1990’s. Nest sites were confirmed on the Zigzag and Clackamas Districts. There are no records of sightings of peregrines in the project area and they are not known to exist within the watershed. However, habitat was identified in the East Fork Hood River and Middle Fork Hood River Watershed Analysis (WA) and quantified as medium to high quality habitat. The WA stated that the habitat was of medium to high quality, but the presence of Highway 35 and trail use in the area may impact the quality of the habitat due to human disturbances by vehicles and trail use. There are two rock outcrops near Polallie creek that are in close proximity to each other. Due to territoriality and presence of mature forest that could limit food availability there would likely be only one pair present in the project area. Should peregrines be discovered, trail closures and other mitigations to prevent disturbance would be assessed and implemented.

Effects Analysis

The analysis area for determining effects to peregrine falcons is the project area boundary.

No Action Alternative

Habitat would remain un-changed in the short term and long term for peregrine falcons. Cliff sites would be unaltered as there are no proposed activities that would be occurring. Human disturbance would continue from recreational and highway use. There would be no habitat impacted and no change in the potential use patterns of peregrine falcons with this alternative. An indirect effect of not implementing would be the potential for stand replacing wildfires. This would not impact eyrie sites, and has the potential to provide for better and more foraging opportunities. This alternative would have **no impact** to peregrine falcons.

Proposed Action Alternative

A direct effect to peregrines include the disturbance associated with the action alternative could temporarily disturb nesting birds if present. Areas adjacent to potential habitat are proposed to be logged by helicopter. This would be disruptive to peregrines if in the area due to an aerial disturbance above potential nesting locations. Potential disruption would take place during harvest activities and impact no more than one potential breeding pair. No nesting habitat would be directly impacted by the Proposed Action and there would continue to be sufficient foraging habitat adjacent to the project area within the territory of a nesting pair. Foraging habitat is not being removed due to the feeding techniques of peregrines. Foraging opportunities may be negatively altered during the increase in human presence that would occur during implementation. However, a positive long term indirect effect to distribution and availability of prey species would likely be increased. As the lower canopy closure in areas and ability to spot prey may become easier. Underburning in the area would likely occur in the fall due to spotted owls in the vicinity, thus having no direct effect to peregrines. An indirect effect of fuels treatments could be an increase in shrubs and thus a larger diversity of passerines to prey on.

The proposed project **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.** If a peregrine is spotted surveys will be conducted and a PDC would be put in place to limit the impacts if an eyrie is located.

Cumulative Effects

The spatial scale for peregrines are the proposed action area and within close vicinity to the presumed nest structure, the following list of past, present, and reasonably foreseeable future projects overlap the analysis area in time and space and were considered in the cumulative effects analysis: Projects considered when determining cumulative effects include those that would cause disturbance, impact prey abundance or distribution, habitat, and rock features; those considered are found in Chapter 3.

The primary impacts would be disturbance and no nesting habitat would be impacted. Projects considered for cumulative effects assume work is done below eyries as helicopters and people disturbance wouldn’t be on rock faces. Impacts during the nesting season are presumed prey dispersal and forage habitat. Foraging opportunities would be reduced, but it is not considered limited in the project area or on the District. As such the cumulative effects associated with this project **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.**

Consistency Determination

The Proposed Action alternative is consistent with the following Standards and Guidelines for sensitive species: (1) FW-174: Threatened, endangered and sensitive plants and animals shall be identified and managed in accordance with the Endangered Species Act (1973), the Oregon Endangered Species Act (1987), and FSM 2670; and, (2) FW-175: habitat for threatened, endangered and sensitive plants and animals shall be protected or improved.

Summary of Effects

For Peregrine falcons the no action alternative would have no impacts on the birds or their habitat. Habitat would remain unaltered and disturbance from project activities would not occur. For the Proposed Action temporary impacts from helicopter use for harvest activities, distribution of food resources/ prey availability **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.**

Harlequin Duck

Existing Condition

This species has a holarctic range. Breeding occurs in Eurasia and two disjunct regions in North America (Natureserve 2007). The North American Pacific population breeds from western Alaska, northern Yukon, northern British Columbia, and southern Alberta south to Oregon, Idaho, Wyoming, and east of the Continental Divide in Montana (perhaps historically in California and Colorado) (Natureserve 2007). Harlequin ducks have disappeared from former breeding sites in Idaho and Montana (Wiggins 2005). Wintering populations in eastern North America are currently much smaller than historical (late 1800s) numbers, but populations grew in the last part of 20th century (Cornell 2003).

Harlequins nest along fast-moving rivers and mountain streams on rocky islands or banks. Streams are usually braided with many riffles and rapids (Cassirer et al. 1993). They require relatively undisturbed, low gradient, meandering mountain streams with dense shrubby riparian areas (greater than 50% streamside shrub cover), and woody debris for nesting and brood rearing; also need mid-stream boulders or log jams and overhanging vegetation for cover and loafing; indicator of high water quality (Spahr et al. 1991).

Harlequin ducks typically nest on the ground in well-concealed locations, usually on mid-stream islands (Wiggins 2005) although successful nest sites have also been located in tree cavities or cliff ledges which afford safety from high water (Street 1999). Occasionally harlequin ducks may nest up to 45m away from a stream (EUG BLM), but nests are typically located close (within 10m) to water and have some degree of vertical cover close to the nest (Bruner 1997, Robertson and Goudie 1999). Nests may also be situated at the base of trees, on piles of woody debris, under fallen logs, or on sheltered banks (Robertson and Goudie 1999). They will sometimes nest beside mountain lakes and lake outlets (Natureserve 2007).

In Oregon, the majority of nesting attempts appear to be initiated by the second week of May, though a few hens are brooding in late April, and some may initiate as late as early June (Dowlan 1996). After the chicks hatch the female moves her young to backwater and slow-moving channels (Street 1999). When they are old enough, females may accompany their broods to their wintering grounds at the coast (Regehr et al. 2001), although some females leave when the young are less than 2 weeks old, and others after the young are capable of flight (Hendricks and Reichel 1998).

The harlequin duck dives for food in strong currents or fast-flowing streams, looking for prey on or near the bottom. Their diet is almost exclusively aquatic invertebrates, but also insects and a few small fish. Freshwater invertebrates are the most common prey in mountain rivers.

Relative to other species of ducks, they occur at low population densities and exhibit high breeding site fidelity, low reproductive rates, and delayed reproduction. All of these traits contribute to making harlequin duck populations particularly slow to recover from habitat degradation or loss (Wiggins 2005).

The primary factors thought to be responsible for local declines in the number of harlequin ducks are the degradation of breeding streams, such as damming, and human disturbance (such as rafting and other river-associated recreation) during the breeding season. In many areas, the vast majority of harlequin ducks breed on National Forest System lands, thus human recreation use of breeding streams during the summer months has the potential to cause stream abandonment or to decrease reproductive success (Wiggins 2005).

Effects Analysis

The analysis area is comprised of the East Fork Hood River as well as additional large stream segments that fall within the project area boundary including all uplands within 135 feet of these rivers and streams. Harlequin ducks have been documented in the East Fork Hood River Watershed within the project area boundary.

No Action Alternative

There would be no short-term effects to harlequin ducks under this alternative. In 20 to 30 years, the stands would start to differentiate to varying degrees and show an increase in the levels of small snags and small down wood.

Proposed Action Alternative

Impacts to habitat, including those that could destroy, alter, degrade or reduce the food supply, as well as destruction of nest sites, could adversely affect harlequin ducks. Because harlequin ducks inhabit areas with swift moving water, it is expected that the sediment created by logging and underburning would be very minor throughout the planning area and not impact the ability of the ducks to forage in the immediate area. There is a 130 foot no cut buffer off of the East Fork, meaning there would be little to no direct effects to nesting habitat structure.

Because activities would take place during the nesting season, there may be impacts to nests by causing females to abandon the area because of disturbance in close proximity to nesting sites. Since the majority of nests in Oregon are initiated by the second week of May, and chicks are mobile within days of hatching (after 30 days of incubation), it is likely that both young and adults would be able to move away from the area during project implementation, helicopter use in the vicinity of the East Fork would take place after July 15. This disturbance would impact a given nesting site for no more than two seasons and individuals would be able to return the following year.

Habitat for harlequin duck would be improved over the long-term by increasing the rate at which large trees would be recruited on the landscape; becoming large woody debris for nesting and brood rearing potentially increasing the number of nesting pairs in the project area. Underburning would occur in the fall and there would be no impact from smoke or firefighter presence due to harlequins likely already having migrated out of the project area to their wintering grounds.

The temporary impacts to harlequins from project implementation **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.** These impacts would be temporary and habitat would be improved in the long-term.

Cumulative Effects

Projects considered for cumulative effects include those found in Chapter 3 of the EA, and they include those that would impact water quality, human disturbance, woody debris in stream, and streamside wood inputs. Due to consistent PDC's that protect streamside habitat with buffers, timing restrictions, restoration project to enhance large wood components, and guidelines for sediment inputs it is not anticipated that past or future projects would impact harlequin ducks in the long term, but that they would have a net positive impact on habitat components. People disturbance from recreation use is less predictable but not anticipated to have a measureable impact on harlequins.

Consistency Determination

The Proposed Action alternative is consistent with the following Standards and Guidelines for sensitive species: (1) FW-174: Threatened, endangered and sensitive plants and animals shall be identified and managed in accordance with the Endangered Species Act (1973), the Oregon Endangered Species Act (1987), and FSM 2670; and, (2) FW-175: habitat for threatened, endangered and sensitive plants and animals shall be protected or improved.

Summary of Effects

There would be no short-term effects to harlequin ducks under the No Action alternative. Under the Proposed Action temporary impacts to prey species from disturbance to nesting sites from project activities **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. These impacts would be temporary and habitat would be improved in the long-term.

White headed woodpecker

Existing Condition

White-headed woodpeckers are cavity nesting birds strongly associated with coniferous forests dominated by pines. They are residents from south-central British Columbia, north-central Washington and northern and western Idaho south through eastern and southwest Oregon to southern California and west-central Nevada (, Garrett et al. 1996). White-headed woodpeckers range from very rare in British Columbia to common further south in their range in California.

In Oregon and Washington, white-headed woodpeckers occur primarily in open ponderosa pine (*Pinus ponderosa*) or dry mixed-conifer forests dominated by ponderosa pine (Bull et al. 1986, Dixon 1995a, Frenzel 2004, Buchanan et al. 2003). They have also been found in moderate densities in dry mixed conifer forests which were dominated by firs but contained both ponderosa pine and sugar pine.

Nesting usually occurs in open ponderosa pine forests with higher number of large trees and snags than the surrounding forest (Buchanan et al. 2003, Frenzel 2004, Hollenbeck et al. 2011) and typically excavate nest cavities in large, moderately decayed, ponderosa pine snags (Buchanan et al. 2003, Dixon 1995a, Frenzel 2004). White-headed woodpeckers forage in ponderosa pine trees in stands with higher canopy closure than nest stands (Dixon 1995a, Fredrick and Moore 1991).

White-headed woodpeckers have also been found to use recently burned forest of ponderosa pine (Forristall et al. 2004, 2007, Kozma 2011, 2012, Kozma and Kroll 2012, Saab and Dudley 1998, Wightman et al. 2011). In south central Oregon, nest success was higher in burned habitats than unburned habitats (Forristal et al. 2004, Frenzel 2004).

Landscapes with a mosaic of open habitat for nesting in close proximity to closed-canopy forests which provide foraging habitat seem to be important for White-headed woodpeckers (Hollenbeck et al. 2011, Wightman et al. 2010, Latif et al. 2012). Closed-canopied forests with cone-producing pine trees and insects may be important for year-round foraging, particularly outside the breeding season (Garrett et al. 1996).

White-headed woodpeckers may rely more on decay condition of snags than density (Wightman et al. 2010). Saab and Dudley (1998) found this species selected for the largest and most heavily decayed snags compared to other woodpeckers. However, snags created by fire have lower retention rates than trees killed more slowly by insects or disease and fire-killed snags may not reach levels of decay favored by white-headeds until 2-3 years post-fire (Wightman et al. 2010). Therefore, snags existing before fire, if retained, or those with more advanced decay seem to be critical components in post-fire landscapes, especially in the first few years after fire (Wightman et al. 2010).

Nest trees of White-headed woodpeckers are typically large, moderately decayed, ponderosa pine snags. In Oregon and Washington, 6 separate studies indicate average nest tree dbh of 15 to 40 inches dbh. Wightman et al. (2010) found nest survival rates were higher in burned areas than nest success reported for unburned forests in central Oregon. Wightman et al. (2010) also found white-headed woodpeckers selected for nest snags >20 inches dbh from unburned or low severity burned areas that contained live trees. Table 73 displays summarized data in the 30, 50, and /80 percent tolerance levels for the white-headed woodpecker in post fire habitats. No data was available for white-headed woodpeckers in post fire habitats for large snags (greater than 20 inches). The snags greater than 20 inches are represented in the >10 inches category.

Forests with live trees have more abundant and complex assemblages of predators than high severity burned areas (Wightman et al. 2010). The golden-mantled ground squirrel and yellow pine chipmunk are known nest predators. Golden-mantled ground squirrels are positively associated with down wood volume and yellow pine chipmunks are positively associated with shrub cover (Wightman et al. 2010). Down wood and shrub cover are less in post-fire environments, thus nest placement in high severity burned areas may be a viable strategy to reduce nest predation as long as unburned or low severity burned areas are available within the landscape for foraging (Wightman et al. 2010). Nests in unburned forests may be more vulnerable than those in burned forests as these may also experience lower ambient temperatures which affect incubation behavior and reproductive effort (Hollenbeck et al. 2011).

Hollenbeck et al. (2011) developed a habitat suitability index model for unburned forests of central and southeastern Oregon. Based on this model, there are 2,887 acres of highly suitable habitat, 5,357 acres of marginally suitable habitat, and 1,010,461 acres of non-habitat for white-headed woodpecker on the Forest. Approximately 75 acres of the burned area on the Forest are within the marginal habitat and the remainder is within the non-habitat. Based on the average home range size of 793 acres in fragmented habitat, the project area may provide enough habitat for 1 to 2 pairs of white-headed woodpeckers on the eastside of the project area.

Threats

Habitat loss is the primary threat to White-headed woodpeckers (NatureServe 2008). Logging practices that target large ponderosa pine, snag removal, and fragment forests contribute to declines in habitat, especially in the northern half of the species range (Garrett et al. 1996). Fire suppression has led to changes in forest tree species composition and structure primarily due to the development of true fir (*Abies spp.*) in the understory. These changes have altered fire regimes, and as a result ponderosa pine forests are no longer maintained by frequent natural fire, which leaves the forests susceptible to stand-replacing fires (Nature Serve 2008).

Wightman et al. (2010) and Frenzel (2004) found that predation by small mammals was the most common cause of nest failure of White-headed woodpeckers. Increasing shrub cover may lead to increasing populations of small mammals (Smith and Maguire 2004). Nest success of White-headed woodpeckers is higher at nest sites with lower shrub cover (Frenzel 2004, Kozma and Kroll 2012).

Landbird Conservation Strategy

Oregon-Washington Partners in Flight have developed conservation strategies for the east-slope of the Cascades and the northern Rocky Mountains of Oregon and Washington (Altman 2000a, 2000b). The White-headed woodpecker is a focal species for ponderosa pine or dry habitats in both ecoregions. Strategy objectives include no net loss of this habitat type, retention of all ponderosa pine trees and snags >20 inches dbh, use of natural disturbance regimes such as fire, and restoration of at least 30 percent of the potential late-successional forest by 2025.

Management considerations should focus on white-headed woodpecker habitats on public lands which are primarily, low-elevation, dry forests with a component of large ponderosa pine. In Oregon and Washington, the vast majority of habitat for this species is on National Forest System lands. Private, State, and City lands are not managed for woodpecker habitat, therefore, it is assumed that any habitat currently present in those areas, would not be maintained for the long term. Management considerations should include spatial heterogeneity at the landscape scale that mimics historical conditions.

Effects Analysis

The analysis area includes the East side of the Project Area, as the only habitat that is available to white headed woodpeckers in the project area.

No Action Alternative

With no action ponderosa pine stands would continue to be present in their current state on the east side of the Project Area. Stands are encroached with other conifers, and fairly closed canopy. Snags and down wood would remain in their current condition. Without treatment, the potential for stand replacing fire would be high, and due to the density of trees around ponderosas they would likely be killed even though they are a fire resistant tree species. Habitat would not be improved, and an open ponderosa pine habitat would not be part of the mosaic of stands available to white headed woodpeckers for nesting. The no action alternative would limit nesting habitat available to white headed woodpeckers, while also increasing the potential for predation.

Proposed Action Alternative

Thinning around pine would occur on approximately 978 acres in the Proposed Action. Thinning would help to reduce fuel loading, open up the canopy, make the stands more fire resistant, and create suitable nesting habitat for white headed woodpeckers. The Proposed Action would not remove large ponderosas or large snags unless there is a health and human safety concern. Overall the action would have a positive direct effect to habitat for white headed woodpeckers, as there would be an increase in nesting habitat, there would continue to be areas with higher closed canopies for foraging opportunities and the stands would become more fire resistant, helping to keep habitat present into the future. Indirect effects of the project include the implementation of the project that would have the potential to disturb nesting birds, and alter foraging habitat. Because snags are not proposed for removal the impact to nesting is thought to be very limited. The Proposed 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**

Cumulative Effects

The following list of past, present, and reasonably foreseeable future projects overlap the analysis area in time and space and were considered in the cumulative effects analysis as listed in Chapter 3 of the EA

Most of the other projects considered in the cumulative effects analysis focus on thinning young stands or thinning from below to restore and enhance mixed conifer stands while reducing the risk of stand replacing fires. These projects would thin green stands and would not remove snags aside from hazard tree removal. Overall, treatments proposed would reduce the risk of losing existing habitat from future large-scale disturbances. Private lands are not managed for woodpecker habitat and therefore, it is assumed that any habitat provide there is incidental and may not be long term.

Snags would not be cut in these others projects unless they pose an imminent threat to human safety or infrastructure. The exact number is unknown, but is extremely small and would not contribute to cumulative effects from Hazard Tree treatments under this alternative. None of these projects propose to harvest burned trees associated with east-side mixed conifer or ponderosa pine/Douglas fir habitat types; therefore, there are no cumulative effects from the Restoration Thin Treatments in the moderate to high severity burned areas.

Consistency Determination

Both alternatives are consistent with all Forest Plan standards and guidelines. The Landbird Conservation Strategy objectives include no net loss of this habitat type and retention of all ponderosa pine trees and snags >20 inches dbh. This objective would be met.

Summary of Effects

There would be no short-term direct effects to white headed woodpeckers under the no action alternative. Indirect impacts of the no action alternative would include not opening up the ponderosa stands and enhancing habitat, as well as increasing the risk of a stand replacing fire. The proposed action overall would have a positive direct effect to habitat for white headed woodpeckers. Under the proposed action short term impacts to the species from disturbance by project implementation would occur and thus the project **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.** These impacts would be temporary and habitat would be improved in the long-term.

Fringed Myotis

Existing Condition

The fringed myotis is predominantly found in western North America, occurring from southern British Columbia, Canada (where it is only known from a few animals), south through southern Mexico (O'Farrell and Studier 1980, Hall 1981, Rasheed et al. 1995). It occurs west to the Pacific coast and east to the Rocky Mountains.

Fringed myotis appear to use a fairly broad range of habitats (Cryan 1997). The most common habitats in which this species has been found are oak, pinyon, and juniper woodlands or ponderosa pine and Douglas fir forest at middle elevations (O'Farrell and Studier 1980, Cockrum et al. 1996, Wilson and Ruff 1999, Ellison et al. 2004). This species is mostly found in dry habitats where open areas are interspersed with mature forests, creating complex mosaics with ample edges and abundant snags.

Suitable roosting sites are a critical habitat component, the availability of which can determine population sizes and distributions (Humphrey 1975, Kunz 1982). Throughout their range, fringed myotis use caves, mines, and buildings as maternity colonies, solitary day and night roosts, and hibernacula (O'Farrell and Studier 1980, Perkins et al. 1990, Ellison et al. 2004). They regularly roost underneath bark and inside hollows of tree snags, particularly ponderosa pine and Douglas-fir in medium stages of decay (Chung-MacCoubrey 2001, as cited in Cryan 1997). This may represent the primary daytime roosting structure in some areas.

The best habitat model for predicting bat presence in an area contained only these variables (the number of snags ≥ 30 cm DBH combined and percent canopy cover), where increasing numbers of snags and decreasing canopy cover increased the probability of bat occurrence (Weller 2000). Abundance of large snags and low canopy cover allows more thermal heating of roosts, easier flight access to roosts, and the ability to readily switch roosts, for predator avoidance, or to find more suitable microclimates (Lewis 1995, Weller 2000).

Some studies have suggested that fringed myotis consume mostly beetles (Rainey and Pierson 1996), but others in the Pacific Northwest have suggested mainly moths (Whitaker et al. 1977). Anecdotal information supports a diet largely of beetles and moths (Turner and Jones 1968, Arizona Game and Fish Department 1997). Early studies (Black 1974, Banfield 1975) speculate that fringed myotis hunt insects on the wing, usually over vegetative canopy from sunset until midnight. However, their wing morphology is indicative of dexterous, low-speed flight suggesting that these bats may glean insects from vegetation (O'Farrell and Studier 1980), probably near the top of the forest canopy (Miner et al. 1996).

Effects Analysis

No Action Alternative

Under the No Action alternative, fringed myotis roosting, foraging, or hibernacula habitat would not be impacted and, therefore, there would be no impact to fringed myotis. However, since fringed myotis have a positive response to open canopies and larger trees, the no action may decrease habitat availability into the short term and long term.

Proposed Action Alternative

The proposed action would have no impact on hibernacula's or mines since these habitats are not known to be in the project area. The impacts to fringed myotis would occur from roost removal, however, large snags are not proposed to come down in the project area unless they pose a health and safety risk to operations. Large snags would continue to be present across the proposed project area, and after treatment would be more likely to be recruited into the future. The proposed action is likely to have a beneficial effect by creating openings and decreasing canopy closure in portions of the project area increasing foraging opportunities in the short term. Since fringed myotis are correlated with less canopy cover and roost sites would not be impacted at a measureable scale, the proposed 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.**

Cumulative Effects

Projects identified in Chapter 3 were considered for cumulative effects to fringed myotis when they impacted: roost sites, hibernacula, and foraging. On the Hood River Ranger District there are no known mines or caves that would provide for hibernacula's, so there are no cumulative effects. Hazard tree reduction, timber sales, private and county harvest activities, debris flows, and road creations all have components of their projects that could impact fringed myotis. Projects on NFS lands would have PDC's to preserve large snags where possible, while private and county would not, these types of projects could limit roosting habitat, but provide for better foraging habitat. Temporary road creation where roost sites would be impacted would be a negative impact to fringed myotis. However these projects would all increase foraging habitat for fringed myotis, as they like open areas to forage, and road ways make travel corridors used by bats. These projects would have a beneficial impact to foraging habitat, and a potential negative impact to roost sites. Wildfires, prescribed fires, and debris flows all have the potential to create an increase in snag densities, providing for an increase in roosting habitat. While some projects considered have an increase in some habitat components and others have a decrease, projects considered **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.**

Consistency Determination

The Proposed Action alternative is consistent with the following Standards and Guidelines for sensitive species: (1) FW-174: Threatened, endangered and sensitive plants and animals shall be identified and managed in accordance with the Endangered Species Act (1973), the Oregon Endangered Species Act (1987), and FSM 2670; and, (2) FW-175: habitat for threatened, endangered and sensitive plants and animals shall be protected or improved.

Summary of Effects

Fringed myotis would not be impacted by the no action alternative. Habitat would remain unaltered in form and distribution. The proposed action would not impact hibernacula's, but could impact roost availability in the short term as large snags may be fell for safety reasons. The proposed harvest activities would create better habitat for foraging opportunities for fringed myotis as they are associated with a decreases in canopy cover. Overall the project **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.**

Western Bumblebee

Existing Condition

The western bumblebee was widespread and common throughout the western United States and western Canada before 1998 (Xerces Society 2009). Since 1998, populations of this bumblebee have declined drastically throughout parts of its former range. Populations of the western bumblebee in central

California, Oregon, Washington and southern British Columbia have mostly disappeared. It is difficult to accurately assess the magnitude of these declines since most of this bee's historic range has not been sampled systematically.

Bumblebees would visit a range of different plant species and are important generalist pollinators of a wide variety of flowering plants and crops (Goulsen 2003a; Heinrich 2004). Although bumblebees do not depend on a single type of flower, some plants rely solely on bumblebees for pollination. In addition, native bees, such as bumblebees are adapted to local conditions (Goulsen 2003b).

There are several threats which face bumblebees and are leading to their decline. Agriculture and urban development alter landscapes and habitat required by bumblebees while grazing livestock poses a threat since the animals remove flowering food sources, disturb nest sites and alter the vegetation community. Foraging bumblebees are directly threatened by insecticide applications when used in agricultural settings. Massive bumblebee kills have occurred as a result of insecticide application on Forest Service managed public lands intended for the control of spruce budworm. Bumblebees can be indirectly harmed when the flowers that they normally use for foraging are removed by the application of broad-spectrum herbicides. When exotic plants invade and dominate native grasslands, they may threaten bumblebees by competing with the native nectar and pollen plants relied upon by bumblebees.

Effects Analysis

The analysis area for the Western bumblebee is the area within the project boundary of the Proposed Action.

No Action Alternative

Under the No Action alternative, bumble bee nesting, foraging, and over-wintering habitat would not be impacted and, therefore, there would be no impact to bumble bees.

Proposed Action Alternative

The proposed project may temporarily impact flowering plants during road maintenance, storm proofing, fuels treatments and timber harvest activities. Reducing this food source would reduce the ability of foraging bees to find nectar at these sites which is a required food source for young bees. It is expected that these shrubs would regenerate within a few years and because the entire project area would not likely be treated all at the same time bumblebees would have other nectar plants available within the project area.

The proposed project may temporarily impact nest sites, weight of equipment would likely crush ground nests, abandoned bird nests may be impacted by tree removal. However, since snags are being retained where not a health and safety concern as well as large down wood there would still be nest sites available and likely retained. Tree harvest, fuels treatments, and road maintenance activities could temporarily reduce the number of nests available and, therefore, reduce the number of bumblebees that this area could support in the short term. Nest sites would increase within a few years after treatment.

The temporary reduction in flowering shrubs and nesting sites **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**. An increase in flowering shrubs and herbaceous species is expected to increase with the proposed action, being a positive impact on bumblebees. While the number of bees in the project area may be slightly reduced, this reduction would be temporary as flowering shrubs and nest sites increase within a few years after treatments. Because bumblebees can forage for nectar on a variety of flowering plants, the untreated portions of the East Fork Hood River Watershed would continue to provide a food source. These untreated portions of the watershed would also continue to provide for nesting and hibernating habitat. The adjacent untreated areas and areas dropped within the planning area would provide for bumblebees to recolonize the impacted acres within the treatment area as foraging and nesting habitat return.

Cumulative Effects

The projects that could have cumulative effects to bumblebee include the cumulative past, ongoing, and future activities in the watershed as identified in Chapter 3. Cumulative effects for this species were considered at the watershed scale since genetic diversity and connectivity between colonies is a concern for the bumblebee.

Projects that may increase or improve foraging habitat in the long-term include road decommissioning and closures, pre-commercial thinning, lava restoration, Tilly Jane hazardous fuels reduction riparian thinning, and noxious weed treatments. Depending on the prescription and the condition of the stand before treatments, timber sales may increase or decrease the amount of foraging habitat available. Road and trails have the potential to reduce the amount foraging habitat.

Habitat alterations including those that could destroy, fragment, alter, degrade or reduce the food supply produced by flowers as well as destruction of nest sites and hibernation sites for overwintering queens, such as abandoned rodent burrows and bird nests, adversely affect these bees. Large scale ground disturbing activities alter landscapes and habitat required by bumblebees by removing flowering food sources, disturbing nest sites and altering the vegetation community. The size of bumblebee populations diminish and inbreeding becomes more common as habitats become fragmented. This in turn decreases the genetic diversity and increases the risk of population decline.

While the projects analyzed under cumulative effects may have impacts to individual bumblebees, the main threats to this species are agriculture and urban development, livestock grazing, and broad scale insecticide application (Thorp et al. 2008). These kinds of activities are not included in the Proposed Action. Because some of the proposed activities increase or improve habitat while others may decrease it, the impacts would likely be relatively small and populations of this species would still persist at the watershed scale.

Consistency Determination

The Proposed Action alternative is consistent with the following Standards and Guidelines for sensitive species: (1) FW-174: Threatened, endangered and sensitive plants and animals shall be identified and managed in accordance with the Endangered Species Act (1973), the Oregon Endangered Species Act (1987), and FSM 2670; and, (2) FW-175: habitat for threatened, endangered and sensitive plants and animals shall be protected or improved.

Summary of Effects

For the Western bumblebee, bumble bee nesting, foraging, and over-wintering habitat would not be impacted and, therefore, there would be no impact to bumble bees under the No Action alternative. Under the Proposed Action, there would be a temporary reduction in flowering shrubs and nesting sites that **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.**

Johnson's Hairstreak

Existing Condition

Habitat

Johnson's hairstreak occurs within coniferous forests which contain the mistletoes of the genus Arceuthobium, commonly referred to as dwarf mistletoe. These plants are highly specialized and are known to occur on a number of different conifers (Schmitt and Spiegel 2008). Larsen et al. (1995) states that old-growth and late successional second growth forests provide the best habitat for this butterfly, although younger forests where dwarf mistletoe is present also supports C. johnsoni populations.

Larvae can be found feeding on dwarf mistletoe (Opler and Wright 1999). Caterpillars feed on all exposed plant parts and secrete a sugary solution which is used by ants that in turn protect the caterpillar from predators. Caterpillars can be found on host leaves April-October (Allen et al. 2005). Nectar of flowers in several families from numerous genera including Actostophylos, Ceanothus, Cornus, dandelion, Fragaria, Rorippa and Spraguea is consumed by adult butterflies who obtain additional moisture by visiting mud puddles (Shields 1965). In California, males have been observed awaiting females by perching atop treetops or hilltops (Scott 1986). Adults fly from mid-May to early September with peaks occurring in May and August (Pyle 2002). In the northern part of the range, and at high altitudes, one flight occurs from late May- mid July (Scott 1986). The Johnson's hairstreak is considered to be the only obligate old-growth butterfly (Pyle 2002). Due to their habitat associations and tendency to reside in the forest canopy, these butterflies are not often encountered.

The main threats to this species are the reduction of old-growth, insecticide use, and application of herbicides to flowering plants that are nectar sources.

Effects Determination

The Analysis Area for this species is the project area within the proposed action area. Surveys were not conducted, and presence is assumed in portions of the planning area.

No Action Alternative

Under the No Action alternative Johnson's Hairstreak habitat would not be impacted and, therefore, there would be no impact.

Proposed Action Alternative

The Proposed Action would impact components of habitat for Johnson's hairstreak. Mistletoe brooms would be impacted and removed where it's a ladder fuels component. Trees with mistletoe would not be directly targeted by this project and would be present throughout the planning area, and in the proposed action. Mature forest structure would remain present throughout recently unmanaged stands and areas that were dropped in the project area.

Short term impacts to flowering plants and a reduction of mistletoe would impact Johnson's hairstreak negatively. However with the proposed action an increase in flowering plants for forage opportunities is expected and a continued presence of mistletoe would occur. LSR's are not being treated in the proposed action and thus habitat would remain unaltered if Johnson's hairstreak occurs in LSR areas. Mature forest characteristics would remain in areas of the proposed action and planning area, and overall would be enhanced by variable density thinning and fuels treatments. The Proposed 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.**

Cumulative Effects

The projects that could have cumulative effects to Johnson's hairstreak include the cumulative past, ongoing, and future activities in the watershed as identified in Chapter 3. Cumulative effects for this species were considered at the watershed scale. Projects that impact old growth characteristics and target dwarf mistletoe are limited on forest. On private/county timber lands there is a greater probability that dwarf mistletoe removal is being targeted and removed, with a greater potential for mature forest structure removal. Wildfires and debris flows may remove habitat but indiscriminately having a negative impact.

Cumulative effects of projects considered **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.**

Consistency Determination

The Proposed Action alternative is consistent with the following Standards and Guidelines for sensitive species: (1) FW-174: Threatened, endangered and sensitive plants and animals shall be identified and managed in accordance with the Endangered Species Act (1973), the Oregon Endangered Species Act (1987), and FSM 2670; and, (2) FW-175: habitat for threatened, endangered and sensitive plants and animals shall be protected or improved.

Summary of Effects

Johnson's hairstreak would not be impacted by the no action alternative as habitat would remain unaltered in the project area. The proposed action would reduce dwarf mistletoe where it poses a fire risk as a ladder fuel, but overall is not targeted by the proposed action. Habitat would remain available throughout the project and planning area, as such the proposed **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.**

3.9.5 Survey and Manage Species

Surveys were conducted in the project area in 2014 for Survey and Manage Species in compliance with the applicable species survey requirements and management provisions found in the Record of Decision and Standard and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines 2001.

Larch Mountain Salamander

Existing Condition

The Larch Mountain salamander occurs in an area of 4,550 mi^2 in the Cascade Range of Washington and Oregon (Nauman and Olson 1999). It has been found from 160-4200 feet in elevation. While from 1954-1985, sites were known only in or adjacent to a 31 mi stretch of the Columbia River Gorge (e.g., Nussbaum et al. 1983), today it is found about about 14 miles south of the Columbia River in Multnomah and Hood River Counties, Oregon. The current knowledge of the species range is likely incomplete and additional range extensions may include areas to the north, south and east.

Currently, there are 103 sites known on federal lands, with most occurring on the Gifford Pinchot National Forest and Columbia River Gorge National Scenic Area, and fewer on the Mount Baker-Snoqualmie, Wenatchee and Mount Hood National Forests. Most (~70%) federal sites occur on reserved lands, including Late Successional Reserves, Congressional Reserves, and Administratively Withdrawn land use allocations.

Much of the landscape within the range of the Larch Mountain salamander has been fragmented by past timber harvest practices and is a patchwork of stands of different seral stages, from early seral to mature forests. Sites with salamanders are nested within this patchy forested landscape.

Studies in the Pacific Northwest documented greater salamander abundance in old-growth compared to clearcuts or early seral forest (Raphael 1988; Welsh and Lind 1988, 1991; Welsh 1990; Ollivier et al. 2001). As with other salamanders, the impact of timber harvest on a given population would depend on the effect the impact has on the microclimate and microhabitat structure (Welsh 1990). This is expected to vary on a site-by-site basis, and with the timber management practices implemented.

The Larch Mountain salamander is a fully terrestrial species that does not require standing or flowing water at any time during its life history. Individuals of this species are thought to have limited dispersal ability, making daily to seasonal vertical migrations in the ground surface as microclimate conditions change, but not extensive horizontal overland movements. Genetic analyses indicate limited gene flow and suggest that populations have been on different evolutionary pathways for a long time.

Larch Mountain salamanders occupy old-growth forests; younger naturally regenerated forests in gravelly/cobble soils with residual late successional features (snags and large down logs); scree and talus (forested and un-forested); and lava tube entrances where debris (e.g., pieces of lava, wood, fine organic and inorganic particles) has accumulated. At a coarse level of characterization, these specific habitats can be simplified into two general categories: 1) habitats with pumice-derived loamy soils; and 2) habitats with rocky substrates. The distinction between these two general habitat types may provide a useful and biologically meaningful way to view the species' habitat associations. Crisafulli (unpubl. data) suggests that substrate/soil type and vegetation are important factors in determining the suitability of a site for *P. larselli* occupancy. The relative importance of vegetation composition and structure appears to be related to the substrate/soil conditions present at a site. When rocky substrates (scree, talus or gravelly soils) are prevalent, the role of vegetation composition and structure appears to be less important; and animals are found where several vegetation types occur. In contrast, when loamy soils are present, Larch Mountain salamanders appear to be restricted to sites only with old-growth forest conditions, or confined to small isolated pockets of refugia possessing rocky substrates within the matrix of old-growth forest with loamy soils.

Habitat loss, degradation, and disturbance are the primary threats to the persistence of Larch Mountain salamander populations. Important habitat features used by this species vary by macrohabitat type, and include forest structures (e.g., living and dead), rocky substrates, soils, and microsites that provide cool, moist conditions. Disturbance of macrohabitats and surface microhabitats is of primary concern. Alteration of the microhabitat and microclimatic conditions within these areas may negatively impact these salamanders. Microclimate regimes may be altered by vegetation management activities within and adjacent to occupied habitat areas. While little definitive information is known about key factors contributing to the species long-term persistence, it is perceived that some level of connectivity among neighboring populations and sub-populations is likely important.

