Chapter 3 - Environmental Consequences

This section summarizes the physical, biological, social and economic environments of the affected project area and the potential changes to those environments due to implementation of the alternatives. It also presents the scientific and analytical basis for comparison of alternatives presented in the chart above.

The cumulative effects discussed in this chapter include an analysis and a concise description of the identifiable present effects of past actions to the extent that they are relevant and useful in analyzing whether the reasonably foreseeable effects of the proposed action and its alternatives may have a continuing, additive and significant relationship to those effects. The cumulative effects of the proposed action and the alternatives in this analysis are primarily based on the aggregate effects of the past, present and reasonably foreseeable future actions. Individual effects of past actions have not been listed or analyzed and are not necessary to describe the cumulative effects of this proposal or alternatives (CEQ Memorandum, Guidance on the Consideration of Past Actions in Cumulative Effects Analysis, June 24, 2005). A listing of all past, present, and reasonably foreseeable future actions known of in the watershed are listed in Appendix B.

Road Management

Significant Issue – Road Management

The current road system was built to access timber and other forest resources. Timber sale revenues paid for the majority of past construction and road maintenance. However, timber harvest has declined with the current emphasis on ecosystem management. The Northwest Forest Plan has designated this area as Late-Successional Reserve (LSR). An extensive road system is in conflict of the LSR objectives. The road network creates contrasting edges of forest habitat, fragments connecting habitat, creates barriers to species movement, and provides access and opportunities for human's to extract natural resources. The change in forest management has seriously reduced operating budgets and the ability to maintain an extensive road system. A consequence is that most roads are no longer annually inspected for maintenance requirements and deficiencies are not corrected, which could result in extensive resource damage. Some roads may need to be removed from the system, others closed until future access is needed, and many managed at the lowest maintenance level that still protects resources values.

Existing Conditions – Road Management

This project area contains 121.4 miles of classified system road, including 4.9 miles of arterial road, 29.2 miles of collector road and 87.2 miles of local roads. About 5.2 miles are asphalt surfaced, 103.9 miles are surfaced with crushed rock aggregate, 6.3 miles have a native pit run surface and 5.9 miles are native surfaced.

The road density in the project area is 2.5 miles/square mile. There are currently about 39.5 miles of roads in the project area that are closed. These road closures include roads actively closed by the District and roads that have closed due to trees blown down across the road, road failure and/or disuse.

Road 1800 (Fall Creek Road) is the major east west corridor in this watershed. Road 1800 is a double lane, paved road used year round for recreation (heavy use in the summer season) and provides access to private residences immediately west of this project area and to a large private timber tract adjacent to the north project boundary. In addition, it is the major haul route for commercial thinning and other commodity extraction activities that occur in the watershed.

Many of the culverts on this road were installed 30-50 years ago. The design life for galvanized steel pipe is about 25-30 years. Many of the culverts on this road and throughout the entire project area are in need of replacement before they fail and cause extensive resource damage. Many of these roads have not been maintained for timber haul in the past 15 - 20 years which has created a backlog of needed road work. There are deficiencies identified on Alder Creek and Hehe Creek bridges requiring a need for pier foundation stabilization.

The other roads in this project area have a wide range of conditions and reconstruction needs. During the Clark Fire of 2003 many roads in the west end of the project area were used in the fire suppression effort. These roads had their drainage maintenance needs brought up to date (pipe replacement did not occur) or were hydrologically closed during fire rehabilitation activity. See the Road Report (Sayre, 2007) in the Analysis File for a description of the individual road conditions throughout the project area.

Management Direction - Road Management

This project incorporates by reference the Willamette National Forest Road Analysis Report (USDA, 2003). The Road Analysis Report (RAR) meets the requirements for a science-based analysis process envisioned by the new transportation policy. It was based on the six-step analysis process published in Forest Service Misc. Rep. FS-643, Road Analysis: Informing Decisions about Managing the National Forest Transportation System. The RAR was recently updated with a social assessment relating to forest roads and the key forest roads were updated to reflect adjustments in management emphasis and land allocations.

One of the key findings that the RAR document is the dilemma of managing an extensive forest road system with limited operating funding. There is an estimated budget shortfall for necessary annual maintenance and the projected Forest maintenance funding. The direction in Forest Service Manual 7730, states that it is our policy to determine and provide for the minimum forest transportation systems that best serves forest management objectives as identified in appropriate land and resource management plans. The policy also states that it is important that road analysis consider access needs in relation to realistic funding levels. Based on the funding levels and annual maintenance costs, there is a budget shortfall even if the network of Key Forest Roads is fully maintained to their current objective maintenance levels.

Some of the other findings or results from the RAR that pertain to the Hehe Project area are:

- Economics alone (financial efficiency) does not support large scale road closures or decommissioning in spite of the current imbalance in funding available for forest roads. Road decommissioning is a capital investment, just as road construction was, and decisions regarding these investments must be based on a sound analysis of resource values.
- The analysis shows that access for recreation, vegetation management (including timber harvest), and other administrative uses is adequate and not likely to be a concern.
- As shown by the aquatics and wildlife analyses, roads create many potential hazards that can be displayed spatially and analyzed quantitatively in a variety of ways. Even the limited number of potential hazards identified in the assessment, when overlaid spatially, indicates that some type of hazard exists wherever there is a road.
- The Hehe Creek subwatershed is listed as a Subwatershed of Concern in the RAR. The RAR provides a listing of Forest sub-watersheds prioritized by an evaluation of overlapping the hazards (quaternary landslides and high road densities) and resource values (T&E fish, impacts to LSRs and high emphasis big game areas). This subwatershed has the presence of quaternary landslides which are large, deep-seated, slow moving earthflows that move in a slow, episodic manner, historic fish habitat which denotes areas now blocked by dams that were once occupied by either winter steelhead, spring chinook or bull trout, high big game emphasis areas with greater than 1 mile/mile^2 road density, and moderate impacts to late-successional forest connectivity.

There are 33.79 miles of key forest roads identified in the Roads Analysis Report for this project area. These roads are the 1800, 1817, 1825, 1830, 1831, 1832, and the 1833. The Roads Analysis Report identified a need for these roads for long-term management of the Forest. They are the priority roads that are maintained open for vehicular traffic. They provide the long-term linkages and inter-forest connection necessary to meet forest management objectives.

There are about 39 miles of existing closed road within the project area. Each alternative would be opening some of these roads to access timber stands for thinning. Roads that are opened would be closed or decommissioned in a hydrologically stable condition after harvest activities are completed.

The roads that would remain open for long-term use would be upgraded to meet Standards and Guides and to meet the Aquatic Conservation Strategy Objectives set forth in the Northwest Forest Plan. All reconstruction and maintenance work would meet project mitigation, BMPs and design criteria as listed on page 31.

Direct and Indirect Effects – Road Management

Alternative Design

Alternative 1 (No Action) represents the no action alternative where none of the proposed activities would take place.

Alternative 2 was designed to provide a high level of public access to the area by keeping most of the roads open. This alternative would only implement some of the proposed road closures in the Middle Fork District Supplemental Road Analysis. Most closures would use low cost and low intensity designs to store the roads in a hydrologically stable condition, but would allow for easy re-opening. This alternative would maintain and/or reconstruct the least amount of haul route roads, construct least amount of temporary road, and decommission the least amount of classified road. The road work in this alternative would cost the least among the action alternatives.

Alternative 3 (Proposed Action) was designed to maintain access for fire protection, recreation and administrative use while implementing the proposed road closures in the Middle Fork District Supplemental Road Analysis. Road closures would employ a mixture of closure designs appropriate for given road conditions. This alternative would close roads using low to moderate levels of closure techniques. This alternative would maintain and/or reconstruct a mid range amount of haul route roads, construct a mid range amount of temporary roads, and decommission a mid range amount of classified roads compared to Alternatives 2 and 4. The road work cost would also fall in the mid range between the action alternatives.

Alternative 4 is designed to implement the proposed road closures from the Middle Fork District Supplemental Road Analysis. Road closures would employ a mixture of closure designs appropriate for given road conditions with an emphasis on long-term closure. The difference between closures with this Alternative and Alternative 3 is that more high level (decommissioning) closure would be used. This alternative would maintain and/or reconstruct the most haul route roads, construct the most temporary road, and decommission the most classified roads. The road work cost would also be the greatest among the action alternatives.

Summary of Effects

The extensive road system in the project area is in conflict with LSR objectives. Alternative 2 closes the least amount of road (4.4 miles) whereas Alternative 3 and 4 closes approximately one half the roads (38 miles) and moves the project area toward the desired future conditions and the LSR objectives. Alternative 4 has more moderate and high level road closure then Alternative 3. Alternative 2 maintains the least amount of road (102.1 miles) whereas Alternative 4 maintains a

few more miles of roads then Alternative3 (127.5 versus 115.3 miles). The road work costs would be greater for Alternative 4 than Alternative 3.

All action alternatives would do essential bridge repair work, replace a major culvert to extend fish passage, and repair chronic fill and cut slope failures.

Effects of Alternatives

Haul route

Alternative 1 (No Action) – Alternative 1 would not use haul routes because the proposed project does not take place.

Alternatives 2, 3, and 4 - Surface types for haul routes identified for timber haul for the three action alternatives consist of asphalt pavement, crushed aggregate, improved native (unprocessed pit run surfacing) and native material. The interdisciplinary team established which roads could be used to haul during wet weather. These wet weather roads would have surfacing depth to hold up to wet weather haul and all drainage maintenance would be completed prior to any haul. See Appendix D for specific roads designated for wet weather haul.

Table 4 - Haul Route Summary

Surfacing Type	Alternative 1 (No Action)	Alternative 2	Alternative 3 (Proposed Action)	Alternative 4
Asphalt pavement	0	11.22	13.58	13.58
Aggregate	0	85.02	94.38	106.09
Improved Native	0	3.82	4.13	4.22
Native	0	2.04	3.25	3.60
Total Haul Miles	0	102.10	115.34	127.49
Wet weather Haul Miles	0	42.25	45.61	45.61

Maintenance and reconstruction

Alternative 1 (No Action) – Alternative 1 would not maintain or reconstruct any roads because the proposed project does not take place. The environmental effects of no road maintenance are discussed in the water quality and soils sections.

Alternatives 2, 3, and 4 - All haul routes in the three action alternatives would receive maintenance and/or reconstruction work. Each haul route has been assigned a level of maintenance/reconstruction needs described below:

- Low: Work may consist of brushing of roadside vegetation, falling of danger trees, blading of roadbed, cleaning of ditches and culvert inlets and outlets, removing slough and slide material and placing aggregate and/or asphalt surfacing. In addition, culverts in dry, intermittent channels and ditch relief pipes would be replaced as needed. These standard maintenance activities occur on all roads when commercial activity occurs or on a rotating basis determined by use and need.
- Moderate: Includes work mentioned above with the addition of replacing culverts in non-fish bearing perennial streams. The need to place a high number of culverts in close proximity to fish bearing streams could result in placing a road segment in this classification.
- High: All the above-mentioned work items could be included with the addition of replacing culverts or other in-stream work in fish bearing, perennial streams, repairing of major road failures in riparian areas and road realignments.

Table 5 displays the miles of haul route roads by maintenance/reconstruction for each of the alternatives.

Table 5 - Maintenance / Reconstruction Summary

Maintenance Levels	Alternative 1 (No Action)	Alternative 2	Alternative 3 (Proposed Action)	Alternative 4
Low	0 mi	74.6 mi	94.7 mi	103.9 mi
Moderate	0 mi	27.2 mi	20.3 mi	22.5 mi
High	0 mi	0.3	0.3 mi	1.1 mi
Totals	0 mi	102.1 mi	115.3 mi	127.5 mi

Alternative 2 - Maintenance and reconstruction of 102.1 miles of existing roads would extend their functional life, and provide better surface drainage, reducing erosion and potential sediment delivery to the stream network. Road maintenance would occur in the dry season prior to haul, and during/after haul if necessary. This would result in improved road drainage and reduced sediment delivery to the stream network compared to the current condition.

Winter haul would only be allowed on roads 1800, 1824-163, 1825-217, 1825-218, 1825-219, 1825-240, 1828-402, 1828-407, 1830 and 1832 (Appendix A) between November 1 and May 31 (BMPs T-5, R-18, 20). This would require road upgrades such as the addition of surface aggregate, and additional cross drain culverts. This would result in an improved road system in place after the project is implemented.

Alternative 3 (Proposed Action): This alternative would affect the road system in much the same way as Alternative 2. Maintenance and reconstruction of 115.3 miles of existing roads would extend their functional life, and provide better surface drainage, reducing erosion and potential sediment delivery to the stream network.

Alternative 4 - Maintenance and reconstruction of 127.5 miles of existing roads would extend their functional life, and provide better surface drainage, reducing erosion and potential sediment delivery to the stream network. However this alternative would reconstruct road 1831 to provide access for timber yarding and haul, and then decommission the road after use. The work to decommission this portion of the 1831 road is expected to reduce and prevent the delivery of sediment to Hehe Creek, however during reconstruction and use of the road proposed by this alternative there would be short-term increased risk of sediment delivery to Hehe creek. Over the long-term there would be a reduction in road related sediment delivered to streams. This benefit would be partially offset by the short-term delivery of sediment to the stream network, including the main stem of Hehe Creek, during reconstruction. In order to use this currently failing road equipment and road fill would have to be brought in and the road would essentially need to be rebuilt for approximately ½ mile along and across Hehe Creek. This work is not implemented in the other alternatives.

Appendix D displays the assigned maintenance/reconstruction levels for each road that would be used as a haul route for each alternative.

The following associated road work is included in all action alternatives except for the opening of road 1831 above mp 5.43. That work is only proposed for Alternative 4.

5. Pernot Creek fish passage culvert replacement:
6. Alder Creek and Hehe Creek bridge pier foundation stabilization
7. Road 1831 shoulder failure
8. Reconstruction of 1831
9. Road 1832 retaining wall:

For more details on these road projects refer to the Road Management Report (Sayre, 2007) in the Project File.

Stream culvert installation or replacement

Alternative 1 (No Action) – Alternative 1 would not replace any culverts because the proposed project does not take place. The environmental effects of no culvert replacement are discussed in the water quality and soils sections.

Alternative 2 would replace about 78 culverts; **Alternatives 3 and 4** would replace 100 culverts. For all the action alternatives, 8 culverts are on perennial streams, two of which are within 500 feet of listed fish habitat. Appendix D lists the proposed culverts to be replaced, the size of culverts, and their location. Maps in Appendix D depict the location of these 8 culvert sites.