Dominant disturbances which pose threats to this species include: 1) timber harvesting (including subsequent site scarification and fuels treatment); 2) construction of roads, trails, homes, and railways; 3) mining of rock; 4) fire (both natural and human caused); 5) recreation; 6) vulcanism; and 7) chemical applications. In areas where this salamander is associated with isolated talus slopes, such as the eastern Cascade Range, impacts to those discrete patches are a concern. While fire and volcanism may have been part of the natural disturbance processes with which these animals have occurred historically, those disturbances may now pose a more severe threat due to the species' restricted and fragmented distribution, and in the face of multiple additional stressors that in combination provide heightened concern. Incidental mortality from several sources of human activity in an area may pose significant cumulative impacts to these animals.

Effects Analysis

The Analysis Area for the Larch Mountain Salamander includes the area within the project boundary of the Proposed Action. A complex array of soils and substrates exists across the planning area, including unvegetated talus slopes. No individuals of this species were found in the project area during 2014 surveys.

No Action Alternative

There would be no short-term effects to Larch Mountain salamander under this alternative. The units that are currently providing no suitable habitat would continue to be deficient in snag and down wood levels remaining essentially unchanged. Areas with talus would continue providing habitat available, down wood would remain unaltered and trees would be able to fall into talus providing better habitat.

In the long-term, the stands that are currently considered unsuitable habitat may eventually develop old growth characteristics. However, with no action, it could take as long as 60 to150 years for these stands to develop late-successional features. Refer to the Silviculture Specialist Report for further discussion of tree response under the No Action Alternative.

Proposed Action Alternative

Tree-felling and ground-based logging systems can disturb the substrate resulting in destabilization of talus and substrate compaction, which reduces substrate interstices used by salamanders as refuges and for their movements. The areas underlying skid trails nearest to landings are most likely to incur damage because they receive the most trips with equipment. No work is proposed to occur in talus, and a buffer off of talus of 50 feet is being implemented

The Forest Plan standard (FW-022, 023) of no more than 15 percent detrimental soil condition in an activity area following project completion would protect site productivity, maintain water movement through the soil, reduce erosion risks and associated sedimentation, and protect organic matter. All soils within the planned treatment areas have a low to moderate compaction risk (SRI validated) due to inherent soil properties.

Activities in the young managed stands would not pose significant threats to Larch Mountain salamanders, stand structure is typically uniform, even aged, and lacks the suitable habitat features required for this species. Treatments would improve habitat for Larch Mountain salamanders in the long-term by creating larger diameter trees (future down wood) and improving the overall health of the stand. Variable density thinning in recently unmanaged stands poses a threat to Larch Mountain salamanders; habitat components are available and would be altered to some extent by reduction in canopy cover and down wood. The project is reducing overall the amount of down fuels, but large class 3 and 4 down wood would be maintained within the project area even after fuels treatments consistent with the Forest Plan requirements.

The proposed timber harvest activities would pose a limited risk to these salamanders. Hazard tree removal would have minimal disturbance to substrates. Thinning of the proposed treatment units would avoid severe compaction of substrates (see Soils Report) and likely could be conducted in soils with rocky substrates without adverse effects to this species. Very localized activity may impact a few individuals but would not affect populations.

Colonization of the suitable habitat that would eventually develop in the treated stands would occur from adjacent areas of cliff, talus or scree habitat that support Larch Mountain salamanders. Presumably, salamanders in these rocky habitats would serve as a source population for colonization of adjacent managed stands when habitat conditions become suitable.

Cumulative Effects

The cumulative effects project list in Chapter 3 has been reviewed and no activities overlap in either time or space (timbered areas with components of talus) within the analysis area for Larch Mountain Salamander. Therefore, no adverse cumulative effects are expected.

Consistency Determination

The Propose Action is consistent with the survey requirements and management provisions found in the Record of Decision and Standard and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines 2001.

Summary of Effects

There would be no short-term effects to survey and manage species and Larch Mountain salamander under the No Action alternative. The units that are not providing suitable habitat would continue to function as so and snag and down wood levels would remain essentially unchanged. Under the Proposed Action timber harvest activities would pose a limited risk to these snails. Hazard tree removal would have minimal disturbance to substrates. Thinning of the proposed treatment units would avoid severe compaction of substrates (see Soils Report) and likely could be conducted in soils with rocky substrates without adverse effects to this species. Very localized activity may impact a few individuals but would not affect populations.

Dalles sideband, Crater Lake tightcoil, Evening fieldslug, Puget Oregonian, and Columbia Oregonian

Surveys were conducted in 2013 and 2014 survey seasons for Dalles sideband, Crater Lake tightcoil, Evening fieldslug, Puget Oregonian and Columbia Oregonian. An individual Crater Lake tightcoil was found, while no other Survey and Manage species was observed within the units of the proposed action containing suitable habitat for species. Only the Crater Lake tightcoil analysis will be included in the EA, for more information about the other species, please refer to the wildlife report in the project record.

Crater Lake tightcoil

The Crater Lake Tightcoil may be found in perennially wet situations in mature conifer forests, among rushes, mosses and other surface vegetation or under rocks and woody debris within 10 meters of open water in wetlands, springs, seeps and riparian areas, generally in areas which remain under snow for long periods in the winter. Riparian habitats in the Eastern Oregon Cascades may be limited to the extent of permanent surface moisture, which is often much less than 10 meters from open water. Surveys were conducted for this species, and one occurrence was document. The site would be managed according to the 2001 ROD, and a protection buffer would be implemented.

Effects Analysis

The Analysis Area for Survey and Manage species is the boundary of the Proposed Action area. Surveys were conducted in 2013 and 2014 survey seasons. An individual Crater Lake tightcoil was found, while no other Survey and Manage species was observed within the units of the proposed action containing suitable habitat for species. The site location in Unit 19 that contained the snail would have a buffer around the location consistent with the 2001 ROD direction.

No Action Alternative

There would be no short-term effects to the species under this alternative. The units that aren't providing suitable habitat would continue to be deficient in snag and down wood. Coarse woody levels would remain essentially unchanged. Areas within recently unmanaged stands where habitat is located would likely continue to provide for habitat into the long term future.

In the long-term, the stands that are currently considered unsuitable habitat may eventually develop mature forest characteristics. Refer to the Silviculture Specialist Report for further discussion of tree response under the No Action Alternative. In recently unmanaged stands large trees would be recruited, providing for more potential habitat. The risk of a large scale disturbance fire in the project area would remain high and likely, where the fire occurred habitat would no longer be available for use in moderate to high severity burned areas where species habitat components are consumed.

Proposed Action Alternative

Reduction of the canopy may cause desiccation of soil substrates and loss of the moss ground cover in some areas. Tree-felling and ground-based logging systems can disturb the substrate resulting in destabilization of talus and substrate compaction, which reduces substrate interstices used by some species. The areas underlying skid trails nearest to landings are most likely to incur damage because they receive the most trips with equipment. Refer to the Soils report for discussion of these impacts to soil conditions, organic matter levels, and erosion risks.

The Forest Plan standard (FW-022, 023) of no more than 15 percent detrimental soil condition in an activity area following project completion would protect site productivity, maintain water movement through the soil, reduce erosion risks and associated sedimentation, and protect organic matter. All soils within the planned treatment areas have a low to moderate compaction risk (SRI validated) due to inherent soil properties.

Activities in the plantation thinning, and sapling thinning stands would not pose substantial threats to survey and manage species, as those areas are not suspected to be providing habitat. The existing stand structure is typically uniform, even aged, and lacks the suitable habitat features required for this species. Given the extent of past activity in those stands, the proposed treatment sites would not currently be expected to support populations of this species. Treatments would improve habitat for species in the long-term by creating larger diameter trees (future down wood) and improving the overall health of the stand. Activities in recently unmanaged stands could potentially harm survey and manage species as habitat is present throughout. From the species accounts above it’s documented that most species are associated with moist habitat, close proximity to water, talus/rock, and a stable environment. PDC’s for stream buffers, wetland buffers, rock outcroppings, and seeps would be protected, so the amount of habitat and disturbance to species is assumed very low. Down wood standards would be met as well providing for continued refugia and habitat for species.

The proposed timber harvest activities would pose a limited risk to these snails. Thinning in proposed treatment units would avoid severe compaction of substrates (see Soils Report) and likely could be conducted in soils with rocky substrates without adverse effects to this species. Very localized activity may impact a few individuals but would not affect populations. Under-burning treatments is not anticipated to have adverse direct impacts as compaction from equipment wouldn’t occur. Some habitat components would be lost from fuels treatments, however Forest Plan Standards and Guides would be met for down logs. In addition, the ROD recommends 120 linear feet of down logs per acre greater than 16 inches in diameter within the matrix management areas in eastern Oregon. Although this project would eliminate some habitat within the project area, a minimum of 120 linear feet of down woody material and 4 snags/acre would be maintained.

Cumulative Effects

The cumulative effects to mollusk species from past, present, and future projects, were considered from Chapter 3. Some projects reduce the amount of suitable habitat available for these species such as timber harvesting in stands over 80 years old. In the long term, thinning treatments in young and old stands may accelerate the development of suitable habitat. In addition there are small 100 acres LSR’s in close proximity and within the planning area that would maintain habitat for species. Although all the treatment units are outside of the LSR, the LSR would contribute to habitat requirements for these species within the watershed and for dispersal. All sites found during surveys would be protected by a buffer before treatment activities.

Consistency Determination

The Propose Action is consistent with the survey requirements and management provisions found in the Record of Decision and Standard and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines 2001.

Summary of Effects

There would be no short-term effects to these species under the No Action alternative. The units that are not providing suitable habitat would continue to function as so and snag and down wood levels would remain essentially unchanged. Under the Proposed Action timber harvest activities would pose a limited risk to these species. Hazard tree removal would have minimal disturbance to substrates. Thinning of the proposed treatment units would avoid severe compaction of substrates (see Soils Report) and likely could be conducted in soils with rocky substrates without adverse effects to this species. Very localized activity may impact a few individuals but would not affect populations.

3.9.6 Management Indicator Species

The National Forest Management Act requires the Forest Service to manage wildlife habitat to "maintain viable populations of existing native and desired non-native vertebrate species in the planning area." The National Forest Management Act requires the Forest Service to identify Management Indicator Species through the planning process, and to establish objectives to maintain and improve the habitat of indicator species. The primary assumption of this process is that indicator species represent the habitat needs of other species because they have similar habitat requirements. Spotted owls, for example, indicate the needs of a variety of animals that use old growth forest. This analysis focuses on certain key species and does not specifically address common species except to the extent that they are represented by these management indicator species.

Management Indicator Species for this portion of the Forest within the project area include northern spotted owl (see analysis above), deer and elk, pileated woodpecker, and American marten.

Table 71. Management Indicator Species for the Project Area.

Management Indicator Species	Habitat Description	Habitat Present in Analysis Area	Species Present in Analysis Area
Northern Spotted Owl	Old Growth	Yes	Documented
Deer	Early Forest Succession Mature/Old Growth	Yes	Documented
Elk	Early Forest Succession Mature/Old Growth	Yes	Documented
Pileated Woodpecker	Mature/Over Mature	Yes	Documented
American Marten	Mature/Over Mature	Yes	Suspected

With the selection of some of these species there was a special emphasis on mature, over mature, and old growth habitat. The selection was done at a time when timber harvest was planned to replace many older stands with younger more rapidly growing stands: it was suspected that the mature and over mature stands would decline and the species associated with this habitat could be lost. Several species were selected to represent all of the species that required this type of habitat.

Mule Deer and Elk

Existing Condition

Deer are common and relatively abundant in Spring, Summer, and Fall within the Project Area. They are present in winter but less abundant and more likely use the area as a migration corridor primarily. Elk are less common throughout. Deer and elk both migrate through portions of the cooper spur area, crossing Highway 35 and moving eastward through Puppy Creek and Dog River drainages. The north portion of the project area historically probably received high migration down to private and agriculture lands. However, these lands have become highly fragmented, with high road densities, houses, and game fence around orchards making movement less likely in that direction. Harassment for these species through road access, trails, vehicle collisions, and poaching is thought to be significant.

Elk herds within the project area likely exhibit a close association with riparian habitat in areas of gentle terrain and low road density. Research on elk in this kind of habitat generally shows that elk spend most of their time in close proximity to a stream or wetland. Forage is available, but is generally of low quality. Low quality forage, lack of wetlands and permanent low-gradient streams are considered one of the limiting factors for elk and possibly deer in the Project Area. Habitat on the Westside of the planning area is likely better habitat as it is in close proximity to several recent large fires creating early seral habitat, and there is more managed stands, and is lower gradient in comparison to the Eastside of the project.

Thermal cover for elk is defined as a stand of coniferous trees at least 40-feet tall with an average crown closure of 70 percent or more. Optimal cover is found mainly in multi-storied mature and old-growth stands. Most of the stands in the project area consist of thermal cover. There are many patches of mature habitat within the watersheds that would provide optimal cover. Portions of these stands are proposed for treatment, in some cases it would lower the canopy cover required for optimal cover and be lower than that of thermal cover.

Assumptions for this analysis include using canopy cover as a surrogate for canopy closure. For this project plant associations were identified and overall canopy closure looked at for each dominant plant structure. Furthermore, when considering the difference between canopy closure and canopy cover it is reasonable to assume approximately a 20% increase from canopy cover identified by FS Veg and the silviculturist within the planning areas as discussed in personal communications with the districts silviculturist.

The Forest Plan Standards and Guidelines have minimum requirements for optimal and thermal cover habitat components, but no specific level for forage. During the 1980s and 1990s, wildlife managers considered thermal cover to be important to deer and elk survival and production. Over time, wildlife managers have questioned if elk required thermal cover. Telemetry data presented at the Elk Modeling Workshop (April 2010) indicated that elk were negatively associated with cover and that openings are far more valuable for elk than cover. With the reduction in regeneration timber harvest, the Forest now has abundant optimal and thermal cover, but openings for forage are becoming scarce. There are approximately 69,226 acres of early-seral habitat on the Forest. This level is declining over time at mid and lower elevations since plantations have grown dense with trees that shade out forage. The Gnarl Ridge and Dollar Lake fires have increased forage at higher elevations. There are only a couple small dry meadow areas in the project area, and forage habitat improvement for elk is limited on the eastside of the project area. Opportunities on the Westside exist in areas of old clear-cuts where canopy cover is lower and grasses are still present and abundant.

High road densities lead to harassment of elk herds. Harassed elk move more often than elk left alone and use of habitat decreases as road density increases (Witmer 1985). It is also recognized that elk within or moving through areas of high open-road densities move longer distances; often several miles per day.

Effects Analysis

The analysis area for deer and elk is the East Fork Hood River Watershed. The treatment units are located within inventoried winter range, a small portion of B10 winter rang, and summer range. The East Fork (EF) and Middle Fork Hood River Watershed Analysis found the EF provides some of the best summer range for these species, mainly in the Pocket, Meadows, and Elk Mountain/Bluegrass Ridge areas which are outside the planning area. The deer and elk that reside in the project area during the spring, summer, and fall usually move off-Forest onto other ownerships in the winter. In some cases they may move as far as the White River Wildlife Refuge to the East, head Southwest towards ZigZag, or move North towards Mt. Defiance areas.

The overall open road density within the project area is currently 2.28 miles of road per square mile, the open road density in summer range (lands not in B10 LUA or Inventoried winter range averaged) is 2.5 which is equal to the 2.5 miles per square mile for the Forest Plan Standard in inventoried summer range. At the Action Area the open road density is 2.84 miles of road per square mile, slightly above the standard. The open road density within Inventoried Deer and Elk Winter Range is currently 1.74 miles of road per square mile, which is below the 2.0 miles per square mile standard for inventoried winter range under the Forest Plan. There are 0.0 miles of open roads per square mile within B10 winter range which is below the Forest Plan Standard of 1.5 miles per square mile between December 1 and April 1. See Table 72 below for open road densities.

Table 72. Comparison of Open Road densities in the Proposed Action

Unit of Measure	Land Management Allocation				
	A11	A4	B1	B2	C1
Square Miles	2.0	1.8	1.5	8.3	2.0
Miles of Open Road*	1.5	7.7	3.7	9.4	3.0
Road Density (Miles Open Road/Mile^2)	.75	4.3	2.5	1.1	1.5

**Roads with an Operational Maintenance Level value other than "1 - BASIC CUSTODIAL CARE (CLOSED)"*

No Action Alternative

Disturbance from human presence and activities within the planning area would remain the same as the current levels. Stand structural development would remain unchanged over the short-term within the planning area for deer and elk. No forage habitat would be created and thermal and hiding cover for deer and elk would remain the same. In the long-term, forage habitat would be reduced within the watershed as open areas are overgrown with tree species. With the No Action alternative, the stands would continue to remain crowded and forage would not increase above current levels.

Proposed Action Alternative

The proposed treatments would temporarily remove thermal cover from portions of stands where canopy cover is reduced to below 50%. While there would be a loss of low-moderate quality thermal cover, there would be an increase in forage within these same stands. The loss of thermal cover and increase in forage in the proposed units could alter the distribution and use of habitat by deer and elk in the project area, however, the change would likely be positive for both species. During both the summer and winter, a potential incease in animals would be expected due to the availability of more forage opportunities being created with cover interspersed throughout. Canopy closure is expected to eventually increase over the long term to a point in which most forage benefits are lost and consequently forage levels would return to pre-treatment levels. Most of the lost thermal cover characteristics in the stands should be regained in about 20-40 years as canopy cover increases in both the dry and moist mix conifer stands.

Portions of the stands would include the creation of heavy thins, gaps, landings, and skid trails. These gaps and heavy thins would no longer be providing thermal cover. However, opening the canopy to this degree allows abundant sunlight to reach the forest floor, promoting the development of understory vegetation. Usually this vegetation consists of shrubs and some grasses which are highly palatable to deer and elk. The skips would maintain their forest structure and continue to provide thermal cover.

Deer are a species that can readily adapt to these changes. Elk are more selective and not as adaptive. Only small impacts are predicted to the deer populations in the area. Elk may use portions of the project area in the winter but use is not anticipated to be high, so only small impacts are predicted to the elk population as well. The area being in a transitional location use during early spring and late fall when animals are either following the snow up the mountain or being pushed down is when the project area may be critical for use. The proposed action is expected to have a benefit for deer and elk by providing better forage opportunities for when these critical transitions occur.

Timber removal, road maintenance, sale area preparation activities could potentially disturb animals in the area at the time of implementation. Disturbance that occurs during their respective seasons could temporarily displace animals, and have the potential to affect the health of individuals if the disturbance occurs near active calving sites. Due to the steepness of the Westside of the planning area this is likely only an issue on the Eastside of the project area.

Project activities would not all be occurring at the same time, but in a few places at any one time. The potential disturbance is predicted to be small in scale, temporary in nature and only impact a few individuals. The project is not expected to cause a measurable reduction or increase in the current local population size for either deer or elk.

New temporary road construction and old existing temporary roads would be reopened and reconstructed to access several of the units. These roads would not be open to the public and the only disturbance occurring as a result of these roads being opened would be from activities required to open the road and to accomplish proposed treatments in the project area. After treatments, the roads that were opened would be closed and open-road density would be back to the current level. There would be no increase in the long-term harassment of deer and elk with this alternative; effects would be short-term only. Due to the limited amount of roads in the planning area, poaching is not anticipated to be a major problem in the area

All haul roads that go through the B10 land use allocation would have their use restricted between December 1 and April 1, as described in the Project Design Criteria. Slash would be less than 2 feet deep so movement through the proposed action area would not be impeded at any time consistent with the Forest Plan.

Open road densities under the Proposed Action would be maintained at 2.84 per square mile which is above the Forest Plan Standard of 2.5 miles per square mile for inventoried summer range and maintained at 1.74 miles per square mile which is less than the 2.0 miles per square mile for inventoried winter range. The Forest Plan Standard for open road densities within B10 winter range would remain unchanged and is 0.0 miles per square mile.

The Proposed Action implementation **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.** Deer and elk would be able to move out of areas of disturbance into areas where timber sale activities are not occurring or to adjacent areas out of the project area. In the long term this project would be enhancing habitat for deer and elk by providing forage opportunities in a key location during critical migration seasons, while also maintaining cover at required levels.

Cumulative Effects

Since deer and elk move up and down the watersheds depending on the season, the analysis area used for cumulative effects includes the private lands in the watershed in addition to those listed in chapter 3 of the EA.

Projects that impact deer and elk forage and cover include; past and future timber harvests on private and federal lands, and pre-commercial thinning. The potential future harvest on private lands has been estimated. It is assumed that 50 percent of the private acreage would not provide thermal cover at any given time. However, cover is not considered a limitation for deer and elk in the area because so much of NFS lands are providing cover and very little forage opportunities. The optimum cover forage ratio is 60 percent forage and 40 percent cover (Thomas, 1979). Forage availability is more of a limiting factor on-Forest, but is more available off-Forest as a result of regeneration harvest on private lands. Cumulatively, there would be a small change in cover forage ratios with forage increasing and cover decreasing after the Proposed Action treatments. This would move the forage to cover ratio towards the optimum ratio.

Trail creation and roads where considered, no new roads would be created on FS lands in the watersheds and since no roads are being closed or obliterated in this project road densities and impacts are not anticipated to change into the future. Several trails are in the PA area, and there are trails proposed and considered for cumulative effects. An increase in human presence would modify behaviors and may cause some avoidance behaviors by both deer and elk. Deer are expected to be more tolerant of recreation, while elk are less, and may move out of areas at certain times of the year. However, seasonal closures on roads and trails are implemented in the areas for winter range, and for reasons of trail stability. Trails would impact deer and elk but are not anticipated to impact populations.

Consistency Determination

This analysis is consistent with The National Forest Management Act which requires the Forest Service to manage wildlife habitat to "maintain viable populations of existing native and desired non-native vertebrate species in the planning area." The National Forest Management Act requires the Forest Service to identify Management Indicator Species through the planning process, and to establish objectives to maintain and improve the habitat of indicator species. A Forest wide analysis was completed and is incorporated by reference. Viable populations of all the Management Indicator Species in this BE would be maintained at the Forest-scale.

Open road densities under the Proposed Action would remain unaltered, and would not be increased or decreased. However, the Forest Plan Standard of 2.5 miles per square mile for inventoried summer range, and less than the 2.0 miles per square mile for inventoried winter range (FW-208) would be met. The Forest Plan Standard for open road densities within B10 winter range would remain unchanged and would continue meeting the Forest Plan Standard of 1.5 miles per square mile.

Summary of Effects

Under the No Action Alternative no cover would be lost and no forage would be gained in this alternative for deer and elk. For deer and elk, the timber removal, and road maintenance activities in the Proposed Action could potentially disturb deer and elk in the area at the time of implementation; however, the seasonal restriction identified in the project design criteria is expected to reduce disturbance effects created by the project in the winter. Thinning may have short-term impacts on downed wood quality, but tree response to thinning is expected to result in increased growth which would speed the ability of the stands to provide for thermal and optimal cover. An increase in forage is a benefit as cover is not a limiting factor for deer in elk in the watershed or on Forest. The project **may impact individuals, but is not likely to impact populations, nor contribute to a potential loss of viability of this species**.

Pileated Woodpecker

Existing Condition

The pileated woodpecker was chosen as a management indicator species because of its need for large snags, large amounts of down woody material, and large defective trees for nesting, roosting and foraging. Pileated woodpeckers use mature and older, closed canopy stands (>60% canopy cover) for nesting and roosting, but may use younger (40 to 70 years), closed-canopy stands for foraging if large snags are available; large snags and decadent trees are important habitat components for pileated woodpeckers (Hartwig et al. 2004, Mellen et al. 1992).

The association with late seral stages comes from the need for large-diameter snags or living trees with decay for nest and roost sites, large-diameter trees and logs for foraging on ants and other arthropods, and a dense canopy to provide cover from predators. Nest cavities average 8 inches in diameter and 22 inches in depth and are excavated at an average height of 50 feet above the ground, therefore nest trees must have a large diameter in order to contain nest cavities. Because ants are the main diet for pileated woodpeckers, large diameter snags and logs with some decay are selected for foraging because carpenter ants inhabit these sites.

Nest excavation occurs from late March to early May, incubation from May to early June, and fledging in early July. Both birds excavate, incubate, and rear young.

The mean home range for pileated woodpeckers is 1,181 acres with approximately a 9-30 percent overlap (about 200 acres) between territories. Therefore an average home range with overlap for pileated woodpeckers would be approximately 970 acres (Mellen et al. 1992).

There are 405,092 acres of pileated woodpecker habitat on the Mt Hood National Forest based on GIS data for habitat 80 years and older. By dividing the acres of pileated woodpecker habitat by the average home range with overlap of 970 acres there are 418 potential home ranges on the Mt Hood National Forest. With an average clutch size of 4 (Marshall, D.B. et al. 2003), this would indicate that the summer population of pileated woodpeckers could be as high as 2,500 birds including adults and fledglings. Given the amount of habitat available, there may be up to two home ranges in the project area when considering unmanaged stands as habitat.

Timber harvest has the most significant effect on habitat for the pileated woodpecker. Removal of large-diameter live and dead trees, down woody material, and canopy reductions limits nest and roost sites, foraging habitat, and protective cover. Forest fragmentation likely reduces population density and makes birds more vulnerable to predation as they fly between forest fragments. Activites that reduce the number of snags, logs, and cover may reduce the ability of an area to support nesting, roosting, and foraging for this species (Marshall, D.B. et al. 2003).

Effects Analysis

The Analysis Area for the pileated woodpecker includes the area within the project boundary of the Proposed Action. The East Fork Hood River Watershed has a large amount of late seral habitat within the watershed. The amount of late seral forest remaining and the distribution of this is relatively similar to historic (pre-logging) conditions (WA, J-1). There are two B5 pileated woodpecker/pine martin habitat areas within the Analysis Area.

No Action Alternative

There would be no short-term effects to pileated woodpecker under this alternative. In the short-term, some units would not provide nesting habitat and snag levels would remain essentially unchanged while other areas would continue to provide for habitat. In areas of non-habitat it could take as much as 20 to 40 years from eastside to westside of the project area. Stands would start to differentiate to varying degrees and show an increase in the levels of small snags and small down wood, while still not providing large diameter snags and down wood for some time. Some of the stands may eventually become suitable habitat. However, with no action, it could take years for these stands to develop into suitable habitat. Refer to the Silviculture Specialist Report for further discussion of tree response under the No Action Alternative.

In areas that are providing habitat it is anticipated that they would continue as such and likely be improved over the long term as more large snags and down wood are recruited for nesting and foraging. However, without treatment the likelihood for a catastrophic wildfire is elevated. In this circumstance, it would likely be a stand replacing event that would remove habitat from the area for the long term. See the fuels report for further discussion. Small fires would be beneficial as they could provide a potential increase in snags in patches.

Proposed Action Alternative

Recently unmanaged stands in the proposed action units provide nesting habitat for this species. Approximately 1,576 acres are over 100 years in age with the potential to have large enough trees to support nesting and roosting for pileated woodpeckers. See Table 73 for acres in each B5 management area, and canopy cover changes with the proposed action. Recently unmanaged stand units contain sufficient numbers of large trees and/or snags to provide nesting habitat for the pileated woodpecker. The number of large diameter snags and down logs that are currently in these units would not be impacted greatly as logs would be maintained according to Forest Plan S & G's and snags would only be felled for safety reasons. Fuels treatments are targeting small diameter down logs, and based on timing of burning are not anticipated to remove a substantial amount of down wood (see Fuels Specialist Report for timing, anticipated impacts, and goals of fuels treatments).

Table 73. B5 pileated woodpecker/ American Marten Acres

	B5 Type	Existing Condition Acres	Burned Acres	Proposed Action Acres	Canopy Cover retained in PA	Canopy Cover downgraded in PA	Habitat Available after implementation
Eastside	Marten	325	0	138	41 acres treated but retained at 70% CC	97 acres at 40% CC	228 acres
Westside	Pileated/Marten	754	458	103	77.6 acres retained at current CC of 50%	25.4 acres downgraded from 70% to 50% CC	296 acres*

** 296 acres is below Management Area Direction B5-008. This is due to mature/ old growth habitat not available in the area primarily due to Gnarl Ridge Fire.*

Open road densities under the Proposed Action would be unaltered from current conditions, and remain at 2.62 miles per square mile which is above the Forest Plan Standard of 2.0 miles per square mile for B5.

The proposed treatments include a thinning prescription that would improve the growth rate of the stands in all treatment types. Larger trees would eventually be provided in the second-growth stands in a faster timeframe than they would with no thinning. This would increase the rate that suitable nesting and foraging (large snags) habitat would be available for pileated woodpeckers.

The main threats to pileated wood pecker includes activites that reduce the number of snags, logs, and cover which may reduce the ability of an area to support nesting, roosting, and foraging. The Proposed Action would temporarily reduce cover by opening the stands, but as these stands respond to thinning treatments, the cover needed by pileated woodpecker would return in 20 to 30 years. The Proposed Action would not reduce the number of large snags and logs drastically, and it would eventually increase the number of large trees for nesting. The Proposed 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,** and viable populations of the species would be maintained at the Forest-scale.

Cumulative Effects-

Projects considered to have cumulative impacts to Pileated woodpeckers were considered from Chapter 3. These projects include those that would reduce the amount of suitable habitat for these species by modifying or removing components of habitat. Private and county timber harvest would likely have a negative impact on recruiting habitat for pileated woodpeckers. In the long term, some of the thinning treatments would accelerate the development of suitable habitat and areas that are habitat are expected to remain. LSR's within the watershed would provide suitable habitat with 240 linear feet of down logs per acre. In addition to the LSR, approximately 452 acres within treatment units would be maintained in suitable habitat with a canopy cover of 50% +, and large logs, and snags retained for American marten.

Although all the treatment units are outside of the LSR, the LSR would contribute to habitat requirements for these species within the watershed. Since old growth habitat is not limited across the watershed, untreated suitable habitat would remain in the project area, LSR's are in close proximity and within the planning area there are no anticipated reasons to believe the proposed action or cumulative effects would have a long term adverse impact on pileated woodpecker, and viable populations of the species would be maintained and persist at the Forest scale.

Consistency Determination

This analysis is consistent with The National Forest Management Act which requires the Forest Service to manage wildlife habitat to "maintain viable populations of existing native and desired non-native vertebrate species in the planning area." The National Forest Management Act requires the Forest Service to identify Management Indicator Species through the planning process, and to establish objectives to maintain and improve the habitat of indicator species. A Forest wide analysis was completed and is incorporated by reference. Viable populations of all the Management Indicator Species in this BE would be maintained at the Forest-scale.

The Forest wide Standards and Guidelines would be met for pileated woodpeckers and pine marten B5-Pileated Woodpecker/Pine Marten land allocation. At least 300 acres of mature and/or old growth forest habitat shall be maintained within each 600 acre Management Area for pileated woodpecker habitat areas (B5-008) and at least 160 acres of mature and/or old growth forest habitat shall be maintained within each 320 acre Management Area for pine marten (B5-010). Snags are discussed below under "Snag and Down Log Associated Species."

Summary of Effects

There would be no short-term effects to pileated woodpecker under the No Action alternative. In the short-term for the proposed action, the some units would not provide nesting habitat and snag levels would remain essentially unchanged. The proposed treatments include a thinning prescription that would improve the growth rate of the stands. Larger trees would eventually be provided in the second-growth stands in a faster timeframe than they would with no thinning. This would increase the rate that suitable nesting and foraging (large snags) habitat would be available for pileated woodpeckers. In all stand types large diameter snags and down wood would be retained to meet forest plan objectives. The project **may impact individuals, but is not likely to impact populations, nor contribute to a potential loss of viability of this species**.

American Marten

Existing Condition

In the western United States, the American marten's distribution is fragmented. Home ranges vary from 1 to 4.5 square miles for males and from 0.4 to 3.6 square miles for females (Simon 1980, Zielinski et al. 1997).Martens prey on vertebrates smaller and larger than themselves, eat carrion, and forage for bird eggs, insects, and fruits (Martin 1994).

American martens are closely associated with forested habitats with complex physical structure near the ground. Structure can include the lower branches of living trees, tree boles in various stages of decomposition, coarse woody debris, shrubs, and rock fields. Martens show a preference for forest canopy cover of > 50%. Use of non-forested habitats by martens increases in summer and includes meadows and small harvest units near forest edges, as well as areas above the tree line in western mountains (Buskirk and Ruggiero 1994). While martens may utilize meadows and small harvest units, marten populations markedly decline in areas with clear cut logging (Thompson and Harestad 1994).

Activities such as timber harvest and road construction that fragment, dissect, and isolate habitats are the largest threats to marten. Fragmented habitats attract habitat generalist predators like the great-horned owl, coyote, and bobcat which can all prey on marten. In addition, fragmentation eliminates the connectivity and creates isolated individuals and populations which are more susceptible to extirpation.

Effects Analysis

The analysis area for the pine marten includes the area within the project boundary of the Proposed Action. While there are pockets of late seral forest, The East Fork Hood River Watershed contains the lowest amount of late seral habitat on the Forest and the Watershed analysis indicates that there is not enough habitat present to support populations of late seral, large home range species including marten. Marten have been sighted in the Cloud Cap/Tilly Jane area, on the border with the East Fork Watershed outside of the Analysis Area. There are two B5 pine marten habitat areas with treatment units and one B5 pileated woodpecker/pine martin habitat area within the Analysis Area with treatment units.

No Action Alternative

There would be no short-term effects to American marten under this alternative. In the short-term, the units would not provide habitat and snag levels would remain essentially unchanged. In 20 to 30 years, the plantation and sapling thinning stands would start to differentiate to varying degrees and show an increase in the levels of small snags and small down wood. Some of the stands may eventually become suitable habitat. However, with no action, it could take as long as 60 to150 years for these stands to develop into suitable habitat. Refer to the Silviculture Specialist Report for further discussion of tree response under the No Action Alternative.

Proposed Action Alternative

None of the proposed harvest units in sapling thinning and plantation thinning provide nesting habitat for this species. Recently unmanaged stands provide habitat in the PA, habitat components including down wood, and the vertical and horizontal complexity would be reduced in the proposed action by either timber or fuels reductions.

While canopy would be reduced, B5 management objectives would be meet by prescription or by PDC's, structural components that support martens would remain, and the number of large snags and down logs that are currently present in these units would not be impacted greatly as standards and guides are met, and large down wood is not a fuels concern.

Open road densities after implementation under the Proposed Action would be the same at 2.62 miles per square mile which is above the Forest Plan Standard of 2.0 miles per square mile for B5.

The main threats to marten is habitat fragmentation. The Proposed Action would not further fragment habitat substantially as suitable habitat would be present across the project area. Dispersal and migration is expected to be occur in all directions, with the exception of due North onto private timber and up into the Upper Hood River Valley. However, migration to the NE and NW would allow movement through lands. The Proposed **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.** Viable populations of the species would be maintained at the Forest-scale.

Cumulative Effects

The cumulative effects for Pine marten are similar to those of pileated woodpeckers, as threats, and habitat needs are similar in nature. Because marten are easily habituated to human presence the culmination of projects considered **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.**

Consistency Determination

This analysis is consistent with The National Forest Management Act which requires the Forest Service to manage wildlife habitat to “maintain viable populations of existing native and desired non-native vertebrate species in the planning area.” The National Forest Management Act requires the Forest Service to identify Management Indicator Species through the planning process, and to establish objectives to maintain and improve the habitat of indicator species. A Forest wide analysis was completed and is incorporated by reference. Viable populations of all the Management Indicator Species in this BE would be maintained at the Forest-scale.

The Forest wide Standards and Guidelines would be met for pileated woodpeckers and pine marten B5-Pileated Woodpecker/Pine Marten land allocation. At least 300 acres of mature and/or old growth forest habitat shall be maintained within each 600 acre Management Area for pileated woodpecker habitat areas (B5-008) and at least 160 acres of mature and/or old growth forest habitat shall be maintained within each 320 acre Management Area for pine marten (B5-010). Snags are discussed below under “Snag and Down Log Associated Species.”