Appendix D includes a listing of all culverts replacements within ½ mile of listed fish habitat, all intermittent replacements within in 1 mile of listed fish habitat and all perennial culverts proposed to be replaced throughout the entire in the project area. In addition to these replacements,

culverts in dry, intermittent channels outside a 1 mile buffer of listed fish habitat and ditch relief pipes outside a ½ mile buffer of listed fish habitat would be replaced as needed.

Temporary road construction

The original road system was constructed to accommodate large yarding towers that were used to log large tracts of lands. Thinning activity uses small, mobile, land-based yarders that have limited reach. Temporary road construction has been kept to a minimum in all alternatives, utilizing the existing system wherever possible.

Alternative 1 (No Action) – Alternative 1 would not construct any new temporary roads because the proposed project does not take place. The environmental effects are discussed in the water quality and soils sections.

Alternative 2 and 3 - Access to landings and yarding sites would require the construction of 3.8 miles of new temporary road. These new roads pose little risk to water quality as they are located on stable slopes, do not cross any streams or wetlands, and have no hydrologic connection to the stream network. They would be built, utilized for the sale, and decommissioned after the end of the project.

Alternatives 4 – This alternative would construct 4.8 miles of new temporary roads.

Table 6 -Temporary Road Summary

Surface Type	Alternative 1 (No Action)	Alternative 2	Alternative 3 (Proposed Action)	Alternative 4
Existing Native	0	0.4	1.2	1.1
Existing Aggregate	0	0.4	0.6	0.7
Subtotal		**0.8**	**1.8**	**1.8**
New Native	0	2.7	2.8	3.6
New Aggregate	0	1.1	1.0	1.2
Subtotal		**3.8**	**3.8**	**4.8**
Total Miles	**0**	**4.6**	**5.6**	**6.6**

Road closure

The interdisciplinary team reviewed each road in the project area that was recommended for closure by the Supplemental District Roads Analysis. The team assigned closure levels to each of these roads based primarily on the aquatic risk rating assigned to the road. The aquatic risk rating was determined by:

1. Critical Habitat Areas (proximity to fish stocks),
2. Stream Crossing/Road Surface Type,
3. Geologic/Road Failure Hazard.

Criteria were established for each category and given a numerical risk rating. Risk rating and closure levels generally correspond with each other. The group also considered access needs to large blocks of managed stands where thinning could be accomplished in the future to promote late-successional reserve habitat. Closure levels where low in these cases to allow for future access with minimal impact to resources.

- Low level closure: Close with a physical barrier and water bar as needed. Water bars would not be drivable. Cost: $2,000 - $5,000/mile.
- Moderate level closure: Close with a physical barrier and water bar as needed. Water bars would not be drivable. Include following work items listed below as needed. Cost: $5,000 - $15,000/mile.
    1. Remove culverts from stream channels with fills of shallow to moderate depth.
    2. Reduce fill depth for culverts in deep fill locations.
    3. Pull back side-cast material.
- High level closure (Decommissioning): Close with a physical barrier and water bar as needed. Water bars would not be drivable. Include work items described at the moderate level and as listed below as needed. Costs: $15,000 - $30,000/mile.
    1. Remove culverts from stream channels in deep fills
    2. Re-contouring
    3. Sub-soiling

Table 7 - New Closed Road Summary

Closure level	Alternative 1 (No Action)	Alternative 2	Alternative 3 (Proposed Action)	Alternative 4
Low	0	4.0	20.3	7.2
Moderate	0	0.4	17.7	29.2
High - Decommission	0	0.0	0.0	1.7
Totals	0	4.4	38.1	38.1
Existing Closed Road to be Decommissioned	0	0.5	6.2	12.6

Alternative 1 (No Action) – This alternative would not maintain or close any roads which would likely cause future resource damage to the water quality and soil productivity. Generally, funding is not readily available to repair or upgrade aging and damaged roads in the Hehe Creek sixth field sub watershed. Chronic erosion of the existing problem roads would continue. Additional failures are likely to occur over time, potentially delivering large volumes of sediment to the stream network.

Alternative 2 - Alternative 2 was designed to provide a high level of public access to the area by keeping most of the roads open. Of the action alternatives, this alternative does the least in

moving toward the LSR objectives. The majority of roads would remain open in this alternative and these roads would continue to require road maintenance funding in the future to prevent resource damage.

There would be about 0.5 miles of road decommissioning, reducing road density and restoring proper hydrologic function to the affected areas. However, about 38 miles of high aquatic risk roads would remain open and connected to the stream network. This would continue to pose a risk for road failure and subsequent delivery of sediment to the stream network.

Alternative 3 (Proposed Action) - This alternative would close 38 miles of road in the project area that were identified as potential high aquatic risk roads in the Middle Fork District Supplemental Road Analysis (see Appendix D, Table D5). High aquatic risk roads would have a moderate level of closure to address any aquatic concerns and be stored. Decommissioning of several roads would occur to address aquatic concerns and remove them from the road system.

Decommissioning the upper portion of the 1831 road would include removal of the fill/culverts at several stream crossings. Surface erosion from laid back slopes would be mitigated with mulching or placing of slash to reduce the effect of direct raindrop impact from the first winter storms. Sediment produced is dependent on the amount of road fill excavated to remove the culvert. It is estimated that a culvert with a small fill would generate <1 cubic yards of sediment, for a medium fill < 3 cubic yards and for large fill < 5 cubic yards over the first winter. Segments of the decommissioned road in between fill/culvert removals would either be waterbarred to disperse surface drainage and prevent connection to streams or sub-soiled to cause sediment-laden runoff to infiltrate. Berm closures would prevent further use that could cause more rutting and erosion in winter. All unstable sidecast would be pulled from above steep slopes below and placed against the hill slope side of the road bed. All waste from fill removals would also be compacted and shaped on the hill slope side of the road bed. All bare mineral soil would be seeded with grass to prevent surface erosion. There would also be an immediate and long-term reduction in sediment erosion potential due to this work, and therefore a net decrease in road-related stream turbidity throughout the watershed over time. This work is expected to reduce and prevent the delivery of sediment to Hehe Creek from this portion of failing road. The result of this work would be a road system that would be much less likely to have chronic or episodic sediment delivery to the stream network.

Alternative 4 -This alternative would close the same roads identified for Alternative 3.

Table 8 - Project Area Road Closure Summary

	Alternative 1 (No Action)	Alternative 2	Alternative 3 (Proposed Action)	Alternative 4
Project Area - Open road miles	81.9 existing	77.0	38.6	33.8
Project Area - Closed road miles	39.5 existing	44.4	82.8	87.6

Material Sources

Road reconstruction and maintenance work proposed for this project would involve use of crushed aggregate, pit run and riprap for multiple construction practices. Commercial sources for crushed aggregate or crushing from either Cowhorn or Porcupine Rock pits would be considered at the project design phase.

Cowhorn Rock Pit is located on road 1817433, T. 18 S., R. 2 E., Sec. 3, SE, SE. Material for producing crushed aggregate, pit run and riprap is available from this source. This source has not been surveyed for invasive weeds but would be prior use and mitigated if found.

Porcupine Rock Pit is located on road 1824163, T. 19 S., R. 2 E., Sec. 12, SE, NW. This source is heavily used in the Fall Creek watershed due to its high quality of rock and central location. Pit also contains a wide range of riprap classes. Invasive weed surveys indicate large populations of invasive weeds that would require treatment prior to use of this material. Treatment would meet guidelines established in the Willamette National Forest Noxious Weed Prevention Guideline, March 2005.

Costs for road work

The tables below summarize cost for all road work and haul collections. The miles of closure differ in Table 7 because of roads that would be opened and then closed after thinning operations are completed. For road details, see Appendix D. Estimates are based on projects completed in the past 3 years. No inflation factor is applied.

Table 9- Road Work Costs Alternative 2

Road Work Type			
Maintenance & Reconstruction Levels	**$/Mile**	**Miles**	**Total**
Low	$12,000	74.60	$895,200
Moderate	$20,000	27.15	$543,000

Road Work Type			
Maintenance & Reconstruction Levels	**$/Mile**	**Miles**	**Total**
High	$60,000	0.35	*$225,000
Subtotal			$1,66,200
Maintenance Collections	**$/MBF**	**MBF**	**Total**
	$20.00	45,856	$917,120
Maintenance & Reconstruction Total			$2,580,320
Closure Levels	**$/Mile**	**Miles**	**Total**
Low	$3,500	17.30	$60,550
Moderate	$10,000	3.57	$35,700
Decommission	$24,000	0.45	$10,800
Total Closure Costs			$107,050
Alternative 2 Total			**$2,687,370**

*Cost is derived from 2 bridge sites @ $30,000 each plus $150,000 for Pernot Ck. pipe replacement and $60,000/mile for .25 mile.

Table 10 - Road Work Cost Alternative 3 (Proposed Action)

Road Work Type			
Maintenance & Reconstruction Levels	**$/Mile**	**Miles**	**$**
Low	$12,000	94.70	$1,136,400
Moderate	$20,000	20.29	$405,800
High	$60,000	0.35	*$225,000
Subtotal			$1,767,200
Maintenance Collections	**$/MBF**	**MBF**	**$**
	$20.00	53,596	$1,071,920

Road Work Type			
Maintenance & Reconstruction Total			$2,839,120
Closure Levels	**$/Mile**	**Miles**	**$**
Low	$3,500	36.05	$126,175
Moderate	$10,000	23.25	$232,500
Decommission	$24,000	5.25	$126,000
Total Closure Costs			$484,675
Alternative 3 Total			**$3,323,795**

*Cost is derived from 2 bridge sites @ $30,000 each plus $150,000 for Pernot Ck. pipe replacement and $60,000/mile for .25 mile.

Table 11 - Road Work Costs Alternative 4

Road Work Type			
Maintenance & Reconstruction Levels	**$/Mile**	**Miles**	**Total**
Low	$12,000	103.90	$1,246,800
Moderate	$20,000	22.49	$449,800
High	$60,000	1.10	*$270,000
Subtotal			$1,966,600
Maintenance Collections	**$/MBF**	**MBF**	**Total**
	$20.00	60,598	$1,211,960
Maintenance & Reconstruction Total			$3,178,560
Closure Levels	**$/Mile**	**Miles**	**Total**
Low	$3,500	23.62	$82,670
Moderate	$10,000	30.47	$304,700
Decommission	$24,000	11.70	$280,800

Road Work Type			
Total Closure Costs			$585,500
Alternative 4 Total			**$3,764,060**

*Cost is derived from 2 bridge sites @ $30,000 each plus $150,000 for Pernot Ck. pipe replacement and $60,000/mile for 1 mile.

Cumulative Effects – Road Management

The cumulative effects analysis area for road management was the Hehe Creek subwatershed which defined the project area. All past present and future roads were included in the analysis. See Appendix B for a summary of the history of road development in the watershed. The current open road density is 2.5 miles per square mile which would represent the result of the No Action Alternative. Alternative 2 would reduce the open road density to 2.4 miles per square miles in the sub-watershed, Alternative 3 would reduce the open road density to 1.2 miles per square miles, and Alternative 4 would reduce it to 1.0 miles per square miles.

Interior Habitat

Significant Issue – Interior Habitat

Various plant and animal species benefit from maintaining connectivity of late-successional forest stands and large continuous blocks of interior forest habitat. This connectivity facilitates movement, dispersal and migration of many forest species. Intensive management activity (road building and clearcut harvesting) has occurred in this project area over the past 40-50 years. This activity has created a fragmented forest landscape with reduced interior habitat. These conditions are unfavorable to those species that rely on interior forest habitat for a portion or all of their life history. Stand density reduction in managed stands close to late-successional forest habitat may alter interior habitat conditions.

Existing Conditions – Interior Habitat

Interior forest habitat plays a critical role in maintaining healthy populations for many wildlife species (Chen 1991, Chen et al. 1993, Hagar et al 2007). Along edges of strongly contrasted habitats (i.e. old-growth habitat adjacent to stand initiation), edge effects could extend up to 400 meters in the Central Cascades (Chen et al. 1993). Large blocks of interior habitat provide for sustainability of a larger number of species. The edge effect to micro-climatic conditions is typically short-term in duration (7-10 years) and can degrade the remaining quality of the interior habitat (Chen et al. 1993). It should be noted that the contrast of edge of these 35-60 years old plantations with trees heights up to 120 feet tall adjacent to old-growth stands with trees heights up to 200 feet tall is different in comparison with research on the edges between young

plantations trees 3-4 feet tall and old growth 200 feet tall. The micro-climate effects are evaluated to be of a much lesser magnitude.

Interior forest habitat in the project area was analyzed by calculating acres of late-successional forested stands no closer than 400 feet from a managed stand (Chen et al 1991). Approximately 2,462 acres of interior forest habitat exists in the project area.

Management Direction - Interior Habitat

The Willamette Late-Successional Reserve Assessment (USDA, 1998) identified criteria to consider in the design and location of silvicultural prescriptions to avoid the potential to adversely affect interior forest function in nearby stands. In early-mid and mid seral stands, prescriptions for thinning that substantially open canopies to wind and solar radiation, could have lasting detrimental effects to interior habitat conditions. The LSRA suggested using approach of prescribing different width bands of varying thinning intensities adjacent to existing mature and old-growth stand to eliminate or reduce the affects of microclimate changes to interior forest functions. The interdisciplinary team (IDT) evaluated these techniques to be difficult to layout on the ground and very costly to implement. The LSRA also provided an option to modify the application of these principles given due considerations of landscape features that alter the effects of edges (seral stages, aspect, slope, elevation, prevailing wind directions, etc.) and other site-specific management goals for late-successional forests and associated species.

Direct and Indirect Effects – Interior Habitat

Alternative Design

The IDT developed a decision matrix which evaluated the percentage of each unit contained within a 400 foot buffer away from late-successional forests, aspects of the units, percent slope, and position on the slope to determine the general thinning intensity (low, moderate, and heavy) for each unit. The thinning prescriptions are further designed to incorporate elements of variable density thinning concepts to vary the spacing tolerances, creation of gaps and openings, retention of un-thinned areas, tree selection characteristics (deformities and decadence),species selection (protect hardwoods), and coarse woody debris. Table 12 displays the mixture of thinning intensities by alternative which addressed the effects to interior habitat.

Table 12 - Thinning Prescription by Alternative

Thinning Prescription	Alternative 1 (No Action)	Alternative 2	Alternative 3 (Proposed Action)	Alternative 4
Heavy Thin	0	963 ac.	1,074 ac.	1,513 ac.
Moderate Thin	0	1,573 ac.	1,846 ac.	1,676 ac.
Light Thin	0	650 ac.	842 ac.	9,90 ac.

Thinning Prescription	Alternative 1 (No Action)	Alternative 2	Alternative 3 (Proposed Action)	Alternative 4
Totals	0	**3,186 ac.**	**3,762 ac.**	**4,179 ac.**

Heavy Thin = Residual 55 trees per acre, Moderate Thin = Residual 80 trees per acre, Light Thin = Residual 105 trees per acre

Summary of Effects

The proposed thinning in each of the action alternatives would have a short-term effect on the micro-climate in the buffer zone between the units and interior habitat. The long-term beneficial effect would be the development of late-successional forest conditions which would eventually increase the amount of interior habitat with in the LSR.

Effects of Alternatives

Alternative 1 (No Action) - No effects on interior habitat area expected under the Alternative 1 (No Action) as no actions would take place. The current interior conditions would be maintained in the short-term and slowly increase in the long-term with the development of late-successional forest conditions. There is a slight risk to the interior habitat due to wildfire risks associated with not thinning these dense stands as mentioned in the fuel loading section.

Alternatives 2, 3, and 4 - The effects of the three action alternatives on interior habitat are displayed in

Table 13 below. Overall, there would be no effect on interior habitat by the proposed thinning and associated activities because the areas of interior habitat are not physically disturbed by the action alternatives. There would be a minor short-term (7-10 years) effect to the micro-climate in the buffer zone along the edge between the plantations proposed for thinning and the adjacent late-successional forest stands. The linear feet of affected edge are correlated to the size of the unit or quantity of acres (Chen, 1991). Alternative 2 proposes to thin the least amount of acres and therefore affects the least amount of linear feet adjacent to the late-successional forest interior habitat. Alternative 4 proposes to thin the most acres, therefore affects the most linear feet of edge. Alternative 3 would affect an amount of edge between Alternative 2 and 4. The intensity of thinning (light, moderate, heavy) also influences the degree of effects. Light thinning intensities that create a post thin canopy closure of 45-55 percent would have the least affect to the edge. Heavy thinning intensities that create post thin canopy closure of 25-35 percent would have the most effect on the edge. And the moderate thinning intensities that create post thin canopy closure between 35-45 percent would fall in between the range of the light and heavy thinning. The percentage of light thinning intensities among the three action alternatives are within 1-2 percent of each other for the proportion of edge affected. The moderate intensity thinning intensity proposed in Alternative 4 is about 7 percent less of the proportion of total affected edge than with the two other action alternatives. Alternative 4 would have about twice the linear feet of edge adjacent to heavy thinning as Alternative 2 and 3 (about 7 percent more).

Table 13 - Alternative Effects to Interior Habitat

	Alternative 1 (No Action)	Alternative 2	Alternative 3 (Proposed Action)	Alternative 4
Linear Feet of Edge adjacent to Heavy Thin	0	5,154 (14%)	6,150 (14%)	12,891 (21%)
Linear Feet of Edge adjacent to Moderate Thin	0	16,345 (45%)	18,563 (44%)	23,231 (37%)
Linear Feet of Edge adjacent to Light Thin	0	14,616 (40%)	17,301 (41%)	25,387 (41%)
Total Linear Feet of Edge adjacent to Thinning	0	36,115	42,014	61,509

Cumulative Effects – Interior Habitat

The cumulative effects analysis area for interior habitat was the Late-Successional Reserve (#RO-219). The LSRA estimated 16,475 acres of interior habitat in the LSR – #RO-219. That amount of interior habitat represents about 52% of the late-successional forest within the LSR. The total amount of late-successional forest in LSR-#RO-219 is about 31,379 acres (48% of the total LSR 65,928 acres). About 79% of the late-successional forest is old growth and about 21% in the mature stand type. Past timber management practices (see Appendix B) have contributed to the decrease in interior habitat. The practice of dispersing clearcuts to maximize forest edge and cover for big game management resulted in the fragmentation the large contiguous stands of old growth. The last clearcut to occur in LSR-#RO-219 was in early 1990's. No present of foreseeable actions would affect the amount of current interior habitat within LSR-#RO-219.

Alternative 1 (No Action) would have no cumulative effects to interior habitat because no actions would take place. Alternative 2, 3, and 4 would not physically affect any interior habitat within LSR-#RO-219, therefore would not have any cumulative effects to interior habitat conditions. The amount of interior habitat within the project area (2,462 acres) represents about 15 percent of the total interior habitat in the LSR.

Spotted Owls

Significant Issue – Spotted Owls

The Northern spotted owl is well documented within the Fall Creek LSR and within the Hehe project area. Assessment of current habitat conditions indicate that foraging habitat conditions for owls can be improved through density management activities. Focusing treatments adjacent to some activity centers based on occupancy and reproductive rates may benefit owls by improving habitat and foraging condition around these sites.

Existing Conditions – Spotted Owls

Knowledge of spotted owl activity centers locations within the project area is a result of past surveys efforts associated with Regional population monitoring, District timber sale planning, and recent LSR owl and activity center site monitoring done through the HJ Andrews Experimental Forest (Anthony and Ackers, 2006). Based on these surveys, the project area is considered surveyed to protocol (USDA, 1993).

Table 14lists Northern spotted owl habitat and owl activity center conditions within the Hehe Project spotted owl analysis area. Spotted owl home ranges in the Willamette Province have typically been considered to incorporate a 1.2 mile radius around an owl activity center, and that at least 40% of the area within that home range should provide suitable habitat in order to support successful nesting. The 40% suitable owl habitat within 1.2 miles of an activity center was once considered a viability threshold. But along with suitable capability and protection status it is now recognized as a measure of fitness for owls (Courtney et al. 2004).

The Middle Willamette LSR Assessment (USDA, 1998) states that maintaining and increasing occupancy of spotted owls is a priority and that activities within LSRs should avoid incidental take of spotted owls due to disturbance or habitat modification. Moreover, it states that in Fall Creek LSR where a large amount of currently not suitable habitat exists, restoration prescriptions should be considered. Within the Hehe LSR Thin project area, most of the owl activity center exceed the >40% thresholds as previously discussed (23 of 27) and only 3 of the owl activity centers are below the <30% thresholds. The general trend for spotted owls within the Central Cascades study area and the Hehe LSR Thin project area is a slight increase in the overall population (Anthony, et al., 2006).

Table 14 - Status of Northern Spotted Owls and its Habitat within the project area.

	Acres Within Project Area	Percent of Project Area
Suitable Habitat	11,286 ac.	54 %
Dispersal Habitat	7,106 ac.	24 %
Unsuitable Habitat	1,881 ac.	9 %
Federal Ownership	20,482 ac.	98%
Private Ownership	418 ac.	2%
Total # Spotted Owl Activity Centers[1]	27	
Spotted Owl Activity Centers with > 40 % Habitat[2]	23	
Spotted Owl Activity Centers with 30-40 %[3]	1	
Spotted Owl Activity Centers with < 30 %[4]	3	

[1]Spotted owl activity center data based on current HJ Andrews studies, GIS coverage and prior (2003) protocol survey results

[2]Spotted owl activity centers with greater than or equal to 1182 acres of suitable habitat within a 1.2 mile radius.

[3]Spotted owl activity centers that have between 886 and 1182 acres of suitable habitat within a 1.2 mile radius.

[4]Spotted owl activity centers with less than 886 acres of suitable habitat within a 1.2 mile radius.

Table 14 shows that 27 activity centers are known to exist within the overall analysis area. Based on activity center locations relative to locations of proposed harvest units within the planning area, commercial thinning activity would occur within a 1.2 mile home range radius for 14 of the 27 activity centers.

Thinning within 1.2 miles of activity centers represents about 78% of all thinning proposed under any of the Action Alternative. About 43% of the proposed thinning occurring within a 1.2 mile radius would also occur within a 0.7 mile radius for 6 of the 17 historic activity centers. A 0.7 mile radius is considered to be the core home range for spotted owls in this portion of their range, and an area where the amount and quality of suitable habitat is particularly important for supporting resident owls.

Management Direction – Spotted Owls

This project is consistent with current standards established for projects that would specifically affect the northern spotted owl and its habitat. The standards were established for the Willamette Province by the Level 1 Consultation Team and are listed in both the Batched Biological Assessment (BA) (USDA et al, 2006) addresses spotted owl habitat modification projects proposed for implementation during FY 2007 and 2008. The Hehe Project is among the projects identified in the BA, which also considered new information from the 5-year species status review and other recent documents (USDI 2004, Anthony et al. 2004, Courtney et al, 2004). The literature updates our knowledge related to northern spotted owl biology, ecology, and connected issues such as climate change on regional vegetation patterns, sudden oak death syndrome, West Nile virus, wildfire, barred owls, timber harvest, and range wide population decline as presenting individual and cumulative threats to the species.

Of those concerns and threats listed above, it may be that in the vicinity of the Hehe Project area past timber harvest, wildfires, and barred owls influence spotted owls and their habitat to a greater degree than the other factors. This analysis reviews, incorporates, and addresses new information to the extent appropriate for the scope and scale of this project. Effects not specifically discussed in this document pertain to issues that cannot be addressed at the project scale, but are further discussed and analyzed in the 2007 – 2008 Habitat Modification BA and BO which provide a thorough analysis of new information pertaining to potential threats to this species in the Willamette Province (USDA et al. 2006, USDI 2006).

Direct and Indirect Effects – Spotted Owls

Alternative Design

Alternative 1(No Action) is where no proposed activities would take place.

Alternative 2 would protect known (as determined by the survey protocol) spotted owl activity centers with less than 40 percent of their 1.2 mile radius home range in suitable habitat by not thinning within 0.7 miles of the activity centers and any type of thinning greater than 0.7 miles

away. If the owl activity centers are known and have greater than 40 percent suitable habitat conditions within 1.2 mile home range, light to moderate thinning is allowed within 0.25 to 0.7 miles of owl activity centers and any type of thinning greater than 0.7 miles away. If the owl activity centers are resident single owls and suitable habitat conditions are less than 40 percent within 1.2 mile radius home range, light to moderate thinning is still allowed within 0.25 to 0.7 miles of owl activity centers and any type of thinning greater than 0.7 miles away.

Alternative 3 would protect known spotted owl activity center with less than 40 percent of their 1.2 mile radius home range in suitable habitat by not thinning within 0.5 miles of the activity centers, light to moderate thinning from 0.5 to 0.7 miles, and any type of thinning greater than 0.7 miles away. If the owl activity centers are known and have greater than 40 percent suitable habitat conditions within 1.2 mile home range, light to moderate thinning is allowed within 0.25 to 0.5 miles of owl activity centers and any type of thinning greater than 0.5 miles away. If the owl activity centers are resident single owls and suitable habitat conditions are less than 40 percent within 1.2 mile radius home range, light to moderate thinning is still allowed within 0.25 to 0.5 miles of owl activity centers and any type of thinning greater than 0.5 miles away.

Alternative 4 would protect known spotted owl activity centers with less than 40 percent of their 1.2 mile radius home range in suitable habitat by not thinning within 0.5 miles of the activity centers and any type of thinning greater than 0.5 miles away. If the owl activity centers are known and have greater than 40 percent suitable habitat conditions within 1.2 mile home range, light to moderate thinning is allowed within 0.25 to 0.5 miles of owl activity centers and any type of thinning greater than 0.5 miles away. If the owl activity centers are resident single owls and suitable habitat conditions are less than 40 percent within 1.2 mile radius home range, light to moderate thinning is still allowed within 0.25 to 0.5 miles of owl activity centers and any type of thinning greater than 0.5 miles away.

Summary of Effects

The activities associated with Alternatives 2, 3, and 4 are a “may affect, but is not likely to adversely affect” for the northern spotted owl. In addition, the activities associated with all action alternatives may have a short-term negative effect, but long-term beneficial effect as these thinning projects move the Fall Creek Late-Successional Reserve (LSR) habitat towards a more sustainable and fire safe late seral condition within the LSR and the designated Critical Habitat (CHU).

Effects of Alternatives

Alternative 1 (No Action) – This Alternative would have no effect on federally listed threatened, endangered, or proposed species, and is also expected to have no impact on sensitive species identified by the Regional Forester.

The No Action proposal would have no effect/impact on TES terrestrial wildlife species based on the following assumption – that habitat within and adjacent to the project area would continue to

provide existing habitat for wildlife species that may be present as it evolves without human management. The evolution of habitat and associated dynamic nature of habitat suitability that may be subject to an unknown frequency and variety of stochastic events is considered beyond the scope of this evaluation. The potential effects or impacts from proposed Action Alternatives are discussed in this document. References used to support discussion, determinations, and recommendations are provided in Biological Evaluation (Quintana, 2007) located in the Project File.

Alternative 2, 3 and 4 - Alternative 2 thins the least amount of acreage of the action alternatives within 1.2 miles radius home range of owl activity centers. Alternative 3 thins 100 acres less than Alternative 4 and Alternative 4 thins the most acreage within 1.2 mile radius home range.

Table 15 – Acres of thinning within 1.2 miles of Owl Activity Center

	Alternative 1 (No Action)	Alternative 2	Alternative 3 (Proposed Action)	Alternative 4
Total Acres of thinning within 1.2 miles of all Activity Centers (AC)	0 ac	2,960 ac	3,514 ac	3,854 ac

Effect Common to the Action alternatives 2, 3, and 4

Habitat Modification

Direct effects associated with habitat modification activities are considered as short-term, and summarized as follows:

- No suitable habitat is proposed for thinning in the Hehe LSR Thin project area.
- Within the Hehe LSR Thin project area 4500 acres of LSR/Riparian Reserve Dispersal habitat was consulted on in the Willamette Province "batched" Habitat Modified Biological Assessment in Spring of 2006 and concurred upon in Biological Opinion (BO) FW-1-7-06-F-0179 which was signed on 09/22/06. In that BO the US Fish & Wildlife Service concurred with our finding of:
  - Dispersal Removed (Heavy Thin): 2,315 acres downgraded in OR-18 with a Not Likely to Adversely Affect (NLAA) determination in LSR and Riparian Reserve habitat.
  - Dispersal Degraded (Lt/Mod Thin): 2,185 acres degraded in OR-18 with a Not Likely to Adversely Affect determination in LSR and Riparian Reserve habitat.
  - Modification of dispersal habitat as proposed may affect, but is not likely to adversely affect (NLAA) spotted owls across all action alternatives.