Summary of Effects

There would be no short-term effects to American marten under the No Action alternative. In the short-term, the units would not provide habitat and snag levels would remain essentially unchanged. The main threat to marten is habitat fragmentation. The Proposed Action would not further fragment habitat and would not impact open road densities which would have a neutral impact on marten. Open road densities under the Proposed Action would be maintained at 2.62 miles per square mile which is above the Forest Plan Standard of 2.0 miles per square mile for B5. The project may impact individuals, but is not likely to impact populations, nor contribute to a potential loss of viability of this species.

3.9.7 Snag and Down Log Associated Species

Analysis Assumptions and Methodology

The East Fork Hood River Watershed as a whole would be analyzed for historic and current snag levels as stand level analysis does not provide a meaningful measure to snag and down wood dependent species. It is further broken down by both the east and west side stand structures, Eastside mixed conifer and Moist mix conifer. Management for snags and down wood are compared to unharvested stands, which represent historic conditions.

DecAID Advisor

DecAID is a planning tool intended to help advise and guide managers as they conserve and manage snags, partially dead trees and down wood for biodiversity (Mellen et al. 2003). It also can help managers decide on snag and down wood sizes and levels needed to help meet wildlife management objectives. This tool is not a wildlife population simulator nor is it an analysis of wildlife population viability.

A critical consideration in the use and interpretation of the DecAID tool is that of scales of space and time. DecAID is best applied at scales of subwatersheds, watersheds, subbasins, physiographic provinces, or large administrative units such as Ranger Districts or National Forests. DecAID is not intended to predict occurrence of wildlife at the scale of individual forest stands or specific locations. It is intended to be a broader planning aid not a species or stand specific prediction tool.

Modeling biological potential of wildlife species has been used in the past. DecAID was developed to avoid some pitfalls associated with that approach. There is not a direct relationship between the statistical summaries presented in DecAID and past calculations or models of biological potential.

Refer to the DecAID web site listed in the References section for more detail and for definition of terms. This advisory tool focuses on several key themes prevalent in recent literature:

- Decayed wood elements consist of more than just snags and down wood, such as live trees with dead tops or stem decay;
- Decayed wood provides habitat and resources for a wider array of organisms and their ecological functions than previously thought; and,
- Wood decay is an ecological process important to far more organisms than just terrestrial vertebrates.

Existing Condition

Currently, the project area contains stands of immature plantations less than 80 years old in moist mix conifer plant communities and recently unmanaged stands over 80 years old in both moist and dry mix conifer plant communities.

The proposed treatment area is dominated by four plant associations, common to the drier mix conifer plant associations the overstory would be dominated by Douglas-fir and ponderosa pine with an understory dominated by a variety of shrubs like Oregon grape (Berberis nervosa), serviceberry (*Amelanchier alnifolia*), oceanspray, vine maple, greenleaf manzanita (*Arctostaphylos patula*). Currently ponderosa pine is only representing less than 20% of the overstory component and very little to no shrub component is present in the stands due to high stand densities. Common to the moist and wet plant associations the overstory would be dominated by Douglas-fir, Pacific silver fir and Western hemlock. (Silviculturists report).

Many wildlife species evolved to use large snags and logs that were historically abundant on the landscape. The loss of large snags and logs from managed stands affects biodiversity. Currently, there are roughly 1 snags per acre in the moist mix conifer and 2 snags per acre in the dry mix conifer 20 inches DBH and larger. The proposed treatment areas (excluding the Dollar Lake fire) average an estimated 6 snags per acre in the moist mix conifer and 7 snags per acre in the dry mix conifer 11 inch DBH trees and larger.

Effects Analysis

The analysis area includes the East Fork Hood River Watershed. All of the units are located within the habitat types identified in DecAID as the Eastside Mixed Conifer Forest Cascades/Blue Mountains (EMC) and Moist Mixed Conifer (MMC) with vegetation condition of both “small/medium trees and large trees.”

For the small/medium trees in the Eastside Mixed Conifer, the DecAID advisor identifies the 30 percent tolerance level for snags as 6.7 snags per acre greater than 10 inches in diameter with 2.7 of those snags greater than 20 inches in diameter. It identifies the 30 percent tolerance level for down wood as up to 6.5 percent cover of down wood (including all decay classes) with sizes of logs averaging 5 to 8 inches in diameter. For the large trees in this habitat type, the DecAID advisor identifies the 30 percent tolerance level for snags as 15 snags per acre greater than 10 inches in diameter, with 3.6 of those snags greater than 20 inches in diameter. It identifies the 30 percent tolerance level for down wood as up to 2 percent cover of down wood (including all decay classes) with sizes of logs averaging 5 to 8 inches in diameter.

For the small/medium trees in Moist Mixed Conifer, the DecAID advisor identifies the 30 percent tolerance level for snags as 10 snags per acre greater than 10 inches in diameter, with 2.7 of those snags greater than 20 inches in diameter. It identifies the 30 percent tolerance level for down wood as up to 2.5 percent cover of down wood (including all decay classes) with sizes of logs averaging greater than 5 inches in diameter. For the large trees in this habitat type, the DecAID advisor identifies the 30 percent tolerance level for snags as 11 snags per acre greater than 10 inches in diameter, with 6.5 snags per acre greater than 20 inches in diameter. It identifies the 30 percent tolerance level for down wood as up to 3.3 percent cover of down wood (including all decay classes) with sizes of logs averaging greater than 5 inches in diameter.

Most of the proposed treatment units currently average snag and down wood numbers at the 30 percent tolerance levels. Areas of plantation thinning and sapling thinning may not have the components in them; however, the Proposed Action is not removing them from units. Down log percent cover would likely be exceeded in unmanaged stands with all logs over 20 inches dbh at the big end being maintained.

No Action Alternative

In the short-term, plantations would provide low amounts of down wood cover. Most areas would be below 6.5 percent cover of down wood and therefore be below the 30 percent tolerance level for wildlife habitat. However, some of the harvest units would likely have at least 3 percent of down wood comprised of classes 1 thru 4 and therefore would meet the 30 percent tolerance level for natural down wood conditions, as indicated by DecAID inventory data from unharvested plots.

In the next 20 to 30 years, these stands would begin to experience increased stand density and start to become increasingly more susceptible to damaging agents such as insects and diseases. These natural processes would recruit new snags and down logs, mainly from the smaller intermediate and suppressed trees. Trees would take more than 70 years to reach the 24-inch size class (USDA 2009). Table 74 shows the number of snags per acre recruited over time for the No Action and Proposed Action alternatives.

Based on the snag analysis in Table 74, the No Action alternative in recently unmanaged stands would recruit a greater number of snags over time in both habitat types compared to the Proposed Action alternative, with the exception of large snags ≥24 inches dbh in the dry habitat type. This is due mainly to the creation of healthier stands under the proposed thinning which would become less susceptible to stress and disease caused mortality.

Over the next 50 years, an increased number of snags would be recruited as the stands age and current snag levels would be again be achieved and then exceeded in both habitat types.

Table 74. Snags in the No Action and Proposed Action Alternatives

Proposed Action — Moist

Years After Treatment	QMD	# of Trees per acre	Snags per acre ≥12" DBH	Snags per Acre ≥24" DBH
0	15.2	90	6.0	1.0
10	8.4	300	5.0	1.0
20	7.4	443	4.0	1.0
30	7.9	435	2.0	1.0
40	7.7	525	4.0	1.0
50	7.4	659	3.0	1.0
60	8	639	3.0	1.0
70	7.8	760	3.0	1.0
80	7.5	924	4.0	1.0
90	8.1	869	5.0	2.0
100	8.6	815	5.0	2.0

Proposed Action — Dry

Years After Treatment	QMD	# of Trees per acre	Snags per acre ≥12" DBH	Snags per Acre ≥24" DBH
0	16.6	80	7.0	2.0
10	7.3	685	6.0	2.0
20	6.8	766	5.0	2.0
30	7.3	745	5.0	2.0
40	7.1	823	4.0	2.0
50	6.9	924	4.0	2.0
60	7.3	900	4.0	2.0
70	7	1021	5.0	2.0
80	6.6	1165	6.0	2.0
90	7	1103	7.0	2.0
100	7.3	1042	7.0	3.0

*snags densities are not as high in the PA because we are creating healthy growing conditions and so trees live longer and are less susceptible to insect and diseas

** all out year snags densities are based on FVS modeling predictions

No Action — Moist

Years After Treatment	QMD	# of Trees per acre	Snags per acre ≥12" DBH	Snags per Acre ≥24" DBH
0	6	1089	6.0	0.0
10	5.9	1235	5.0	1.0
20	6	1332	5.0	1.0
30	6.6	1251	6.0	1.0
40	6.9	1236	8.0	1.0
50	7	1247	12.0	1.0
60	7.7	1067	17.0	1.0
70	8.4	939	20.0	1.0
80	9.1	829	22.0	2.0
90	9.9	724	24.0	2.0
100	10.7	634	24.0	2.0

No Action — Dry

Years After Treatment	QMD	# of Trees per acre	Snags per acre ≥12" DBH	Snags per Acre ≥24" DBH
0	6.7	1052	7.0	1.0
10	6.3	1197	8.0	2.0
20	6.3	1267	8.0	1.0
30	6.8	1151	10.0	2.0
40	6.9	1172	10.0	1.0
50	6.9	1239	11.0	1.0
60	7.3	1132	13.0	2.0
70	7.8	1043	14.0	2.0
80	8.3	964	15.0	2.0
90	8.7	895	15.0	2.0
100	9.1	841	15.0	2.0

Proposed Action Alternative

It is likely that some snags would need to be cut during harvest operations, temporary road construction, and storm proofing due to safety considerations and that some downed logs would be degraded during project implementation and fuels treatments. However, no snags are proposed for treatment as part of the proposed action. All large down wood and large snags that need to be cut or moved but would remain nearby.

Snags that are left standing after thinning would be more prone to wind damage and snow breakage than they would have been without thinning. There would likely be some loss of the remaining snags within 10 years after harvest which would become down wood.

Some live trees would be selected as leave trees that are defective or have the elements of decay as described in DecAID advisor. Hollow structures are created in living trees by heart rot decay organisms over many years. These hollow structures in living trees provide especially valuable habitat for a variety of wildlife, including cavity users. Trees that have heart rot decay present may include features such as, openings in the bole, broken boles with bayonet tops, large dead tops or branches, old wounds on the bole, crooks in the bole signifying previous breakage, and the presence of fruiting bodies. Defective trees with deformities such as forked tops, broken tops, damaged and loose bark or brooms caused by mistletoe or rust can also provide important habitat for a number of species.

Large logs existing on the forest floor would be retained. Prior to harvest, sale administrators would approve skid trail and skyline locations in areas that would avoid disturbing key concentrations of down logs or large individual down logs where possible. The harvesting operations would also add small woody debris of the size class of the cut trees at the site. This would include the retention of cull logs, tree tops, broken logs and any snags that would be felled for safety reasons. Snags or green trees that fall down after the harvest operation would contribute to the down wood component of the future stand. See Figures 5 for reference and current conditions for MMC large log and Figure 50 for EMC large log.

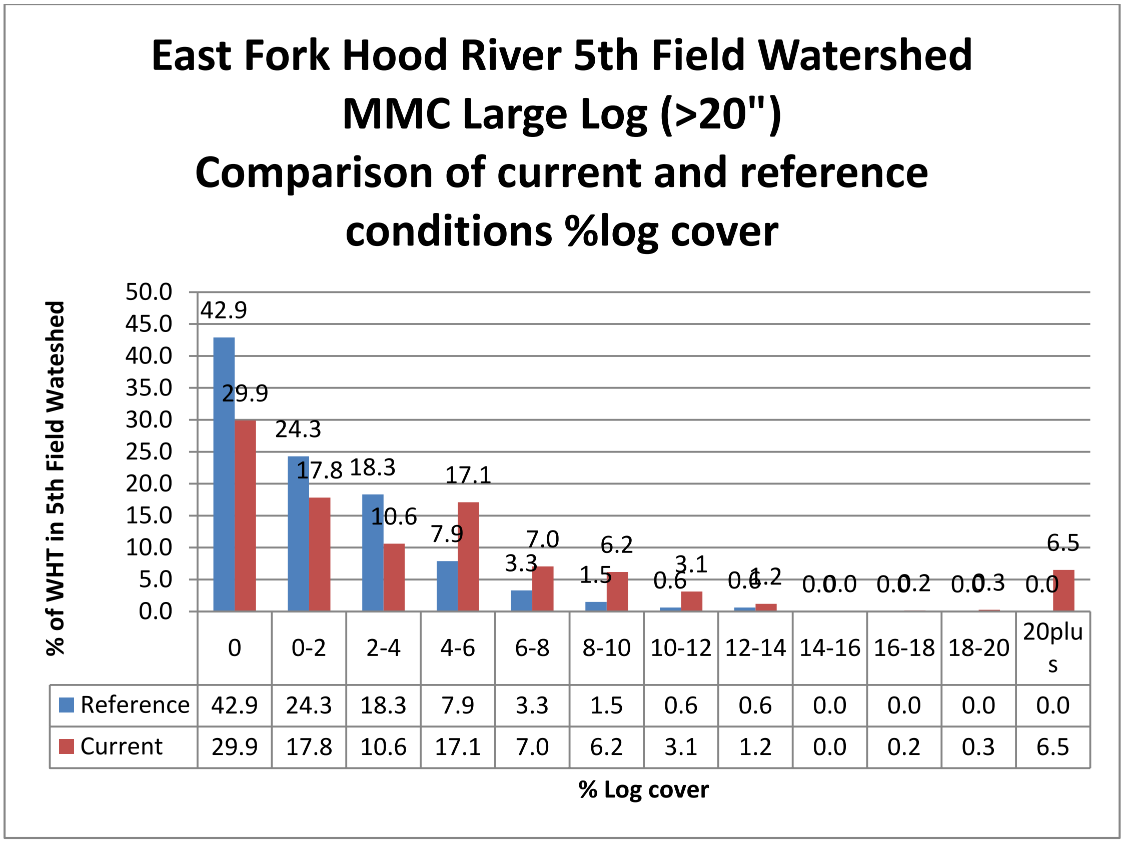
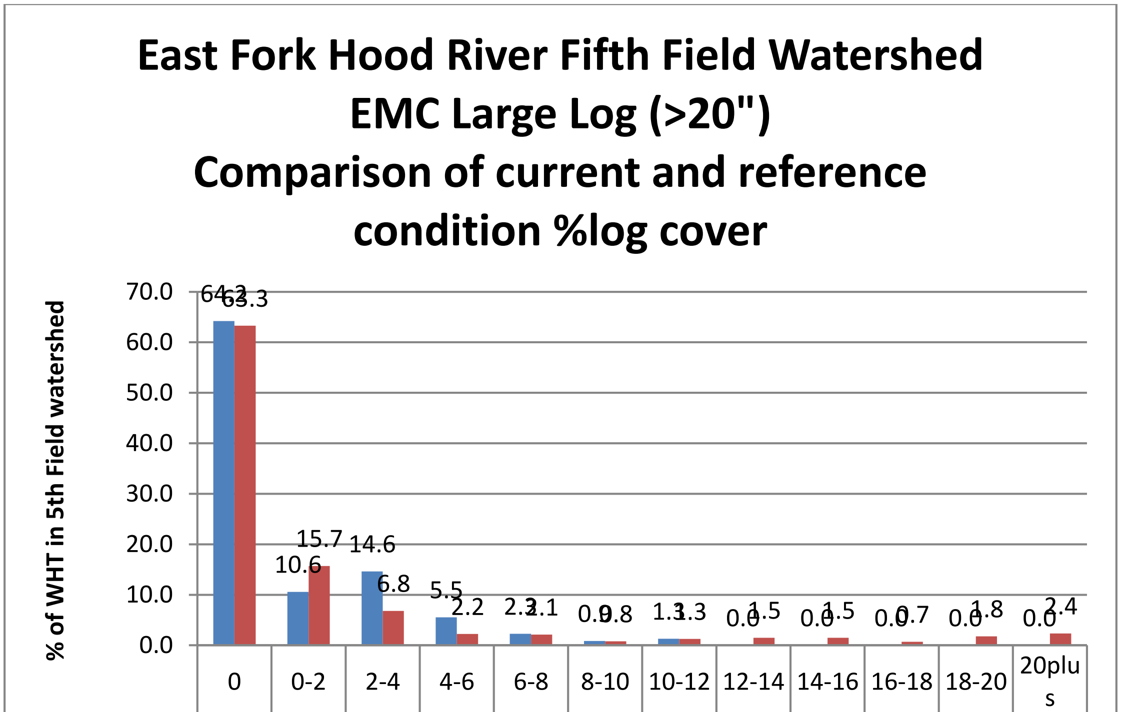


Figure 49. East Fork Hood River 5th Field Watershed Moist Mixed Conifer (MMC) Large Log Comparison



	0	0-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16-18	18-20	20plus
Reference	64.2	10.6	14.6	5.5	2.3	0.9	1.3	0.0	0.0	0.0	0.0	0.0
Current	63.3	15.7	6.8	2.2	2.1	0.8	1.3	1.5	1.5	0.7	1.8	2.4

Figure 50. East Fork Hood River Fifth Field Watershed Eastside Mixed Conifer (EMC) Large Log Comparison

Under the Proposed Action, skips and streamside protection buffers would provide short and mid-term recruitment of snags and down wood similar to the level described for no action. Large snags and down wood would continue to be provided in the late-successional habitat within the watershed.

Structural diversity is a combination of several stand characteristic which would include, but would not be limited to, number of canopy layers, down wood and snags. The stands under the Proposed Action are a mix of different stand structures see Veg report. In the young stands there is lower tree diversity, are single-canopied, even-aged stands, and/or have trees that are insufficient in size to provide quality snags or downed wood. In recently unmanaged stands structural diversity is more diverse in tree species with a regeneration component of shade tolerant species and no shrub components. Thinning can have both immediate effects on forest diversity and long-term effects restoring native plant communities as understory species are released and provide a seed source for future snag and down wood recruitment.

Structural diversity would be improved by initiating a new age class and by creating openings. Thinning would also have an indirect impact by releasing the green retention trees. These retention trees would later become large diameter snags and downed wood.

Based on the snag analysis in Table 74, the Proposed Action would recruit fewer snags over time in both habitat types compared to the No Action alternative, with the exception of large snags ≥24 inches dbh in the dry habitat type. This is due mainly to the creation of healthier stands that become less susceptible to stress and disease caused mortality.

Over the next 100 years, the numbers of snags in these stands would be slightly reduced as existing snags fall and become down wood. Snags would then eventually be recruited as the stands age and current snag levels would be again be achieved or exceeded as is the case of large snags ≥24 inches dbh in the dry habitat type. In all cases, the 30 percent tolerance level would be maintained under the proposed action.

Cumulative Effects

Past harvest activities in the analysis area have reduced the abundance of snags, although there are small and large snags in the mature forests within the project boundary. The Dollar Lake and Gnarl Ridge Fires have both contributed an abundance of snags in the watershed. For the MMC habitat type there is 13.2 percent that currently contains no snags compared to the historic condition of 6.1 percent (Figure 51). For EMC_ECB habitat there is 44.2 percent that currently contains no snags as compared to the historic condition of 20.1 percent (Figure 52). The remainder of the watershed in these habitat types are well below historic levels for the number of snags per acre with the exception of the 30 + category in MMC. Implementation of this project could result in the loss of some snags cut for safety concerns. Because of the small number of snags expected to be cut, there would not be a reduction in the percentage of biological potential being provided for species dependent on snags and down wood.

The boundary used for this DecAID analysis includes the East Fork Hood River Watershed. Other projects in the watershed include past timber harvest on federal and private lands and conversion to agricultural lands which have the potential to reduce and remove snags and down wood on the landscape.

It is not likely that private lands would provide snags and downed wood in the foreseeable future. Other timber harvest activities on Forest Service land would have similar impacts as the Proposed Action. Structural diversity would be improved by initiating a new age class and by creating openings. Thinning would also have an indirect impact by releasing the green retention trees. These retention trees would later become the large diameter snags and downed wood. The blocks of unharvested habitat would provide large snags and down wood while the treated areas of the watershed move toward the mature forest state. The adjacent untreated areas would allow for snag and down wood-dependent species to recolonize habitat as snags and down wood increase in the treated areas.

The Dollar Lake and Gnarl Ridge fires increased the number of snags in the Watershed. The Dollar Lake burned a total of 6,304 acres, 5,189 of these acres burned in the East Fork of the Hood River Watershed. The Gnarl Ridge fire burned a total of 3,280 acres, 754 of these acres burned in the East Fork of the Hood River Watershed. These acres increased the level of high density snags in the watershed by 13 percent. With the addition of these snags, the current percentage of snags in the 30 + snags/acre category for this wildlife habitat type would be 15 which is above the reference condition of 9.2 percent of the watershed in high density patches of snags.

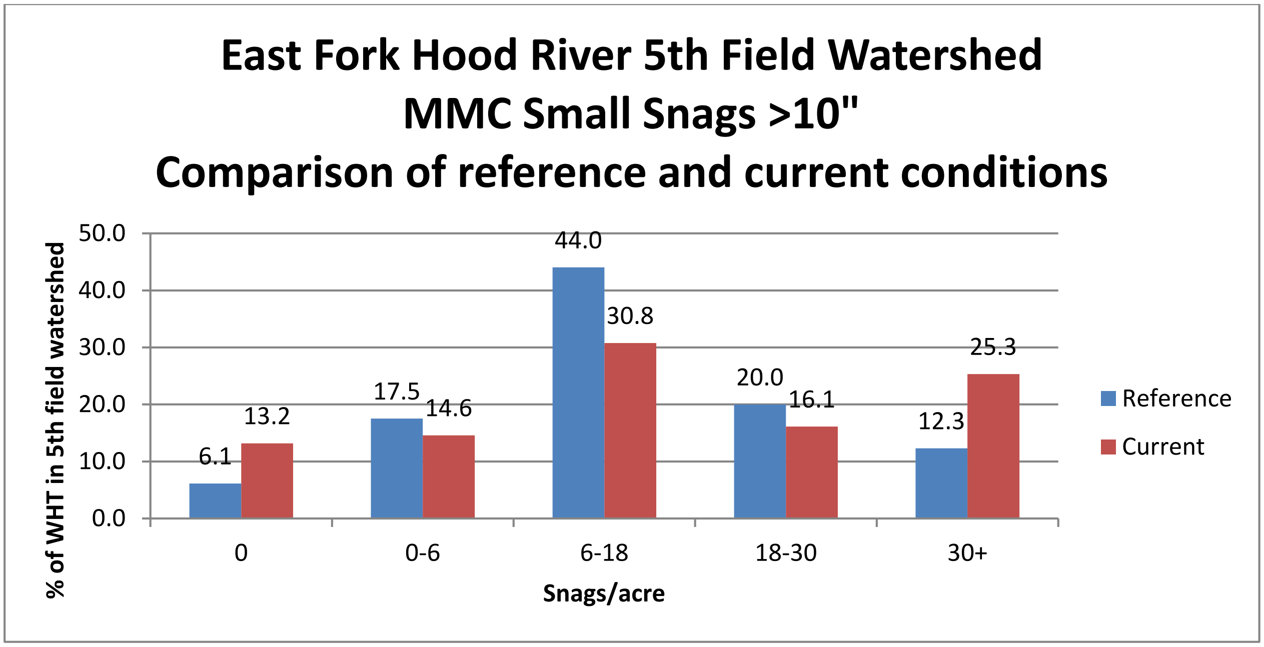


Figure 51. Comparison of Current and Reference Condition for MMC Snag Densities

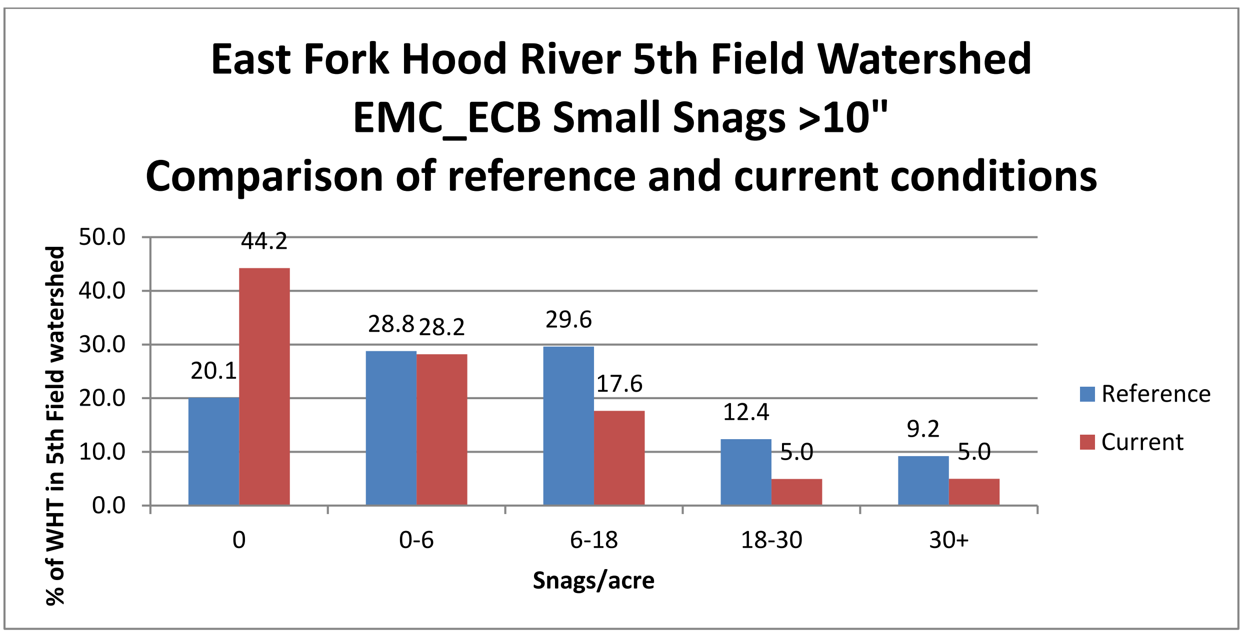


Figure 52. Comparison of Current and Reference conditions for EMC_ECB snag densities

Consistency Determination

Thinning may have short-term impacts on downed wood quality, but tree response to thinning is expected to result in increased growth which would speed the ability of the stands to provide the size of snags and down wood needed to continue to meet the Forest Plan standards FW-215, FW-216, FW-219 through FW-223.

FW-219 and FW-223 indicate that stands should have 6 logs per acre in decomposition class 1, 2, and 3 and that they should be at least 20 inches in diameter and greater than 20 feet in length. However, FW-225 and FW-226 indicate that smaller size logs may be retained if the stand is too young to have 20 inch trees. Under the Proposed Action, logs representing the largest tree diameter class present in the stand would be retained.

Currently most of the trees are not large enough to produce snags of the desired size, (22 inches diameter, FW-234), but FW-235 allows the retention of smaller trees if the treated stand is too young to have trees of sufficient size. In this case, snags and green leave trees retained would be representative of the largest size class present in the stand.

Summary of Effects

The stands have areas that lack snags and downed wood in comparison to reference conditions. In addition, plantations and sapling units have low tree diversity, are single-canopied, even-aged stands, or have trees that are insufficient in size to provide quality snags or downed wood. Thinning can have both immediate effects on forest diversity and long-term effects restoring native plant communities as understory species are released and provide a seed source for future snag and down wood recruitment. In areas of recently unmanaged stand thinning is expected to have a beneficial impact on tree diversity and structural complexity. Thinning may have short-term impacts on downed wood quality, but tree response to thinning is expected to result in increased growth which would speed the ability of the stands to provide the size of snags and down wood needed to meet the Forest Plan standards.

3.9.8 Neotropical Migratory Birds

Analysis Assumptions and Methodology

The Forest Service has implemented management guidelines that direct migratory birds to be addressed in the NEPA process when actions have the potential to impact migratory bird species of concern.

Conservation strategies for land birds of the east slope of the Cascade Mountains in Oregon and Washington and a conservation strategy for land birds in coniferous forests in western Oregon and Washington were prepared in June 2000 and March 1999 respectively by Bob Altman of American Bird Conservancy for the Oregon-Washington Partners in Flight. The strategies are designed to achieve functioning ecosystems for land birds by addressing the habitat requirements of “focal species.” By managing for a group of species representative of important components of a functioning ecosystem, it is assumed that many other species and elements of biodiversity would be maintained. The East Fork Hood River Watershed contains elements of both these physiographic regions.

Existing Condition

Table 75 displays the focal species potentially positively or negatively affected by changes in habitat in the eastern slope of the Cascade Mountains region, and the forest conditions and habitat attributes they represent.

Table 75. Focal Migratory Bird Species

Forest Conditions	Habitat Attribute	Focal Species
Ponderosa Pine	Old forest, large patches	White-headed woodpecker
Ponderosa Pine	Large trees	Pygmy nuthatch
Ponderosa Pine	Open understory, regeneration	Chipping sparrow

Forest Conditions	Habitat Attribute	Focal Species
Ponderosa Pine	Burned old-forest	Lewis' woodpecker
Mixed Conifer	Large trees	Brown Creeper*
Mixed Conifer	Open understory, regeneration	Williamson's sapsucker
Mixed Conifer	Grassy openings, dense thickets	Flammulated owl
Mixed Conifer	Multi-layered, structural diverse	Hermit thrush
Mixed Conifer	Fire edges and openings	Olive-sided flycatcher*
Oak-Pine Woodland	Early-seral, dense understory	Nashville warbler
Oak-Pine Woodland	Large oaks with cavities	Ash-throated flycatcher
Oak-Pine Woodland	Large pine trees/snags	Lewis' woodpecker
Lodgepole Pine	Mature/old-growth	Black-backed woodpecker
Whitebark Pine	Mature/old-growth	Clark's nutcracker
Montane Meadows	Wet and dry	Sandhill crane
Aspen	Large trees/snags, regeneration	Red-naped sapsucker
Subalpine fir	Patchy presence	Blue grouse*

**Significantly declining population trends in the Cascade Mountains Physiographic Region.*

Close to 30 species of migratory birds occur within the District, some of which are present within the project area during the breeding season. Some species favor habitat with late-successional characteristics, such as the hermit thrush and brown creeper, some favor while others favor early-successional habitat such as the Nashville warbler or the Williamson's sapsucker who likes open mixed conifer regeneration. Others like the white headed woodpecker and pygmy nuthatch like open ponderosa pine habitat.

In developing the list of species to be considered in the planning process, the current (updated every 5 years) FWS Birds of Conservation Concern was consulted as was the State lists, and comprehensive planning efforts for migratory birds. This analysis was completed in part to evaluate the effects of the agency actions on migratory birds, focusing first on species of management concern along with their priority habitats and key risk factors.

Effects Analysis

The analysis area for migratory birds includes the area within the project boundary of the Proposed Action.

No Action Alternative

There would be no habitat alteration under this alternative. As such, there are no direct or indirect effects on migratory birds.

Proposed Action Alternative

There would be no effects to migratory birds from road closures. Research has demonstrated that thinning enhances habitat for a number of migratory species and provides habitat for some species that are rare or absent in un-thinned stands (Hagar and Friesen 2009). However, some species of migratory birds have been shown to decline following thinning. The effects of thinning in mid-successional stands would most likely have a combination of positive, neutral, and negative impacts on migratory bird use within the stands depending on which species are present.

The following migratory species present in the watershed may benefit from thinning:

- Hammond's flycatcher
- warbling vireo
- western tanager
- white headed woodpecker

- pygmy nuthatch
- Williamson's sapsucker
- brown creeper

The following migratory species may be negatively impacted by thinning:

- hermit warbler
- Pacific slope flycatcher
- black-throated gray warbler
- Swainson's thrush

This project covers only a very small portion of the migratory songbirds breeding habitat on the Forest. In young stands, some species may redistribute throughout the planning and project area, as well as outside, as young stands are dispersed across the forest. These effects would be short-term since more structurally diverse conditions are expected to return as these stands develop over the next 20 to 40 years.

In recently unmanaged stand, habitat is available for a variety of species associated with older structural components. Those species vary likely according to moist vs dry habitat availability.

On the dry side (East of Hwy 35) stands have ponderosa pine incorporated into the stands. Thinning around ponderosas would enhance habitat for those species that rely on large ponderosa pine dominated forests. Dry mixed conifer components of mature forest would also likely be enhanced in the long term. Short term effects for both habitat types include habitat avoidance, and potential impacts to nesting for a season during implementation.

While on the moist side, Douglas fir is the dominant species providing for a mixed conifer habitat that has greater structural diversity than what is found in sapling and plantation stands.

Thinning in all stands would have a benefit to birds that like structural diversity, increase in forage opportunities, need grassy openings/ shrub and brush components, and small openings. Trees would be fell throughout the breeding season and would have a negative impact on reproduction for likely one breeding season as units would most likely be completed in a one year timeframe.

Cumulative Effects

The projects that could have cumulative effects to migratory birds include the cumulative past, ongoing, and future activities in the watershed as identified in Chapter 3 that would impact components of habitat or nesting success. Cumulative effects for this species were considered at the watershed scale. The effects of thinning in mid-successional stands would most likely have a combination of positive, neutral, and negative impacts on migratory bird use within the stands depending on which species are present. Open habitat that would be created could be beneficial for early seral species like the Nashville warbler and Williamson's sapsucker. The hermit thrush and brown creeper would be negatively impacted by habitat removal. Some projects reviewed remove habitat for early, mid, and late successional nesting migratory birds. The watershed has habitat available that includes all seral stages, the projects listed and analyzed don't limit habitat available for Neotropical migrants, nor is habitat limited at the Forest level.

Consistency Determination

The Proposed Action is consistent with Executive Order 13186 (66 Fed. Reg. 3853, January 17, 2001) "Responsibilities of Federal Agencies to Protect Migratory Birds." This Executive Order directs federal agencies to avoid or minimize the negative impact of their actions on migratory birds, and to take active steps to protect birds and their habitat. This Executive Order also requires federal agencies to develop Memorandum of Understandings (MOU) with the FWS to conserve birds including taking steps to restore and enhance habitat, prevent or abate pollution affecting birds, and incorporating migratory bird conservation into agency planning processes whenever possible. The BLM and FS have both completed, and are currently implementing, their respective MOU's with the FWS.

Summary of Effects

There would be no direct, indirect, or cumulative effects to Neotropical migratory birds, as no habitat alteration is occurring under the no action alternative. The proposed action would have both positive and negative effects for several migratory bird species based on habitat preferences. Direct impacts include avoidance during implementation, disturbance, and potential impacts to nesting structures. These impacts would be short term, and habitat would persist in all stages throughout the project area as to not limit habitat or persistence of a species.

3.10 Botany

3.10.1 Analysis Assumptions and Methodology

Survey guidelines for R6 Sensitive species and survey protocols for Survey and Manage botanical species do not require surveying 100 percent of a planning area; individual species might be missed between survey transects. If a listed species is not found during surveys through all suitable habitats in a planning area it is reasonable to assume the target species is not present. If a species is found in one or more locations it can be assumed it is present in similar habitat with similar associated plant communities throughout a planning area.

Methodology - Forest Service Direction

R6 Sensitive Species

The 2011 Region 6 Regional Forester and OR/WA State Director Special Status Species List Including Federal TEP Species and Region 6 Regional Forester Sensitive Species applies to this project. Table 76 below displays the R6 Sensitive botanical species that are documented in the planning area. A complete review of all species document or suspected on the Mt. Hood National Forest is located in Table 3 of the Biological Evaluation in the Project Record. Survey results are discussed under Existing Condition / Affected Environment.

Table 76. Biological Evaluation Summary for Region 6 Sensitive, Threatened, Endangered, Proposed Species on the Regional Forester's Special Status Species List with Species Present in the Planning Area

2011 R6 Species Documented within the Planning area[1]	General Habitat & Survey Season	Species Present	Project Impact/Effects[2]
Arabis sparsiflora v. atrorubens	D Dry meadows, roadsides, oak/pine transition zone, rocky shrub-steppe, eastside MHNF. May-July.	Shellrock Quarry	NI
Clavariadelphus ligula	D In mixed mid-late- successional coniferous forests; associated with true fir, Douglas-fir, pine, cedar and hardwoods, coastal to east Cascades. July-Oct.	Yes/Units 13, 14, 15, 16	NI

[1]*Northwest Forest Plan Survey and Manage Categories for Rare and Uncommon Species (ROD SG pages 6-14)*

[2] *FS Policy Biological Evaluation Effects Determination: No impact (NI); 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 (MIIH); Will impact individuals or habitat with a consequence that the action may contribute to a trend towards federal listing or cause a loss of viability to the population or species (WIFV); Beneficial impact (BI). (FSM 2672.42)*

Forest Service policy (FSM2670.3) requires a 5-step biological evaluation process 1) Pre-field review of all existing information; 2) Field reconnaissance if sensitive species or habitats are determined to be present and may be affected by proposed project activities; 3) Evaluation of project effects on sensitive species and habitats; 4) Analysis of the significance of the project's effects on species locally and throughout their range; and 5) A biological investigation if needed (due to lack of information). Management of known sites can be addressed during the project planning phase to avoid sites by project design if needed to maintain viability of a species in the planning area and throughout the species' range.