Indirect effects associated with habitat modification activities are considered beneficial for spotted owls for the following reasons. Estimates of down wood size and distribution for the project area when compared to DecAid data (Mellen et al. 2006) indicate conditions are approaching or exceed the 50% tolerance level exist throughout the area. Data are limited, but

suggest that dispersal habitat throughout the project area is approaching suitability as foraging habitat.

Implementing the silvicultural prescription as proposed would result in accelerating the transition from dispersal to foraging habitat as released trees respond by increasing size and structural diversity, and as additional levels of larger down wood continue to accumulate. Current suitable habitat would respond favorably to propose thinning as structural diversity increases among younger live trees in stands where existing components such as large down wood, snags, and remnant overstory trees are protected.

Based on the silvicultural prescription and growth response projections, dispersal or suitable capability in thinned stands across the project area should recover within approximately 10 years.

Disturbance

Direct effects associated with project activities that may result in disturbance to spotted owls are considered as short-term, and summarized as follows.

Any activity proposed by the Hehe LSR Thin Project conducted beyond disturbance distances described in the Provincial BA (USDA et al. 2006), would have no effect on spotted owls regardless of the time period relative to the spotted owl breeding season.

Disturbance activities such as use of chainsaws, use of heavy equipment, and hauling associated with proposed thinning activities are considered to may affect, but is not likely to adversely affect (MA-NLAA) spotted owls if conducted from March 1 to September 30 outside the disruption distances and within the disturbance distances described in the Provincial BA (USDA et al. 2006).

Helicopter yarding proposed under all action alternatives would also result in a MA-NLAA situation during this timeframe as long as the activity involved a Type I KMAX or any Type II-IV helicopter. If other Type I helicopters are used it may trigger a Likely to Adversely Affect (LAA) determination depending on their flight paths. Due to the terms associated with the Biological Opinion, it would require re-consulting with the US Fish and Wildlife Service.

Prescribed underburning is proposed in both Alternative 3 (281 acres) and Alternative 4 (362 acres) of dispersal habitat. All prescribed underburning units are greater than 0.25 miles away from known activity centers. Prescribed burning conducted beyond the disturbance distances described in the Provincial BA (USDA et al. 2006), would have no effects on spotted owls.

There are no recognized indirect effects to spotted owls related to disturbance associated with this thinning project as currently proposed.

Critical Habitat

Direct effects associated with habitat modification activities in designated Critical Habitat for the northern spotted owl are considered short-term, and described below.

Critical Habitat is designated to provide for the conservation and eventual recovery of the species. The primary constituent elements of spotted owl Critical Habitat are those physical and biological habitat features which support nesting, roosting, foraging, and dispersal. The Hehe LSR Thin Project proposes 2,315 acres of heavy thinning in Critical Habitat. The affected acres are currently considered dispersal spotted owl habitat based on stand age and structural characteristics. Thinning would result in a short-term downgrade of this dispersal habitat due the reduction in canopy closure.

The silvicultural prescription for thinning this area involves a variable density thinning component along with measures to protect existing snags, down wood, and any remnant overstory trees. This prescription would speed the attainment of late-successional characteristics and the desired future condition for this area. Thinning these acres as proposed may affect, but is not likely to adversely affect Critical Habitat because the effects are considered discountable and entirely beneficial when evaluated at the stand scale.

Indirect effects associated with habitat modification activities in Critical Habitat are considered beneficial for spotted owls for the same reasons stated pertaining to habitat modification in general.

Cumulative Effects – Spotted Owls

The cumulative effects analysis area for spotted owls was the area covered by any owl's activity center 1.2 mile radius home range which overlapped into the project area. Timber harvest activity has occurred within the Hehe LSR Thin project area extending back approximately 100 years. Since the 1910's about 48 % of the project area has been subject to some type of harvest activity. The majority of that harvest activity was fire salvage following the large Hehe burn. A summary of all the past, present, and foreseeable actions in the watershed can be found in Appendix B. No harvest activity has occurred on Federal land in the project area since the inception of Fall Creek LSR.

A small amount of private lands occur within the project area boundary (about 110 acres). In addition, there are private lands adjacent to the project area to southwest and north. These areas have generally been cleared of forested vegetation. Private lands currently provide non-forested habitat in active forest regeneration management (private logging company) on the northern boundary and rural residential and agricultural settings adjacent to the project area on the southwestern boundary.

Overall, past management activities (timber harvest) that have affected habitat throughout the project area on a measurable scale have had a mixed effect on terrestrial wildlife species. The

maintenance and development of habitat associated with old-growth characteristics on approximately 52% of the area has favored one group of species, while the conversion of approximately 48% of the area to early or mid-seral habitat set in a mosaic across the landscape has favored another group of species.

There are no reasonably foreseeable actions that would affect current seral class conditions in stands throughout the planning area. The overall effect of the Hehe Project under any action alternative would not result in a consequential post thinning change in seral class, and would therefore have no measurable contribution to cumulative effects from past actions. Although this project would not demonstrably change seral conditions, areas thinned under all action alternatives (2, 3, & 4) should respond with an increase in vegetative growth rate that would improve structure and composition within the plant community. This effect should result in a positive qualitative improvement in biodiversity on all of the previously harvested stands throughout the project area and provide a recognizable cumulative effect in those areas.

Habitat Modification and Critical Habitat

Beyond the direct/indirect effects addressed associated with proposed activities under all action alternatives, there are no future State or private activities that are reasonably certain to occur within the action area that would result in cumulative effects to spotted owl habitat – including Critical Habitat.

Current Standards and Guidelines governing management of this and surrounding areas provide direction that should provide for the long-term maintenance of amount and distribution of potentially suitable habitat for the spotted owl. The changing trend in forest management that has occurred within the past decade, and projected for the future, should positively influence occupancy of suitable habitat for the spotted owl as previously harvested stands redevelop and more emphasis is placed on recruitment of key structural components missing from harvested stands, retention of key structural components present in unharvested stands, and restoration/maintenance of special habitats as key components of biodiversity at a landscape level. The cumulative effect of the Hehe Project to habitat throughout the analysis area covering both the action area and project area is considered positive in this regard.

Because of the present condition and location of current non-harvest allocations, cumulative effects of past or present actions such as the Hehe LSR Thin Project would not influence the ability of local populations to persist, or become known, by eliminating demographic linkages beyond the species dispersal capabilities. There is about 15% difference in acres treated between Alternative 2 and 3 and about 9 % difference between Alternative 3 and 4 in the cumulative effects with regard to this species

Consultation –Spotted Owls

Spotted owls consultation with USFWS is required based on analysis of proposed actions. Consultation for effects from proposed activities has been incorporated into the Willamette Province FY 2007-2008 Batched BA for Habitat Modification Projects dated July 2006 and concurred upon on September 22, 2006 (FWS 1-7-06-F-0179).

The USFWS has issued their BO for calendar years 2007-2008 habitat modification activities within the Willamette Province (FWS Reference Number 1-7-06-F-0179. The Hehe LSR Thin Project is listed in the BO and will comply with the reasonable and prudent measures, plus terms and conditions pertaining to project activities described therein.

Compliance with stated conditions ensures consultation requirements under the ESA have therefore been met regardless of which Action Alternatives (Alt 2, 3, or 4) may be selected for implementation.

Fire and Fuels

Significant Issue - Fuel Loadings

The proposed action would commercially thin about 3,800 acres. Implementing the proposed thinning along with the coarse woody debris strategies from the LSRA could create an accumulation of fine fuels (0-3 inch) that exceeds fuel loading recommended levels and could increase fire risk, cost to suppress fires, resource damage by wildfires, and risk to firefighters safety.

Several winter storms over the past years have caused considerable snow damage and blowdown that have contributed to the buildup of fuels within these plantations. Fuel prescriptions to reduce both management activity-created fuels and blowdown fuels have been difficult and costly to implement under certain thinning prescriptions. The cumulative fuel loading from these events are potentially in excess of fuel loading standards and guidelines.

Existing Conditions – Fuel Loading

Fuel Models

Three major Fire Behavior Prediction System fuel models are represented within the Hehe project area. Field observations have indicated that fuels in the planning are primarily a mosaic/mix of fuel models 5, 8 and 10 (see Table 16). These three fuel models are distributed rather evenly throughout the project area. Fuel model 5 is characterized by conifer stands where the primary carrier of fire is understory brush. Under the right conditions, understory brush fires spread quickly with high intensity, and may lead to the development of crown fires in the overstory trees.

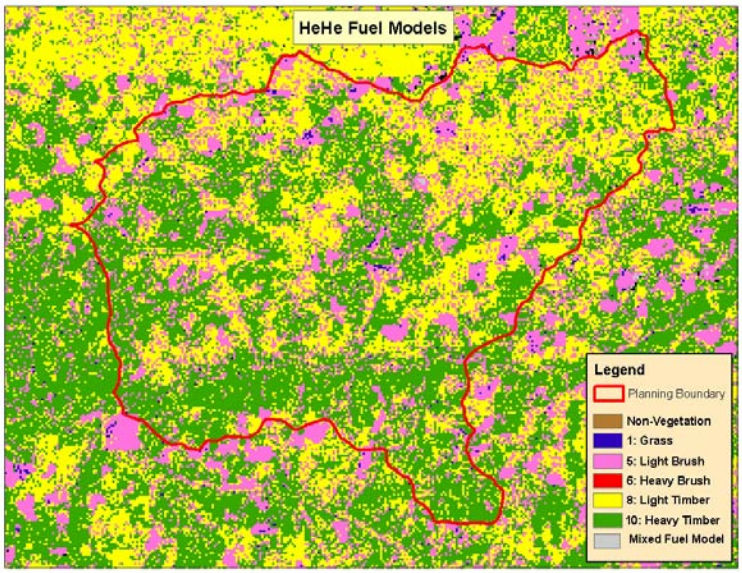
Fuel model 8 is characterized by closed conifer stands where fires spread primarily through litter and light fuels on the forest floor. Under normal conditions, fires in fuel model 8 burns with low intensity and do not spread quickly.

Fuel model 10 is characterized by closed conifer stands with a component of dead and down fuels. Fires in this fuel type spread primarily through dead/down fuels on the forest floor, and generally burn with greater intensity than fires in fuel model 8. Fires in this fuel model have a higher probability of developing into crown fires, which may lead to large fires with high percentage of mortality when hot, dry and windy conditions persist. The following table (

Table 16) gives descriptions of Fire Behavior Prediction System (FBPS) fuels models commonly used in fuels/fire modeling.

Table 16 - Fuel Models

Fuel Model	Description
1	Short Grass
2	Open Timber (grass understory)
3	Tall Grass
4	Chaparral
5	Timber (w/understory brush)
6	Tall Brush
7	Southern Rough
8	Timber (w/ light litter)
9	Hardwood Litter
10	Timber (w/heavy dead/down)
11	Light Logging Slash
12	Medium Logging Slash
13	Heavy Logging Slash



Source: Willamette NF GIS

Figure 5 – Hehe LSR Thin project area Fuel Model map

Because landscape fuels mapping is done at a coarse scale, it is not as accurate as observations in the field. However, the above map does give an indication of how fuel models exist in a mosaic in the Hehe Project Area (Fuel modeling sources: GTR-INT-122, Willamette NF GIS and field obs.).

Fuel Loading

Fixed area plots were established throughout the project area to determine existing surface and crown fuel loads. Table 17 represents existing surface fine and coarse fuel loads in the project area.

Table 17 - Current Fine (0-3") and Coarse (>3") Fuel Loadings (mean tons/acre)

0-3" Fuels	3-6" Fuels	6-9" Fuels	9-20" Fuels	>20" Fuels	Total Fuel Load
6.7	2.6	2.7	9.6	34.9	56.5

Source: Field Surveys

Table 18 represents current and predicted (post-harvest) fuel loads for the project area.

Table 18 - Current Predicted Surface Fine Fuel Loading Estimates (0-3"fuels)

Thinning Prescriptions	Current Fine Fuel Load Average (tons/acre)	Post-Harvest Fine Fuel Load Total (without yarding tops/limbs)	Post-Harvest Fine Fuel Load Total (with yarding tops/limbs)
Light	6.7	9-12	7-9
Moderate	6.7	12-15	9-12
Heavy	6.7	15-20	12-16

Source: Field Surveys/PREDICT Spreadsheet

*Post-harvest fuel load varies depending on harvest prescription.

Direct and Indirect Effects – Fuel Loading

It is well documented that coarse woody fuels have little influence on the spread and intensity of initiating surface fires (Brown et al, 2003). Fine fuels are required for fires to spread and gain the intensity needed to ignite heavier fuels. Harvest activities primarily generate fine fuels and create relatively small amounts of coarse woody fuels. In addition, treating coarse fuels on the landscape without treating fine fuels is not feasible. For all of these reasons, coarse woody fuels will not be considered further in this analysis. Snag and down wood requirements for wildlife are addressed in the wildlife section. Predictions for fine fuels generated as a result of harvest in the project area will be discussed in detail in this section.

Fine fuel loadings were measured against the guideline levels established in FW-252. Forest Pan Update No 2 (10/18/1993) clarified that the tons per acre of fuel established in FW-252 were not an acre by acre or unit level standards, but thresholds for a certain level of fire intensity.

Individual unit fuel loadings can be lower of higher than guidelines levels based on a larger area analysis of short-term and long-term fuel conditions.

Alternatives Design

Alternative 2 was designed to yard tops and limbs on all skyline logged acres. No yarding of tops and limbs would occur on the helicopter logged acres. Roadside grapple piling and burning cleanup would be prescribed on all open classified roads (post project) that are adjacent to harvest units. As a result of these treatments, approximately 50% of the treatment acres would have residual fuel loadings which would meet the recommendations for 0-3” fine fuels. Fuel loadings in the other 50% of the treatment acres would be above forest guidelines for about 5-10 years, depending on the pre-harvest fuel loads, pre-harvest trees per acre, and thinning prescription.

Alternative 3 was designed to yard tops and limbs on all skyline logged acres and on the moderate and heavy thinning units which would be helicopter logged. Roadside grapple piling and burning would occur on all open classified roads (post project). In addition to these treatments, prescribed underburning would be done on approximately 281 acres. As a result of these treatments, approximately 74% of treatment acres would meet recommended levels. The remaining 26% of the treatment acres would remain above guidelines for about 5-10 years.

Similar to Alternative 3, Alternative 4 would yard tops and limbs on all skyline logged acres and on the moderate and heavy thinning units which would be helicopter logged. Roadside grapple piling and burning would occur on all open classified roads (post project). Underburning would also be prescribed on 362 acres. In addition to these treatments, handpiling and burning would be prescribed to achieve additional fuels reduction on most heavily thinned harvest units. As a result of these treatments, approximately 98% of the treatment acres would meet recommended for fine fuels. The remaining 2% of acres would remain above guidelines for 5-10 years.

Summary of Effects

Under the No Action Alternative, no fuels would be generated from harvest activity and forested stands would continue on a path of natural succession. Due to fire suppression practices, the buildup of fuels would continue to occur as stands grow older. Eventually, a large, intense wildfire may escape fire control efforts and damage stands in the project area. Recommended fuels treatments in the action alternatives would reduce fine fuels to forest guidelines in 50%-98% of the project area, depending on which alternative is chosen. The analysis shows that reducing stand density and treating fine fuels would reduce the long-term risk of larger, more intense wildfires. Alternative 2 treats the least amount of residual harvest slash, and therefore includes a short-term risk of high intensity wildfires. As a result of Alternative 2 fuels treatments, approximately 50% of harvest acres would be within guidelines for fine fuel loading and about 12% of the total treated acres would be priority acres. Alternative 3 fuels treatments are more than Alternative 2 but less than Alternative 4 which presents a moderate level of risk of high intensity wildfires may be expected as a result of selecting this alternative. As a result of

Alternative 3 fuels treatments, approximately 74% of harvest acres would be within guidelines for fine fuel loading and about 15% of the total treated acres would be priority acres. Alternative 4 treatments would reduce residual slash to levels within guidelines in approximately 98% of the project area and about 44% of the total treated acres would be priority acres representing the least risk among the action alternatives of producing high intensity wildfires. Treatment costs are lowest in Alternative 2, and highest in Alternative 4. All direct, indirect, or cumulative effects associated with fuels treatments in the Hehe Project area would be mitigated with appropriate management practices.

Effects of Alternatives

Alternative 1 (No Action) - Under Alternative 1, no fuels would be generated from harvest activity and forested stands would continue on a path of natural succession. However, fire suppression policies would continue to dictate fire exclusion from the project area. A lack of disturbance would mean that stands would continue growing into an overstocked condition. Slow growing and weakened trees would die and contribute to the fuel buildup on the forest floor. Condition Class 1 stands would progress towards condition class 2 and 3. Over time, the increasing fuel loads and dense canopies could be associated with greater fire intensity, severity and rates of spread. Fire occurrence on the landscape would continue only under uncontrolled wildfire situations. The risk of large, stand destroying fires would increase and pose a future danger to the Late-Successional Reserve.

Effects Common to Alternatives 2, 3 and 4 - The proposed commercial thinning in the Hehe project area would open the stands, creating a forest canopy less susceptible to sustaining a crown fire. Ladder fuels would be reduced as harvest operations remove the vertical fuel continuity. Because heavily thinned stands would have fewer residual trees and more crown spacing, these stands would ultimately be less susceptible to crown fires than light or moderately thinned stands. The proposed treatments for all action alternatives includes varying amounts of the following treatments: skyline yarding trees with tops and limbs attached, roadside grapple piling cleanup, and pile burning on roads/landings.

The amount of harvest-related slash remaining in a unit depends primarily on the pre-existing surface fuel load and the number of trees to be harvested (thinning prescription). In the Hehe project area, a variety of thinning prescriptions and fuels treatments would be applied to the landscape, which in turn would create a diversity of post-treatment fuel loadings. The goal of the fuels treatment plan is to reduce fuel loadings (logging slash) to levels within Forest Plan guidelines.

Increased surface fuel loads (slash) affect fire behavior by temporarily increasing fire intensity and rate of spread. The increase in fuel loading is temporary because moderate to heavy winter precipitation in the western Cascade Mountains accelerates the decomposition process, especially for fine fuels. As a result, fire danger in an untreated stand would be highest 1-5 years after

thinning, and would decrease thereafter. Studies done by Fahnestock and Dieterich have shown that Douglas-fir slash decomposes to approximately 79% of its original volume after 5 years (Fahnestock 7). Field observations on the Willamette National Forest have indicated that Douglas-fir and Western hemlock slash (0-3” fuel) decomposes to approximately 50% of its original volume after 10 years; observations have found that less than 10% of residual slash remains after 20 years. This indicates that all harvest units in the Hehe Project Area would be within guidelines for 0-3” fuels after 10 years. Because fire spread is primarily influenced by 0-3” fuels, guidelines for 0-3” fuels are used to determine when slash loadings are above recommended levels.

Because the project area is currently defined as Condition Class 1, no technical change in condition class would occur as a result of thinning and fuels treatments. However, thinning the stands and removing residual fuels would result in stands that remain in Condition Class 1 for a longer period of time than would be true for un-thinned stands.

Alternative 2 -Under Alternative 2, yarding tops and limbs would occur on all skyline logged acres. However, no yarding of tops/limbs would occur on helicopter logged acres. Roadside grapple piling and burning cleanup would be done on all permanent roads that are adjacent to harvest units. As a result of these treatments, residual fuel loadings on approximately 50% of the project area would be within recommended levels for 0-3” fuels. Fuel loadings would be above guidelines for 5-10 years, depending on the pre-harvest fuel load/pre-harvest trees per acre/harvest prescription.

The following table (Table 19) displays the recommended fuels treatment by unit, predicted post treatment slash loading and percentage of project area occupied by the different fuel loadings:

Table 19 - Alternative 2 Fuels Treatment Information

Fuels Treatments	Harvest Acres	Post Treatment Acres Within Guidelines+	Priority Acres Within Guidelines++
Skyline Yarding of tops and limbs & piling and burning @ landings	1996	1339	180
Roadside grapple piling and burning (includes landings acres	N/A	190	190
No fuel treatment	1190	60	0
Totals	**3186**	**1589**	**370**

+Harvest acres where post-treatment fine fuel loads are 11 tons per acre or less.

++Priority acres include acres along permanent roads and heavily thinned acres. Acres are counted in this category only if fine fuels would be reduced to levels within or below Forest Guidelines (Guidelines = 7-11 tons/acre).

As illustrated by Table 19, the recommended fuels treatments would reduce fine fuels to guidelines on 1589 acres (50% of total harvest areas); of these acres, approximately 370 priority acres would be treated (12% of total harvest acres). In helicopter and skyline units where the thinning prescription is light, fine fuels created by harvest activity would generally not exceed guidelines. In skyline units where the thinning prescription is moderate, residual fine fuel loads (slash) would generally be reduced to levels within guidelines. For Alternative 2, this means that guidelines would be exceeded on helicopter/skyline units with a heavy thin prescription, and on helicopter units with a moderate thin prescription.

As a consequence of not yarding tops/limbs on helicopter units and not doing additional fuels treatments on heavily thinned skyline units, there would be an elevated level of risk until residual slash has decayed to levels within guidelines, or up to 10 years, as noted previously. As would be seen later in this document, the fuels treatment strategies for Alternatives 3 and 4 treat more acres.

In summary, Alternative 2 fuels treatments would be limited to skyline yarding tops/limbs, and grapple piling/burning along permanent roads that are adjacent to harvest units. This alternative would create the most wildfire risk, since only about 50% of harvest acres would receive fuels treatments that reduce fine fuels to recommended levels. The remaining 50% of the area would remain above guidelines for 5-10 years.

Alternative 3 (Proposed Action) - In this alternative, yarding tops/limbs would occur on all skyline logged acres, and on helicopter logged units with moderate and heavy thinning prescription. Roadside grapple piling/burning would occur on all units next to permanent roads. In addition to these treatments, prescribed underburning would be done on approximately 281 acres. As a result of these treatments, approximately 74% of harvest acres would be reduced to guidelines. The remaining 26% of acres would remain above guidelines for 5-10 years, depending on the pre-harvest trees per acre/pre-harvest fuel load/harvest prescription. Mortality of trees in underburned units would range from 5-25%, depending on fuel loading and surface fuel moisture. The following table (Table 20) represents the fuels treatment plan for Alternative 3:

Table 20 - Alternative 3 (Proposed Action) Fuel Treatment Information

Fuels Treatments	Harvest Acres	Post Treatment Acres Within Guidelines+	Priority Acres Within Guidelines++
Skyline yarding of tops and limbs & piling and burning @ landings	1846	1310	96
Skyline & Helicopter yarding of tops & limbs & piling and burning @ landing	1253	643	46
Helicopter yarding of tops & limbs & piling and burning @	561	320	0

Fuels Treatments	Harvest Acres	Post Treatment Acres Within Guidelines+	Priority Acres Within Guidelines++
landing			
Roadside grapple piling and burning (includes landings ac	N/A	130	130
Underburn	15	281	281
No fuel treatment	85	85	0
Totals	**3760**	**2769**	**553**

+Harvest acres where post-treatment fine fuel loads are 11 tons per acre or less.

++Priority acres include acres along permanent roads, heavily thinned acres, or acres within ½ mile of Fall Creek Road. Acres are counted in this category only if fine fuels would be reduced to 11 tons per acre or less.

As shown in Table 20, the recommended fuels treatments would reduce fine fuels to guidelines on 2,769 acres (74% of total harvest acres); of these acres, approximately 553 priority acres would be treated (15% of total harvest acres). In helicopter and skyline units where the thinning prescription is light, fine fuels created by harvest activity would generally not exceed guidelines. In skyline and helicopter units where the thinning prescription is moderate, residual fine fuel loads (slash) would generally be reduced to levels within guidelines. For Alternative 3, this means that guidelines would be exceeded on helicopter and skyline units with a heavy thin prescription.

As a consequence of not doing additional fuels treatments on heavily thinned units, there would be a small increase in the level of risk until residual slash has decayed to levels within guidelines, or up to 10 years (as previously noted). As would be seen later in this document, the fuels treatment strategy for Alternative 4 treats even more acres.

In summary, Alternative 3 fuels treatments would include skyline yarding tops/limbs on all units, helicopter yarding tops/limbs on heavy and moderate thin units, and grapple piling/burning along permanent roads that are adjacent to harvest units. In addition to these treatments, approximately 281 acres would be treated by underburning. Because Alternative 3 would reduce fine fuels to recommended levels on approximately 74% of harvest acres, this alternative would create less wildfire risk than Alternative 2.

Alternative 4 - Under Alternative 4, yarding tops/limbs would occur on all skyline logged acres, and on all heavily and moderately thinned helicopter logged acres. Underburning would also be done on 362 acres. Roadside grapple piling/burning would occur on all units adjacent to permanent roads. In addition to these treatments, hand piling and burning would be done to achieve additional fuels reduction on most heavily thinned harvest units. As a result of these treatments, approximately 98% of harvest acres would be reduced to guidelines for fine fuels. The remaining 2% of acres would remain above guidelines for 5-10 years, depending on the pre-harvest fuel load/pre-harvest trees per acre/harvest prescription. The following table (Table 21) represents fuels treatment plans for Alternative 4.

Table 21 - Alternative 4 Fuel Treatment Information

Fuels Treatments	Harvest Acres	Post Treatment Acres Within Guidelines+	Priority Acres Within S& Gs++
Skyline yarding of tops and limbs & piling and burning @ landing	2027	1360	61
Skyline & Helicopter yarding of tops & limbs & piling and burning @ landing	1618	698	72
Helicopter yarding of tops & limbs& piling and burning @ landing	457	256	0
Roadside grapple piling and burning (includes landings ac	N/A	141	141
Underburn	15	362	362
Hand piling & burn	N/A	1196	1196
No Treatment	62	62	0
Totals	**4179**	**4075**	**1832**

+Harvest acres where post-treatment fine fuel loads are 11 tons per acre or less.

++Priority acres include acres along permanent roads, heavily thinned acres, or acres within ½ mile of Fall Creek Road. Acres are counted in this category only if fine fuels would be reduced to 11 tons per acre or less.

As illustrated by Table 21, the recommended fuels treatments would reduce fine fuels to guidelines on 4,075 acres (98% of total harvest acres); of these acres, approximately 1,832 priority acres would be treated (44% of total harvest acres). In helicopter and skyline units where the thinning prescription is light, fine fuels created by harvest activity would generally not exceed guidelines. In skyline and helicopter units where the thinning prescription is moderate, residual fine fuel loads (slash) would generally be reduced to levels within guidelines. Heavily thinned units would remain above guidelines after yarding tops/limbs. However, hand piling/burning would reduce most heavily thinned acres to guidelines.

In summary, Alternative 4 fuels treatments would include yarding of tops/limbs on all skyline and most helicopter units, underburning on approximately 362 acres, and hand piling treatments on approximately 1196 acres. Grapple piling/burning would also occur along all permanent roads. Alternative 4 would reduce fine fuels (slash) to recommended levels on approximately 98% of

harvest acres. Among the three action alternatives, Alternative 4 is the most comprehensive in terms of fuels treatments, and represents the least potential wildfire risk.

The only damage to residual trees would come from prescribed underburning. In these stands, mortality would range from 5-25%, depending on fuel loading and fuel moisture. Because the project area as a whole is currently best described as Condition Class 1, no technical change in condition class would be observed as a result of harvest and fuel treatments. However, thinning the stands and removing residual fuels would result in stands that would remain in Condition Class 1 for a longer period of time. If all stands were unthinned, most stands in the project area would lapse into Condition Class 2 within 20-50 years.

Table 22 (below) represents predicted mortality for stands underburned in Alternatives 3 and 4. Table 23 helps describe potential wildfire behavior in project area stands. The information in this table applies to pre-and-post treatment conditions for all alternatives. Current fuel types in the project area are Fuel Model 8, Fuel Model 5 mixed with Fuel Model 8, and Fuel Model 10. Post-harvest fuel loadings in some stands are represented by fuel models 10 and 12.