Forest Service policy also directs the biological evaluation process to conclude with a determination of the effects or impacts on each species and summary of the rationale for each determination. For Region 6 Sensitive species make a determination of: 1) No impact; 2) Beneficial impact; 3) May adversely impact individuals, but not likely to result in a loss of viability in the Planning area, nor cause a trend toward federal listing; or 4) Likely to result in a loss of viability in the Planning area, or in a trend toward federal listing. A determination of No Impact for sensitive species can be made at any step in the process, at which time the biological evaluation is complete.

Survey and Manage Species

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 applies to this report.

Methodology for Survey and Manage botanical species is essentially the same as the five step biological evaluation process except a determination of effects is not required to conclude a biological/botanical analysis. Species that are listed under Survey and Manage Category A, B, C, D (ROD SG pages 6-14) have "Manage Known Sites" requirements intended to prevent habitat-disturbance that could impact species viability. Survey and Manage Categories are: Category A = Pre- disturbance surveys are practical and must be conducted if suitable habitat is present, and manage all known sites; Category B = Equivalent Effort surveys required in old growth habitat unless Strategic Surveys have been completed, and manage all known sites; Category C = Pre- disturbance surveys are practical and must be conducted if suitable habitat is present, and manage high-priority sites; Category D = Pre-disturbance surveys not practical or not necessary, manage all known sites until high-priority sites can be determined; Category E = Pre-disturbance surveys are not required, status undetermined, manage all known sites until a determination is made whether the species meets the basic criteria for Survey and Manage.

Table 77. 2001 ROD Compliance Review for Survey & Manage (SM) Botany Species

Species	General Habitat & Survey Season	Would Project Activities Potentially Negatively affect Species Habitat	Surveys Required	Known Sites or Sites Found During Surveys	Site Management Required
Buxbaumia viridis	On soil or rotten wood. In mature forests. 100ft-4000 ft. elevations. May-Dec.	Potential	No	Yes, Unit 8 along Doe Creek[1]	Yes
Clavariadelphus ligula	In mixed mid-late-successional coniferous forests with true fir, Douglas-fir, pine, cedar and hardwoods. Coastal to east Cascades. July-Oct.	Potential	Yes	Yes / New sites. Units 13, 14, 15, 16 in Spotted Owl Habitat	Yes
Mycena overholtsii	On rotten wood near melting snow in coniferous forests, esp	Potential	Yes	Yes, edge of Unit 9 near	Yes

	true fir. West and east Cascades. Mar-July.	Trail 688 jct.

[1]Although Pre-Disturbance surveys are deemed practical for this species, continuing pre-disturbance surveys is not necessary in order to meet management objectives." (2001 Rod Standards and Guidelines, page 50 footnote)

3.10.2 Existing Condition

Plant associations in the planning area are typical of forests on the north slopes of Mt. Hood and vary within the East Fork Hood River watershed: Grand fir/Oregon grape, Grand fir/vine maple/vanilla leaf, Grand fir/oceanspray, Grand fir/twinflower, Mt. Hemlock /queenscup, Western hemlock/vanilla leaf, Pacific silver fir/vanilla leaf. Other tree species include Douglas fir, noble fir, Engelmann spruce lodgepole pine, western white pine, ponderosa pine, western larch, and western red cedar. Ponderosa pine, scrub oak, and native dry-site grasses and sedges (*Agropyron spicatum*, *Bromus carinatus*, *Festuca idahoesnis*, *Carex geyeri*) are widely scattered in open forested plant communities on the east side of highway 35.

The planning area is located in a crucial position on the landscape for the connectivity of late-successional forest associated species around the north side of Mt. Hood; this connectivity corridor is key to providing genetic linkage for late-successional/old-growth associated species, especially species associated with forests that have a natural history of wildfire in pine/oak communities in the transitional ecological zone on the east side of the Cascade crest (East Fork and Middle Fork of the Hood River Watershed Analysis).

Botany Surveys

R6 Sensitive Species and Survey & Manage Species

The pre-field review process concluded that suitable habitat is present in the proposed planning area listed in Table 76, and Survey and Manage species listed in Table 77.

Field surveys were conducted during May, August, and October 2013, April-November 2014, and April-May 2015 for species that have suitable habitat in the planning area. Surveys were also conducted in the original Polallie Cooper Planning area during May-August 2001. Surveys focused on suitable high probability micro-habitats for the species listed in Table 76 and Table 77 as having suitable habitat present in the planning area.

Survey Results

Region 6 Sensitive Species

There are two species listed as R6 Sensitive in the planning area: *Clavariadelphus ligula* (orange-strap fungus) and *Susdorfia violacea* (Suksdorf's violet rock-break). One R6 Sensitive species *Arabis sparsiflora var. atrorubens* (sickle-pod rock cress) is outside the planning area in Shellrock Quarry which is near the planning area and might be accessed for rock and gravel or might be used as a staging area for project equipment.

Survey and Manage Species

There are three Survey and Manage species in the planning area: *Buxbaumia viridis* (bug-on-a-stick moss), *Clavariadelphus ligula* (orange-strap fungus), and *Mycena overholtsii* (fungus).

Management of Known Sites

The five species listed above are discussed separately below under R6 Sensitive Species and Survey & Manage species listed below. Management recommendations are not needed for Suskorfia violacea and it is not discussed under Effects Analyis.

R6 Sensitive Species – Known Sites

Clavariadelphus ligula (orange-strap fungus)

This mycorrhizal fungus grows in scattered groups in units 8, 13, 14, 15, and 16 primarily within the two Spotted Owl core habitat protection areas. *C. ligula* is also currently a Category B Survey and Manage species (Manage Known Sites).

Suksdorfia violacea (Suksdorf's violet rock-break)

This species was reported at two different sites in the planning area prior to 2005; both sites were revisited during botanical surveys for the proposed planning area and were not found at either location. These sites are actually outside the propose planning area so they are not discussed under Effects Analysis. Details are discussed below by unit:

Unit 11: In approximately *2005 S. violacea* was reported on the westside of Highway 35 near the Tilly Jane Creek crossing. The site was not found at that location during surveys in Unit 11. However, there is a known site nearby on wet forested cliffs above Tilly Jane Creek on the opposite side of Highway 35 outside of the planning area. My conclusion is that the site record is actually for the site on the eastside of Highway 35 and there might have been an error related to UTM coordinates.

Unit 17: *S. violacea* was originally reported at the site in approximately 1994 growing in cobble and rocks sluffed off of the hill adjacent to road 4400-620. Subsequent revisits to the site over the years have not found *S. violacea*. The habitat for *S. violacea* in range of the project is wet, shaded, cliffs and moist shaded soil around boulders above the cliffs adjacent to Unit 19 which is not similar to the dry, rocky, exposed habitat in the 1994 site. My conclusion is the site record is a misidentification, or if *S. violacea* was present at some point it may have been extirpated from the site due to loss of shade and moisture over time.

Arabis sparsiflora var. atrorubens (sickle-pod rock cress)

Shellrock quarry: This species was not found in the planning area during surveys but does grow around the edges of Shellrock Quarry which might be used for rock and gravel or staging equipment. The site is not within the proposed planning area so it is not discussed under Analysis of Effects. However, management recommendations are listed at the end of this report.

Clavariadelphus ligula (orange-strap fungus)

This species is discussed under R6 Sensitive Species above.

Buxbaumia viridis (bug-on-a-stick moss)

Unit 8: This species was found growing on class 5 logs in the Doe Creek riparian reserve area in unit 8. The area is not proposed for treatment under the Proposed Action so it is not discussed under the analysis of effects.

Mycena overholtsii fungi

Unit 9: This species was found growing directly south of unit 8 boundary between the road and the edge of the unit. The site is outside the planning area so it is not discussed under the analysis of effects.

3.10.3 Effects Analysis

The analysis area is the planning area. The analysis of cumulative effects also considers the presence of suitable habitat connectivity between the planning area and surrounding protected reserves in the East Fork of the Hood River Watershed, The Dalles Watershed, Mt. Hood Wilderness, and Badger Wilderness. Only the proposed projects or portions of projects proposed in this EA that have direct or indirect effects are included below under cumulative effects.

The spatial context for the following effects analysis is the affected environment described under Existing Conditions. The discussion of cumulative effects also considers the presence of suitable habitat in protected reserves outside the planning area because the areas encompass similar habitats that would provide for persistence of rare botanical species on Mt. Hood National Forest.

The temporal context for the following effects analysis depends on existing and future project related activities; if there is an overlap in time from an effects perspective discussion is included under cumulative effects. The discussion of cumulative effects also considers the desired future condition of units that would be treated to encourage development of fire-tolerant forest plant communities and late-successional/old-growth forest components and connectivity with similar suitable habitats in surrounding reserves. Past and future projects considered during this analysis are listed in Table 15 of the Environmental Assessment.

No Action

Under the No Action alternative Survey and Manage species would continue to evolve with the natural processes of forest succession and environmental influences.

Proposed Action - Direct and Indirect Effects

Proposed activities that would not have direct or indirect effects on Survey and Manage and R6 Sensitive species are not discussed below.

Vegetation Treatments

Direct and Indirect Effects on Survey and Manage Bryophytes

Moss *Buxbaumia viridis* in unit 8 is within the Doe Creek riparian reserve retention buffer in an area that would not be treated under the Proposed Action.

Direct and Indirect Effects on R6 Sensitive and Survey and Manage Fungi

Fungi *Clavariadelphus ligula* populations in units 13, 14, 15, and 16 are within the two Spotted Owl core habitat area that would not be treated under the Proposed Action.

There is a short-term risk that residual trees in thinned areas around the buffer retention area might be susceptible to wind-throw and breakage into the retention buffer circles and knock down fungal host trees. In the long term the downed trees would add nutrients to the soil and provide decomposing material for spore dispersal.

Direct and Indirect Effects on Fungal Community Diversity

In thinned forests the highest reduction in mycorrhizal fungal diversity corresponds with the lowest tree retention levels (15%); fungal fruiting (reproduction) is not significantly affected at the 40 % retention level, but is almost eliminated at the 15% retention level. (Luoma et al. 2004).

The silviculture prescription for the proposed project states: “Within the proposed treatment areas the canopy closure would be reduced from 60% to 40% in the moist mix conifer and 64% to 38% in the dry mix conifer on average (FVS runs).” (Olsker, 2015).

Residual trees in thinned stands may maintain or accelerate the re-establishment of mycorrhizal communities associated with mature forests by enhancing the mycorrhizal diversity on adjacent host seedlings.(Cline et al. 2005). Colgen et. al (1999) documented a shift in fungal species dominance within the lightly thinned and heavily thinned treatments and the presence of 16 species found *only* in the thinned stands. This suggests that some species were induced to fruit by the thinning operations. (Lippert, 2014)

Fuel Treatments

The 2001 ROD states that "in high fire frequency areas such as east of the Cascades or in the Klamath provinces, specific consideration should be given to the acceptability of the use of prescribed fire in known sites to reduce the risk of future large-scale or high intensity fire, even if it entails some risk to individual site occupancy" (S&M S&Gs pg. 20). The S&M ROD highlights the need to integrate S&M requirements with National Fire Plan priorities, and references this S&G as one tool to accomplish this (S&M ROD pg. 12).

Recognition that high intensity wildfires may be potentially harmful to some fungal species "should lend credence to efforts to restore forest health; fire may be important to the reproductive evolution of ectomycorrhizal fungi" and this should "add further impetus to the development of management plans that seek to restore forest health from the effects of decades of fire suppression." (Luoma 2005)

Direct and Indirect Effects on Survey and Manage Bryophytes

Moss *Buxbaumia viridis* in unit 8 is within the Doe Creek riparian reserve retention buffer in an area that would not be treated under the Proposed Action.

Direct and Indirect Effects on R6 Sensitive and Survey and Manage Fungi

Fungi Clavariadelphus ligula populations in units 13, 14, 15, and 16 are within the two Spotted Owl core habitat area that would not be treated under the Proposed Action

Cumulative Effects

There are no effects to accumulate under the Proposed Action. Habitat conditions within known sites would remain the same as under No Action. Habitat connectivity around the sites would continue in the long term and would provide for dispersal of species in surrounding forests in and outside of the planning area.

3.10.4 Consistency Determination

Activities proposed under the Proposed Action are consistent with the following Forest Service policy, direction, standards and guidelines for the following reasons: 1) Surveys have been completed in all suitable habitats for R6 Sensitive bryophytes, lichens, and vascular plant species and have been conducted according to protocols for Survey and Manage species; 2) Recommendations for management of known sites have been made; 3) The proposed project as described under the Proposed Action would not lead to a loss of viability or trend toward Federal listing of undetected R6 Sensitive fungi species and Survey and Manage fungi species on the Mt. Hood National Forest or throughout their range; and 4) The proposed project is consistent with direction to use the 2011 R6 Sensitive Species list and the 2001 ROD list of Survey and Manage Species.

The Polallie Cooper Hazardous Fuels Reduction Project, combined with the Project Design Criteria outlined in Section 2.3 is consistent with the Forest Plan land allocations within the planning area

3.10.5 Summary of Effects

The Proposed Action would have No Impact on R6 Sensitive/Survey and Manage fungal species *Clavariadelphus ligula,* or Survey and Manage moss species *Buxbaumia viridis.*

Surveys have been completed according to Survey and Manage protocols for Survey and Manage vascular plants, lichens, bryophytes, and fungi.

3.11 Invasive Plant Species

3.11.1 Analysis Assumptions and Methodology

The U.S. Forest Service has limited influence on weed vectors (humans, vehicles, livestock, wildlife, wind, water, etc.); invasive plant species would likely continue to be introduced and spread throughout the planning area regardless of proposed project activities. Invasive plants can usually be controlled by annual adaptive treatment methods; it is assumed that funding would be available for annual treatment in the planning area.

Methodology - Noxious Weed Risk Assessment Process

The Forest Service is required to identify measures intended to prevent establishment and spread of invasive plants as a result of Forest Service actions. A finding of risk is the basis for identifying appropriate prevention mitigation measures (Project Design Criteria). The Risk Assessment process is detailed below under Effect Analysis.

Criteria Used to Determine Effects

The following criteria are used to determine the effects to invasive species:

1) Presence of noxious weed species in or around the proposed planning area
2) Presence of vectors
3) Potential for project to spread or introduce invasive plant
4) Potential for project to contribute to a cumulative increase of invasive plant s in the analysis area

Analysis Area

The analysis area includes the planning area and peripheral transportation routes and staging areas for project equipment and machinery (including log trucks). Potential sources of rock/gravel (commercial or private) are also considered as part of the analysis area and are discussed under Direct and Indirect Effects. Proposed project activities that have potential for direct or indirect effects are also included in the analysis of Cumulative Effects.

Spatial and Temporal Boundary

The spatial context for the analysis of effects is the affected environment described under Existing Conditions. The discussion of cumulative effects (and the final determination of effects) also considers past and future treatments to control invasive plant in the analysis area. The temporal context for analysis depends on existing and future project related activity – if there is an overlap in time from an effects perspective it is included in the discussion under cumulative effects.

3.11.2 Existing Condition

Invasive plant species on the Oregon Department of Agriculture (ODA) Noxious Weed list are present in the proposed planning area. Invasive plants compete with native plants for nutrients and moisture and alter the natural ecological successional development of native plant communities including interdependent pollinators, invertebrates, wildlife, and aquatic species.

"Invasive plants" is an umbrella term for plant species that are not native to the continental United States or are undesired invasive native plant species. "Noxious weeds" are invasive plants that have legal status defined by Oregon Department of Agriculture (ODA) Weed and Pest Control as "…any non-native plant classified by the Oregon State Weed Board that is injurious to public health, agriculture, recreation, wildlife, or any public or private property." ODA emphasizes: "Noxious weeds have become so thoroughly established and are spreading so rapidly on private, state, county, and federally owned lands, that they have been declared by ORS 569-350 to be a menace to public welfare. Steps leading to eradication, where possible, and intensive control are necessary. It is further recognized that the responsibility for eradication and intensive control rests not only on the private landowner and operator, but also on the county, state, *and* federal government."

Executive Order 13112 and the executive summary of The National Invasive Species Management Plan also define invasive species as "An alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health."

Invasive Plant Species Present

There are five invasive plant populations in the planning area approved for treatment under the 2008 Environmental Impact Statement for Site Specific Invasive Plant Treatments for Mt. Hood National Forest: Treatment ID #66-008 (Highway 35), 66-013 and 66-041 (road 3512-620 to unit 8), 66-018 (road 44 to 4410 junction), and 66-043 (quarry at junction of road 3511-620, previously Forest Service land). The Forest Service would treat the areas or coordinate treatment with county/state weed departments prior to project activities or sale planning. The species of concern are: Diffuse knapweed (*Centaurea diffusa*), spotted knapweed (*Centaurea stoebe, i.e C. maculosa*), meadow knapweed (*Centaurea debeauxii, i.e C. pratensis*), yellow toadflax, (*Linaria vulgaris*). Infestations are most obvious where knapweed has become established along Highway 35, Road 44, and Road 17.

The quarry at the junction of roads 3511 and 3511-620 is scheduled for weed inspection during summer 2015. If invasive plants are found The Forest Service would work with the land owner to treat the area or coordinate treatment with county/state weed departments prior to project activities or sale planning (if the quarry is planned for project use).

Other more common invasive plant species are scattered throughout the planning area as well as adjacent county and private lands; St. Johnswort (*Hypericum perforatum*), Canada thistle (*Circium arvense*), and Bull thistle (*Circium vulgare*) can be found along most road corridors. Over the past 20 years biological control insects have been released in the East Fork Watershed by Hood River County Weed and Pest Control and ODA to help control these ubiquitous species.

Populations of the species listed above are within, or adjacent to, the planning area; all are listed on the Oregon noxious Weed Policy and Classification (Oregon Department of Agriculture 2015) and are B Listed weeds (weeds of economic abundance which are regionally abundant).Canada thistle, bull thistle, and St. John's-wort are widely established regionally and management objectives on the Mt. Hood National Forest are to control infestations on a case-by-case basis. Spotted knapweed and diffuse knapweed are widely established on the east side of the Mt. Hood National Forest and early detection followed by rapid response is coordinated annually with the ODA to check the spread of these species especially along road corridors and adjoining project activity areas and trails.

Invasive plant species in the planning area are briefly described below including their mode of establishment and the threat each species poses to native ecosystems and agricultural lands:

Bull thistle

A biennial weed with a short, fleshy taproot. It is common in areas with previous soil disturbance, including roadsides, forest plantations, old log deck landings, and manipulated openings in forests and grasslands. Present control efforts are limited to hand-pulling associated with specific site objectives or planning areas.

Mode of Establishment: Spreads by wind, animals, and vehicles.

Threats: This plant is a threat to agricultural lands and to native forest biodiversity.

Canada thistle

A perennial weed distributed on the west side of the Cascade Rangecrest in areas where previous soil disturbance has occurred (e.g., roadsides, timber harvest areas, forest plantations, forest openings, and meadows). It can also colonize areas with little or no disturbance such as dry or wet meadows. Canada thistle is difficult to eradicate because of its deep rhizomes (root system) and new plants can sprout from rhizomes even if all the above ground plants have been removed.

Mode of Establishment: Spreads asexually via rhizomes (underground stems) or by wind, animals, and vehicles.

Threats: This plant is a threat to agricultural lands and to native forest biodiversity.

Knapweed species

Knapweed species have been documented in concentrated and sparsely dispersed populations throughout the planning area. The tap-rooted plants displace native vegetation and can form dense populations. Population distributions are spotty on the west side of the Cascade Range crest (e.g., scattered along Highway 26), but on the east side they can form dense populations that exclude native shrubs, forbs, and grasses. A number of areas and Forest Service roads on the nearby Hood River Ranger District are infested with spotted, diffuse, and meadow knapweed.

Mode of Establishment: Spreads by seed. Dispersal distances for the seed are short; seeds generally fall within a 3-12 dm radius of the parent plant. Movement over greater distances requires transport by rodents, livestock, vehicles, or hay or commercial seed.

Threats: Displaces native vegetation.

St. John's-wort

Distributed across the Forest along road shoulders, in rock storage areas, in quarries, and in other areas of soil disturbance. Bio-control insects are well established and are the primary means of control on the Forest. Active management to control or eradicate an infestation occurs when there are overriding resource concerns.

Mode of Establishment: St. John‘s-wort establishes from seed that may be transported by vehicles carrying soil or plant parts.

Threats: St. John‘s-wort displaces native vegetation and can alter ecological functioning of native plant communities and biodiversity.

3.11.3 Effects Analysis

No Action Alternative

The Forest Service has limited influence on weed vectors (humans, vehicles, livestock, wildlife, wind, water, etc.). Vectors contributing to a *High Risk* rating would continue to be present throughout the planning area even if proposed project activities are not implemented. The Forest Service and Oregon Department of Agriculture Weed and Pest Control would continue to prioritize annual treatment of known invasive plant populations and new infestations in the planning area depending on species, location, and available funding sources.

Proposed Action Alternative

All proposed project activities, including associated vectors listed below in Table 3, have potential to spread or introduce invasive plants. Project Design Criteria associated with the Proposed Action would provide mitigation for the introduction and spread of invasive species through the cleaning of equipment, use of weed-free materials, and restoration with native seed. Known infestations would be treated prior to implementation.

Vegetation Treatments

Activities associated with logging (including log decks and equipment staging areas) have potential to spread or introduce invasive plants especially via machinery and equipment entering and leaving the planning area. The Proposed Action would involve cutting trees, temporary road building, and landing construction, which would cause a reduction in canopy and stems. This would provide favorable light conditions for invasive species establishment. Harvest activities, deep ripping, and grapple piling, could expose and compact soils which would provide a seedbed for invasive species establishment.

Conceivably, all the harvest treatment acres would become more susceptible to some degree of a weed establishment opportunity, as a result of this action. The level of disturbance activity also determines the risk of weed introduction and infestation. For example, the acres of ground based skid trails and landings would create highly disturbed ground leading to the best opportunity for weed establishment.

Fuel Treatments

Activities associated with fuels treatments have potential to spread or introduce invasive plants via machinery and equipment entering and leaving the planning area.

Road Treatments

Activities associated with road treatments have potential to spread or introduce invasive plants via machinery and equipment entering and leaving the planning area. Construction of new temporary roads would create exposed soil ideal for invasive plants. Long term monitoring and treatment of invasive plants could be complicated and expensive if invasive plants become established in units and areas around temporary roads after roads are closed.

Invasive plants could also be introduced and spread in rock/gravel used for road construction and road maintenance.

Noxious Weed Risk Assessment

The proposed projects have a **HIGH** risk of introducing or spreading known populations of noxious weeds. The process for risk ranking is detailed below.

Forest Service Manual (FSM) direction requires that Noxious Weed Risk Assessments be prepared for all projects involving ground-disturbing activities. For projects that have a moderate to high risk of introducing or spreading noxious weeds, Forest Service policy requires that decision documents must identify noxious weed control measures (Project Design Criteria – PDC's) that would be undertaken during project implementation (FSM 2081.03, 11/29/95). The identification of PDC's is also consistent with the Region 6 Invasive Plant EIS/ROD (2005) and the Site-Specific Invasive Plant Treatments for Mt. Hood National Forest and Columbia River Gorge National Scenic Area in Oregon EIS/ROD (2008).

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

Table 78. Risk Rating Factors and Vectors

Project: Polallie Cooper HFR	Factors	Vectors	Risk
No Action	A, C	5,6,7,8	High
Proposed Action	A, B, C	1,2,34,5,6,7,8	High

- Factors
  A. Invasive plants present in project vicinity and/or associated equipment haul routes.
  B. Proposed project activities within noxious weed population(s).
  C. Any of vectors 1-8 in planning area.

- Vectors
  1. Heavy equipment/machinery (on and off-road)
  2. Imported gravel/rock/soil/sand (for roads, culverts, trails, etc.)
  3. Imported mulch (straw, hay, wood chips)
  4. Nursery plants/tree seedlings (soil material)
  5. Grazing (range allotments)
  6. Recreationists (hikers, campers, equestrians/pack animals, mountain bikers) and trailers
  7. ATVs (all-terrain vehicles) and trailers
  8. Forest Service vehicles and trailers, contractor vehicles and trailers

High Risk: Factors A and C, or B and C.
Moderate Risk: Factor A and Vectors #1-5.
Low Risk: Factor A and Vectors #6-8 or known weeds within or adjacent to the planning area, without vector presence.

Cumulative Effects

Past, ongoing, and future activities have been analyzed for potential cumulative effects. Various project related activities, unrelated vehicular traffic, and recreational uses, over the years have contributed to the cumulative spread of invasive plants in the analysis area and East Fork Hood River watershed (timber harvests on federal, county and private lands, including associated road/landing construction; road construction and maintenance; Highway 35 road maintenance and sanding; developed and dispersed campsites; recreation trails).

Past, ongoing and future site-specific invasive plant treatment is also considered in this cumulative effects analysis. The Mt. Hood National Forest (in partnership with the ODA and Hood River County) has applied approved herbicides since 2008 and biological controls since 1995, to control high priority invasive plant populations in the East Fork watershed. Treatments are conducted annually and have been effective in slowing the cumulative spread and establishment of invasive plants. Implementation of PDC associated with the Proposed Action would contribute to this effort and reduce the risk of introducing and spreading invasive plants as a result of proposed project activities.

3.11.4 Consistency Determination

Forest Service policy, direction, guidelines, and Best Management Practices are intended to minimize and prevent the introduction and establishment of noxious weed infestations. The proposed project and Project Design Criteria for prevention and control of invasive species are consistent with the following:

Executive Order 13112 - Invasive Species

Directs Federal agencies to: (1) identify actions that may affect status of an invasive species; (2)(a) prevent introduction of such species; (b) detect and control such species; (c) monitor population of such species; (d) provide for restoration of native species; and (3) not authorize, fund, or carry out actions likely to cause the introduction or spread of invasive species in the United States or elsewhere unless the benefits of the action clearly outweigh the harm and the agencies take steps to minimize the harm.

Forest Service Policy

FSM 2900 (Invasive Species) directs the Forest Service to : 1) Identify the vectors, environmental factors, and pathways that favor the establishment and spread of invasive species in terrestrial areas in the National Forest System, and design management practices to reduce or mitigate the risk for introduction or spread of invasive species in those areas (FSM 2903.3); 2) Determine the risk of introducing, establishing, or spreading invasive species associated with any Proposed Action, as an integral component of project planning and analysis, and where necessary provide for alternatives or mitigation measures to reduce or eliminate that risk prior to project approval (FSM 2903.4); 3) Ensure that all management activities are designed to minimize or eliminate the possibility of establishment or spread of invasive species on the National Forest System, or to adjacent areas (FSM 2903.4).

FSM 2070.3 (Vegetation Ecology) directs the Forest Service to ensure genetically appropriate native plant materials are given primary consideration in areas that are identified for restoration.

Mt. Hood Forest Plan

FW-299: Noxious weed control projects shall comply with Invasive Species environmental assessments.

FW-300: Plants that have been identified as pests by the State Department of Agriculture shall be controlled as described in the Mt. Hood National Forest Noxious Weed Implementation Plan.

FW-301: Implementation of control measures should adhere to the following priorities: 1) Prevention, 2) Early detection and treatment, 3) Maintenance, 4) Correction.

2005 and 2008 Invasive Plant FEIS ROD Direction and Amendments

Region 6 completed a Final Environmental Impact Statement (FEIS) for Preventing and Managing Invasive Plants in April 2005. In 2008 the Mt. Hood National Forest and Columbia River Gorge National Scenic Area completed an EIS for Site-Specific Invasive Plant Treatments for Mt. Hood National Forest and Columbia River Gorge National Scenic Area in Oregon, including Forest Plan Amendment #16; the document authorizes herbicide use and an early detection/rapid response program.

Note: The US Fish and Wildlife Department Programmatic Biological Opinion for Aquatic Restoration Activities in the States of Oregon, Washington and portions of California, Idaho and Nevada (July 2013), section 33 Invasive Plant Control, supersedes the aquatic section of the 2008 Site-Specific EIS.

USDA Forest Service Guide to Noxious Weed Prevention Practices

Weed prevention practices (e.g. best management practices) are supported by Forest Service noxious weed policy and strategy. Prevention and control guidelines are listed in the Project Design Criteria.

3.11.5 Summary of Effects

No Action Alternative

Invasive plant vectors identified in Table 3 would continue and a *High Risk* ranking would remain the same as the High risk associated with the Proposed Action. Only some of the invasive plant infestations listed under Existing Conditions would continue to be targeted for future treatment by the Mt. Hood National Forest and/or Oregon Department of Agriculture as limited annual funding allows.

Proposed Action Alternative

The Proposed Action would have a high risk of weed introduction. The harvesting, fuel and road activities would create disturbed conditions for invasive species growth, and the equipment may introduce seeds or propagules from nearby roadside sources.

3.12 Recreation

3.12.1 Analysis Assumptions and Methodology

The following factors are being analyzed for the impacts the Proposed Action may have on recreation: the Recreation Opportunity Spectrum, developed recreation facilities, general dispersed recreation, trails, wild and scenic rivers and special use permits. Impacts to recreation have been reviewed on a case-by-case basis and described in more detail in the *Effects Analysis/Environmental Consequences* section of this report. The Shadow Model was used to determine the requisite amount of shade needed to protect the tread of the trails crossing through the planning area. This model is often used to determine the required amount of shade needed through riparian areas within vegetation projects. The purpose of the model is to determine the amount of shade required for a linear feature such as a stream or in this case, a trail, to maintain existing shadows and moisture levels pre and post treatment.

This report will also discuss potential Impacts to the Recreation Opportunity Spectrum (ROS). The ROS assists with the planning and management of recreation by arranging possible mixes or combinations of activities, settings, and probable experiences and opportunities along a spectrum or continuum. The seven classes along the continuum have been used in the Mount Hood Forest Plan to provide a framework for defining the types of outdoor recreation opportunities the public might desire as well as the types of recreation opportunities the Forest may be able to provide.

In the context of this analysis, the ROS settings within the planning area are examined to 1) identify the specific management objectives for each ROS setting and to then 2) determine whether the goals and objectives for each setting would be impacted by the Proposed Action (ROS Users Guide, 1982).

3.12.2 Existing Condition

A variety of recreational activities occur within the planning area. State Highway 35, a scenic byway, bisects the planning area. Cooper Spur Road, or Forest Road 3512, bisects the portion of the planning area west of Highway 35 and falls within scenic viewshed in the Forest Plan. Both roads offer scenic views and many people drive them for pleasure throughout the year. Forest Road 3512 also provides access to Cloud Cap Road, which is one of the most popular roads on the Mount Hood National Forest due to its terminus at Cloud Cap Inn, its access to several trails including the Timberline Trail, and the view of Mount Hood from the top of the road. There are numerous trailheads for popular non-motorized trails within the planning area. Recreation use is popular during both the summer and the winter. Groomed snowmobile routes and dispersed use are also prevalent within the planning area. Due to the variety of activities available, and its proximity to Hood River, a popular tourist destination, recreation as a whole consistently grows in this location annually.

The following existing conditions within the planning area will be examined: the Recreation Opportunity Spectrum, developed recreation facilities, general dispersed recreation, trails, wild and scenic rivers, and special use permits.

Recreation Opportunity Spectrum

The Polallie Cooper planning area falls within three Recreation Opportunity Spectrum (ROS) settings as identified in the Forest Plan: Semi-Primitive Non-Motorized, Roaded Natural, and Roaded Modified. These ROS settings provide for the following recreation experiences:

- **Semi-Primitive Non-Motorized:** Areas characterized by a predominantly natural or natural appearing environment; moderate-to-large size interaction is low but there is often evidence of other users. The area is managed in such a way that minimum on-site controls and restrictions may be present, but those controls are subtle. Motorized use is not permitted.

- **Roaded Natural:** Areas characterized by predominantly natural-appearing environments with moderate evidences of the sights and sounds of man. These evidences usually harmonize with the natural environment. Interaction between users may be low to moderate but with evidence of other users prevalent. Resource modification practices are evident but harmonize with the natural environment. Conventional motorized use is provided for in construction standards and the design of facilities.
- **Roaded Modified:** Areas that provide for a range of recreation experiences that are consistent with substantially modified, motorized settings in which the sights and sounds of humans are readily evident and the interaction between users can be from low to high. Recreation experiences and opportunities in these areas often depend on vehicular access off the primary routes via secondary roads. Camping experiences are relatively primitive, with few on-site facilities provided, requiring some self-reliance and use of primitive outdoor skills.

Developed Recreation Facilities

Developed recreation sites within the planning area include several trailheads, two campgrounds, five historic buildings, and Cooper Spur Ski Area. Trailheads include Dog River, Surveyors Ridge, Tilly Jane Trailhead and Snopark and Cloud Cap Trailhead. All three trailheads are day use areas and primary trailheads.

Dog River Trailhead is located along Highway 35 and Surveyors Ridge Trailhead is located along Forest Road 44. They provide designated parking, toilets, bulletin boards, trails, picnic tables, and interpretive and directional signing. They are both popular hiking and mountain biking trails.

The Cooper Spur Warming Shelter is a historic warming shelter near Forest Road 3512. The Shelter has been maintained in the past by the Oregon Nordic Club. A primitive trail accesses the hut, which is used by dispersed recreationists including hikers and cross-country skiers.

Dispersed Recreation Use

Dispersed recreation occurs throughout the planning area. Activities include driving for pleasure, hunting, camping, rock climbing, and ski-touring.

Driving for pleasure can occur on any open road within the planning area, but is most heavily concentrated along Highway 35, Forest Road 3512 (Cooper Spur Road), and Cloud Cap Road (also Forest Road 3512 after the gate adjacent to Tilly Jane Trailhead). Highway 35 is one of the most popular scenic routes on the Mount Hood National Forest. Forest Road 3512 (Cooper Spur Road) is very popular for drivers as well as road bikers, who enjoy the road which provides access from Highway 35 to Parkdale, which is North of the planning area. Cloud Cap Road accesses the Cloud Cap Cloud Cap-Tilly Jane Historic Area and leads to stunning views of Mount Hood.

Dispersed camping occurs in various locations throughout the planning area. Most dispersed camping occurs off of secondary routes within the planning area. Hunters utilize parts of the planning area and use dispersed campsites during hunting season.

There is a small climbing zone within the planning area. The area is called Pete’s Pile and is comprised of numerous routes. The majority of the routes require climbers to place their own gear, while others are bolted.

For the most part, ski touring occurs in the southwest portion of the planning area near the Tilly Jane Trail #643, Cloud Cap Inn, and the area burned by the Dollar Lake fire. These locations receive the most snowfall in the planning area and provide adequate slopes for people to tour up and ski down. Depending on snow levels, ski touring could occur in other locations within the planning area. The area burned by the

Dollar Lake Fire has no overstory, and receives a lot of snow most years making some of the steeper aspects desirable for some skiers.

Trails

System trails within the planning area are designed for non-motorized use. These trails are close to the City of Hood River and relatively close to Portland and draw large numbers of visitors annually. Tamanawas Falls, Dog River, and Tilly Jane trails are some of the most popular trails on the Hood River Ranger District. A portion of these trails are maintained by District trail crews, but they are also maintained by multiple volunteer groups, who assist with needs such as log out, brushing, and tread work.

Table 79. Trails Crossing the Planning area

Trail Name and Number	Permitted Use	Length (Miles)
Tilly Jane 643	Pack and Saddle, Hiking, Cross-country ski	3
Bluegrass Ridge 647	Pack and Saddle, Hiking	5.7
Zigzag Vista 678A	Bike, Hike	.2
Zizag 678	Bike, Hike	1.85
Wagon Road 642	Cross-country ski	2.5
Elk Meadows 645	Pack and Saddle, Hike	9.43
East Fork 650	Bike, Hike	6.2
Dog River 675*	Bike, Hike	5.3
Tamanawas Tie 650A	Hike	.4
Tamanawas Falls 650B**	Hike	1.4

**Very popular for hikers and mountain bikers*
***One of the most popular trails on the Hood River Ranger District*

In addition to the trails listed above, groomed snowmobile routes are located within the planning area. These routes are roads in the summer, but become part of a system of snowmobile trails during the winter. Forest Road 44 is a groomed route that accesses the planning area and Forest Roads 1700680 is a groomed route bordering the east side of the planning area. Snowmobiles are permitted for cross-country travel on National Forest Lands, except where they are specifically prohibited as well as wilderness areas.

User-created trails are also found in locations within the planning area, especially in areas bordering private homes. These trails are not condoned or maintained by the Forest Service, but they are a method some individuals access the National Forest.

Wild and Scenic Rivers

East Fork Hood River is a designated wild and scenic river which flows through the planning area. The Omnibus Public Land Management Act of 2009 designated 13.5 miles of the river from State Highway 35 to the Mount Hood National Forest Boundary. This Wild and Scenic River corridor is administered by the Secretary of Agriculture as a recreational river. Under the Forest Plan, this land is designated as B1 – Designated Wild, Scenic, and Recreational Rivers lands. The goal for B1 lands is to protect and enhance the resource values for which a river was designated into the Wild and Scenic River System, to provide opportunities for recreation activities, and to maintain the visual quality of river corridors.

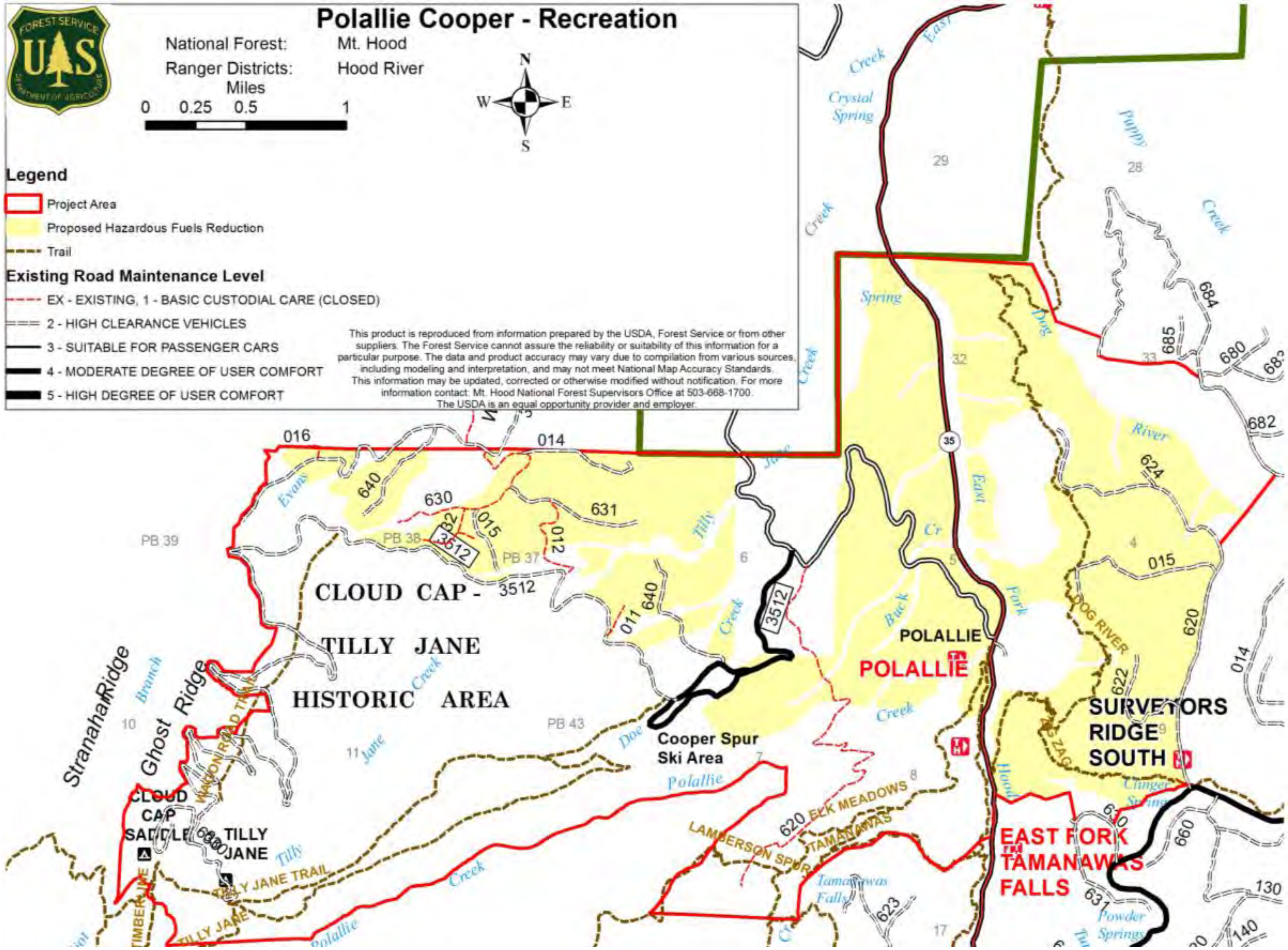


Figure 53. Map of Recreation Trails, Trailheads and Campgrounds in the Planning Area

Designated Wild and Scenic Rivers are evaluated to identify and protect their Outstanding and Remarkable Values (ORVs). Geologic/Hydrologic ORVs have been identified for East Fork Hood River. The East Fork flows along the edge of a complex series of glacially and fluvial derived deposits before entering a narrower bedrock canyon. Recent debris flows from Newton, Clark and Polallie Creek drainages continue to shape the valley floor and influence the river's free-flowing nature. These attributes are deemed ORVs because they are an easily observable example of active glacial and geologic processes at the national level.

Special Use Permits

There are several recreation-related special use permits issued within the planning area. Tilly Jane A-Frame, Cloud Cap Inn, the Snowshoe Club Cabin and the concessionaire campgrounds were mentioned under Developed Recreation Facilities. The Dog River Super D is a popular mountain bike race that occurs on Dog River Trail each May. The two day event is held at the Dog River Trailhead. Racers are shuttled to the top of Dog River Trail and race to the bottom.

3.12.3 Effects Analysis

No Action Alternative

There would be no direct or indirect effects from the No Action Alternative. Taking No Action would not create any impact to the ROS spectrum, developed or dispersed recreation use, trails, wild and scenic rivers, or special use permits.

Concurrently, no actions would be taken to help reduce the risk of large stand replacing fire at a landscape scale. Vegetation health, growth and vigor would continue to decline on dense stands of moist mixed conifer and dry mixed conifer. Over time, there would be an increased risk of loss of recreation opportunity to fire by not treating dense vegetation and fuel within the planning area.

If this were to occur there would be a direct impact on all recreation-related items discussed. Lands within the B2, scenic viewshed, would be especially impacted. Stand replacing wildfire would prevent lands within the scenic viewshed from meeting Forest Plan Standards for an extended period of time. Furthermore, trails or portions of trails could be closed due to overhead hazards from dead snags, and recreation facilities could be lost.

Proposed Action Alternative

Various treatments are planned throughout the planning area. By reducing the risk of stand-replacing wildfire, and improving the health of the surrounding vegetation, the treatments would have a long-term benefit to recreation within the planning area. All project design criteria listed in Section 2.3 would be used to mitigate impacts to recreation during and after project implementation:

Recreation Opportunity Spectrum

Alternative 2 would not lead to measurable impacts to the ROS classes within the planning area.

Semi-Primitive Non-Motorized: No treatments are prescribed for lands classified as Semi-primitive non-motorized. Land within this ROS class would continue to be managed as a predominantly natural or natural appearing environment. Treatments are prescribed for some lands adjacent to the planning area, but the treatments would not have a negative impact to the ROS setting.

Roaded Natural: Various treatments are proposed within the planning area for lands designated as Roaded Natural. Proposed treatments would not preclude these lands from meeting their ROS classification as treatments are designed to move all of the planning area towards historical vegetation conditions. Project designs would minimize unnatural-appearing effects such as landings and piles near recreation facilities, trails, and roads. Modification practices would harmonize with the natural environment over time, making the practices themselves unnoticeable.

Roaded Modified: Various treatments are proposed throughout the Roaded Modified land base as well. Treatments would fit within the parameters of this ROS setting, which allows for recreation experience consistent with modified, motorized settings. These settings would not be changed by treatments to reduce fuel loading. Treatments could lead to temporary road closures in some locations, but such closures would be minimal and of short duration.

Developed Recreation Facilities

Treatments are planned near some sites within the planning area, while other sites are not within proposed treatment areas. Treatment activities near developed recreation sites would be beneficial in the long term as they would reduce the risk of catastrophic wildfires and improve the health of the surrounding vegetation.

There are no proposed treatments within the A4, Special Interest Area Land Use Allocation or the Cloud Cap-Tilly Jane Historic Area. There would be no treatments overlapping with or adjacent to Tilly Jane A-Frame, Tilly Jane Guard Station, Tilly Jane Campground, Cloud Cap Campground, Cloud Cap Saddle Trailhead, Cloud Cap Inn, or the Snowshoe Club cabin. Due to the lack of proposed activities in these locations, Alternative 2 would have no direct or indirect impact on these recreation facilities.

Treatments are proposed for the land adjacent to Dog River, Surveyors Ridge and Tilly Jane Trailheads. Treatments themselves would protect these trailheads in the long term by reducing fuel loading and risk of wildfire that could obliterate the infrastructure at the trailheads and create hazards along the trail system.

These trailheads would be closed to protect public safety for certain periods during project implementation. Trail and trailhead closures would inconvenience users in the short term. In the long term the trailheads would be useable with no major changes other than short term aesthetic changes from vegetative treatments and burning. Project design criteria require coordination with the trails manager to alert the public prior to activities and closures before they occur. Design criteria also address rehabilitation to Surveyors Ridge Trailhead which would be bisected by a haul route and used as a landing during project implementation. The trailhead would be fully restored to existing conditions at the conclusion of project activities.

Treatment activities are prescribed for the lands adjacent to Cooper Spur Warming Shelter. The warming shelter would not be accessible during harvest and fuel activities, and the user-created trail accessing the shelter would be used as a haul route. The shelter itself would not be impacted by treatment activities other than impacts to the surrounding vegetation, which would protect the structure from wildfire.

Treatment would occur on a small portion of land within the Cooper Spur Ski Area permit boundary. Treatment would also occur adjacent to the ski area boundary. Treatments would not occur during ski area operations. These activities would protect the ski area infrastructure from wildfire.

Dispersed Recreation Use

Treatments could have direct and indirect effects on dispersed recreation use. In general dispersed use would be temporarily disrupted. For the most part, this disruption would only occur during treatment operations.

Direct impacts to driving for pleasure would occur during treatment activities. Highway 35 may be temporarily closed or have short waiting times and shuttle cars during helicopter logging operations along the Highway 35 corridor. In addition, traffic control measures could be used along Cooper Spur Road

(Forest Road 3512) which also accesses Cloud Cap Road. Hauling would occur along Highway 35, Forest Road 3512 and Forest Road 44, which accesses the planning area. During hauling, recreationists may encounter log trucks along these roads.

In the long term, the views along Highway 35 and Forest Road 3512 would change. Short-term effects during project implementation would result from opening up stands. Design criteria such as ensuring that landings, piles and skyline corridors are not visible from these critical viewpoints (Highway 35 and recreation sites along Highway 35) would make these treatments less visible to the viewer, especially within one to two years after treatment is completed. Long-term effects from proposed treatments would become less noticeable due to natural changes in the landscape over time such as vegetative growth. After treatment, drivers would encounter more open stands of ponderosa pine, Douglas fir and larch.

Dispersed camping occurs in various locations within the planning area. This activity would be impacted during treatment when dispersed campsites may not be accessible. There is also potential for dispersed campsites to be destroyed if they are used as landings.

Climbers' access to Pete's Pile could be disrupted during treatment. This disruption would be temporary and conclude once treatment in this zone is complete. There would be no direct impact to the climbing routes and the site would remain at the conclusion of treatment activities.

Impacts to ski touring would be negligible. No treatment activities are proposed for the most popular locations for ski touring, which are within the Cloud Cap-Tilly Jane Historic Area. Ski touring could occur in other locations of the planning area, but are less likely due to slope angle and elevation. If they were displaced by treatments, it would be for a short duration, and treatment areas could improve conditions for ski touring by providing larger glades and openings for skiers.

Trails

Multiple trails cross the planning area (Table 79). Several trails are located within the planning area but are not within or adjacent to treatment areas. The proposed treatment activities would have no direct or indirect effects on these trails (Tilly Jane 643, Bluegrass Ridge 647, Wagon Road 642, Elk Meadows 645, Tamanawas Tie 650A and Tamanawas Falls 650B).

A number of trails are within planned units (Zigzag Vista 678A, Zigzag 678, East Fork 650, and Dog River 675). For public safety, project design features require closing of trails during operations. Project design criteria require coordination with the trails manager on public information materials and outreach using a combination of key entry/exit portals, visitor information boards and outreach to notify recreationists ahead of time of trail closures.

The Shadow Model was used to determine the requisite amount of shade needed to protect the tread of the trails crossing through the planning area from increases in solar heating. This model is often used to determine the required amount of shade needed through riparian areas within vegetation projects. The purpose of the model is to determine the amount of shade required for a linear feature such as a stream or in this case, a trail, to maintain existing shadows and moisture levels pre and post treatment. Utilizing this model, design criteria ensure that all trails within treatment units would have a 55 foot shade buffer on either side the trail (US Forest Service and Bureau of Land Management 2012). Inside the buffer all overstory and all class 4 and 5 fuel would be retained in order to maintain the current visual integrity and existing shade along the trail corridors. There would be no ground-based yarding within the 55 foot buffer. Class 4 and 5 fuel would also be retained to help maintain moisture levels adjacent to the trail and maintain scenic quality. The composition of class 4 and 5 fuel is defined in the Fuels Report.

Trail closures would displace some recreationists to other locations during operations. These closures would inconvenience users in the short term. In the long term trails would be useable with no other changes than aesthetic changes resulting from vegetative treatments and burning. These changes would include longer site distances due to openings in stands. Once treatments are concluded no landings or skyline corridors would be visible from trails. Slash Piles would be visually subordinate within shade buffers.

Wild and Scenic Rivers

The proposed treatment activities would have no direct effect on the Outstanding and Remarkable Values identified for the East Fork Hood River. The geology and hydrology of the river would not be impacted by treatments, and there would be no negative impact to recreational opportunities within the Wild and Scenic River Corridor.

Special Use Permits

The proposed treatment activities would have no impact on special use permits for Tilly Jane A-Frame, Cloud Cap Inn, the Snowshoe Club Cabin or the concessionaire campgrounds and these facilities are located within areas that are not proposed for treatment.

The Dog River Super D Recreation Event may be impacted by the proposed activities. During treatment Dog River Trail (675) would be closed to public use. If treatment activities began and had not yet concluded prior to the race, it would have to be canceled for a season. This could be a financial hardship on the event coordinator and an inconvenience for racers who enjoy this event annually. The event coordinator would be informed a season prior to the race that this was a possibility so that other arrangements could be made to hold the event elsewhere and the cancellation of the event could be communicated with potential participants.

Cumulative Effects

The items documented in Table 80 were considered when analyzing cumulative effects for recreation. These items were analyzed as a result of their proximity to the planning area and their potential to have an effect on recreation within the planning area. The spatial context of the cumulative effects analysis lies within the planning area itself. While closures of trails and trailheads as well as impacts to roads could displace recreation use within the planning area during project implementation, this displacement would not be measurable, and the adjacent recreation sites have the capacity to absorb this displacement.

Under Alternative 2, the Proposed Action, these items could have an impact on the planning area. Combined with the Proposed Action, these actions would not deviate from Forest Plan standards.

3.12.4 Consistency Determination

The Polallie Cooper Hazardous Fuels Reduction Project, combined with the Project Design Criteria outlined in Section 2.3 is consistent with the four primary Forest Plan land allocations within the planning area are Scenic Viewshed (B2), Winter Recreation Area (A11), Special Interest Area (A4), and Wood Product Emphasis (C1). Designated Wild and Scenic Rivers (B1) and Special Interest Areas (A4) are also analyzed. Please see the Recreation Specialist Report for the full analysis of Forest Plan consistency.

Table 80. Cumulative Effects to Recreation

Project	Potential Effects	Overlap in Time	Overlap in Space	Measurable Cumulative Effect?	Extent, Detectable?
Ongoing road and trail maintenance	ROS	No	No	No	No cumulative effects would occur. Trails would be closed and some minor impacts may occur to trail tread during implementation, but project design criteria would mitigate any cumulative long term impacts after the project was complete.
	Developed Facilities	No	No	No	
	Dispersed Use	No	No	No	
	Trails	Yes	Yes	No	
	Wild and Scenic Rivers	No	No	No	
	Special Use Permits	No	No	No	
Dog River Pipeline replacement	ROS	No	No	No	No cumulative effects would occur.
	Developed Facilities	No	No	No	
	Dispersed Use	No	No	No	
	Trails	No	No	No	
	Wild and Scenic Rivers	No	No	No	
	Special Use Permits	No	No	No	
Tilly Jane Hazardous Fuels Reduction	ROS	No	Yes	No	No cumulative effects would occur. The planning areas overlap, but the Tilly Jane Hazardous Fuels treatment location would not overlap with any proposed treatment units within the planning area.
	Developed Facilities	No	Yes	No	
	Dispersed Use	No	Yes	No	
	Trails	No	Yes	No	
	Wild and Scenic Rivers	No	No	No	

Project	Potential Effects	Overlap in Time	Overlap in Space	Measurable Cumulative Effect?	Extent, Detectable?
	Special Use Permits	No	Yes	No	
2006 Debris Flow in the Middle Fork Hood River	ROS	No	No	No	No cumulative effects would occur. A portion of the East Fork trail was lost during the 2006 debris flow. This portion of the trail may be addressed under a separate analysis. Any impacts to the existing trail during implementation would be mitigated by project design criteria protecting trail tread and visuals. The East Fork Hood River was impacted by the 2006 Debris Flow, but it did not have a negative impact on its outstanding and remarkable values. Similarly, the proposed project would not have a negative impact on these values.
	Developed Facilities	No	No	No	
	Dispersed Use	No	No	No	
	Trails	No	Yes	No	
	Wild and Scenic Rivers	No	Yes	No	
	Special Use Permits	No	No	No	
Dollar Lake Fire, including burn area rehabilitation	ROS	No	Yes	No	No cumulative effects would occur. The Dollar Lake Fire burn area falls within the planning area, but does not have an impact on the ROS setting. The Wagon Road cross-country ski trail meanders through the burn area and dispersed use could occur within this area, There are no proposed treatments within these areas. Impacts to these activities have already occurred.
	Developed Facilities	No	No	No	
	Dispersed Use	No	Yes	No	
	Trails	No	Yes	No	
	Wild and Scenic Rivers	No	No	No	
	Special Use Permits	No	No	No	
Road decommissioning and road closures	ROS	No	No	No	No cumulative effects would occur. Road closures within and adjacent to the planning area could eliminate access to dispersed camp sites and other dispersed recreation use like berry picking. There are already a minimal number of roads in the vicinity. Any closures would be minimal and would have a small impact on access for dispersed recreation.
	Developed Facilities	No	No	No	
	Dispersed Use	No	Yes	No	
	Trails	No	No	No	
	Wild and Scenic Rivers	No	No	No	
	Special Use Permits	No	No	No	

Project	Potential Effects	Overlap in Time	Overlap in Space	Measurable Cumulative Effect?	Extent, Detectable?
Cloud Cap Hazard Tree Removal	ROS	No	Yes	No	No cumulative effects would occur. Dispersed use could occur within this area, but it would be very limited as hazard tree removal only impacted trees that could hit the Cloud Cap Road. There are no proposed treatments within these areas. Impacts to these activities have already occurred.
	Developed Facilities	No	No	No	
	Dispersed Use	No	Yes	No	
	Trails	No	No	No	
	Wild and Scenic Rivers	No	No	No	
	Special Use Permits	No	No	No	
Crystal Springs Watershed Special Resources Management Unit and Crystal Springs Zone of Contribution	ROS	No	No	No	No cumulative effects would occur.
	Developed Facilities	No	No	No	
	Dispersed Use	No	No	No	
	Trails	No	No	No	
	Wild and Scenic Rivers	No	No	No	
	Special Use Permits	No	No	No	
Future Hazard Tree Harvest Along Roads and Trails	ROS	No	No	No	Over time, potential hazard tree harvest along roads and trails could open up scenic views within the planning area. This could improve views of Mount Hood as well as other unique natural features within the planning area.
	Developed Facilities	No	No	No	
	Dispersed Use	No	No	No	
	Trails	No	Yes	No	
	Wild and Scenic Rivers	No	No	No	
	Special Use Permits	No	No	No	

3.12.5 Summary of Effects by Alternative

ROS

There would be no direct effects to the three ROS settings identified within the planning area under Alternative 1 or Alternative 2. Regardless of the course of action, the ROS settings would remain the same, and recreational opportunities within the settings would remain the same.

Developed Recreation Facilities

Alternative 1, the No Action alternative, would not have an impact on the developed recreation facilities within the planning area. Under Alternative 2, the Proposed Action, several trailheads could be impacted. Dog River and Surveyor's Ridge Trailheads would be closed temporarily. Vegetation around these trailheads as well as Tilly Jane Trailhead would be thinned and more open, making the environment around the trailheads more open. During treatment Cooper Spur Warming Hut could be inaccessible, and the vegetation around the facility would be thinned, but it would be accessible once treatment was complete in the surrounding area. Treatments would also occur within the Cooper Spur Ski Area boundary, but not during winter operations. The most direct impacts of these activities would inconvenience recreationists during implementation. Once complete, all of these facilities would become accessible again and they would be better protected from wildfire.

Dispersed Recreation Use

There would be no direct or indirect effects to dispersed recreation under Alternative 1. Under Alternative 2, driving for pleasure could be impacted in the short term, during implementation by temporary road closures or traffic controls and some minimal sights of treatment activities. Once activities are complete, some views would be more open similar to historic vegetation conditions in the area. Over the long term, this would be a benefit as the area would be less susceptible to large-scale wildfire. There could also be some direct effects to dispersed campsites if they happen to be in spots where landings are located. These sites could be obliterated and access to dispersed sites could be blocked during project implementation. Access to dispersed climbing and ski touring could also potentially be impacted during project implementation, but would be restored once treatment activities were complete.

Trails

Alternative 1 would not have an impact on the trails within the planning area. Alternative 2 would impact trails intersecting with treatment areas. During treatments, these trails would be closed to public use. Signs at trailheads and trail intersections as well as other venues of public information would be utilized to notify recreationists of closures ahead of time. Shade buffers would be applied to all trails within the planning area to protect trail tread and visuals. Visual quality design criteria would also be utilized to protect scenic values along trails. In the short term, trail closures would be an inconvenience to recreationists and could displace use to other areas nearby. In the long term, treatments would protect the trail corridors from large-scale wildfire and enhance views in scenic areas.

Wild and Scenic Rivers

There would be no direct or indirect effects to the wild and scenic qualities of the East Fork Hood River under the No Action Alternative or the Proposed Action Alternative. Neither alternative would impact the geologic or hydrologic values or recreational opportunities along the Wild and Scenic River Corridor.

Special Use Permits

There would be no impact to special use permits under Alternative 1. Alternative 2 could have an impact on the Dog River Super D bike race during treatment activities. If Dog River Trail 675 was closed during the timeframe that the race was to take place, it would need to be canceled or relocated for a season. After completion of treatments, the trail would be open again and the race could occur.

3.13 Visual Quality

3.13.1 Analysis Assumptions and Methodology

The Mount Hood National Forest Land and Resource Management Plan (1990) recognizes the Visual Management System (USDA Handbook 462) to protect and enhance scenic resources. This analysis utilizes the Visual Management System which uses Visual Quality Objectives, to provide measurable standards or objectives for the visual management of National Forest Lands. In addition, the State Highway 35 Viewshed Management Guide was utilized to guide the scenic resource objectives where the planning area can be viewed along the Highway 35 corridor. The balance between social (human) and ecological (natural) needs within the planning area are also taken into consideration in this analysis.

The majority of the planning area falls within Scenic Viewshed. The following critical viewpoints will be discussed within the viewshed: views from Highway 35 and Highway 35 recreation sites as well as views from Forest Road 3512 within the A11 land use allocation as discussed in the Forest Plan. Views from Dog River Trail and the entire stretch of Forest Road 3512 (Cooper Spur Road) are also considered as they are discussed in the “State Highway 35 Viewshed Management Guide” (Burns 1991).

Visual Resource Management for lands classified as B2 (Scenic Viewshed) is defined as allowing management activities to create and maintain a long term desired landscape character. A Visual Quality Objective (VQO) of Retention is prescribed for up to 0.5 miles from designated viewpoints along travel ways, waterbodies or public use areas. A11 lands (Winter Recreation Areas) have a VQO of Partial Retention for up to 0.5 miles from travel ways, water bodies or public use areas. C1 (Timber Emphasis) is defined as allowing management activities with a Visual Quality Objective (VQO) of Modification as viewed from open roads.

The visual dominance of management activities vary depending on the VQO prescribed for each land use allocation. The VQOs for each management area and management goals for these land use allocations would be discussed in further detail in the existing condition portion of this report.

3.13.2 Existing Condition

Scenic views vary along the critical viewpoints within the planning area. According to the Forest Plan, critical viewpoints include Highway 35 and recreation sites along Highway 35 within the Scenic Byway and Forest Road 3512 within the A11 land use allocation. Dog River Trail is also considered an important viewpoint in the State Highway 35 Viewshed Management Guide. Views of Mount Hood can be seen from various locations along Dog River Trail. Within the planning area, open ponderosa pine stands dominate South facing slopes, with dense stands of fir dominating the western side of Highway 35. This segment of Highway 35 is characterized by rugged, canyon landscape with rock outcrops. The East Fork of the Hood River, a designated Wild and Scenic River, can be seen from Highway 35 as well. The segment of the highway bisecting the planning area is unique as it is the only portion of the “Mount Hood Loop” road system including portions of Highway 26 and Interstate 84, where ponderosa pine forest can be seen (Burns 1991).

Land Management Allocations within the Planning area

Table 81 below describes the Forest Plan land allocations located within the project boundary and their respective VQOs. The VQOs associated with these land allocations represent the minimum level of visual quality that should be achieved in terms of long term visual resource management.

Table 81. Forest Plan Land Use Allocation and Visual Quality Objectives

Management Area	Percentage of Planning area	VQO Foreground	VQO Middleground	VQO Background
Scenic Viewshed (B2)	44	R	PR	PR
Winter Recreation Area (A11)	19	PR	PR	PR
Special Interest Area (A4)	16	R	PR	PR
Wood Product Emphasis (C1)	6	M	M	M
Deer Winter Range (B10)	<1	M	M	M
Wild and Scenic River Corridor (B1)	14	PR	PR	PR
Pileated Woodpecker/Pine Martin Habitat Area (B5)	<1	M	M	M

Forest Service direction provides the following definitions of the Visual Quality Objective (VQO) categories (Agriculture Handbook 462):

- Preservation (P) – This VQO allows ecological changes only. This objective applies to Wilderness areas, primitive areas and other special classified areas awaiting designation.
- Retention (R) – This VQO provides for management activities which are not visually evident. Under Retention activities may only repeat form, line color and texture which are frequently found in the characteristic landscape.
- Partial Retention (PR) – Management activities remain visually subordinate to the characteristic landscape. Activities may repeat or introduce form, line, color, or texture common to the characteristic landscape but and may change in their qualities of size, amount, intensity, direction, pattern, etc., so long as they remain visually subordinate to the characteristic landscape.
- Modification (M) - Under the modification VQO management activities may visually dominate the original characteristic landscape however, they should borrow from naturally established form, line, color and texture so completely and at such a scale that the visual characteristics are compatible with the natural surroundings.

Distance zones are classified as foreground, middleground, and background:

- Foreground – 0 to 1/2 mile from viewpoint
- Middleground – ½ mile to 5 miles from viewpoint
- Background – Beyond 5 miles from viewpoint

The 58% of the planning area located within Scenic Viewshed (B2) falls within the “Highway 35 North of Bennett Pass” viewshed in the Mount Hood National Forest Plan. Viewer position within this viewshed is considered from Highway 35 and the recreation sites within the viewshed. The remaining portion of the viewshed is located along 3512 and secondary access roads throughout the planning area. Visual quality objectives of retention must be met for foreground from viewer positions along Highway 35, and Highway 35 recreation sites. Partial Retention must be met for middleground and background.

A portion of the Scenic Viewshed is included in the “State Highway 35 Viewshed Management Guide” in Design Cell #18 Narrows. Scenic Resource objectives for this portion of the Guide include retaining the diversity of cover types, perpetuating large yellow barked pine in foreground as long as possible, increasing larch where feasible to enhance fall color, promoting ground cover and within-stand age class diversity, and using fire to promote pine regeneration.

A4 Special Interest Area is located along the southwest portion of the planning area. The Tilly Jane Cloud Cap Historic District makes up 15% of the planning area. The Tilly Jane Trail (643) is located within this land management unit. Similar to the scenic viewshed, this land management area has a visual quality objective of Retention for foreground and middleground and background visual quality objectives of Partial Retention.

Winter Recreation Area or A11 makes up 18% of the planning area. This land allocation is located within the Cooper Spur Ski Area boundary and has visual quality objectives of partial retention. Both the A11 and A4 lands fall within the western portion of the planning area. This portion of the planning area is characterized by dense stands of fir. According to the Forest Plan, a VQO of Retention must be met from Forest Road 3512 in A11 lands. In other locations, within the planning area A11 lands have a VQO of Partial Retention for foreground, middleground, and background.

Less than 1% of the planning area is classified as B1, Designated Wild and Scenic Rivers. The East Fork of Hood River flows through the planning area. Management of designated Wild and Scenic Rivers must protect the river's free-flowing quality and must protect or enhance the river's outstanding and remarkable values (ORVs). Geologic/Hydrologic values have been identified as the ORV for the East Fork Hood River due to the river's location; it is a relatively observable example of active glacial and geologic processes at the national level. The river is designated as recreational and has a visual quality objective of Partial Retention as seen from the river, river banks, and state highway within the B1 river corridor.

Trails within the Planning area

Multiple Trails are located entirely within the planning area or intersect with the planning area. Table 82 below lists the trails that cross the planning area as well as their visual sensitivity levels. The Mount Hood National Forest Plan classifies trails as sensitivity levels I, II or III. Within these sensitivity levels visual quality objectives are prescribed for foreground, far foreground, and middleground. The distance zones for trails are as follows:

- Near Foreground – 660 from each side of the trail unless screened by topography
- Far Foreground – 660 beyond the first 660 feet
- Middleground – Anything visible beyond 1,320 feet from each side of the trail

Table 82. Designated Trails Intersecting with the Polallie Cooper Planning area

Trail Name and Number	Sensitivity Level	Near Foreground	Far Foreground	Middleground
Tilly Jane 643	I	Retention (R)	Partial Retention (PR)	Modification (M)
Bluegrass Ridge 647	I	Retention (R)	Partial Retention (PR)	Modification (M)
Zigzag Vista 678A	II	Partial Retention (PR)	Modification (M)	Modification (M)
Zizag 678	II	Partial Retention (PR)	Modification (M)	Modification (M)
Wagon Road 642	I	Retention (R)	Partial Retention (PR)	Modification (M)
Elk Meadows 645	I	Retention (R)	Partial Retention (PR)	Modification (M)

Trail Name and Number	Sensitivity Level	Near Foreground	Far Foreground	Middleground
East Fork 650	II	Partial Retention (PR)	Modification (M)	Modification (M)
Dog River 675	II	Partial Retention (PR)	Modification (M)	Modification (M)
Tamanawas Tie 650A	II	Partial Retention (PR)	Modification (M)	Modification (M)
Tamanawas Falls 650B	II	Partial Retention (PR)	Modification (M)	Modification (M)

3.13.3 Effects Analysis

No Action Alternative

Under the No Action alternative there would be no long-term vegetation management for the existing vegetation conditions within the planning area. Natural and ecological processes, such as insect and disease, wind and snow damage, and dead and down tree accumulations would continue and would be exacerbated by continued fire suppression. No actions would be taken to help reduce the risk of large stand replacing fire at a landscape scale. Vegetation health, growth and vigor would continue to decline on dense stands of moist mixed conifer and dry mixed conifer.

Vegetation within the planning area is dependent on aspect and fire history. Goals of the Forest Plan and State Highway 35 Viewshed Management Guide are to emphasize large ponderosa pine in areas where this is a feasible seral stage, promote ground cover, and shrubs and within-stand age class diversity, and use fire to promote pine regeneration. The Mount Hood National Forest LRMP objectives and Desired Future Condition for Scenic Viewshed (B2), Foreground and State Highway 35 Viewshed Management Guide are not expected to be met.

Proposed Action Alternative

Short-term effects from critical viewpoints within the scenic byway (B2), including Highway 35, and recreation sites along Highway 35, would result from opening up stands. Design criteria such as ensuring that landings, piles and skyline corridors are not visible from these viewpoints would make these treatments less visible to the viewer, especially within one to two years after treatment is completed. Long-term effects from proposed treatments would become less noticeable due to natural changes in the landscape over time such as vegetative growth.

The largest potential for negative effects on scenery generated by the proposed activities may be from the combination of logging disturbance and fuel treatment activities. Logging of green trees, as well as prescribed burning and mowing, may reduce scenic quality and recreation experience during the short-term (less than 5 years). During the peak recreation season between May and October logging activities may reduce or impede recreation access and experience in specific locations such as along trails within the proposed treatment units.

Considerable change can take place within areas designated under the Retention Visual Quality Objective if the change achieves desirable variety and follows principles of landscape design including the proper scale and arrangement of elements. By manipulating the edges, shapes and scales of treatment units as well as their distribution over space, positive elements of the landscape can be emphasized such as views of Mount Hood from trails within the planning area and views of large, mature ponderosa pine and Douglas fir from Highway 35 (Bacon and Twombly 1977).

More specifically, within dry mixed conifer treatment stands, negative perceptions of treatment activities typically arise from slash, skid roads, and disturbed soil. These items must be completely obscured from critical viewpoints within the planning area where visual quality objectives of Retention are prescribed. In most other locations, Partial Retentions is prescribed for the foreground along trails and the remaining land base that would be treated. Here management activities would need to remain visually subordinate to viewers. To attain these requirements, treatments would be designed to create irregularly appearing openings in stands, promote small-scale diversity, and retain large yellow-bark ponderosa pine. Within moist mixed conifer, treatments would be designed to soften unnatural edges and blend with landforms and natural openings in the middleground. Treatments would be designed to minimize views of slash, skid roads, and disturbed soils (Bacon ad Twombly 1977).

To minimize short-term effects on scenic views, the majority of units visible from Highway 35 would be helicopter logged ensuring that corridors and piles would not be visible from the highway. Units utilizing skyline and ground-based techniques adjacent to Forest Road 3512 would create corridors perpendicular to the roadway so they would not be visible to viewers from the road. Corridor widths themselves would be smaller than the desired gaps proposed for treatments adjacent to these veiwpoints. Trails within the planning area would be buffered to minimize visual impacts of management activities. All design criteria listed in Section 2.3 would be implemented to minimize the visual impacts and ensure compliance with the Forest Plan, as amended.

The proposed treatment activities with the design criteria would meet the prescribed visual quality objectives within the planning area. Outside of the scenic viewshed (B2), the treatment units within the planning area have a foreground requirement of partial retention except for C1, which has visual quality objectives of Modification for all distance zones and A4, which has a foreground requirement of Retention and a middleground requirement of Partial Retention. No treatment would occur within A4, Special Interest Area or A11, Winter Recreation Area. Treatment would not occur in the near foreground or foreground views of Sensitivity Level 1 trails. Treatment would occur within the foreground of sensitivity level II trails, but the mitigations would ensure there would be minimal visual impact to viewers within the trail corridor.

Compared to Alternative 1, the Proposed Action would reduce fuel loading, create defensible space in communities throughout the WUI, and improve and enhance naturally appearing landscape characteristics and scenic quality. Reintroduction of fuel management into the planning area is a step towards restoring the ecosystem's natural processes. At times ecologically healthy ecosystems and the processes that sustain them are not perceived as aesthetically pleasing or good management. Significant predictors of negative perceptions of scenic quality include residual woody debris such as slash piles and visual tree stumps from timber harvest. Post-harvest cleanup of these activities are crucial to enhance and maintain positive scenic quality. Short-term scenic impacts must be weighed against other management objectives (Ryan 2005).