Table 22 - Prescribed Fire Scorch/Mortality Prediction (Spring Conditions)

Fuel Model	Tree Scorch Height	Mortality Predicted
10/12	10-40 feet	5-25%

Source: BEHAVE and FOFEM

Table 23 - Fire Behavior (Late Summer Conditions)

Fuel Models*	Flame Length (ft.)	Rate of Spread (ch/hr)+	1 Hour Fire Size (acres)
8/5	2.9	7.4	2.8
10	4.2	5.0	1.4
11/12	7.2	9.6	4.9

Source: BEHAVE
*Fuel model 11/12 represents forests with light to moderate amounts of untreated slash on the ground. Fuel models 8/5 and 10 represent current fuel models. Under Alternatives 2, 3, & 4, portions of the project area would remain as fuel model 11 or 12 for 5-10 years, and return to fuel model 8/5 thereafter.
See Table 1 for fuel model references.
+one chain = 66 feet

Cumulative Effects – Fuel Loading

The cumulative effects analysis area for fuel loading was the project area. Refer to Appendix B for a summary of all past, present and foreseeable actions within the Fall Creek watershed.

Alternative 1 (No Action) - Modern fire suppression practices, past wildfires, and timber management have created cumulative effects in the project area. On the Willamette National

Forest, approximately 80% of wildfires are naturally ignited by lightning. Under the no-action alternative, stands in the Hehe project area would not be thinned, but would exist in a state of continual fire exclusion. Because there has been active timber management and wildfires in the project area during the past several decades, most stands in the project area are in relatively good condition. Fire records from 1950-present indicate that approximately 44 wildfires have been ignited and/or burned into the 20,900 acre project area. Approximately 75% of these fires were contained at one-tenth of an acre or less. As earlier noted, the largest fire in known history was the 1951 Hehe fire, which burned approximately 2,800 acres within the project area. Wildfires have burned approximately 5,126 acres in the project area since 1950, or about 90 acres annually. During the pre-suppression era, natural fires in the project area would have burned about 139 acres annually or approximately 5,824 acres since 1950. This estimate is based upon a natural fire return interval of 150 years. Prescribed fires implemented in the project area since 1950 are discussed below.

The cumulative effects of fire exclusion during the modern fire suppression era are well-documented and have been observed in fire prone ecosystems throughout the American West (RMRS-GTR-42 vol. 5, p.185-203). Increasing stand density and the accumulation of fuels would inevitably lead to a wildfire that is much more difficult to control than a fire in a thinned, treated stand. Condition class would continue to worsen until future thinning/treatments are accomplished or a stand destroying wildfire occurs. A severe, large wildfire may not occur in the project area for 25 years or more, but natural combinations of weather and fuel conditions would ensure that it would happen eventually.

Cumulative Effects Common to Alternatives 2, 3, and 4 - As earlier noted, modern fire suppression practices, past wildfires, and timber management have created a cumulative effects in the project area. Wildfires—even naturally occurring ones—do the most damage when they occur in stands where previous suppression efforts have been successful in excluding fire for long periods of time. Timber management can be designed to act as a surrogate for natural fire occurrence in certain ways. Timber harvests and subsequent slash treatments reduce tree density and fuel loadings, making it easier for stands to fully mature and more difficult for stand destroying fires to occur. During the modern fire suppression era, past timber harvest in the Hehe project area has had the secondary benefit of reducing fuels. This is because broadcast burning was generally prescribed for all acres during the clearcut harvest era. Action alternatives with the higher amounts of fuels treatments would have the most impact in reducing the probability of large, stand-destroying wildfires that might occur in the near future. However, all action alternatives would have the benefit of mitigating the future, long-term effects of fire exclusion in the project area. Residual slash, even if untreated, would decompose and be reduced to background levels after approximately 10 years.

As was explained in the No Action Alternative section above, approximately 139 acres per year would have burned in the project area under the natural, pre-suppression era fire regime (150 year

fire return interval). Since 1950, wildfires have burned approximately 5126 acres in the project area. Approximately 7,306 acres in the project area have been broadcast burned to treat slash produced by timber sales during the same period of time. This means that about 12,432 total acres in the project area have been burned by wildfires and prescribed fires since 1950, or an average of 218 total acres annually. This indicates that the combined effects of wildfires and prescribed fires in the project area have (in effect) established a more frequent occurrence of fire than might naturally have occurred in the project area. However, since the implementation of the Northwest Forest Plan (1991), logging and associated prescribed burning on the Middle Fork Ranger District consist of only about 1/5 of the annual acres of the 1950-1991 logging era. The combined annual acres burned on the Middle Fork District as a result of wildfire and prescribed fire (since 1991) is less than ½ of the average annual acres that would have burned under the natural, pre-suppression era fire regime.

Alternative 2 - The cumulative effect of these activities has been a long-term reduction of large fire potential that is still in place. In contrast, the lack of comprehensive fuels treatments in Alternative 2 would result in higher than normal fuel concentrations in about 50% of planned harvest areas. The temporarily higher fuel loads in these areas would create short-term potential for large, intense wildfires. Such wildfires would be difficult for firefighters to safely access, control and contain with initial attack. As earlier noted, thinning stands would also have the long-term benefit of mitigating the effects of fire exclusion by reducing the future potential of large, stand destroying fires (after harvest-related fine fuels have decomposed). Stands in the area are currently categorized as Condition Class 1, and would remain in that condition for up to 50 years as a result of thinning.

Alternative 3 (Proposed Action) - Although not comprehensive, the recommended fuels treatments in Alternative 3 would result in higher than normal fuel concentrations in only about 26% of harvest acres. From a fuels perspective, the temporarily higher fuel loads in these areas would create short-term potential for intense wildfires in some areas. Because Alternative 3 would thin more acres than Alternative 2, there would be an even greater long-term benefit of mitigating the negative effects of fire exclusion and stabilizing condition class.

Alternative 4 - As was noted earlier, comprehensive fuels treatments (broadcast burning) were generally prescribed for all timber harvest areas in the pre-1991 harvest era. Although Alternative 4 fuels treatments do not include large acres of broadcast burning, the prescribed fuels treatments would reduce fine fuel loads in a fairly comprehensive way. As a result of yarding tops/limbs on nearly all acres, underburning, hand piling/burning, and roadside grapple piling/burning, post-treatment fuel loads would meet recommended levels on approximately 98% of harvest acres. Alternative 4 fuels treatments represent the most comprehensive scenario for lowering short-term wildfire risk in the project area. Because the most acres would be thinned under Alternative 4, this alternative would also create the most long-term benefit in terms of mitigating the negative effects of fire exclusion and stabilizing condition class.

Vegetation

Non Significant Issue - Stand management in Late-Successional Reserves will focus on stands that have been regenerated following timber harvest. These are stands that will acquire late-successional characteristics more rapidly with treatment, or are prone to fire, insect, disease, wind, or other disturbances that would jeopardize the reserve. Depending on stand conditions, treatments could include, but would not be limited to: 1) thinning or managing the overstory to produce large trees; releasing advanced regeneration of conifers, hardwoods, or other plants; or reducing the risk from fire, insect, diseases, or other environmental variables; 2) underplanting and limit understory vegetation control to begin development of multistory stands; 3) killing trees to make snags and coarse woody debris; 4) reforestation; and 5) limit use of prescribed fire to maintain non-forest special habitats. Thinning prescriptions will encourage development of diverse stands with large trees and variety of species in the overstory and understory (ROD, B-6).

Existing Conditions – Vegetation

The average stand is 49 years old, 13 inches in diameter, and 97 feet tall. These second growth managed stands are classified as being in the stem exclusion seral development stage (Oliver and Larson, 1990). Stands in this seral stage have dense crowns which block out the light to the forest floor, and limit additional tree regeneration in the understory. Typically, shade-tolerant understory trees that are present persist but grow very slowly. Intermediate or suppressed trees that do not tolerate shade well suffer from competition and have high mortality rate. Shade-intolerant shrubs and forbs frequently disappear at this stage.

These stands have densities that range from 177 to 510 trees per acre. The relative densities range from 36 to 95 with an average of 64. Stand vigor and growth is declining in these stands. Some trees have begun to die due to overcrowding and competition between trees for nutrient and light as evidenced by competition-induced mortality.

Appendix E provides the current (and post thin) conditions in more detail and specific to the stands being considered for treatment with this project.

There are many methods of expressing or evaluating density or stocking levels of plantations. The method used for determining the timing of commercial thinning treatments in the proposed units was Curtis's Relative Density (Curtis, 1982). This relative density method relates existing or planned density to some maximum biological potential density, hence the term "relative". The two factors used in the formula are the quadratic mean diameter and stand basal area per acre. For Douglas-fir a relative density of 50 and above has been determined to be a stand density sufficient to cause competition mortality. The recommended density for managing Douglas-fir to maximize stand vigor and growth is within the range of 35 to 50. The majority of the proposed

units have relative densities greater then 50. The growth and yield projection model - Forest Vegetation Simulator (FVS) (USDA 2002) was used to model the growth of the stands.

Due to the conditions of many of these stands, Middle Fork District requested a project-specific deviation from the Willamette Late-Successional Reserve Assessment (LSRA) 20 inch DBH cutting limit in order to accomplish density management through commercial thinning. The LSRA adopted Regional Ecosystem Office (REO) exemption criteria for commercial thinning which includes limitations on cutting trees exceeding 20 inches DBH. These stands are on productive sites and many of the stands received early precommercial thinning and fertilization under the past intensive timber management regime. The diameter distribution and growth of these stands are greater than anticipated by the REO exemption criteria for managed plantations. In order for the thinning to be effective and produce desire results (diameter growth, crown growth, understory development, species diversification) more than an incidental cutting and removal of ≥ 20 inch DBH trees needs to occur. Approximately 1,503 acres of proposed units would benefit from cutting trees exceeding 20 inches DBH to achieve the silvicultural objectives for density management. Excess 20 inches DBH trees would be used where applicable to meet snag and down wood debris requirements, but some excess 20 inches DBH trees are proposed to be removed to manage the fuel loading levels and meet tree density objectives. The Middle Fork District received a letter of consistency (USDA, 2007) from the REO which concurs with the Middle Fork Districts rationale for cutting > 20 inch DBH trees and that finds the project is consistent with the objectives of the Northwest Forest Plan Guidelines for managing LSRs.

Direct and Indirect Effects – Vegetation

Summary of Effects

The stands proposed for treatment are in a condition based on stocking levels, average stand diameters, and crown ratios that would respond and benefit from commercial thinning. Commercial thinning would accelerate the development of late-successional forest characteristics, improve growth and maintain the health of the residual trees by reducing the competition between trees. It would also improve diameter growth, develop the understory and diversify the species composition by opening up the tree canopies. It would provide for an intermediate harvest of merchantable size trees from the excess trees which would normally die out from competition.

Commercial thinning proposed in the action alternatives would develop the live components of late-successional forest characteristics (5 TPA, 32” DBH Douglas fir and 6-20 TPA >9 DBH shade tolerant species) about 10-30 years faster than un-thinned stands depending on the prescription.

Commercial thinning would not change the current seral stage classifications of these stands. The treatments would move these stands along the successional pathway toward understory re-initiation and the development of late-successional forest characteristics. The treatments promote

the development of large diameter trees, multi-storied canopies, horizontal patchiness, and species diversification.

Effects of Alternatives

Alternative 1 – No Action - These over-stocked stands would continue to grow, but at slower rates as trees compete with each other for growing space. Diameter growth would be low or would decline and live crown ratios would get smaller. These trees would become less vigorous and more susceptible to insects and diseases. Competition-induced mortality would increase thus increasing both snag and down wood levels. The down material would increase fuel loadings making the stands more vulnerable to wildfire and insect infestations. The competition-induced mortality would not be available for commercial wood products. Low light levels in un-thinned stands would suppress development of shade-tolerant trees and limit understory vegetation. The diameter and product value of trees harvested in the future would be reduced without treatment.

Effects Common to Alternatives 2, 3 and 4 - The proposed stand treatments have been designed to meet the purpose and need to accelerate the development of late-successional forest characteristics and maintain or improve stand growth and health of these stands, which provides prevention and protection against insects, diseases, and fires. The commercial thinning proposals are designed to facilitate development of additional late-successional habitat from young, dense stands by:

1. Improving or maintaining growth and health of the young stands,
2. Facilitating/accelerating development of structural conditions found in late-successional forests such as large bole size and variability in tree spacing,
3. Producing long-term variability in tree size and tree spacing through variable thinning densities,
4. Enhancing or promoting canopy development for vertical diversity and complexity,
5. Diversifying species composition and structure,
6. Reducing long-term buildup of fuel and increasing crown spacing to lower risk of catastrophic wildfire.

The thinning would open up the tree canopy, allowing more sunlight and precipitation to reach the forest floor. This would result in changes in the microclimate (increased air and soil temperatures, relative humidity's, and air movement) (Chan, 1995), under the main canopy for a short-term (10-20 years) until the canopy closes back in. These changes in microclimate stimulate an increase in favorable growing conditions for most plant species.

Thinning would promote the development of diverse, multi-layered stands (Bailey and Tappeiner, 1998, Muir et all 2002), primarily by providing conditions that favored the establishment of shrubs, hardwoods, and conifers in the understory after thinning, and by releasing saplings and intermediate crown-class trees in the stand.

Thinning would maintain or enhance stand-level plant species diversity. A study found that species richness for herbaceous species and total species richness across trees, shrubs, and herbaceous vegetation (Bailey et al 1998) were greater in thinned stands than in un-thinned and old-growth stands. A portion of the increased species richness was associated with exotic species, but grasses and nitrogen-fixing species also were more abundant in thinned stands

Thinning promotes the crown differentiation by allowing overstory trees to develop deep canopies and larger diameter branches in open stand (McGuire et al 1991).

The heavier thinning would promote rapid growth of trees with characteristics normally associated with old trees in old-growth stands. Many old trees grew rapidly when they were young (30-100 years), and produced large stems and crowns. Recent evidence (Franklin et al 1981, Tappeiner et al. 1997; Poage and Tappeiner 2002) suggests that growth rates of some older forests indicate slow regeneration and at low densities over a long period with little tree-to-tree competition.

Other old-growth forests appear to have developed from relatively even-aged cohorts that had undergone long-term suppression mortality, little understory regeneration of Douglas-fir, and episodic release of established tolerant conifers (Winter et al 2002a, 200b). Therefore, stand management can follow multiple routes that emulate natural processes to move dense young stands towards structure similar to old-growth forest.

Some stages of forest succession may be shortened or side-stepped by commercial thinning in young stands (Andrews, et al 2005).

A short-term negative effect to understory vegetation and below ground fungi would be the mechanical damaged from logging. The removal of host trees and soil disturbance from the yarding operation impacts below ground fungi (Courtney et al 2004). This negative effect is mitigated by the rehabilitation of temporary spurs and landings and log-suspensions capabilities of skyline and helicopter yarding systems.