Under this alternative, visuals throughout the planning area are expected to move towards desired conditions. Long-term enhancement of landscape character, scenic quality and visual quality objectives are expected while meeting guidelines set forth in the Mount Hood National Forest LRMP. Proposed activities would make stands within the planning area more resilient to large scale disturbance which is widely perceived negatively. Fuel treatments would also enhance views of Mount Hood as well as large, yellow bark ponderosa pine within the planning area.

Cumulative Effects

The items documented in Table 83 were considered when analyzing cumulative effects for visual quality. These items were analyzed as a result of their proximity to the planning area and their potential to have an effect on visual quality within the planning area. The spatial context of the cumulative effects analysis lies within the planning area itself. While the planning area is visible from locations outside of the planning area itself, such as from portions of the Mount Hood Wilderness, from this distance, impacts of management activities should not be evident. In many locations outside of the planning area, management activities would be screened by topography, due to the steep rugged nature of the Highway 35 Corridor. In locations where the planning area flattens out, such as the eastern boundary of the planning area, visual quality objectives are modification for all distance zones, which would easily be met utilizing project design criteria.

Under Alternative 2, the Proposed Action, these items could have an impact on the planning area and viewsheds adjacent to the planning area falling under middleground. Combined with the Proposed Action, these actions would not deviate from Forest Plan standards. They would move towards desired future conditions as harvest activities would promote visual diversity of vegetation, open views, and views of distant mountain peaks.

3.13.4 Consistency Determination

The Polallie Cooper Hazardous Fuels Reduction Project combined with the Project Design Criteria outlined in Section 2.3 are consistent with the four primary Forest Plan land allocations within the planning area; Scenic Viewshed (B2), Winter Recreation Area (A11), Special Interest Area (A4), and Wood Product Emphasis (C1). Designated Wild and Scenic Rivers (B1) and Special Interest Areas (A4) were also analyzed, although there would be no direct or indirect effects to those land use allocations. Please see the Visual Quality Specialist Report for the full analysis of Forest Plan consistency.

Table 83. Cumulative Effects for Visuals

Project	Potential Effects	Overlap in Time	Overlap in Space	Measurable Cumulative Effect?	Extent, Detectable?
Ongoing road and trail maintenance	FS System Trails VQO	No	Yes	No	No cumulative effects would occur.
	Land Allocation VQO	No	Yes	No	
Dog River Pipeline Replacement	FS System Trails VQO	No	No	No	No cumulative effects would occur.
	Land Allocation VQO	No	No	No	
Tilly Jane Hazardous Fuels Reduction	FS System Trails VQO	No	Yes	No	No cumulative effects would occur. The planning areas overlap, but the Tilly Jane Hazardous Fuels treatment location would not overlap with any proposed treatment units within the planning area and would maintain foreground visual quality objectives of Retention within the A4 Special Interest Area where it is proposed.
	Land Allocation VQO	No	Yes	No	
2006 Debris Flow in the Middle Fork Hood River	FS System Trails VQO	No	Yes	No	No cumulative effects would occur.
	Land Allocation VQO	No	Yes	No	
Dollar Lake Fire, including burn area rehabilitation	FS System Trails VQO	No	No	No	No cumulative effects would occur.
	Land Allocation VQO	No	No	No	
Road decommissioning and road closures	FS System Trails VQO	No	No	No	No cumulative effects would occur.
	Land Allocation VQO	No	Yes	No	
Cloud Cap Hazard Tree Removal	FS System Trails VQO	No	No	No	No cumulative effects would occur.
	Land Allocation VQO	No	No	No	
Crystal Springs Watershed Special Resources	FS System Trails VQO	No	Yes	No	No cumulative effects would occur.

Project	Potential Effects	Overlap in Time	Overlap in Space	Measurable Cumulative Effect?	Extent, Detectable?
Management Unit and Crystal Springs Zone of Contribution	Land Allocation VQO	No	Yes	No	
Future Hazard Tree Harvest Along Roads and Trails	FS System Trails & VQO	No	Yes	Yes	Over time, potential hazard tree harvest along roads and trails could open up scenic views within the planning area. This could improve views of Mount Hood as well as other unique natural features within the planning area.
	Land Allocation VQO	No	Yes	Yes	

3.13.5 Summary of Effects by Alternative

Under the No Action Alternative, natural and ecological processes, including insect and disease, wind and snow damage, and dead and down tree accumulations, would continue and be exacerbated by fire suppression. Actions would not be taken to help reduce the risk of large stand replacing fire at a landscape level and vegetation health and vigor would continue to decline within the dense stands of moist mixed conifer and dry mixed conifer.

In the long term, effects from the lack of vegetation management within the planning area would deviate from the Goals of the Mount Hood National Forest Land and Resources Management Plan and State Highway 35 Viewshed Management Guide. Goals of these plans include the emphasis of large ponderosa pine in areas where this is a feasible seral stage, the promotion of ground cover and shrubs and within-stand diversity, and the use of fire to promote pine generation. Under the No Action Alternative, or Alternative 1, these objectives are not expected to be met.

The Proposed Action alternative, or Alternative 2, would be in conformance with the standards and guidelines for visual resource management in the Mount Hood National Forest Land and Resource Management Plan. Under the Proposed Action, forest health resilliency actives would occur within Scenic Viewshed (B2), Winter Recreation Area (A11), and Wood Product Emphasis (C1).

The Retention and Partial Retention VQOs assigned to these areas would be met through visual screening and the proposed PDCs. Short-term effects from critical viewpoints within the scenic byway (B2), including Highway 35, and recreation sites along Highway 35, would result from opening up stands. Design criteria would make these treatments less visible to the viewer, especially within one to two years after treatment is completed. Long-term effects from proposed treatments would become less noticeable due to natural changes in the landscape over time such as vegetative growth. Furthermore, considerable change can take place within areas designated under the Retention Visual Quality Objective if the change achieves desirable variety and follows principles of landscape design including the proper scale and arrangement of elements.

3.14 Cultural Resources

3.14.1 Analysis Assumptions and Methodology

Heritage resources include structures, sites, and objects that reflect the prehistory, protohistory, and history of people. The analysis area for heritage resources in this EA is the area of ground disturbance as proposed for all alternatives. Ground disturbance includes treatments using heavy machinery associated with logging, burning, temporary road construction, and road decommissioning.

The National Historic Preservation Act and the National Environmental Protection Act both require consideration be given to the potential effect of federal undertakings on heritage resources. The guidelines for assessing effects and for consultation are provided in 36 CFR 800. To implement these guidelines, in 2004, Region 6 of the Forest Service entered into a Programmatic Agreement (PA) with the Oregon State Historic Preservation Office (SHPO) and the Advisory Council on Historic Preservation (ACHP).

The proposed activities of the Polallie Cooper Restoration project include tree removal, fuel treatments, temporary road construction, and ground disturbance. In accordance with the 2004 agreement, heritage resource surveys have been conducted for those ground disturbing activities requiring inspection and documented in Heritage Resource Report 2015/060606/0002 (Dryden 2015) for the Proposed Action.

3.14.2 Existing Condition

The East Fork of Hood River is a perennial tributary to the Hood River, which flows directly into the Columbia River. Glacially fed tributaries to the drainage within the planning area include Polallie Creek, Tilly Jane Creek, Doe Creek (tributary to Tilly Jane Creek) and Buck Creek. As a largely glacial stream, the East Fork of Hood River provided a gateway onto the slopes of Mount Hood for both Native Americans and early pioneers.

Relatively few archaeological excavations have been conducted within or near the planning area, and little is known about the prehistory of the region. There is some evidence that huckleberries and other plant resources were gathered, along with hunting forays for deer, elk and other wildlife. Huckleberries remain numerous along the lower slopes of the Cloud Cap-Tilly Jane National Historic District.

Current and past hiking trails likely followed earlier Indian trails. One such trail is the Polallie Ridge Trail with its earliest indications on a 1912 Oregon National Forest map, where it is shown as an intermittent dotted line. The Polallie Ridge Trail most likely followed an earlier Native American trail for summertime exploitation of alpine resources. Another trail on the same map extends east from the East Fork Hood River, steeply ascending the steep west-facing slopes, to continue on to Brooks Meadow. The 1914 General Land Office (GLO) plat map for T2S, R10E shows the two previous trails as part of the "Trail from Brooks Meadow to Parkdale and Cloudcap Inn." Another early trail is shown heading upstream along the East Fork Hood River as far as Robinhood Creek. By 1916 the trail had extended south to connect to the Barlow Road. Another early trail is simply labeled "old trail" and travels north along Surveyor's Ridge from the Brooks Meadow Trail.

Early settlement continued to spread south from Hood River after a wagon road was constructed up into the Upper Valley in 1867. The completion of the transcontinental railroad in 1882 also served to increase immigration into the valley. By 1884, the town of Mt. Hood contained a school, general store, and post office. The post office also served the towns of Dee and Parkdale after they were settled. American Indians picked strawberries in the Upper Valley, but were eventually replaced by Japanese and other immigrants.

The 1901 map of the Northern Portion of the Cascade Range Forest Reserve (Langille 1901) shows the East Fork Hood River as drivable during freshets or "upon improvements" as far south as Newton Creek. The western portion of the planning area is described as "remote" with no immediate access for timber (Langille et al. 1903). For the eastern portion of the planning area, forest fires have "devastated nearly the entire township"; however, timber on the East Fork Hood River canyon could be "logged down Hood River during freshets." Burned areas at the time are listed at 3,310 acres.

Another wave of immigration to the Parkdale area occurred in 1905 when the "New Yorkers" started appearing in groups. The community voted on the name "Parkdale" in 1906, and opened its own post office. Additional acreage to the south of Parkdale was opened to settlement in 1907 in an area known as Valley Crest. Settlements spread to the area below Cooper Spur.

The importance of fruit production to the economy of the Hood River valley increased. The usual sequence of events was for homesteaders to log the valuable timber, followed by the conversion of the lands to agriculture. By the turn of the century, the value of the affected acreage tripled and plantings of fruit crops increased. In 1895, the East Fork Irrigating Company was formed and began to appropriate water. Around 1907, the Glacier Ditch Company began constructing an irrigation ditch to serve the residents of the Valley Crest area. The ditch diverted water from Sand Creek, now known as Polallie Creek. The 1914 GLO plat map shows the Glacier Ditch "under construction." Between 1950 and 1953, the Middle Fork Irrigation District (MFID) merged with the Glacier Ditch Company operating out of the headwaters of the East Fork of the Hood River.

Between 1898 and 1903, logs were floated down both the East and West Forks of Hood River to a mill owned by the Lost Lake Lumber Company at the mouth of Hood River. However, the construction of splash dams on the East Fork in 1901 did not raise the stream to desired levels, and the method of timber transport was abandoned.

The East Fork area was utilized for sheep grazing by the turn of the century, with those coming from the Willamette Valley following around the south side of the mountain, continuing along the eastern slopes to Elk Meadows and Blue Grass Ridge. Sheep coming from The Dalles utilized the slopes to the east of the East Fork, including Surveyor's Ridge. Sheep were grazed on the slopes to the west of the Cloud Cap Inn, including Red Hill and Clear Creek. However, the establishment of the Cascade Range Forest Reserve in 1893 gradually closed much of the area of the East Fork to sheep grazing.

Three early sheepherders around the turn of the century included Jim Slede, who grazed sheep around Bald Butte, Joe Hess, and Dennis and Hugh McCulley. Dennis reportedly owned an expensive gold watch, and was known to sip whiskey while he herded his sheep. The story goes that one day Dennis had accidentally mistaken a bottle of sheep dip for his whiskey, which was the end of Dennis. His brother Hugh found the body, and by the time that he had convinced others to come and retrieve the remains, the body had been exposed to the elements for a week and was in no condition to move. The men buried Dennis and his watch where he lay under a pile of rocks on Surveyor's Ridge (Hood River News; undated article).

Mining played a very small role in the development of the watershed; however, prospectors tested areas on Surveyor's Ridge and along the East Fork Hood River in the vicinity of the Robinhood Campground from the 1850s into the 1930s.

Patents for early farmsteads within the planning area were filed as early as 1908, with most finally approved by 1917. However, the farmsteads were quickly abandoned as a result of the high altitude and short growing season.

In the 1880s, David Cooper, Henry Coe and Oscar Stranahan decided that they should capitalize on the tourism brought to Hood River by the railroad with the construction of a mountain resort. The three started construction on a wagon road up the mountain following Indian trails, but were eventually blocked by brush and wind-blown trees. Aided by a "wild" fire, they eventually finished their toll road and erected a tent camp at Tilly Jane Meadows, named after one of their first visitors, Tilly Jane Ladd. They charged $1.00 for camping and $10.00 for the wagon ride to and from the tent camp. In 1888, Cooper's company sold their interest to William Ladd, who went on to finance the construction of Cloud Cap Inn in 1889.

The upper portion of the East Fork Hood River remained bypassed by meaningful transportation. The Barlow Wagon Road skirted around the south side of Mount Hood. The wagon road from the Valley Crest area up to Cloud Cap Inn was the only development through the area until the construction of the Mount Hood Loop Highway in 1925.

The construction of the Mount Hood Loop Highway was an idea largely supported by the tourism and agricultural industries in Hood River and the upper valley. Local residents Homer Rogers and J.O. Hannum participated in the selection of the route for the highway. In addition to operating the Mt. Hood Lodge, Rogers also acquired the Cloud Cap Inn while Hannum constructed the Homestead Inn at the Cooper Spur Junction in 1922 in anticipation of the tourism potential. At that time, the Loop Highway was usually closed due to snow, and the junction was situated at the end of the road. However, neither the Lodge nor the Homestead Inn realized expectations and both establishments were gone by the 1930s. The highway unlocked the previously inaccessible areas along the East Fork of Hood River to automobiles, and expanded opportunities for recreation and timber harvest. Campgrounds along Robinhood Creek and Hood River Meadows were developed and improved through the 1920's.

By this time, Sand Creek had been renamed Polally Creek and the Mount Hood Loop Highway had been completed. According to Oregon Geographic Names (McArthur 2003), the Forest Service began a campaign of replacing mundane or repetitious place names in the 1920s, and Sand Creek was widely used. The spelling later changed to Polallie, which was believed to be Chinook jargon meaning powdery or sandy; however, George Gibb believes that the name derives from the French word poudre and was not originally Chinook or Chehalis.

The construction of the Loop Highway affected the overall philosophy of the Forest Service to incorporate recreation and public access into its management. A new road was constructed to Cloud Cap Inn in 1926, along with construction of the Tilly Jane Guard Station and campground. The Civilian Conservation Corps (CCC) contributed further to the recreational development of the area and may have added stone culverts to the Cloud Cap Road, made improvements to the Tilly Jane Campground, constructed the Tilly Jane Warming Hut, and may have built a campground at the mouth of Polallie Creek. The CCC also constructed another warming shelter in the Cooper Spur area and may have improved a ski trail down from the Tilly Jane Warming Hut.

Downhill skiing lessons were offered at the Mt. Hood Lodge as early as 1913, and Hannum began brushing an area for the sport in the 1920s. In the 1940s, local residents resurrected the area near the Cooper Spur junction for skiing, which is now managed and operated under a special use permit.

In the 1950's and 1960's, the Mount Hood Loop Highway was continually improved as it was transformed into modern Oregon State Highway 35. Improvements included resurfacing, reconstruction, realignment and widening. As a result, segments of the old historic highway became isolated and were either obliterated, incorporated into other road systems, used as parking lots, or simply abandoned. Beginning in 1968, the highway has been kept open all around the mountain.

The only named spring within the planning area, Clinger Springs is thought to be named for Louis J. Klinger. Klinger was an early settler in the Eightmile area and also maintained a supply camp on the Barlow Road. Klinger later retired to Dufur where he served as mayor. Klinger was also a major proponent for a road from Dufur to the Mount Hood area.

Almost the entire planning area had been previously surveyed in preparation for the Polallie Cooper Fuels Reduction Project 98/06/03; however, the project was postponed for later consideration. Previously documented Heritage Resources within the planning area include culturally-modified (peeled) cedar trees, historic farmsteads, historic irrigation ditches, remains of the Homestead Inn, a historic hunter's camp, a possible historic grave, and a historic warming shelter.

3.14.3 Effects Analysis

No Action Alternative

Under the No Action Alternative, Heritage Resources would only be affected by decay and other natural and physical forces that are already occurring. This alternative would have no effect on heritage resources.

Proposed Action Alternative

The Glacier Ditch (666EA0050) and the Polallie Creek Ditch (666EA0079) are linear features that travel across areas proposed for timber harvest and prescribed burning. A buffer zone designated 50 feet from the center line on both sides of the ditches would be flagged through the treatment units. Heavy machinery would be excluded from the buffer zones. Any trees harvested within the buffer zones would be felled directionally away from the ditches. Hand bucking and piling of slash would be the only method used within the buffer zones. Slash may be piled immediately adjacent to, but not within the ditches. Skidding across the ditches would be restricted to previously disrupted crossings as determined by an archaeologist. With these stipulations, the project would have no effect to the Glacier Ditch (666EA0050) or the Polallie Creek Ditch (666EA0079).

The East Fork Peeled Cedar 666NA0063 could not be relocated. No protective measures are required or recommended for non-cultural objects that cannot be relocated.

The Zig Zag Peeled Cedars 666NA0080 consists of cedar trees exhibiting bark peel scars. The trees are located within an area scheduled for timber harvest and prescribed burning. A 100-foot buffer zone for the exclusion of heavy machinery would be flagged around the trees. Any trees harvested near the buffer zone should be felled directionally away from the buffer zone. Broadcast burning may occur within the buffer zone, but piling may not occur. With these stipulations, the project would have no effect to site 666NA0080.

Historic Homestead Entry sites 666EA0082, 666EA0085, 666EA0086, 666EA0087, and 666EA0088 consist of the remains of historic farmsteads from the 1910s, along with the Homestead Inn site 666EA0083. All of these sites contain combustible features, along with scattered artifacts. The sites are situated in areas scheduled for timber harvest and prescribed burning. A 100-foot buffer zone for the exclusion of heavy machinery would be flagged around each of the sites. Any trees harvested near the buffer zone should be felled directionally away from the buffer zone. Prescribed fire would also be excluded from the buffer zone. With these stipulations, the project would have no effect to these heritage resources.

A Sheepherder's Grave 666EA0115 is located within an area scheduled for timber harvest and prescribed burning. The grave was reported to be in a vague location from an old newspaper article; however, multiple previous attempts to locate the grave have been unsuccessful. The grave could not be relocated for the current project despite intensive inspection of the area. No protective measures are required for heritage resources that cannot be located.

The Cooper Spur Warming Hut 666EA0161 is a log structure with a stone chimney constructed by the Civilian Conservation Corps (CCC). The structure is located within an area scheduled for timber harvest and prescribed burning. A 100-foot buffer zone for the exclusion of heavy machinery would be flagged around the structure, with the exception of the use of a road passing by the structure. Any trees harvested near the buffer zone would be felled directionally away from the structure. No slash piling may occur within the buffer zone. Prescribed fire would also be excluded from the buffer zone. With these stipulations, the project would have no effect to the Cooper Spur Warming Hut 666EA0161.

Don's Cabin 666EA0179 consists of the remains of a small cabin including cedar shakes and milled timber. The site is located within an area scheduled for timber harvest and prescribed burning. A 100-foot buffer zone for the exclusion of heavy machinery would be flagged around the structure. Any trees harvested near the buffer zone would be felled directionally away from the structure. No slash piling may occur within the buffer zone. Prescribed fire would also be excluded from the buffer zone. With these stipulations, the project would have no effect to Don's Cabin 666EA0179.

Tilly Jane Hunter's Camp 666IS0180 consists of milled lumber constructed as a semi-temporary hunting camp. The structure lies within an area scheduled for timber harvest and prescribed burning. The feature was found to be constructed of modern materials, and only modern artifacts were associated with the isolate. Isolated finds of modern derivation are generally considered to be ineligible for inclusion on the National Register of Historic Places (NRHP). No protective measures are required or recommended for ineligible finds.

Collapsed Cabin 666EA0199 and Collapsed Cabin II 666EA0200 consist of the remains of small log cabins. The structures are both situated within an area scheduled for timber harvest and prescribed burning. It is my opinion that both of these structures are associated with the Homestead Inn 666EA0083, based on proximity, contemporaneousness, a 1926 photograph of the area showing additional nearby structures. Both of the sites include combustible features such a milled timbers. A 100-foot buffer zone for the exclusion of heavy machinery would be flagged around the cabin remains. Prescribed fire would also be excluded from the buffer zones. With these stipulations, the project would have no effect to the Collapsed Cabin 666EA0199 and Collapsed Cabin II 666EA0200.

The Parkdale to Brooks Meadow Trail 666EA0290 consists of a historic trail. The trail has since been named the Zigzag Vista Trail 678A and the Dog River Trail 675. The trails travel through areas scheduled for timber harvest and prescribed burning. Multiple trail crossings would occur, as well as mechanical activity near the trail. Included mitigation measures would result in no adverse effect on the historic Parkdale to Brooks Meadow Trail 666EA0290.

Cumulative Effects

For heritage resources, any effects are limited to site specific locations. Any cumulative effects would also be limited to heritage resources situated within proposed areas of ground disturbance. The project design criteria for the Proposed Action resulted in no direct or indirect effects to heritage resources since there are no significant heritage resources affected by any alternatives. For cumulative effects, all projects shown in Table 15 were considered; however, none of the proposed projects involve heritage resources situated within the proposed planning areas. Also, heritage resources are generally avoided for all federal undertakings with no cumulative effects. Because this project would have no effect on heritage resources eligible for the NRHP and none of the projects considered for potential cumulative effects overlap the affected area, there would be no cumulative effects to heritage resources as a result of implementing any of the action alternatives.

The consultation for the Heritage Resource Survey results and recommendations for the project have been completed in accordance with the 2004 PA and submitted to the Oregon SHPO for review; the results of the SHPO review are pending.

3.14.4 Consistency Determination

The project would not impact any significant heritage resources. Based on the proposed protective measures, the project meets the criteria in the Programmatic Agreement for "No Historic Properties Adversely Affected" determination (Stipulation III (B) 4).

This action is consistent with Forest Plan goals to protect important heritage resources. Heritage resource inventories were conducted in compliance with the 2004 PA during the project planning stage (FW-598, FW-600, FW-610, FW-602 and FW-606), the field survey results were fully documented (FS-608), and the potential effects to heritage resources from the proposed projects were assessed (FW-609, FW-610). Heritage resources potentially affected by project activities were evaluated as ineligible for inclusion on the NRHP (FW-612). All records and documents concerning heritage resources for the project are kept on file at the Hood River Ranger District, Mt. Hood National Forest (FW-626).

3.14.5 Summary of Effects by Alternative

Under the No Action Alternative, heritage resources would continue to be subject to naturally occurring processes.

Under the Proposed Action, historic structure remains 666EA0082, 666EA0083, 666EA0085, 666EA0086, 666EA0087, 666EA0088, 666EA0161, 666EA0179, 666EA0199, 666EA0200, have been excluded from project activities involving heavy equipment and prescribed burning; the project would have no effect on the sites.

Peeled cedar tree site 666NA0063 was determined to be non-cultural with no required protective measures. Sheepherder’s grave 666EA0115 could not be relocated and does not require protective measures. Tilly Jane Hunter’s Camp was determined to be ineligible for the NRHP and does not require protective measures.

Peeled cedar tree site 666NA0080 was flagged for avoidance. Historic ditches 666EA0050 and 666EA0079 were flagged for avoidance from heavy machinery. Any ditch crossings consisting of temporary roads or skid trails would follow previous breaches. The project would have no effect on these sites.

Project Design Criteria would result in no adverse effect to the historic Parkdale to Brooks Meadow Trail 666EA0290.

3.16 Climate Change

This proposed action would affect 2,830 acres of forest by commercially thinning smaller trees from the stand, retaining a residual stand of about 80-120 square by basal area. This scope and degree of change would be minor relative to the approximately 1,000,000 acre Mt. Hood National Forest. Climate change is a global phenomenon because major greenhouse gasses (GHG) mix well throughout the planet's lower atmosphere (IPCC 2013). Considering emissions of GHG in 2010 was estimated at 49 ± 4.5 gigatonnes[5] globally (IPCC 2014) and 6.9 gigatonnes nationally (US EPA, 2015), a project of this magnitude makes an infinitesimal contribution to overall emissions. Therefore, at the global and national scales, this proposed action's direct and indirect contribution to greenhouse gasses and climate change would be negligible.

In addition, because the direct and indirect effects would be negligible, the proposed action's contribution to cumulative effects on global greenhouse gasses and climate change would also be negligible.

The Intergovernmental Panel on Climate Change has summarized the contributions to climate change of global human activity sectors in its Fifth Assessment Report (IPCC 2014). In 2010, anthropogenic (human-caused) contributors to greenhouse gas emissions came from several sectors:

- Industry, transportation, and building – 41%
- Energy production – 35%
- Agriculture – 12%.
- Forestry and other land uses – 12%

There is agreement that the forestry sector contribution has declined over the last decade (IPCC, 2014; Smith et al., 2014; FAOSTAT, 2013). The main activity in this sector associated with GHG emissions is deforestation, which is defined as removal of all trees, most notably the conversion of forest and grassland into agricultural land or developed landscapes (IPCC 2000).

This hazardous fuels reduction does not fall within any of these main contributors of greenhouse gas emissions. Forested land would not be converted into a developed or agricultural condition. In fact, forest stands are being retained and thinned to maintain a vigorous condition that supports trees, and sequesters carbon long-term. US forests sequestered 757.1 megatonnes[6] of carbon dioxide after accounting for emissions from fires and soils in 2010 (US EPA, 2015). However there is growing concern over the impacts of climate change on US forests and their current status as a carbon sink. There is strong evidence of a relationship between increasing temperatures and large tree mortality events in forests of the western US. There is widespread recognition that climate change is increasing the size and frequency of droughts, fires, and insect/disease outbreaks, which would have major effect on these forests' role in the carbon cycle (Joyce et al. 2014).

The project is in line with the suggested practice of reducing forest disturbance effects found in the National Climate Assessment for public and private forests (Joyce et al. 2014). Here specifically, the project proposes to conduct thinning and follow-up with prescribed fire to reduce the fuel loading. The release of carbon associated with this project is justified given the overall change in condition increases forest resistance to release of much greater quantities of carbon from wildfire, drought, insects/disease, or a combination of these disturbance types (Millar et al. 2007).

This project falls within the types of options presented by the IPCC for minimizing the impacts of climate change on forest carbon, and represents a potential synergy between adaptation measures and mitigation.

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[5] A gigatonne is one billion metric tons of CO_2; equal to about 2.2 trillion pounds.
[6] A megatonne is one million metric tons of CO_2; equal to about 2.2 billion pounds.

Actions aimed at enhancing forest resilience to climate change by reducing the potential for large-scale, catastrophic disturbances such as wildfire also prevents release of GHG and enhances carbon stocks (Smith et al. 2014). The proposed action reflects the rationale behind these recommendations because there exists the threat of a large scale disturbance outside of the range that historically occurred on the landscape that could threaten both NFS land and adjacent privately owned lands. There is a need to reduce the fire hazard in order to protect life and property and to restore forest to conditions that are more resilient to wildfire on National Forest System (NFS) lands. This planning area is the last untreated wildland urban interface (WUI) on the eastside of the Mt. Hood National Forest.

Timber management projects can influence carbon dioxide sequestration in four main ways: (1) by increasing new forests (afforestation), (2) by avoiding their damage or destruction (avoided deforestation), (3) by manipulating existing forest cover (managed forests), and (4) through transferring carbon from the live biomass to the harvested wood product carbon pool. Land-use changes, specifically deforestation and regrowth, are by far the biggest factors on a global scale in forests' role as sources or sinks of carbon dioxide, respectively (IPCC, Intergovernmental Panel on Climate Change, 2000). Projects like the proposed action that create forests or improve forest conditions and capacity to grow trees are positive factors in carbon sequestration.

3.17 Environmental Justice and Civil Rights

On February 11, 1994, President Clinton issued the Executive Order on Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (Executive Order 12898). This order directs agencies to identify and address disproportionately high and adverse human health or environmental effects of projects on certain populations. In accordance with this order, the proposed activities have been reviewed to determine if they would result in disproportionately high and adverse human and environmental effects on minorities and low-income populations.

The communities of Mt. Hood/Parkdale, Odell and Hood River are less than 20 miles of the planning area. The communities of Dufur and The Dalles are less than 20 miles to the east / northeast of the planning area. Other communities that may have an interest in the proposal would include Sandy, Gresham and Portland to the West.

The Polallie Cooper Hazardous Fuels Reduction planning area is located on usual and accustomed land for the Confederated Tribes of Warm Springs (as is all of the Mt. Hood National Forest). The Treaty of 1855 granted the Confederated Tribes of the Warm Springs (CTWS) the right of “usual and accustomed” gathering of traditional native plants and “special interest” use. According to the Ethnographic Study of the Mt. Hood National Forest (French et al. 1995), no traditional use areas have been identified in this planning area. No activities are proposed that would preclude any granted rights. Therefore, the proposal to implement this project would not have any adverse effect on members of the CTWS.

Although there is no formal tracking system, based on observations, it suspected that many of the foliage/greenery permits are sold to low-income individuals and minorities. It is likely that the Polallie Cooper project would generate more special forest products as the area is treated and new understory vegetation grows (e.g., huckleberry and bear grass). Therefore, the proposal to implement this project is not expected to have any negative effect on special forest product gatherers.

3.18 Congressionally Designated Areas

This section discusses Congressionally Designated areas, including Wild and Scenic Rivers and Wilderness areas. It does not discuss future designations, including the Crystal Springs Watershed Special Resource Management Unit or Tilly Jane wilderness addition which are contingent on the successful completion of the Government Camp/Cooper Spur land exchange.

3.18.1 Existing Condition

Wild and Scenic Rivers

When the Forest Plan was approved there were five rivers on the Forest, which comprised the Wild and Scenic Rivers System: Clackamas, Roaring, Salmon, Sandy and White Rivers. The 1968 Wild and Scenic Rivers Act calls for maintaining the free-flowing character of the designated rivers and protecting their "outstandingly remarkable values." Outstandingly remarkable values are values or opportunities in a river corridor that are directly related to the river and which are rare, unique or exemplary from a regional or national perspective.

The Omnibus Public Land Management Act of 2009 (H.R. 146) added additional segments to the Wild and Scenic River System on the Forest, including portions of the East Fork Hood River, which is located within the Polallie Cooper Hazardous Fuels Reduction Project planning area. Geologic/Hydrologic ORVs have been identified for East Fork Hood River. The East Fork flows along the edge of a complex series of glacially and fluvial derived deposits before entering a narrower bedrock canyon. Recent debris flows from Newton, Clark and Polallie Creek drainages continue to shape the valley floor and influence the river's free-flowing nature. These attributes are deemed ORVs because they are an easily observable example of active glacial and geologic processes at the national level.

Wilderness

There are seven wilderness areas that are entirely within the Forest (Badger Creek, Bull of the Woods, Clackamas, Mark O. Hatfield, Mt. Hood, Roaring River, and Salmon-Huckleberry) and portions of two other wilderness areas within the administrative boundary of the Forest (Lower White River and Mt. Jefferson).

The 1964 Wilderness Act established the National Wilderness Preservation System to ensure that parts of the United States would be preserved and protected in their natural condition. A wilderness area is defined, in part, as an area that generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable. The Wilderness Act places responsibility upon the administering agency for preserving the wilderness character of the area. The Act specifically prohibits motor vehicles, motorized equipment and mechanical transport in all wilderness areas (Public Law 88-577, Sec. 4 (c) Prohibitions of Certain Uses).

The Omnibus Public Land Management Act of 2009 (Public Law 111-11) created additional wilderness areas and enlarged some existing wilderness areas including the Mt. Hood Wilderness, which now boarders the south and western portion of the Polallie Cooper planning area.

Inventoried Roadless Areas

Inventoried roadless areas (IRAs) possess social and ecological values and characteristics that are becoming scarce in our nation's increasingly developed landscape. Protecting air and water quality, biodiversity and opportunities for personal renewal are highly valued qualities of roadless areas. Conserving IRAs leaves a legacy of natural areas for future generations.

The Forest Plan directs the Forest to maintain the roadless character of the Bull of the Woods, Lake, Mt. Hood Additions, Olallie, Roaring River, Salmon-Huckleberry, Twin Lakes, and Wind Creek IRA's. Of these areas only the Mt. Hood Additions IRA is in the vicinity of the Polallie Cooper planning area, bordering the southwestern edge. The Omnibus Public Land Management Act of 2009 (Public Law 111-11) designated some IRA as part of the National Wilderness Preservation System, and identified additional areas with IRA's as potential wilderness with a process to become part of the wilderness system. Not all of the IRAs identified in the Forest Plan were designated as wilderness or potential wilderness in 2009 including the Mt. Hood Additions IRA, which would continue to be managed for roadless characteristics.

3.18.2 Effects Analysis

Wild and Scenic Rivers

A full analysis of the effects to the Wild and Scenic Rivers is included in Section 3.12.3, Effects Analysis from the Proposed Action Alternative on Wild and Scenic Rivers.

As the ORV's for the East Fork Hood River Wild and Scenic River segment are associated with geologic landforms (lava flow and debris flows) that exist outside any proposed treatment areas there would be no adverse effect to the ORV's for which the river segment was added to the National Wild and Scenic River System.

Wilderness

No activities of any kind are proposed within the wilderness itself. Additionally, none of the proposed treatment areas are adjacent or border any existing or proposed wilderness areas. However, activities up to the wilderness boundary are permissible under the Oregon Wilderness Act of 1984 and the Omnibus Public Land Management Act of 2009. Section 6 of the 1984 Act states:

"Congress does not intend that designation of wilderness areas in the State of Oregon lead to the creation of protective perimeters or buffer zones around each wilderness area. The fact that non-wilderness activities or uses can be seen or heard from the areas within the wilderness shall not, of itself, preclude such activities or uses up to the boundary of the wilderness area."

Inventoried Roadless Areas

No activities are proposed with the Hood Additions IRA. As such it is not expected that there would be any impact to the Hood Additions IRA though implementation of the Proposed Action.

3.19 Other Required Disclosures

3.19.1 Conflicts with Plans, Policies or Other Jurisdictions

This project would not conflict with any plans or policies of other jurisdictions, including the Tribes. This project would not conflict with any other policies, regulations, or laws, including the Clean Water Act (see Section 3.5), Endangered Species Act (see Sections 3.6, 3.8 and 3.9), National Historic Preservation Act (see Section 3.13) and Clean Air Act (see Section 3.2). Other potential conflicts with plans, policies, or other jurisdictions are discussed below.

3.19.2 Floodplains and Wetlands

There would be very limited impacts to floodplains or wetlands from this project. Due to the steepness of the topography, small stream size and confined nature of streams in this area, floodplain width is fairly limited. The impacts to wetland and floodplains are discussed in Section 3.5, Water Quality. Due to the PDCs and BMPs which are aimed at minimizing the impacts to wetlands and floodplains, there would be minimal direct and indirect effects.

3.19.3 Air Quality

Section 3.2, Fuels Management and Air Quality describe the impacts associated with pile burning on air quality. Fuel treatments would have a minimal impact on local airshed/air quality. All burning would be burned under conditions that minimize impacts to protected and sensitive areas, and would move smoke away from populated areas in the least amount of time. Currently, and in the future, all planned ignitions are and would be conducted according to the Operational Guidance for the Oregon Smoke Management Program (OSMP). The Operational Guidance contains the direction for meeting the terms of the OSMP. The Environmental Protection Agency has approved the OSMP as meeting the requirements of the Clean Air Act, as amended.

3.19.4 Consumers, Civil Rights, Minority Groups, Women, and Environmental Justice

Executive Order No. 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations, directs Federal agencies to address effects accruing in a disproportionate way to minority and low income populations. No disproportionate impacts to consumers, civil rights, minority groups, and women are expected from this project. Commercial thinning work would be implemented by contracts with private businesses. Project contracting for the project's activities would use approved management direction to protect the rights of these private companies. Section 3.16 contains more information on Environmental Justice.

3.19.5 Treaty Resources and Reserved Indian Rights

No impacts on American Indian social, economic, or subsistence rights are anticipated. No impacts are anticipated related to the American Indian Religious Freedom Act. The Confederated Tribe of Warm Springs was contacted in reference to this Proposed Action. More information on consultation with the tribes is available in Chapter 4.