Thinning may help these stands to develop resistance to environmental variables. Studies have compared live-crown ratio and height: diameter (H:D) ratios of trees in young stand managed for timber production to those of trees in old-growth stands (Poage 2001). Live –crown ratios averaged about 50 percent or higher in the old trees, and 30 percent or less in trees in young stands, depending on stand density and whether or not the trees had been thinned. Old trees also had low H:D ratio (often <40-50), which suggests that they are resistant to disturbances by agents such as wind, fire, and ice (Wilson and Oliver 2000, Wonn and O'Hara 2001). In young stand, these ratios were often closer to 70, which suggest that these trees are relatively, unstable, and have relatively low resistance to wind, fire, and ice. Thinning reduces the densities and promotes greater diameter growth of residual trees that increases the stability of these stand over time by making them more resistant to windthrow. However, the heavier thinning could possibly make the residual trees more susceptible to windthrow initially (Garmen, et al. 2003). Following

thinning, some trees may blow down as a result of increased exposure to wind. Windthrow creates canopy gaps and supplies coarse woody material as a fine-scale distance (Hayes et al 1997).

Appendix E compares stand conditions for pre and post treatments scheduled for year 2009 in thinned units for the proposed action.

Stand Modeling

The stand exam data for three stands (Unit #606, #12, and #780) which represent the three thinning prescriptions, light, moderate, and heavy, respectively, were modeled in the Forest Vegetation Stimulator (FVS) (USDA, 2002) to evaluate the progression of the stands toward the criteria of late-successional forest structure minimum thresholds (see Silvicultural Prescription in Project File).

Table 24 - Unit 606 - Light Thin - Modeled Stand Conditions at 150 years

	No Thinning	Light Thinning
Large Diameter Douglas fir TPA >32" DBH @ 150 years	1	14
Shade Tolerant Species TPA >9" DBH @ 150 years	28	25

Table 25 - Unit 12 -Moderate Thin - Modeled Stand Conditions at 150 years

	No Thinning	Light Thinning
Large Diameter Douglas fir TPA >32" DBH @ 150 years	2	6
Shade Tolerant Species TPA >9" DBH @150 years	32	53

Table 26 - Unit 780 - Heavy Thin - Modeled Stand Conditions at 150 years

	No Thinning	Heavy Thinning
Large Diameter Douglas fir TPA >32" DBH @ 150 years	2	7
Shade Tolerant Species TPA >9" DBH @ 150 years	0	21

The density of Douglas-fir > 32"DBH projected in the 100 years model analysis period (stand age about 150 years old) is increase by about 4-13 TPA with the different thinning intensities. The scenario where no thinning would take place shows that the minimum threshold 5 trees per acre for Douglas-fir would not be produced within the next 100 years. Each of the three thinning

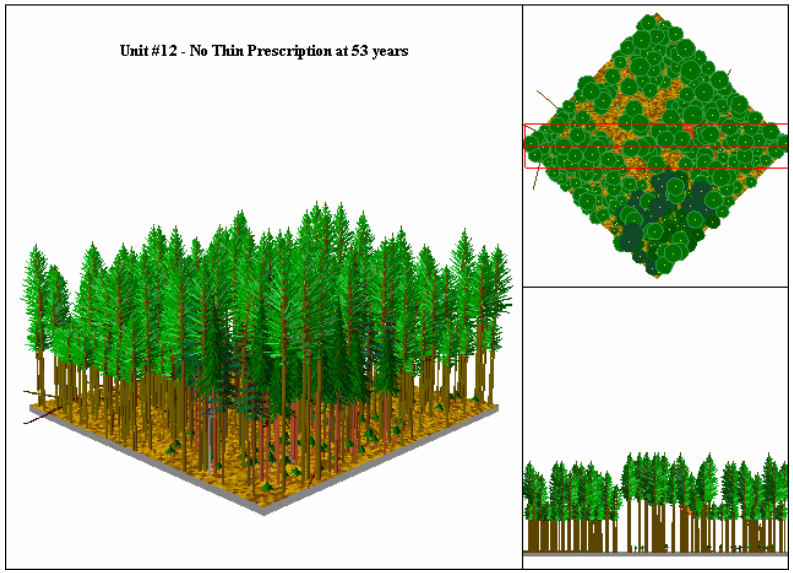


Figure 6 - No Thin Prescription

Figure 7 - Light Thin Prescription

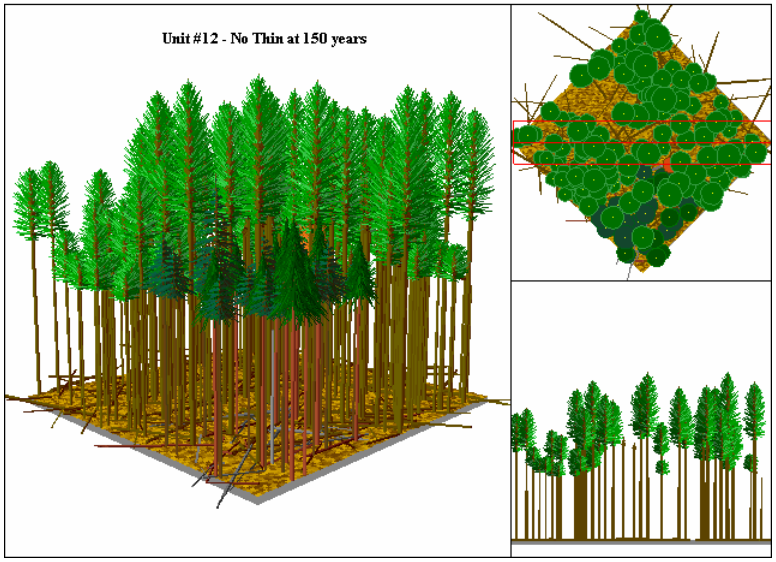


Figure 8 - No Thin Prescription at 150 years

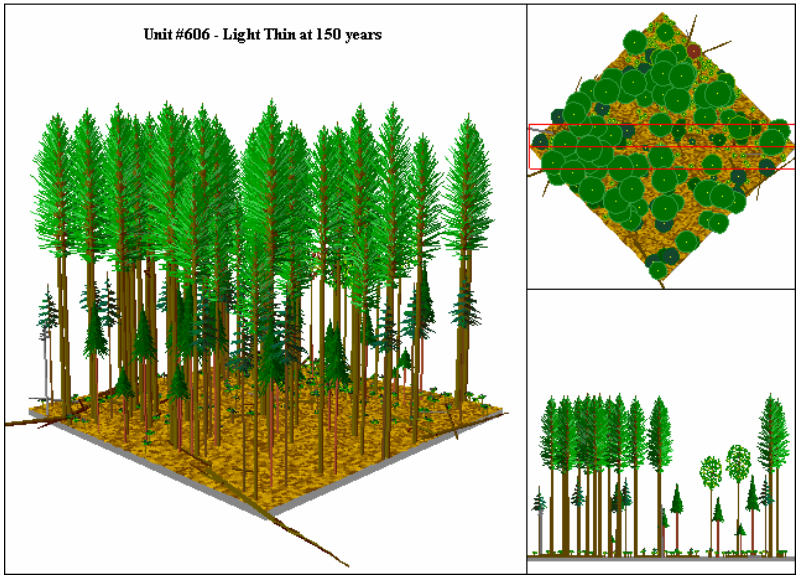


Figure 9 - Light Thin Prescription at 150 years

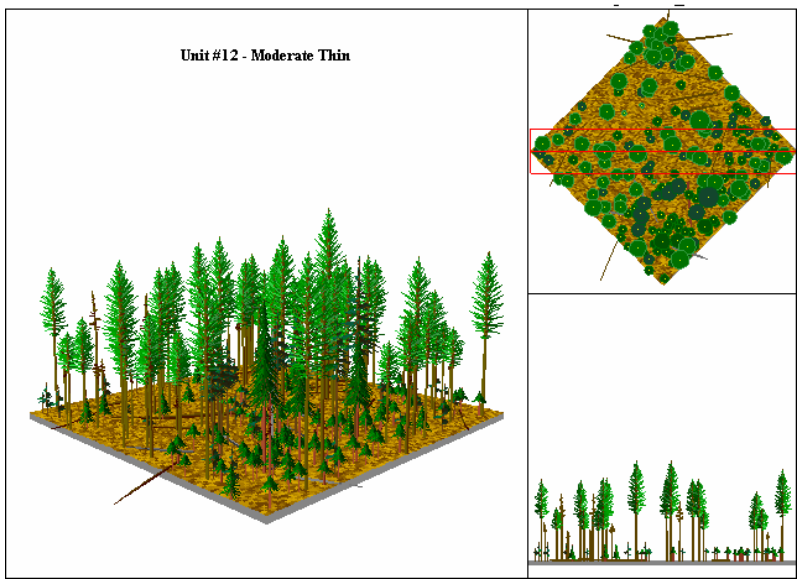


Figure 10 - Moderate Thin Prescription

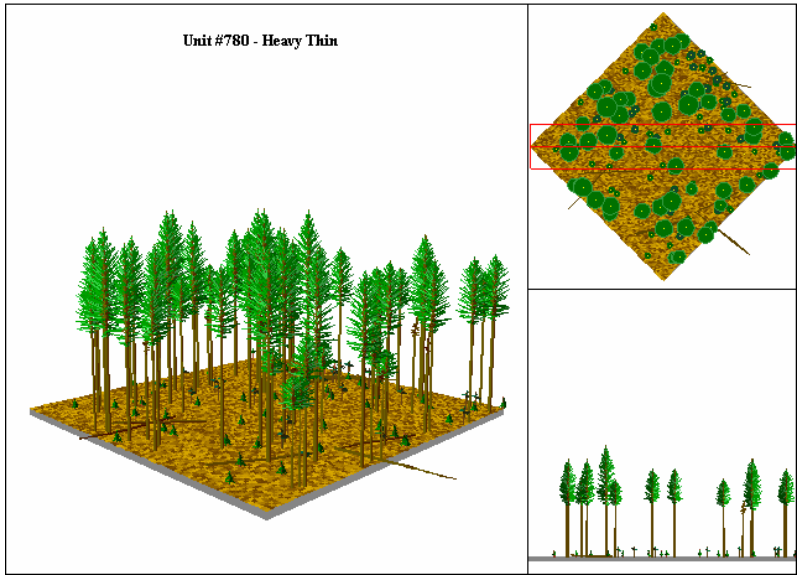


Figure 11 - Heavy Thin Prescription

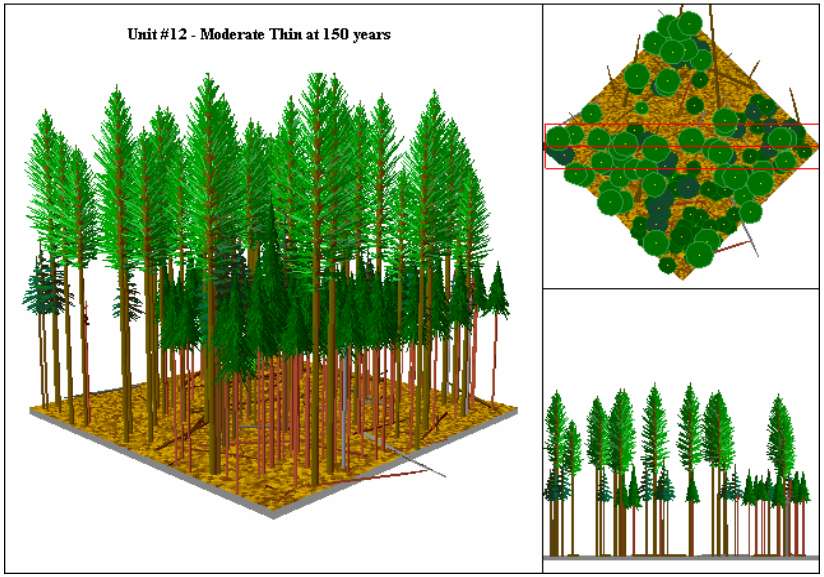


Figure 12 - Moderate Thin Prescription at 150 years

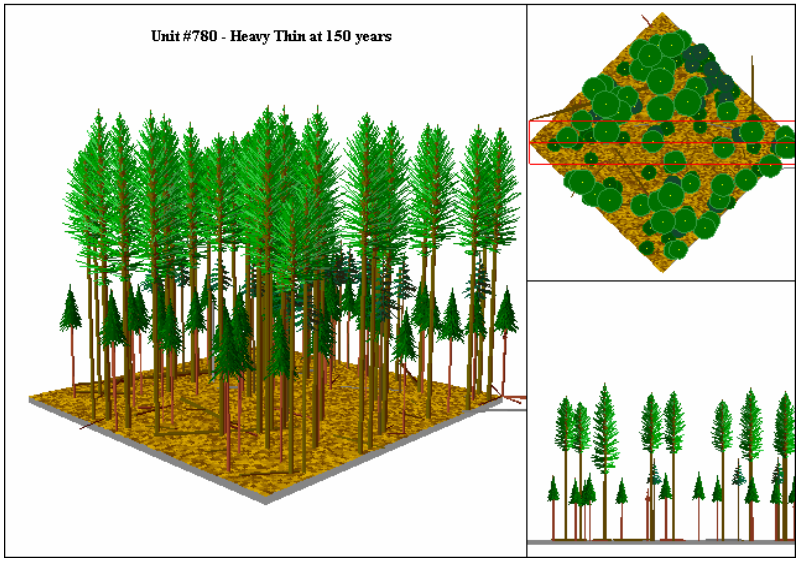


Figure 13 - Heavy Thin Prescription at 150 years

intensities, light, moderate, and heavy would exceed the threshold number of 5 Douglas-fir >32" DBH trees per acre at 143 years, 131 years, and 122 years, respectively.

The shade tolerant understory criterion at 150 years is met for both the light and moderate thins and with the no thinning prescription in each of the sample Units #606 and #12. The shade tolerant trees per acre would not be met in Unit #780 with the no thinning prescription but would exceed the threshold levels with the heavy thin (21 TPA). Each of the three thinning intensities, light, moderate, and heavy would exceed the threshold number of 16 shade tolerant species >9" DBH trees per acre at 143 years, 107 years, and 122 years, respectively. It should be noted that Unit #12 with no thinning prescriptions would meet the shade tolerant criteria at age 53 years old given the current species composition dominated by big leaf maple clumps.