3.19.6 Inventoried Roadless Areas and Potential Wilderness Areas

There would be no impacts to Inventoried Roadless Areas (IRA) as none exist within the planning area. The planning area contains no potential wilderness areas within the bounds of the planning area. There are some wilderness areas adjacent to the planning area, but no thinning is proposed directly adjacent to these areas or within adjacent areas that are undeveloped. However, any inventory of these lands is a Forest Planning requirement, not a project planning requirement. See section 3.18, Congressionally Designated Areas for more information about other congressionally designated areas.

3.19.7 Prime Farmlands, Rangelands, and Forestlands

None of the alternatives would have an adverse impact to the productivity of farmland, rangeland, or forestland because none were identified in the project area.

3.19.8 Potential or Unusual Expenditures of Energy

The No Action alternative would not require any expenditure of fuel or energy. The Proposed Action would require expenditures of fuel for workers to access the planning area, use power equipment, and to utilize the logging systems. Jet fuel use for helicopter operations would also occur. Overall, the Proposed Action would not result in any unusual expenditure of fuel.

3.19.9 Irreversible and Irretrievable Commitments of Resources

Irreversible commitments of resources are those that are forever lost and cannot be reversed. Irretrievable commitments of resources are considered to be those that are lost for a period of time and, in time, can be replaced. The use of rock for road surfacing is an irreversible resource commitment.

3.19.10 Conflicts with Plans, Policies, or Other Jurisdictions

NEPA at 40 CRF 1502.25(a) directs “to the fullest extent possible, agencies shall prepare draft environmental impact statements concurrently with and integrated with . . . other environmental review lands and executive orders.”

Based on information received during scoping, informal consultation meetings, and analysis in the EA, none of the alternative under consideration would conflict with the plans or policies of other jurisdictions, including the Confederated Tribes of Warm Springs. This project would not conflict with any other policies and regulations or laws, including the Clean Water Act, Endangered Species Act, Magnuson-Stevens Fishery Conservation and Management Act, National Historic Preservation Act, and Clean Air Act. Refer to the following sections for discussions regarding these laws:

Section 3.5 Water Quality – Clean Water Acts;

Section 3.6 Fisheries and Aquatic Fauna, 3.8 Wildlife and 3.9 Botany – Endangered Species Act;

Section 3.6 Fisheries and Aquatic Fauna – Magnuson-Stevens Fishery Conservation and Management Act;

Section 3.13 Cultural Resources– National Historic Preservation Act; and

Section 3.2 Fuels Management and Air Quality – Clean Air Act

Chapter 4 – Consultation and Coordination

The Forest Service consulted with the following individuals, Federal, State, and local agencies, tribes and non-Forest Service persons during the development of this environmental assessment.

4.1 Federal, State and Local Agencies

In addition to the formal government-to-government consultation description below, other state and local agencies were involved in the collaborative process through the Hood River Stewardship Crew. These agencies included: Hood River Soil and Water Conservation District, Oregon Department of Fish & Wildlife, Oregon Department of Forestry, and Hood River County. Each of these agencies also received the scoping information for this project.

4.1.1 Consultation with the National Marine Fisheries Service (NMFS)

Early involvement with NMFS was conducted in regard to listed anadromous fish species and their habitat that occur within or near the action area. A Biological Assessment has been completed for this project and a Letter of Concurrence is pending. No final decision would be signed before the Letter of Concurrence is received. The Forest would comply with all additional terms and conditions set forth by NMFS.

4.1.2 Consultation with the US Fish and Wildlife Service (FWS)

Early involvement with U.S. Fish and Wildlife Service (FWS) was conducted in regard to northern spotted owls and critical habitat within the action area. Throughout 2014 and 2015, several field trips and meetings about the Proposed Action occurred.

The effects to spotted owls and critical for this revised project will be included in Biological Assessment, which will be submitted to the U.S. Fish and Wildlife Service. Consultation will be completed prior to signing any decision for this project. All terms and conditions and/or conservation measures will be required actions for this project and incorporated into the final Environmental Assessment and Decision Notice.

4.1.3 Consultation with the Oregon State Historic Preservation Officer (SHPO)

The National Historic Preservation Act and the National Environmental Protection Act both require consideration be given to the potential effect of federal undertakings on historic resources, (including historic and protohistoric cultural resource sites). The guidelines for assessing effects and for consultation are provided in 36 CFR 800. To implement these guidelines, in 2004, Region 6 of the Forest Service entered a Programmatic Agreement (PA) with the Oregon State Historic Preservation Office (SHPO) and the Advisory Council on Historic Preservation (ACHP).

In accordance with the 2004 agreement, the proposed activities of the project, including road decommissioning, temporary road construction, commercial thinning, pile burning, mastication, and non-commercial thinning, involve heavy machinery and ground disturbance and required Heritage Resource inventory surveys. A modified survey strategy was designed and implemented which excluded most of the intensively-treated plantations. The results, findings, and recommendations of the survey have been documented in Heritage Resource Report 2015/060606/0002 (Dryden 2015).

The recommended protective measures would adequately protect the known heritage resources. The site protection measures were developed on the Mt. Hood National Forest to be consistent with the National Historic Preservation Act and adapted for use across the forest. A final decision will not be signed until a letter of concurrence from The Oregon State Historic Preservation Officer is received.

4.2 Tribes

The Polallie Cooper planning area is located on usual and accustomed land for the Confederated Tribes of Warm Springs (as is all of the Mt. Hood National Forest). The Treaty of 1855 granted the Confederated Tribes of the Warm Springs (CTWS) the right of “usual and accustomed” gathering of traditional native plants and “special interest” use. According to the Ethnographic Study of the Mt. Hood National Forest (French et al. 1995), no traditional use areas have been identified in this planning area. No activities are proposed that would preclude any granted rights. Therefore, the proposal to implement this project would not have any adverse effect on members of the CTWS.

CTWS was part of the collaborative group who provided guidance in the development and design of the Polallie Cooper project and did not raise any issues with the proposed project.

4.3 List of Preparers

The following is a list of Interdisciplinary Team (IDT) members who assisted in the development of the Environmental Assessment.

Role	IDT Member
IDT Leader / NEPA	Casey Gatz
Silviculturist	Whitney Olsker
Logging Systems	Andrew Tierney
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Hydrologist	Mark Kreiter
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Wildlife Biologist	Stephanie McKinney
Botanist / Invasive Species	Susan Nugent
Aquatic Conservation Strategy	Mark Kreiter / Diane Hopster
Fuels Specialist/Air Quality	Leo Segovia
Recreation / Visual Quality	Claire Pitner
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References

Vegetation

Carlson, Clinton E., James W. Byler and Jerald E. Dewey. 1995. Western Larch; Pest-Tolerant Conifer of the Northern Rocky Mountains. Ecology and Management of Larix Forests: A Look Ahead. Proceedings of International Symposium. USDA Forest Service, Intermountain Research Station General Technical Report 319.

Choi, Young D. 2007. Restoration Ecology to the Future: a call for a new paradigm. Restoration Ecology Vol. 15. No. 2. pp 351-353.

Drever, C. Ronnie, Garry Peterson, Christian Messier, Yves Bergeron, and Mike Flannigan. 2006. Can forest management based on natural disturbances maintain ecological resilience?. Can. J. For. Res. 36. 2285-2299.

Dixon, Gary. E. Gen. Technical Report. Ft. Collins, CO. Rocky Mountain Research Station USDA Forest Service, 2007.

Fellin, David G. and Jerald E. Dewey. 1986. Western Spruce Budworm. Forest Insect and Disease Leaflet 53. USDA Forest Service.

Goheen, Ellen Michaels and Elizabeth A. Willhite. 2006. Field Guide to the Common Diseases and Insect Pests of Oregon and Washington Conifers. USDA Forest Service, Pacific Northwest Region. R6-NR-FID-PR-01-06.

Harvey, Alan E.; Paul F. Hessburg; James W. Byler, Geral I. McDonald; Julie C. Weatherby; and Boyd E. Wickman. 1995. Health Declines in Western Interior Forests: Symptoms and Solutions. Ecosystem Management in Western Interior Forests. Symposium proceedings. Richard Everett and Dave Baumgartner, eds. Washington State University Cooperative Extension.

Hawksworth, Frank G. and Delbert Wiens. 1996. Dwarf Mistletoes: Biology, Pathology, and Systematics. Agriculture Hand book 709. USDA Forest Service. Washington, DC.

Hessburg, P.F.; R.G. Mitchell; G.M. Filip. 1994. Historical and current roles and pathogens in Eastern Oregon and Washington forested landscapes. Gen. Tech. Rep. PNW-GTR-327. Portland, OR: USDA Forest Service, Pacific Northwest Research Station. 72 p.

Hopkins, B. 1993. Region 6 Interim Old Growth Definition for Douglas-Fir Series, Grand Fir/White Fir Series, Interior Douglas-Fir Series, Lodgepole Pine Series, Pacific Silver Fir Series, Ponderosa Pine Series, Port-Orford-Cedar and Tanoak (Redwood Series, Subalpine Fir Series, and Western Hemlock Series

Lindh, Briana C. and Patricia S. Muir. 2004. Understory vegetation in young Douglas-fir forests: does thinning help restore old growth composition? Forest Ecology and Management 192 (2004) 285-296.

MacCleery, Douglas W. 1998. When is a landscape natural? Forest History Today. Forest History Society. Durham, NC.

McCain, Cindy and N. Diaz. 2002. Field Guide to the Forested Plant Associations of the Westside central Cascades of Northwest Oregon. Technical Paper R6-NR-ECOL-TP-02-02. Portland , OR: USDA Forest Service, Pacific Northwest Research Station.

North, M., J. Chen, B. Oakley, B. Song, M. Rudnicki, A. Gray, and J. Innes. 2004. Forest Stand Structure and Pattern of Old-Growth Western Hemlock/Douglas-Fir and Mixed-Conifer Forests. Forest Science 50(3) 2004.

Olive, C.D., B.C. Larson. 1996. Forest Stand Dynamics. John Wiley & Sons, INC. New York, Chechester, Brisbane, Toronto, and Singapore.

Perry, David A. Huang Jing, Andrew Youngblood, and Doug. R. Oetter. 2004. Forest Structure and Fire Susceptibility in Volcanic Landscapes of the Eastern High Cascades, Oregon. Conservation Biology, Pages 913-926. Volume 18. No. 4. August 2004

Peterson, David L, Morris C. Johnson, James K. Agee, Theresa B. Jain, Donald McKenzie, and Elizabeth D. Reinhardt. 2005. Forest Structure and Fire Hazard in Dry Forests of the Western United States. Gen. Tech Report PNW-GTR-628. Portland, OR: USDA Forest Service, Pacific Northwest Research Station.

Ragenovich, I.R., R.G. Mitchell. 2006. Balsam Woolly Adelgid. Forest Insect and Disase Leaflet 118. Technical Paper R6-NR-FID-PR-04-2006. USDA Forest Service.

Rippy, Raini C.; Jane E. Stewart; Paul J. Zambino; Ned B. Klopfenstein; Joanne M. Tirocke; Mee-Sook Kim; Walter G. Thies. 2005. Root Diseases in Coniferous Forests of the Inland West: Potential Implications of Fuel Treatments. Gen. Technical Report RMRS GTR-141. Ft. Collins, CO: US Dept. of Agriculture. Forest Service. Rocky Mountain Research Station. 32. p.

Schmitz, R.F., K.E. Gibson. 1996. Douglas-fir Beetle. Forest Insect and Disase Leaflet 5. Technical Paper R1-96-87. USDA Forest Service.

USDA Forest Service. 1985. Managing trees and stands susceptible to western spruce budworm. Cooperative State Research Service. Technical Bulletin No. 1695. Martha Brookes, JJ. Colbert, Russell Mitchell, R.W. Stark, Technical Coordinators. Canada United States Spruce Budworms Program – West.

Williamson, Richard L. 1982. Response to Commercial thinning in a 110-year-old Douglas-fir Stand. USDA Forest Service, Pacific Northwest Forest and Range Experiment Station PNW-296.

Wimberly, M.C. 2002. Spatial simulation of historical landscape patterns in coastal forests of the Pacific Northwest. Res. 32: 1316-1328 (2002)

Fuels/Air Quality

Haymen Fire Case Study, Russell T Graham, Technical Editor, General Technical Report RMRS-GTR-114, September 2003

James K. Ageea,*, Berni Bahrob, Mark A. Finneyc, Philip N. Omid, David B. Sapsise, Carl N. Skinnerf, Jan W. van Wagtendonkg, C. Phillip Weatherspoon 2000. The use of shaded fuelbreaks in landscape fire management

Philip N. Omi, Erik J. Martinson, Geneva W. Chong. 2006. Effectiveness of Pre – Fire Fuel Treatments.

General Technical Report RMRS – GTR – 120. Science Basis for Changing Forest Structure to Modify Wildfire Behavior and Severity. U.S. Department of Agriculture Forest Service April 2004. Dr. Russell T. Graham, Dr. Sarah McCaffrey, Dr. Theresa B. Jain,

Dr. Russell T. Graham, USDA Forest Service Rocky Moutain Research Station and Dr. Sarah McCaffrey, USDA Forest Service North Central Research Station. Influence of Forest Structure on wildfire Behavior and The Severity of its Effects. May 16 2003.

Fire Effects Guide, National Wildlife Coordinating Group, Fire Use Working Team. 2001

Wildlife Habitats in Managed Forests the Blue Mountains of Oregon and Washington, U.S. Department of Agriculture, Forest Service September 1979, Agriculture Handbook No. 553

Wildlife Habit Management, Concepts and Applications in Forestry

Photo Series for Quantifying Natural Fuels, VolumeXI: Easternoregon Sage-Steppe and Spoted Owl Nesting Habitat in the Pacific Northwest, Clinton S.Wright, Robert E. Vihnanek, Joseph C. Restaino, and Jon E. Dvorak, General Technical Report, PNW-GTR-878 December 2012

Modeling wildfire risk to northern spotted owl (strix occidentails caurina) habit in Central Oregon. USA, Alan A Ager, Mark A Finney, Becky K Kerns, Helen Maffei

Transportation

Design of Very Low-Volume Local Roads (ADT ≤ 400), 2001. American Association of State Highway and Transportation Officials.

American Association of State Highway and Transportation Officials, 2004. A Policy On Geometric Design of Highways and Streets, 2004, Fifth Edition. American Association of State Highway and Transportation Officials.

American Association of State Highway and Transportation Officials, 2006. Standard Specifications for Transportation Materials and Methods of Sampling and Testing, Twenty-Sixth Edition, 2006. American Association of State Highway and Transportation Officials.

Rice, R.M., 1992. The Science and Politics of BMPs in Forestry: California Experiences.

In: Naiman, R.J. editor, 1992. Watershed Management: Balancing Sustainability and Environmental Change (385-400). Springer-Verlag. New York.

Swift, L.W. Jr., 1984. Soil Losses from Roadbed and Cut and Fill Slopes in the Southern Appalachian Mountains. Southern Journal of Applied Forestry. 8(4): 209-216.

USDA Forest Service, 1980. Influence of Forest and Rangeland Management on Anadromous Fish Habitat in Western North America: Planning Forest Roads to Protect Salmonid Habitat. Pacific Northwest Forest and Range Experiment Station, General Technical Report PNW-109, July 1980. Portland, OR.

USDA Forest Service, 1989. Mt. Hood Extended Season Haul Policy. December 18, 1989. Mt. Hood National Forest. Sandy, OR.

USDA Forest Service, 1989. Reduction of Soil Erosion on Forest Roads. Intermountain Forest and Range Experiment Station. Ogden, UT.

USDA Forest Service, 1990. Land and Resource Management Plan: Mt. Hood National Forest. Pacific Northwest Region. Portland, OR.

USDA Forest Service, 1994. EM-7170-13 Slope Stability Reference Guide for National Forests in the United States; Vols. I, II, and III. August, 1994. Engineering Staff. Washington D.C.

USDA Forest Service, 1995. The Effects of Winter Haul on Low Volume Forest Development Roads. December 1995. Technology & Development Program. San Dimas, CA.

USDA Forest Service, 1996. East Fork Hood River and Middle Fork Hood River Watershed Analysis. Pacific Northwest Region. Portland, OR.

USDA Forest Service, 2001. Forest Roads: A Synthesis of Scientific Information. Pacific Northwest Research Station, General Technical Report PNW-GTR-509, May 2001. Portland, OR.

USDA Forest Service, 2002. Cost Estimating Guide for Road Construction: Cost Guide Zone 5, Davis Bacon Area 5. Pacific Northwest Region. Portland, OR.

USDA Forest Service, 2003. Roads Analysis, Mt. Hood National Forest. Mt. Hood National Forest. Sandy, OR.

USDA Forest Service, 2008. EM-7730-20 Forest Service Specifications for Maintenance of Roads in Timber Sales. Pacific Northwest Region. Portland, OR.

USDA Forest Service, 2011. Motor Vehicle Use Map: Mt. Hood national Forest, America's Great Outdoors. Mt. Hood National Forest. Sandy, OR.

USDA Forest Service, 2012. Environmentally Sensitive Road Maintenance Practices for Dirt and Gravel Roads. National Technology & Development Program, San Dimas, Ca.

Soil

Graham, Russell T., and others. 1994. Managing Coarse Woody Debris in Forests of the Rocky Mountains. Intermountain Research Station Research Paper INT-RP-477. Ogden, Utah.

Howes, Steve. 1979. Soil Resource Inventory, Mt. Hood National Forest. Mt. Hood National Forest. Sandy, OR.

Rashin, E. B., C. J. Clishe, A. T. Loch, J. M Bell. 2006. Effectiveness of Timber Harvest Practices for Controlling Sediment Related Water Quality Impacts. Journal- American Water Resources Association, Vol. 42 (5): 1307-1328

Sherrod, D.R., and Scott, W.E., 1995. Preliminary Geologic Map of the Mt. Hood 30- by 60-Minute Quadrangle, Northern Cascade Range, Oregon. USGS. Open File Report 95-219. pp 35 plus attached geologic map.

Water Quality/Aquatic Conservation Strategy

Agee, J.K. 1993. Fire ecology of Pacific Northwest Forests. Washington, DC: Island Press. 493 p.

Anderson, H.W. 1976. Fire effects on water supply, floods, and sedimentation. Tall Timbers Fire Ecol. Conf. Proc. 15:249-260.

Aulerich, D.E., K.N. Johnson, H. Froehlich. 1974. Tractors or skylines: what's best for thinning young-growth Douglas-fir? Forest Industries 10 1:42-45.

Bradshaw, G. 1979. Preplanned skid trails and winching versus conventional harvesting on a partial cut. Research Note 62. Forest Research Lab, School of Forestry, Oregon State University. Corvallis, Oregon. 4pp.

Brown, G.W. 1972. The Alsea Watershed Study. Pac. Logging Cong. Loggers Hbk. Vol. 32. 6 p.

Burroughs, E.R., Jr., John G. King. 1989. Reduction of soil erosion on forest roads. General Technical Report INT-264. USDA Forest Service, Intermountain Research Station. Ogden, Utah. 21pp.

Christner, J., R. D. Harr. 1982. Peak streamflows from the transient snow zone, Western Cascades, Oregon. Proceedings of the 50th Western Snow Conference, Colorado State University, Fort Collins, Colorado, pp. 27-38.

Coker, R. J., Fahey, B. D., Payne, J. J. 1993. Fine Sediment Production from Truck Traffic, Queen Charlotte Forest, Marlborough Sounds, New Zealand. Journal of Hydrology (NZ) 31, 56-64.

Czarnomski, N., C. Hale. 2013. Effectiveness of Riparian Buffers at Protecting Stream Temperature and Shade in Pacific Northwest Forests: A Systematic Review. 258pp.

DeBano, L.F., D.G. Neary, P.F. Ffolliott. 1998. Fire' s Effects on Ecosystems. New York: John Wiley & Sons. 333 p.

Froehlich, H.A., D.E. Aulerich, R.Curtis. 1981. Designing skid trail systems to reduce soil impacts from tractive logging machines. Research Paper 44. Forest Research Lab, School of Forestry, Oregon State University. Corvallis, Oregon. l5pp.

Geren, B. A. 2006. Predicting sediment delivery from small catchments in the western Cascades of Oregon using the U.S.F.S. Disturbed Water Erosion Prediction Project (WEPP) model. M.S. Thesis, Oregon State University. Corvallis, Oregon. 84pp.

Harr, R. D., W. C. Harper, J. T. Kregier, F. S. Hsieh. 1975. Changes in storm hydrographs after road building and clear cutting in the Oregon Coast Range. Water Resource Research 11(3):436-444.

Harr, R. D., Richard Fredriksen, and Jack S. Rothacher. 1979. Changes in stream flow following timber harvest in southwestern Oregon. Research Paper PNW-249. USDA Forest Service, Pacific Northwest Forest and Range Experiment Station. Portland, Oregon. 22pp.

Harr, R. D. 1979. Effects of timber harvest on stream flow in the rain-dominated portion of the Pacific Northwest. In: Process Workshop on Scheduling Timber Harvest for Hydrologic Concerns, Portland, Oregon, November 27-29, 1979. USDA Forest Service, Pacific Northwest Region. Portland, Oregon. 45pp.

Harr, R. D. 1981. Some characteristics and consequences of snowmelt during rainfall in western Oregon. Journal of Hydrology 53:277-304.

Helvey, J.D. 1980. Effects of a north central Washington wildfire on runoff and sediment production. Water Resour. Bull. 16:627-634.

Helvey, J.D., A.R. Tiedemann, T.D. Anderson. 1985. Plant nutrient losses by soil movement after wildfire. J. Soil Water Conserv. 40:168-173.

Jones, J. A., G. E. Gordon. 1996. Peak flow response to clear-cutting and roads in small and large basins, Western Cascades, Oregon. Water Resources Research 32 (4): 959-974.

Lakel, William A., III; Aust, Wallace M.; Aust, M.; Bolding, Chad; Dolloff, C. Andrew; Keyser, Patrick; Feldt, Robert. 2010. Sediment trapping by streamside management zones of various widths after forest harvest and site preparation. Forest Science 56(6):541-551.

Levno, A., J. Rothacher. 1969. Increases in maximum stream temperatures after slash burning in a small experimental watershed. USDA For. Serv., Pac. Northwest For. Rge. Exp. Sta., Portland, OR. Res. Note PNW-110. 7.

Oregon State Department of Human Services and Oregon State Department of Environmental Quality. 2003. Source Water Assessment Report; Crystal Springs Water District, Odell, Oregon; Hood River County; PWS#4100386. 36pp.

Packer, P.E. 1967. Criteria for designing and locating logging roads to control sediment. Forest Science 13 (1). l8pp.

Rashin, E. B., C. J. Clishe, A. T. Loch, J. M Bell. 2006. Effectiveness of Timber Harvest Practices for Controlling Sediment Related Water Quality Impacts. Journal- American Water Resources Association, Vol. 42 (5): 1307-1328

Reid, L.M., T. Dunne, 1984. Sediment production from road surfaces. Water Resources Research vol. 20:1753-1761.

Rhoades C. C., D. Entwistle, D. Butler, 2011. The influence of wildfire extent and severity on streamwater chemistry, sediment and temperature following the Hayman Fire, Colorado. International Journal of Wildland Fire 20, 430–442.

Robichaud, P. R., R. E. Brown. 1999. What happened after the smoke cleared: onsite erosion rates after a wildfire in Eastern Oregon. Presented at the Wildland Hydrology Conference, Bozeman, MT. American Water Resources Assoc. 419- 426.

Rosgen, D. 1996. Applied River Morphology. Wildland Hydrology, Pagosa Springs, CO: 343 pp.

Tollefson, Jennifer E., F. J. Swanson, J. H. Cissel. 2004. Fire severity in intermittent stream drainages, western Cascade Range, Oregon. Northwest Science. 78(3): 186-191.

USDA Forest Service. 1996,1997,2000,2002. Hood River and Barlow Ranger District Stream Surveys. Mt. Hood National Forest, Parkdale, OR.

USDA Forest Service. 1998. “Forest Plan Management Direction - Interpretation #8, Eastside Watershed Hydrologic Recovery”. Mt. Hood National Forest, Sandy, OR.

USDA Forest Service, et al. 2004. Sufficiency Analysis for Stream Temperature: Evaluation of the adequacy of the Northwest Forest Plan Riparian Reserves to achieve and maintain stream temperature water quality standards. Portland, OR.

USDA Forest Service, et al. 1994. Record of Decision for amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl, and Standards and Guidelines for Management of Habitat for LateSuccessional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl. Portland, OR.

USDA Forest Service. 2012. National Best Management Practices for Water Quality Management on National Forestm System Lands – Volume 1: National Core BMP Technical Guide. FS-990a. 165pp.

USDA Forest Service. 2014. Mt. Hood BMP Monitoring Report - 2013. Mt. Hood National Forest, Sandy, OR.

USDA Forest Service. 2015. Mt. Hood BMP Monitoring Report Executive Summary - 2014. Mt. Hood National Forest, Sandy, OR.

US Environmental Protection Agency. 2005. Draft EPA Region 10 Source Water Protection Best Management Practices for USFS, BLM.

Salminen, E. 2006. “Likely Effects of Catastrophic Wildfire on Crystal Springs Water Quality/Quantity” memo. Eastfork Environmental LLC.

Welsh, M.J., L.H. MacDonald, and E. Brown, and Z. Libohova. 2006. Erosion and sediment delivery from unpaved roads and off-highway vehicles (OHV). Presented at AGU fall meeting. San Francisco, CA.

Wemple, B.C., J. A. Jones, G. E. Grant. 1996. Channel network extension by logging roads in two basins, Western Cascades, Oregon. Water Resources Bulletin 32 (6):11951207.

Ziegler, A. D., Sutherland, R. A. and Giambelluca, T. W. (2001), Interstorm surface preparation and sediment detachment by vehicle traffic on unpaved mountain roads. Earth Surf. Process. Landforms, 26: 235–250.

Fisheries

Aldridge, D. W., B. S. Payne, and A. C. Miller. 1987. The effects of intermittent exposure to suspended solids and turbulence on three species of freshwater mussels. Environmental Pollution 45:17-28.

Allen, J.D., and M.M. Castillo. 2007. Stream ecology: structure and function of running waters. 2nd ed. Dordrecht, The Netherlands. 436 pages.

Anderson, N.H. 1976. Distribution and ecology of Oregon trichoptera. Technical Bulletin #134. Agricultural Experiment Station, Oregon State University, Corvallis, Oregon, 152 pp.

Beechie, T. J., and T. H. Sibley. 1997. Relationship between channel characteristics, woody debris, and fish habitat in northwestern Washington streams. Transactions of the American Fisheries Society. 126: 217-229.

Beechie, T. J., G. Pess, P. Kennard, R.E. Bilby, and S. Bolton. 2000. Modeling recovery rates and pathways for woody debris recruitment in northwestern Washington streams. North American Journal of Fisheries Management 20: 436-452.

Bjornn, T. C., and seven coauthors. 1974. Sediment in streams and its effects on aquatic life. University of Idaho, Water Resources Research Institute, Research Technical Completion Report Project B-025-IDA, Moscow.

Bjornn, T. C., and six coauthors. 1977. Transport of granitic sediment in streams and its effects on insects and fish. University of Idaho, College of Forestry, Wildlife and Range Sciences, Bulletin 17, Moscow.

Bjornn, T. C., and D. W. Reiser. 1991. Habitat requirements of salmonids in streams. American Fisheries Society Special Publication 19: 83-138.

Borgias, D., and R. W. Wisseman. 1999. Report on the 1998 and 1999 survey for *Rhyacophila colonus*, in forested torrents near O'Brien, Oregon. The Nature Conservancy of Oregon. Prepared for Diane Perez, Siskiyou National Forest.

Buffington, J. M., Lisle, T. E., Woodsmith, R. D., and S. Hilton. 2002. Controls on the size and occurrence of pools in coarse-grained forest rivers. River Research and Applications. 18: 507-531.

Bustard, D. R., and D. W. Narver. 1975. Preferences of juvenile Coho salmon (Oncorhynchus kisutch) and cutthroat trout (Salmo clarki) relative to simulated alteration of winter habitat. Journal of the Fisheries Research Board of Canada. 32: 681-687.

Cline, L. D., R. A. Short, and J. V. Ward. 1982. The influence of highway construction on the macroinvertebrates and epilithic algae of a high mountain stream. Hydrobiologia 96: 149-159.

Confederated Tribes of the Warm Springs Reservation and Oregon Department of Fish and Wildlife. 1991. Hood River Production Master Plan. Prepared for the Bonneville Power Administration, Project Number 88-053, Contract Number DE-B179-89BP00631. 90 pp.

Culp, J. M., S. J. Walde, and R. W. Davies. 1983. Relative importance of substrate particle size and detritus of stream benthic macroinvertebrate microdistribution. Canadian Journal of Fisheries and Aquatic Sciences 40:1568-1574.

DeWalt, R. E., and J. H. Olive. 1988. Effects of eroding glacial silt on the benthic insects of Silver Creek, Portage County, Ohio. Ohio Journal of Science 88:154-159.

Everest, F. H. and five coauthors. 1987. Fine sediment and salmonid production- a paradox. In *Streamside management: forestry and fishery interactions*. E. Salo and T. Cundy Eds. University of Washington, Seattle. p 98-142.

Frest, T. J., and E. J. Johannes. 1995. Interior Columbia Basin mollusk species of special concern. Final report: Interior Columbia Basin Ecosystem Management Project, Walla Walla, WA. Contract #43-0E00-4-9112. 274 pp. plus appendices.

Furnish, J., and R. Monthey. 1998. Conservation assessment for mollusk species associated with springs and spring runs: *Fluminicola* new species 2, 3, 11

Vorticifex klamathensis sinitsini; *Juga* (*Oreobasis*) new species 2; and *Lyogyrus* new spp. 1. version. 2.0. USDI, Bureau of Land Management, Portland, OR.

Hall, T. J. 1986. A laboratory study of the effects of fine sediments on survival of three species of Pacific salmon from eyed egg to fry emergence. National Council of the Paper Industry for Air and Stream Improvement, Technical Bulletin 482, New York.

Hillman, T. W., J. S. Griffith, and W. S. Platts. 1987. Summer and winter habitat selection by juvenile chinook salmon in a highly sedimented Idaho stream. Transactions of the American Fisheries Society 116:185-195.

McCullough, D. 1999. A Review and synthesis of effects of alterations to the water temperature regime on freshwater life stages of salmonids, with special reference to Chinook salmon. Columbia Intertribal Fisheries Commission, Portland, OR. Prepared for the U.S. Environmental Protection Agency Region 10. Published as EPA 910-R-99-010.

McClelland, W. T., and M. A. Brusven. 1980. Effects of sedimentation on the behavior and distribution of riffle insects in a laboratory stream. Aquatic Insects 2: 161-169.

McLeay, D. J., A. J. Knox, J. G. Malick, I. K. Birtwell, G. Hartman, and G. L. Ennis. 1983. Effects on Arctic grayling (*Thymallus arcticus*) of short-term exposure to Yukon placer mining sediments: laboratory and field studies. Canadian Technical Report of Fisheries and Aquatic Sciences 1171.

McNeil, J.W., and W.H. Ahnell. 1964. Success of pink salmon spawning relative to size of spawning bed materials. U.S. Fish and Wildlife Service Special Scientific Report – Fisheries 469.

Meleason, M. A., Gregory, S. V., and J. Bolte. 2002. Simulation of stream wood source distance for small streams in the western Cascades, Oregon. USDA Forest Service Gen. Tech. Rep. PSW-GTR-181.

Montgomery, D. R., J. M. Buffington, R. D. Smith, K. M. Schmidt, and G. Pess. 1995. Pool spacing in forest channels. Water Resources Research. 31: 1097-1105.

Montgomery, D. R., B. D. Collins, J. M. Buffington, and T. B. Abbe. 2003. Geomorphic effects of wood in rivers. American Fisheries Society Symposium 37: 21-47.

ODFW (Oregon Department of Fish and Wildlife) and CTWSRO (Confederated Tribes of the Warm Springs Reservation of Oregon). 1990. Hood River subbasin salmon and steelhead production plan. Columbia Basin System Planning Report to the Northwest Power Planning Council, Portland, Oregon.

Oregon Natural Heritage Program. 2005. Scott’s Apatanian caddisfly, *Allomyia scottia.* (Publisher unknown).

Reiser, D. W., and R. G. White.1988. Effects of two sediment size-classes on survival of steelhead and chinook salmon eggs. North American Journal of Fisheries Management 8:432-437.

Rosetta, T. 2005. Technical basis for revising turbidity criteria. DRAFT. Water Quality Division. The Oregon Department of Environmental Quality. 128 pp.

Rutherford, J. E., and R. J. Mackay. 1986. Patterns of pupal mortality in field populations of *Hydropsyche* and *Cheumatopsyche* (Trichoptera, Hydropsychidae). Freshwater Biology 16:337-350.

Sigler, J. W., T. C. Bjornn, and F. H. Everest. 1984. Effects of chronic turbidity on density and growth of steelheads and Coho salmon. Transactions of the American Fisheries Society 113:142-150.

Sheridan, W. L., and W. J. McNeil. 1968. Some effects of logging on two salmon streams in Alaska. J. of Forestry. 66: 128-133.

Spellman, F.R. 2008. The science of water: concepts and applications. Taylor & Francis Group, LLC, Boca Raton, FL. 422.

Spies, T., M. Pollock, G. Reeves, and T. Beechie. 2013. Effects of riparian thinning on wood recruitment: a scientific synthesis. Report to the Interagency Coordinating subgroup from the Science Review Team Wood Recruitment subgroup. 46 pp.

Tagart, J. V. 1984. Coho salmon survival from egg deposition to fry emergence. Pages 173–181 *in* J. M. Walton and D. B. Houston, editors. Proceedings of the Olympic Wild Fish Conference, Port Angeles, Washington, March 1983. Peninsula College, Fisheries Technical Program, Port Angeles, Washington.

Tsui, P. T. P., and P. J. McCart. 1981. Effects of stream-crossing by a pipeline on the benthic macroinvertebrate communities of a small mountain stream. Hydrobiologia 79:271-276.

U.S. Department of Agriculture, Forest Service. 1996. West Fork of Hood River Watershed Analysis. Mt. Hood National Forest. Oregon.

U.S. Forest Service, and U.S. Bureau of Land Management. 1994. 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). Portland, Oregon.

U.S. Forest Service, and U.S. Bureau of Land Management. 2001. Record of decision and standards and guidelines for amendments to the survey and manage, protection buffer, and other mitigation measures standards and guidelines. USFS Region 6 and BLM, Portland, Oregon.

U.S. Fish and Wildlife Service. 2002. Chapter 6, Hood River Recovery Unit, Oregon. 66 p. *In*: U.S. Fish and Wildlife Service. Bull Trout (*Salvelinus confluentus*) Draft Recovery Plan. Portland, Oregon.

U.S. Fish and Wildlife Service. 2010. Endangered and Threatened Wildlife and Plants; Revised Designation of Critical Habitat for Bull Trout in the Coterminous United States; Final Rule. Federal Register, Vol. 75, No. 200, Monday, October 18, 2010

Waters, T.F. 1995. Sediment in streams: sources, biological effects, and control. American Fisheries Society Monograph 7.

Wiggins, G.B. 1973. Contributions to the systematics of the caddisfly family Limnephilidae (Trichoptera). I. Life Sciences Contributions Royal Ontario Museum No. 94. 32 pp.

Wildlife

Anthony, R. G., E.D. Forsman, A.B. Franklin, D.R. Anderson, K.P. Burnham, G.C. White, C.J. Schwartz, J. Nichols, J.E. Hines, G.S. Olson, S.H. Ackers, S. Andrews, B.L. Biswell, P.C. Carlson, L.V. Diller, K.M. Dugger, K.E. Fehring, T.L. Fleming, R.P. Gerhardt, S.A. Gremel, R.J. Gutierrez, P.J. Happe, D.R. Herter, J.M. Higley, R.B. Horn, L.L. Irwin, P.J. Loschl, J.A. Reid, S.G. Sovern. Status and Trends in Demography of the Northern Spotted Owls, 1985-2003. Wildlife monographs vol. 163, issue 1, July 2006. 179pp.

Bruner, H.J. 1997. Habitat use and productivity in the central Cascade Range of Oregon. Master's Thesis, Oregon State University, Corvallis, OR.

Buchanan, J.B. 2009. Balancing competing habitat management needs for northern spotted owls and other bird species in dry forest landscapes. Pages 109–117 in: T.D. Rich, C. Arizmendi, D. Demarest, and C. Thompson

Buskirk, S.W. and L.F. Ruggiero. 1994. Marten. Pages 7-37 in L.F. Ruggiero, K.B. Aubry, S.W. Buskirk, L. Jack Lyon, and W.J. Zielinski, eds. The scientific basis for conserving forest carnivores. Gen. Tech. Rep. RM-254. Ft. Collins, CO: USDA, Forest Service, Rocky Mountain Forest and Range Experiment Station. 184 p.

Cassirer, E.F., J.D. Reichel, R.L. Wallen, and E.C. Atkinson. 1996. Harlequin Duck (*Histrionicus histrionicus*) United States Forest Service/Bureau of Land Management habitat conservation assessment and conservation strategy for the U.S. Rocky Mountains. Idaho Department of Fish and Game, Boise, ID.

Cooke, F. G. J. Robertson, C. M. Smith, R. I. Goudie, and W. S. Boyd. 2000. Survival, emigration, and winter population structure of Harlequin Ducks. Condor 102:137-144

Cooper, J.M, and Wright, K.G. March 1998. Inventory Methods for Riverine Birds: Harlequin Duck, Belted Kingfisher and American Dipper. Version 2.0. http://ilmbwww.gov.bc.ca/risc/pubs/tebiodiv/rbirds/index.htm

Cornell Lab of Ornithology. 2003. http://www.birds.cornell.edu/AllAboutBirds/BirdGuide/Harlequin_Duck_dtl.html

Courtney, S.P., J.A. Blakesley, R.E. Bigley, M.L. Cody, J.P. Dumbacher, R.C. Fleischer, A.B. Franklin, J.K. Franklin, R.J. Gutierrez, J.M. Marzluff, L. Sztukowski. 2004. Scientific evaluation of the status of the Northern Spotted Owl. Sustainable Ecosystems Institute. Portland, Oregon.

Crisafulli, C.M. 1999. Survey Protocol for the Larch Mountain salamander (*Plethodon larselli*), Version 3.0. Chapter VII, pp. 253-310, In: Olson, D.H. (Ed.), Survey protocols for amphibians under the Survey & Manage provision of the Northwest Forest Plan, Version 3.0, October 1999. Interagency Publication of the Regional Ecosystem Office, Portland, OR. BLM Publ. BLM/OR/WA/PT-00/033+1792, U.S. GPO: 2000-589-124/04022 Region No. 10, 310 p.

Crisafulli, C.M. 2005. Larch Mountain salamander, Plethodon larselli Burns. In: Jones, L.L.C.; Leonard, W.P.; Olson, D.H. Amphibians of the Pacific Northwest. Seattle Audubon Society, Seattle, WA.

Csuti, B, A., J. Kimerling, T.A. O'Neil, M.M. Shaughnessy, E.P. Gaines, M.M.P. Huso. 1997. Atlas of Oregon Wildlife - Distribution, Habitat, and Natural History. Oregon State University Press. Corvallis, Oregon.

Dowlan, S. 1996. The breeding status and distribution of Harlequin Ducks in Oregon: a summary of observations and survey efforts. Oregon Birds 22:42-47. in North American Bird Bander, July-September 1996. Volume 21, Number 3.

Dugger, K.M., R.G. Anthony and L.S. Andrews. 2011. Transient dynamics of invasive competition: barred owls, spotted owls, habitat composition and the demons of competition present.

Fontaine, J.B. and Kennedy, P.L. 2012. Meta-analysis of avian and small mammal response to fire severity and fire surrogate treatments in U.S. fire-prone forests. Ecological Applications, 22 (5). pp. 1547-1561.

Forsman, E.D., R.G. Anthony, K.M. Dugger, E.M. Glenn, A.B. Franklin, G.C. White, C.J.Schwarz, K.P. Burnham, D.R. Anderson, J.D. Nichols, J.E. Hines, J.B. Lint, R.J. Davis, S.H. Ackers, L.S. Andrews, B.L. Biswell, P.C. Carlson, L.V. Diller, S.A. Gremel, D.R. Herter, J.M. Higley, R.B. Horn, J.A. Reid, J. Rockweit, J. Schaberl, T.J. Snetsinger and S.G. Sovern. 2011. Population demography of northern spotted owls: 1985–2008. Studies in Avian Biology.

Cooper Ornithological Society.

Goudie, R.I. and C.D. Ankney. 1986. Body size, activity budgets, and diets of sea ducks wintering in Newfoundland. Ecology 67:1475-1482.

Goulsen, D. 2003a. Bumblebees: their behaviour and ecology. Oxford University Press, Oxford, England.

Goulsen, D. 2003b. Conserving wild bees for crop pollination. Food, Agriculture & Environment 1(1): 142-144.

Hagar, Joan, and Friesen, Cheryl, 2009, Young stand thinning and diversity study: Response of songbird community one decade post treatment: U.S. Geological Survey Open-File Report 2009-1253, 20 p.

Hamer, T.E., S.G. Seim, and K.R. Dixon. 1989. Northern spotted owl and northern barred owl habitat use and home range size in Washington: preliminary report. Washington Department of Wildlife, Olympia, Washington. 7 pp.

Hartwig, C.L., D.S. Eastman, and A.S. Harestad. 2004. Characteristics of foraging sites and the use of structural elements by the pileated woodpecker (*Dryocopus pileatus*) on southeastern Vancouver Island, British Columbia, Canada.

Healey, S.P., W.B. Cohen, T.A. Spies, M. Moeur, D. Pflugmacher, M.G. Whitley and M. Lefsky. 2008. The relative impact of harvest and fire upon landscapelevel dynamics of older forests: lessons from the Northwest Forest Plan. Ecosystems 11: 1106-1119.

Heinrich, B. 2004. Bumblebee economics. Harvard University Press, Cambridge, Massachusetts. 245 pp.

Hendricks, D.P. and J.D. Reichel. 1998. Harlequin Duck research and monitoring in Montana: 1997. Unpublished report, Montana Natural Heritage Program, Helena, MT.

Hessburg, P.F., and J.K. Agee. 2003. An environmental narrative of Inland Northwest United States forests, 1800–2000. Forest Ecology and Management 178:23–59.

Hessburg, P.F., J.K. Agee and J.F. Franklin. 2005. Dry forests wildland fires of the inland Northwest USA: Contrasting the landscape ecology of the presettlement and modern eras. Forest Ecology and Management 211:117–139.

Hessburg, P.F., B.G. Smith, R.B. Salter, R.D. Ottmar and E. Alvarado. 2000. Recent changes (1930s–1990s) in spatial patterns of interior northwest forests, USA. Forest Ecology and Management 136:53–83.
Iverson, W.F. 1993. Is the barred owl displacing the spotted owl in western Washington? M.S. Thesis, Western Washington University, Bellingham, Washington. 62 pp.

Kucera, T.E., Zelinski, W.J. and Barrett, R.H. 1995. The current distribution of American marten in California. California Fish and Game, 103pp.

Kuchel, C.R. 1977. Some aspects of the behavior and ecology of Harlequin Ducks breeding in Glacier National Park, Montana. Master's Thesis, University of Montana, Missoula, MT

Marshal, D. B., M. G. Hunter, A. L.Contreras, Eds. 2003. Brids of Oregon: A General Reverence. Oregon State University Press, Corvallis, OR. 768pp.

Martin, S.K. 1994. Feeding ecology of American martens and fishers. In: Buskirk, S.W.; Harestat, A.S.; Raphael, M.B., comps., eds. Martens, sables, and fishers: biology and conservation. Ithaca, NY: Cornell University Press: 297-315.

McComb, B., Kellogg, L., and Tappeiner, J. 2013. Young Stand Thinning and Diversity Study. Establishment Report, Study Plan, and Key Findings. 70pp.

Mellen, T. Kim, E. Charles Meslow, R. William Mannan Source Summertime Home Range and Habitat Use of Pileated Woodpeckers in Western: The Journal of Wildlife Management, Vol. 56, No. 1 (Jan., 1992), pp. 96-103Published by: Allen PressStable URL: http://www.jstor.org/stable/3808796.

Mellen, Kim, Bruce G. Marcot, Janet L. Ohmann, Karen Waddell, Susan A. Livingston, Elizabeth A. Willhite, Bruce B. Hostetler, Catherine Ogden, and Tina Dreisbach. 2003. DecAID, the decayed wood advisor for managing snags, patially dead trees, and down wood for biodiversity in forests of Washington and Oregon. Version 1.10. USDA Forest Service, Pacific Northwest Research Station; USDI Fish and Wildlife Service, Oregon State Office; Portland, Oregon.
http://wwwnotes.fs.fed.us:81/pnw/DecAID/DecAID.nsf

NatureServe. 2007. NatureServe Explorer: An online encyclopedia of life [web application]. Version 6.2. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer.

Nauman, R.S.; Olson, D.H. 1999. Survey and Manage salamander known sites, Version 3.0. Chapter II, pp 43-78 in: Olson, D.H. (Ed.), Survey protocols for amphibians under the Survey & Manage provision of the Northwest Forest Plan, Version 3.0, October 1999. Interagency Publication of the Regional Ecosystem Office, Portland, OR. BLM Publ. BLM/OR/WA/PT-00/033+1792, U.S. GPO: 2000-589-124/04022 Region No. 10, 310 p.

Nussbaum, R.A.; Brodie, E.D., Jr.; Storm, R.M. 1983. Amphibians and Reptiles of the Pacific Northwest. The University Press of Idaho. Moscow, ID. 332 p.

Ollivier, L.M.; Welsh, H.H. Jr.; Clayton, D.R. 2001. Habitat correlates of the Siskiyou Mountains salamander, *Plethodon stormi* with comments on the species' range. U.S. Department of Agriculture Forest Service, Redwood Science Laboratory, 1700 Bayview Drive, Arcata, CA 95521. June, 2001.

Pearson, R.R., and K.B. Livezey. 2003. Distribution, numbers, and site characteristics of spotted owls and barred owls in the Cascade Mountains of Washington. Journal of Raptor Research 37(4):265-276.

Raphael, M.G. 1988. Long-term trends in abundance of amphibians, reptiles and mammals in Douglas-fir forests of northwestern California. In: Szaro, R.C.; Severson, K.E.; Patton, D.R., eds. Management of amphibians, reptiles and small mammals in North America. Gen. Tech. Rep. RM-166. Ft. Collins, CO: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station: 23-31.

Regehr, H.M., C.M. Smith, B. Arquilla, and F. Cooke. 2001. Post-fledging broods of migratory Harlequin Ducks accompany females to wintering areas. Condor 103:408-412.

Robertson, G. J., F. Cooke, R. I. Goudie, and W. S. Boyd. 2000. Spacing patterns, mating systems, and winter philopatry in Harlequin Ducks. Auk 117:299-307.

Robertson, G.J. and R.I. Goudie. 1999. Harlequin Duck (*Histrionicus histrionicus*). In: The Birds of North America. No. 466. A. Poole and F. Gill, editors. The Birds of North America, Inc., Philadelphia, PA.

Simon, T.L. 1980. An ecological study of the pine marten in the Tahoe National Forest. Sacramento, CA: California State University. M.S. thesis 143pp.

Skinner, C.N., and A.H. Taylor. 2006. Southern Cascades bioregion. Pages 195–224 in N.G. Sugihara, J.W. van Wagtendonk, K.E. Shaffer, J. Fites-Kaufman and A.E. Thode (editors), Fire in California's Ecosystems. University of California Press, Berkeley.

Spahr, R., L. Armstrong, D. Atwood, and M. Rath. 1991. Threatened, Endangered, and Sensitive species of the Intermountain Region. USDA Forest Service, Intermountain Region, Ogden, UT.

Street, R. 1999. "*Histrionicus histrionicus*" (On-line), Animal Diversity Web. http://animaldiversity.ummz.umich.edu/site/accounts/information/Histrionicus_histrionicus.html

Thomas, J.W., Editor. 1979. Wildlife habitats in managed forests – The Blue Mountains of Oregon and Washington. U.S. Dep. Agric., For. Serv. Handb. 533. 512pp.

Thomas, J.W., E.D. Forsman, J.B. Lint, E.C. Meslow, B.R. Noon, and J. Verner. 1990. A conservation strategy for the northern spotted owl. Report of the Interagency Scientific Committee to address the conservation of the northern spotted owl. Unpublished interagency document. 458 pages.

Thompson, I.D.; Harestad, A.S. 1994. Effects of logging on American martens with models for habitat management. In: Buskirk, S.W.; Harestad, A.S.; Faraek, M.G., comps., eds. Martens sables and fishers: biology and conservation. Ithica, NY: Cornell University Press: 355-367.

Thorp, R.W., D.S.H. Jr. and L.L. Dunning. 1983. Bumblebees and cuckoo bumblebees of California. University of California Press, Berkeley, Los Angeles, London. 3 pp.

Thorp, R.W., E. Evans and S.H. Black. 2008. Status review of three formerly common species of bumblebee in the subgenus *Bombus*. 63 pp.

USDA Forest Service. 2009. Forest Vegetation Simulator (FVS) http://www.fs.fed.us/fmsc/fvs/

USDA (U.S. Department of Agriculture), and USDI (U.S. Department of the Interior). 1994. Record of decision for amendments to Forest Service and Bureau of Land Management planning documents within the range of the northern spotted owl: standards and guidelines for management of habitat for late-successional and old-growth forest related species within the range of the northern spotted owl. U.S. Forest Service and U.S. Bureau of Land Management, Portland, Oregon.

U.S. Fish and Wildlife Service. 2011. Revised Recovery Plan for the Northern Spotted Owl (*Strix occidentalis caurina*). U.S. Fish and Wildlife Service, Portland, Oregon. xvi + 258 pp.

Welsh, H.H. Jr. 1990. Relictual amphibians and old-growth forests. Conservation Biology 4: 309-319.

Welsh, H.H. Jr.; Lind, A.J. 1988. Old growth forests and the distribution of the terrestrial herpetofauna. In: Szaro, R.C.; Severson, K.E.; Patton, D.R., eds. Management of amphibians, reptiles and small mammals in North America. Gen. Tech. Rep. RM-166. Ft. Collins, CO: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station: 439-458.

Welsh, H.H. Jr.; Lind, A.J. 1991. The structure of the herpetofaunal assemblage of the Douglas-fir forests of Northwestern California and Southwestern Oregon. In: Ruggiero, L.; Aubry, K.; Carey, A.; Huff, M. (tech. coords.), Wildlife and Vegetation of Unmanaged Douglas-fir Forests, USDA Forest Service Gen. Tech. Rep. PNW-285, Pacific Northwest Research Station, Portland, Oregon: 394-413.

Wiens, J.D. 2012. Competitive Interactions and Resource Partitioning Between Northern Spotted Owls and Barred Owls in Western Oregon. An Abstract of Dissertation.

Wiggins, D. (2005, October 17). Harlequin Duck (*Histrionicus histrionicus*): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. http://www.fs.fed.us/r2/projects/scp/assessments/harlequinduck.pdf [date of access].

Witmer, G.W. and D.S. DeCalesta. 1985. Effects of forest roads on habitat use by Roosevelt elk. Northwest Science (2): 122-125.

Xerces Society. 2009. Bumblebees: western bumblebee (*Bombus occidentalis*). Profile prepared by R. W. Thorp, E. Evans and S. H. Black.

Zabel, C. J., J.R. Dunk, H.B. Stauffer, L.M. Roberts, B.S. Mulder, and A. Wright. 2003. Northern spotted owl habitat models for research and management application in California (USA). Ecological Applications 13(4): 1027-1040.

Zielinski, W.J., Trues, R.L., Ogan, C.V. and Busse, K. 1997. Detection surveys for fishers and American martens in California, 1989-1994: summary and interpretations. *Martes: taxonomy, ecology, techniques and management* (ed. By G. Proulx, H.N. Bryant and P.M. Woodard).

Botany

Allen, M. 1991. The Ecology of Mycorrhizae. Cambridge University Press.

Arora, D. 1986. Mushrooms demystified. 2nd Edition. Berkeley, CA: Ten Speed Press. 976 p.

Brodo, I.M., S.D. Sharnoff, & S. Sharnoff. 2001. Lichens of North America. New Haven: Yale

University Press.

Castellano, Michael A.; Smith, Jane E.; O'Dell, Thom; Cázares, Efrén; Nugent, Susan. 1999. Handbook to Strategy 1 Fungal Species in the Northwest Forest Plan, USDA Forest Service, Pacific Northwest Research Station, PNW-GTR-476. Portland, OR. http://www.fs.fed.us/pnw/pubs/pnw_gtr476.pdf

Castellano, M.A., E. Cazares, B. Fondrick, & T. Dreisbach. 2003. Handbook to Additional Fungal Species of Special Concern in the Northwest Forest Plan, USDA Forest Service, Pacific Northwest Research Station, PNW-GTR-572. Portland, OR.

Chen, J., Franklin, J.F., & T. Spies. 1992. Vegetation Responses to Edge Environments in Old-Growth Douglas-Fir Forests. Ecological Applications, Vol. 2, No. 4, (Nov., 1992), pp, 387-396.

Christy, John. A., and David H. Wagner. 1995. Guide for the Identification of Rare, Threatened or Sensitive Bryophytes in the Range of the Northern Spotted Owl, Western Washington, Western Oregon, and Northwestern California. USDA Forest Service, USDI Bureau of Land Management, The Nature Conservancy, and the Northwest Botanical Institute. Portland, Oregon.

Exeter, R.L., L.L. Norvell, and E. Cazares. Ramaria of the Pacific Northwestern United States. USDI BLM/OR/WA/PT-06/050-1792, Salem, OR. 157 p.

Evers, L 2001. "Effects of Fuels Treatments on Habitat Elements Important to Survey and Manage Species. Regional Ecosystem Office. Portland, OR.

Franklin, J.F. and C.T. Dyrness. 1987. Natural Vegetation of Oregon and Washington. Corvallis: Oregon State University Press.

Gibson, Ian. 2009. Trial field key to CLUB-SHAPED FUNGI in the Pacific Northwest. Mycological Society; Pacific Northwest Key Council. http://www.svims.ca/council/Clubs.htm

Hitchcock, C.L. and A. Cronquist. 1987. Flora of the Pacific Northwest. Seattle: University of Washington Press.

Lawton, E. 1971. Moss flora of the Pacific Northwest. Hattori Botanical Laboratory. Nichinan, Japan

McCain, C. and N. Diaz. 2002. Field guide to the forested plant associations of the westside central Cascades of northwest Oregon. USDA Forest Service, Pacific Northwest Region, Technical Paper R6-NR-ECOL-TP-02-02.

McCune, B. & L. Geiser. 2009. Macrolichens of the Pacific Northwest. 2nd Edition. Corvallis: Oregon State University Press.

McIver, J.D. and L. Starr, Editors. 2000. Environmental Effects of Post fire Logging: Literature Review and Annotated Bibliography. USDA Forest Service, Pacific Northwest Research Station, Portland, OR. General Technical Report PNW-GTR486.

Moeur, M., T.A. Spies, M. Hemstrom, , J.R. Martin, J. Alegria, J. Browning, J. Cissel, W. B. Cohen, T.E. Demeo, S. Healey, R. Warbington. Northwest Forest Plan: The First Ten Years (1994-2003) - Status and Trend of Late-Successional and Old-Growth Forest.

National Resources Inventory System (NRIS) - Threatened, Endangered, and Sensitive (TES) Plants database (2011).

Norvell, L.L. & R. L. Exeter.2009. Phaeocollybia of Pacific Northwest North America. Bureau of Land Management Salem District. ISBN-13: 978-0-9791310-1-1.

Oregon Biodiversity Information Center. 2013. Rare, Threatened and Endangered Species of

Oregon. Institute for Natural Resources, Portland State University, Portland, Oregon. *http://orbic.pdx.edu*

Paton, J.A. 1999. The Liverwort Flora of the British Isles. Harley Books. Essex, UK.

Penttila, R. and H. Kotiranta. 1996. Short-term effects of prescribed burning on woodrotting fungi. Silva Fennica 30(4):399-419. USDA, Forest Service and USDOI, Bureau of Land

Peter, D. 1992. Proposed interim definition for old-growth mountain hemlock. Unpublished document. USDA-Forest Service, Pacific Northwest Research Station, Olympia, WA.

Regional Forester's Special Status Species List. USDA Forest Service- Pacific Northwest Region. Updated December 2011.

Simard, S.W. and D.M. Durall. 2004. Mycorrhizal networks: a review of their extent, function, and importance. Can. J. Bot. 82: 1140-1165.

Simpson, Michael. July 2007. Forested Plant Associations of the Oregon East Cascades. USDA-Forest Service. Technical Paper R6-NR-ECOL-TP-03-2007

Trudell, S. & J. Ammirati. 2009. Mushrooms of the Pacific Northwest. Portland, OR: Timber Press. 349 p.

USDA Forest Service & USDI Bureau of Land Management Interagency Special Status and Sensitive Species Program . Conservation Assessment for Fungi Included in Forest Service Region 6 Sensitive and BLM Oregon and Washington Special Status Species Programs. 2013. http://www.blm.gov/or/plans/surveyandmanage/recommendations/fungi.php

USDA Forest Service & USDI Bureau of Land Management Interagency Special Status and Sensitive Species Program . Effects of Prescribed Fire on Sensitive Fungi Species WORKING DRAFT PAPER. 2014. http://www.fs.fed.us/r6/sfpnw/issssp/species-index/flora-fungi.shtml

USDA Forest Service & USDI Bureau of Land Management Interagency Special Status and Sensitive Species Program . Effects of Commercial Thinning and Associated Activities on Habitat and Distribution of Fungi Species WORKING DRAFT PAPER. 2014. http://www.fs.fed.us/r6/sfpnw/issssp/species-index/flora-fungi.shtml

USDA Forest Service Region 6 & USDI Bureau of Land Management. Interagency Special Status/Sensitive Species Program (ISSSSP) Species Factsheets for Bryophytes, Lichens, and Fungi. http://www.fs.fed.us/r6/sfpnw/issssp/

USDA Forest Service Region 6 & USDI Bureau of Land Management. Interagency Special Status/Sensitive Species Program (ISSSSP) Species Survey Protocols for Bryophytes, Lichens, and Fungi Species Bridgeoporus nobillissimus. http://www.fs.fed.us/r6/sfpnw/issssp/

USDA Forest Service & USDI Bureau of Land Management Interagency Special Status and Sensitive Species Program . Mycorrhizal fungi: Biological/ecological information and effects of selected types of forest management actions. 2012. http://www.fs.fed.us/r6/sfpnw/issssp/species-index/flora-fungi.shtml

USDA Forest Service Region 6 & USDI Bureau of Land Management. 2008. Sporocarp Survey Protocol for Macrofungi, Version 1.0. Oregon and Washington.

USDA Forest Service Region 6 & USDI Bureau of Land Management. 2006. EMS TRANSMISSION BLM-Instruction Memorandum No. OR-2006. Category B Lichens and Bryophytes Where Strategic Surveys are Considered Complete. http://www.blm.gov/or/plans/surveyandmanage/files/02-categoryb_lichens_bryophytes.pdf

USDA Forest Service & USDI Bureau of Land Management Interagency Special Status / Sensitive Species Program (ISSSSP). Species Index.

http://www.fs.fed.us/r6/sfpnw/issssp/species-index/flora-fungi.shtml

USDA Forest Service Region 6 & USDI Bureau of Land Management. Survey & Manage Category B Fungi Equivalent-Effort Survey Protocol. Version 1.0. February 2012 Pacific Northwest Region. http://www.blm.gov/or/plans/surveyandmanage/files/sp-fu-catB-equiv-effort-2012.pdf

USDA Forest Service & USDI Bureau of Land Management. 2002. Survey and Manage Management Recommendation Amendments For Fuel Hazard Reduction Treatments Around At-Risk Communities Group 1 – Certain Fungi, Lichens, Bryophytes, Vascular Plants. http://www.blm.gov/or/plans/surveyandmanage/files/mr-fire_amendment-va-li-br-fu-2002-08-att1.pdf

USDA Forest Service & USDI Bureau of Land Management. 2006. Survey Protocol Guidance for Conducting Equivalent Effort Surveys under the Northwest Forest Plan Survey and Manage Standard and Guidelines. Portland, OR.

USDA Forest Service & USDI Bureau of Land Management. 2001. Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines. Pacific Northwest Region.

USDA Forest Service.1997. Management Recommendations for Survey and Manage Fungi Version 2.0. http://www.blm.gov/or/plans/surveyandmanage/MR/Fungi/toc.htm

USDA Forest Service, 1997. Plant Associations and Management Guide for the Mountain Hemlock Zone. McCain, Cindy et al. Gen. Technical Paper R6-MTH-GP-TP-08-95. Pacific Northwest Region.

USDA 2006. Forest Service and BLM policy for Traditional Gathering of Cultural Plants

USDA Forest Service, 1996. East Fork Hood River and Middle Fork Hood River Watershed Analysis. Mt. Hood National Forest - Hood River Ranger District. http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev3_036619.pdf

USDA Forest Service & USDI Bureau of Land Management. July 1993. Forest Ecosystem Management: An Ecological, Economic, and Social Assessment Report of the Forest Ecosystem Management Assessment Team (FEMAT).

USDA Forest Service & USDI Bureau of Land Management. 2008. Appendix I. Fungi species currently listed as Sensitive in the BLM OR/WA Special Status or Forest Service Region 6 Sensitive Species Programs. http://www.blm.gov/or/plans/surveyandmanage/files/ca-fu-appendix-ii-2008-12-18.pdf

USDA Forest Service & USDI Bureau of Land Management. 2013. Appendix I. Fungi species *not* currently listed as Sensitive in the BLM OR/WA Special Status or Forest Service Region 6 Sensitive Species Programs. http://www.blm.gov/or/plans/surveyandmanage/files/ca-fu-appendix-i-2013-08-15.pdf and Appendix II Additional Fungal Species

http://www.blm.gov/or/plans/surveyandmanage/files/ca-fu-appendix-ii-2013-08-15.pdf

USDA Forest Service, 1982. Plant Associations and Management Guide for the Pacific Silver Fir Zone. Hemstrom, Miles A., et al. Gen. Technical Paper R6-ECOL-100-1982a. Pacific Northwest Region.

USDA Forest Service & USDI Bureau of Land Management. March 2006. Category B Species where Strategic Surveys are Considered Complete EMS TRANSMISSION BLM-Instruction Memorandum No. OR-2006-FS-Memorandum.. http://www.blm.gov/or/plans/surveyandmanage/files/02-categoryb_lichens_bryophytes.pdf

USDA Forest Service & USDI Bureau of Land Management. December 1, 2011. Region 6 Regional Forester and OR/WA State Director Special Status Species List Including Federal TEP Species and Region 6 Regional Forester Sensitive Species.

Vogt, K.A., J. Bloomfield, J.F. Ammirati, and S.R. Ammirati. 1992. Sporocarp production by basidiomycetes with emphasis on forest ecosystems. Pp. 563-580 in The Fungal Community: Its

Organization and Role in the Ecosystem. Eds. G.C. Carroll and D.T. Wicklow. New York: Marcel Dekker Inc.

Invasive Plants

Executive Order 13112 Invasive Species. Federal Register: Feb 8, 1999 (Volume 64, Number 25). http://www.invasivespeciesinfo.gov/laws/execorder.shtml

Federal Noxious Weed Act of 1974 (7 U.S.C. 2814). Sec. 2814 Management of undesirable plants on Federal lands. 1990. http://www.aphis.usda.gov/plant_health/plant_pest_info/weeds/downloads/sec2814.pdf

The Knutson-Vandenberg (K-V) Program. USDA Forest Service White Paper F14-SO-WP-Silv-46. February 2014. http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprd3794789.pdf

Oregon Department of Agriculture Noxious Weed Control Program. Noxious Weed Policy and Classification System (List of Oregon Noxious Weeds). 2015. http://www.oregon.gov/ODA/shared/Documents/Publications/Weeds/NoxiousWeedPolicyClassification.pdf

Oregon Department of Agriculture Weed Mapper website. 2015. http://www.oregon.gov/oda/programs/weeds/pages/aboutweeds.aspx

Oregon Revised Statute Chapter 569-Weed Control. Noxious Weeds as Public Nuisance. 2013. http://www.oregonlaws.org/ors/569.180 and https://www.oregonlegislature.gov/bills_laws/lawsstatutes/2013ors569.html

Oregon State Department of Agriculture Pest and Disease Control. Oregon Secretary of State Division 52 (Quarantine Orders for Various Invasive Species). http://arcweb.sos.state.or.us/pages/rules/oars_600/oar_603/603_052.html

The National Invasives Species Council. Invasive Species Definition Clarification and Guidance White Paper Submitted by the Definitions Subcommittee of the Invasive Species Advisory Committee (ISAC). 2006. http://www.invasivespeciesinfo.gov/docs/council/isacdef.pdf

US Fish and Wildlife Department Programmatic Biological Opinion for Aquatic Restoration Activities in the States of Oregon, Washington and portions of California, Idaho and Nevada. Section 33 Invasive Plant Control, pg 43-46. FWS *reference:* OlEOFW00-2013-F-0090. July 2013. Prepared by the Oregon Fish and Wildlife Office U.S. Fish and Wildlife Service Portland, Oregon. http://www.blm.gov/or/districts/medford/plans/files/usfws-arboii.pdf

USDA Forest Service Backcountry Road Maintenance and Weed Management. 2003. http://www.fs.fed.us/invasivespecies/documents/BackcountryRdMtceWeed.pdf

USDA Forest Service. Final Environmental Impact Statement. Site-Specific Invasive Plant Treatments for Mt. Hood National Forest and Columbia River Gorge National Scenic Area in Oregon, including Forest Plan Amendment #16. 2008

USDA Forest Service Guide to Noxious Weed Prevention Practices. 2001. http://www.fs.fed.us/rangelands/ftp/invasives/documents/GuidetoNoxWeedPrevPractices_07052001.pdf

USDA Forest Service Invasive Species Policy FSM2903. 2011. http://www.invasivespeciesinfo.gov/docs/toolkit/fspolicy_2900_20111205.pdf
http://www.invasivespe.gov/toolkit/fs2900.shtml

USDA Forest Service Invasive Species Program. Policy and Authorities. 2015. http://www.fs.usda.gov/main/r6/forest-grasslandhealth/invasivespecies http://www.fs.fed.us/invasivespecies/policy.shtml

USDA National Invasive Species Information Center. Manager's Tool Kit. Best Management Practices – Federal. http://www.invasivespeciesinfo.gov/toolkit/preventionbmp.shtml#fed http://www.invasivespeciesinfo.gov/plants/control.shtml

USDA National Strategy and Implantation Plan for Invasive Species Management. 2004. http://www.fs.fed.us/invasivespecies/documents/Final_National_Strategy_100804.pdf

USDA Forest Service. Native Plant Materials Policy Strategic Framework. 2012. http://www.fs.fed.us/wildflowers/Native_Plant_Materials/documents/NativePlantMaterialsPolicy_Sept2012.pdf

USDA Forest Service. Native Plant Policy – Vegetation Ecology. FSM 2070.3. 2008. http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev3_066309.pdf

USDA Forest Service. National Best Management Practices for Water Quality Management on Forest System Lands. Volume 1: National Core BMP Technical Guide. 2012. http://www.fs.fed.us/biology/resources/pubs/watershed/FS_National_Core_BMPs_April2012.pdf

USDA Forest Service. Mt. Hood National Forest Land and Resource Management Plan Standards and Guidelines. 1990. http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprd3841035.pdf and amendments http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprd3840834.pdf

USDA Forest Service, Region 6, Pacific Northwest Region. Final Environmental Impact Statement for the Invasive Plant Program, Preventing and Managing Invasive Plants. 2005. http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprd3812803.pdf

USDA Forest Service Pacific Northwest Region. Managing Competing and Unwanted Vegetation. Final Environmental Impact Statement. 1988.

USDA Forest Service. Policy FSH6509.11g -Service-wide Appropriation Use Handbook, Chapter 70 – Trust Funds; 71.1 - Knutson-Vandenberg – CWKV Fund and CWKV and CWK2 Program Codes. 2009. http://www.fs.fed.us/im/directives/fsh/6509.11g/6509.11g_70.doc

USDA Forest Service White Paper F14-SO-WP-Silv-46. February 2014. http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprd3794789.pdfUSDA Forest Service National Resources Inventory System (NRIS) Invasive Species (TESP-IS) National Database. 2015.

Recreation

McConnell, Charles and Bacon, Warren D. 1983. “The Spectrum of Forest Settings for Recreation.” pp.182-189.

Thornton, Jim. 2015. “Protecting Trail Tread and User Experience during Fuels and Harvest Activities.” Personal Conversations. March 2015.

U.S. Department of Agriculture, Forest Service, Mount Hood National Forest. 1990. “Land and Resource Management Plan.”

U.S. Department of Agriculture, Forest Service. ROS Users Guide. Washington, DC: U.S. Department of Agriculture, Forest Service; 1982.

U.S. Forest Service and Bureau of Land Management. 2012. Northwest Forest Plan Temperature TMDL Implementation Strategy: Evaluation of the Northwest Forest Plan Aquatic Conservation Strategy.

Visual

Bacon, Warren R. and Twombly, Asa D. 1977. National Forest Landscape Management Volume 2, Chapter 5 Timber. Handbook No. 559.

U.S. Department of Agriculture, Forest Service, Mount Hood National Forest. 1990. "Land and Resource Management Plan."

U.S. Department of Agriculture, Forest Service, "The Visual Management System." VQO, USDA – Agricultural Handbook 462, National Forest Landscape Management, Vol. 2, Chapter. 1.

Ryan, Robert L. 2005. Social Science to Improve Fuels Management: A Synthesis of Research on Aesthetics and Fuels Management. USDA Forest Service, Research Paper. 68pp.

Cultural Resources

Dryden, Michael D. 2015. Heritage Resources Survey, Polallie Cooper Restoration Project, Hood River Ranger District, Mount Hood National Forest. Unpublished Heritage Resource Compliance Report 2015/060606/0002 on file at the Hood River Ranger District, Mt. Hood National Forest.

Greer, Theodore T. 1912. Fifty Years in Oregon; Experiences, Observations, and Commentaries Upon Men, Measures, and Customs in Pioneer Days and Later Times. New York, N.Y.

Langill, Harold Douglas et al 1903. Forest Conditions in the Cascade Range Forest Reserve, Oregon. Washington Government Printing Office, Washington D.C.

Oregon Writers Project. 1940. Mount Hood: A Guide. Duell, Sloan and Pearce, Inc. 270 Madison Avenue, New York.

Climate Change

FAOSTAT (2013). FAOSTAT database. Food and Agriculture Organization of the United Nations. http://faostat.fao.org/

IPCC 2013. Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.). Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535 pp. **http://www.ipcc.ch/report/ar5/wg1/**

IPCC, 2014. Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.). IPCC, Geneva, Switzerland, 151 pp. http://www.ipcc.ch/report/ar5/syr/

IPCC 2000. Intergovernmental Panel on Climate Change (IPCC), Special Report on Land Use, Land Use Change and Forestry, Summary for Policy Makers, 2000. IPCC, Geneva, Switzerland. 20 pp http://www.ipcc.ch/ipccreports/sres/land_use/index.php?idp=0

Joyce, Linda A.; Running, Steven W.; Breshears, David D.; Dale, Virginia H.; Malmsheimer, Robert W.; Sampson, R. Neil; Sohngen, Brent; Woodall, Christopher W. 2014. Chapter 7: Forests. In: Melillo, Jerry; Richmond, Terese (T.C.); Yohe, Gary, eds. Climate change impacts in the United States: The third national climate assessment. U.S. Global Change Research Program: 176–194. http://nca2014.globalchange.gov/report/sectors/forests

Millar, Constance I; Stephenson, Nathan L.; Stephens, Scott L. 2007. Climate change and forests of the future: Managing in the face of uncertainty. Ecological Applications. 17(8): 2145-2151. http://www.nrs.fs.fed.us/pubs/31774

Smith P., M. Bustamante, H. Ahammad, H. Clark, H. Dong, E. A. Elsiddig, H. Haberl, R. Harper, J. House, M. Jafari, O. Masera, C. Mbow, N. H. Ravindranath, C. W. Rice, C. Robledo Abad, A. Romanovskaya, F. Sperling, and F. Tubiello, 2014. Agriculture, Forestry and Other Land Use (AFOLU). In: Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. 121 pp.http://www.ipcc.ch/pdf/assessment-report/ar5/wg3/ipcc_wg3_ar5_chapter11.pdf

US EPA 2015. US Inventory of Greenhouse Gas Emissions and Sinks: 1990 – 2013. Executive Summary. EPA 430-R15-004 United States Environmental Protection Agency. Washington, D.C. 27 pp. http://www.epa.gov/climatechange/ghgemissions/usinventoryreport.html