Figures 6-13 displays representative illustrations of the stand conditions of the four different thinning prescriptions (no thin, light, moderate, and heavy) at about 10 years after the thinning and at 150 years.

Alternative 1 (No Action) does not propose any thinning and these stands would take over 150 years to develop the live components of late-successional forest conditions. Alternative 2 would promote the development of 3,186 acres of late-successional forest conditions in less than 150 years, Alternative 3 would promote the development of 3,762 acres, and Alternative 4 would promote the development of 4,179 acres.

Cumulative Effects – Vegetation

The area analyzed for cumulative effects on vegetation was the project area. The project area is delineated by the Hehe Creek sixth sub-watershed Jones, Alder, Sunshine, Pernot, Hehe, Tiller, Puma, and Marine Creek drainages. This area provides a logical analysis area to assess stand conditions based on the plant association series and the approximate size (5,000 to 10,000 acre) of the typical natural wildfire disturbance event.

Existing conditions are a direct result of the harvest history of the area. Past timber harvest and road construction have been the dominant management activities which has had a cumulative effect on the vegetation. Appendix B in the EA provides a summary of the history of past timber harvest and road management.

As a result of past management actions, the current development stage distribution in the project area is 4,709 acres of stand initiation, 5,255 acres of stem exclusion, 2,599 acres of understory reinitiation, 8,178 acres of late-successional old growth and 160 acres of non-forest. There are no present actions that would affect the seral stage distribution in the analysis area. The only reasonably foreseeable future action affecting vegetation is timber stand improvement treatments such as pre-commercial thinning. This young stand thinning would not change the seral class condition in these stands.

The cumulative effects on development stage distribution in the analysis area that would be caused by the alternatives being considered are displayed in Table 27 below.

The following table displays the acres and percent of each development stage in the project area.

Table 27 -Project Area Development Stages and Effects by Alternative

Development Stage	Alternative 1 (No Action) (Current Conditions)	Alternative 2	Alternative 3 (Proposed Action)	Alternative 4
Stand Initiation	4,709 ac.	4,709 ac.	4,709 ac.	4,709 ac.
Stem Exclusion	5,255 ac.	5,255 ac.	5,255 ac.	5,255 ac.
Understory Re-Initiation	2,599 ac.	2,599 ac.	2,599 ac.	2,599 ac.
Old Growth	8,178 ac.	8,178 ac.	8,178 ac.	8,178 ac.
Non Forest	160 ac.	160 ac.	160 ac.	160 ac.

The Alternatives would have no cumulative effects on development seral stages. Proposed thinning in Alternative 2, 3 and 4 would not alter the development stage but would change the number of trees per acre and the canopy density, in treated stands. The treatments would move these stands along the successional pathway toward the understory re-initiation stage.

Cumulative effects on growth rates would be the same as described in direct effects. This cumulative effect would be the same for thinning in all action alternatives.

Consistency with Direction and Regulations – Vegetation

The commercial thinning treatments are consistent with standards and guidelines in the Forest Plan as they relate to commercial thinning (MA-14a-13) and the land allocations (Late-Successional Reserves and Riparian Reserves). All thinning treatments would take place on land classified as suitable for forest management. Areas determined to be unsuitable have been avoided and dropped for the units. Thinning maintains or enhances species diversity through the development of understory vegetation. The stands have not reach culmination of mean annual increment, therefore no regeneration harvest is planned.

The project is consistent with the competing vegetation direction. In the thinning units, competing and unwanted vegetation is not a concern due the age of the stands, seral stage condition of the stands, and the proposed treatment type. These stands are 35-60 years old and are dominant in size and height over any competing vegetation. Over the long-term, the canopy cover would expand back to where the shading would control the levels of any potential competing vegetation.

Invasive Plants

Non Significant Issue - Timber sale activities may contribute to the spread of invasive plants. The spread of invasive plants displaces native plants, which may have an affect on biotic communities.

Existing Conditions – Invasive Plants

Plants in the project area that pose the most serious threat to native vegetation are: Slender false brome (Brachypodium sylvaticum), Scot's broom (Cytisus scoparius), Himalayan blackberry (Rubus discolor), evergreen blackberry (Rubus laciniatus), meadow knapweed (Centaurea debeauxii), and everlasting peavine (Lathyrus polyphyllus). Reed canarygrass (Phalaris arundinacea), tansy ragwort (Senecio vulgaris), oxeye daisy (Leucanthmum vulgare), St. John'-wort (Hypericum perforatum), foxglove (Digitalis purpurea), Canada and Bull thistle (Cirsium arvense and C. vulgare), white sweet clover (Melilotus alba) and common mullein (Verbascum thapsus) are also present in the analysis area.

The following species are most commonly associated with forest openings such as road corridors, clearcuts and young plantations.

Slender false brome is a highly invasive perennial grass that has the capability to dominate the forest floor to the exclusion of native species. It has been reported to competitively exclude other species in the understory of coniferous forests it invades, even inhibiting establishment of tree seedlings by sequestering much-needed soil moisture (Kaye, T.N. 2001). This highly invasive grass is a high priority for eradication and control on the Forest. It has been documented in dispersed locations throughout the project area. It is mainly found along road ditches and shoulders. Small patches have been found along the banks of Fall Creek and along Road 1800. Other populations exist throughout the Fall Creek watershed. The species has been documented on adjacent Army Corps of Engineers and Lane County lands surrounding Fall Creek Reservoir.

Scot's broom is a well-established, widespread woody shrub in the legume family up to ten feet tall that favors roadsides and early seral plantations. Himalayan and evergreen blackberries are robust evergreen shrubs that prefer open areas and roadsides but can also persist and spread under the forest canopy. Both species are spread by birds and other animals that eat the berries and both species spread vegetatively by root tipping. These species are commonly found along the project area roads, and in, or adjacent to many proposed stands.

For a complete description of the rest of the invasive plants in the project area refer to the Botanical Report (McMahan, 2007) in the Project File. The Botany Report includes a table which summarizes known weed species locations relative to roads, quarries and stands that were botanically surveyed. The list includes potential control measures and associated costs per treatment acre of for three years of treatment. This list is not a complete inventory of the entire subwatershed, as not all areas were surveyed for invasive weeds, only those in proximity to proposed units and along haul routes.

Direct and Indirect Effects – Invasive Plants

Summary of Effects

All alternatives, including No Action, would result in new and continued disturbances that promote introduction and colonization of new weed species and expansion of existing species in the project area. The risk of future weed infestation can be reduced by implementation of Best Management Practices (BMPs) that are incorporated into project design. Mitigating measures to be applied would cumulatively lower the risk of increasing invasive plants populations within the watershed. Some false brome populations in the watershed have been treated with herbicides in the past using weed treatment funds and regardless of alternative design, spot spraying would continue when monitoring documents new localized populations.

Effects of Alternatives

Alternative 1 (No Action) - The no action alternative would not mitigate for any invasive plant populations that persist in the project area. It is unknown whether invasive species are increasing, decreasing or stable because there is no available data on rates of weed spread on federal or non-federal lands in the watershed. Long-term data collection and monitoring of weed populations has not been done on road systems in the project area. Some populations of false brome has been treated with herbicides the past several years, and it appears that patches have diminished. Because no logging or road maintenance machinery would be dispatched to the site, there should be no risk of additional introduction from contaminated off-road equipment. Alternative 1 does not provide any soils or fuels treatment scenarios that could promote short-term weed flushes; no ground would be opened to provide a seed bed for invasive species, therefore this alternative has the least direct risk of spreading weeds. No forest would be thinned; many shade intolerant weed species cannot survive the deeper darker conditions that would result from foregoing thinning in these stands; thus there is less risk that weeds would spread into the closed canopy stands, not only due to light limitations but also because there would be no equipment in the stands that could potentially spread weed seeds. Weed populations already present in perpetually open areas in the project area would remain growing unchecked unless treated.

Effects Common to Action Alternatives 2, 3 and 4

Thinning activities, spur road construction and system road maintenance increase risk of invasive plant seed dispersal and establishment by creating conditions that allow invasive plants to pioneer disturbed sites and eventually out-compete native plants. Soil disturbance and transport of seed are direct effects of timber harvest on weed introduction and persistence. In the action alternatives, the areas that would be permanently opened up to light and disturbance, e.g., roads and landings would be most at risk. These areas are disproportionately subject to ground disturbance and exposure to vehicles and equipment that may bring seed in.

The alternative with the greatest number of disturbed acres and miles of road for hauling logs would create the most habitats for invasive weed introduction. Harvest creates habitat by opening of the canopy and by yarding logs using ground-based equipment that disturbs soils. Limiting mechanical disturbance helps to limit spread of the existing weed seed bank into the stands. Weed invasion into adjacent thinned stands could lead to competition, affecting tree and shrub seedling establishment and growth, which in turn could affect sensitive botanical species. Weeds directly compete with sensitive species like tall bugbane when they invade their habitat.

Alternative 4 has the highest risk of promoting invasive weeds because it has the higher disturbance and habitat modification. This alternative has a higher risk of increasing weed sites because it proposes 350 more acres of skyline yarding than in Alternative 3, and 930 more acres than Alternative 2 where soil disturbance could provide seed beds

Roads would have to be maintained and, in some cases, upgraded for harvest. Of particular concern are road systems that would be used for transport that contain false brome, as vehicular traffic may facilitate movement of weed seed up and down road systems when seed is caught in the mud on vehicle undercarriages. New temporary spur construction and road upgrade could potentially bring in weed seed from contaminated gravel. Hehe Creek and Alder Creek bridge abutment work would involve in-stream excavation and placement of new footings. Numerous road culverts would have to be installed or replaced. All these activities increase the risk of invasive weed introduction through potential contamination from off-road equipment that is not cleaned, as well as by opening up a seed bed. There are at least 41 documented new invader sites located near or at proposed landing areas, most contain blackberries and scattered, linear false brome sites. Two sites are meadow knapweed.

Roads are well documented as vectors for weeds and sites where new populations could easily establish. There are at least 83 new invader sites along haul routes. Because weeds most often travel along road systems, risk of weed infestation decreases in areas where roads and landings are closed, rehabilitated, and seeded with desirable species.

Porcupine rock pit is located on FS Road 1824-163 to the south and outside of the project area. This is a preferred source site for road material which contains abundant Scot’s broom (upper north corner), lesser amounts of both Himalayan and evergreen blackberries, tansy ragwort and

common mullein. Pre-treatment for invasive weeds of this area is necessary before material can be loaded for project use.

No-cut buffers in Riparian Reserves lessen the risk of slender false brome invading and spreading along waterways by protecting these areas from disturbance.. The action alternatives 2, 3, and 4 have approximately 2,048 acres, 2,368 acres, and 2,582 acres no thin buffer areas, respectively.

Alternative 2 would reduce the miles of roads in the project area by about 4 percent. No recorded new invader weed sites are associated with decommissioned roads in this alternative. Alternative 3 (Proposed Action) and Alternative 4 reduce the miles of roads in the project area by about 31 percent. Nine recorded new invader weed sites are associated with decommissioned roads in Alternative 3 and thirty recorded new invader weed sites are associated with decommissioned roads in Alternative 4. All action alternatives would eventually decrease the risk of permanent weed establishment when native vegetation re-grows in the long term, with the provision that any current populations of invasive plants are treated effectively prior to closing.

Table 28 - Comparison of Invasive Plants Introduction and Established Potential by Alternative

Activity	Alt.1 (No Action)	Alt. 2	Alt. 3 (Proposed Action)	Alt. 4 acres
Total area treated through thinning	0 ac	3, 186* ac	3, 762*ac	4, 179* ac
Yarding systems				
Skyline	0 ac	1,996 ac	2, 576 ac	2, 926 ac
Helicopter	0 ac	1, 189 ac	1, 186 ac	1, 253 ac
New landings	0 ac	6.5 ac*	7.6 ac*	9.3 ac*
Road Management				
New Temporary roads	0 ac (0 mi)	5.6 ac (3.9 mi)*	5.5 ac (3.8 mi)*	7.0 ac (4.8 mi)*
Maintenance and reconstruction of haul routes	0 ac.	309.4 ac (102.1 mi)*	349.4 ac (115.3 mi)*	386.4 ac (127.5 mi)*
Road closed to passenger cars	0 ac.(0 mi)	13.3 ac (4.4 mi)	115.2 ac (38.1 mi)	115.2 ac (38.1 mi)
Subsoiling of decommissioned roads	0 mi	3.7 ac	7.6 ac	8.7 ac
Fuel treatments				
Fine fuel mitigation, yarding tops and machine piling at landings	0 ac	1,996 ac	3,660 ac	4,101 ac
Prescribed under-burning	0 ac	0 ac*	281 ac*	362 ac*
Machine grapple piling and burned within 40' of open roads and landings	0 ac	190 ac*	130 ac*	141 ac*
Supplemental hand piling and burning	0 ac	0 ac*	0 ac*	1, 196 ac*

*Treatment acres used in cumulative effects analysis

Alternative 2 includes 190 acres of grapple piling adjacent to roads, representing 26 % more than Alternative 4 and a 32 % increase from Alternative 3 in acres disturbed that would create invasive weed habitat by the soil disturbance. Alternative 3 and 4 include 281 and 362 acres, respectively, of prescribed underburning that could promote additional weed seed germination in the short-term. Alternative 4 also includes an additional 1,196 acres of supplemental hand piling and burning of which creates scattered burned spots of bare soil. These burned spots increase the risk of weeds spread by creating sites favorable for invasive plants.

Cumulative Effects – Invasive Plants

Cumulative effects for weeds are analyzed on a watershed scale since the entire Fall Creek basin contains habitat and weed species similar to those in the project area. Modes and patterns of dispersal and rate of spread of species are similar to those found elsewhere in the watershed. We considered the cumulative effects to all species found in the project area collectively with the other sites in the watershed.

The Fall Creek watershed contains approximately 76,704 acres. Past actions that created habitat for weeds within the watershed include clear-cut and shelterwood harvesting by the Forest Service. Clear-cut harvesting stands less than 20 years old are assumed to be un-recovered and activities such as tractor yarding, temporary road construction, road maintenance and upgrade, soil restoration treatments, hand-piling, grapple piling and burning, and under burning contribute to an overall increase in early seral (potential weed) habitat in the watershed. Several roadside projects in the recent past that included activities such as hazard tree removal, fire salvage, and restoration of fire damaged recreation areas that also included native and non-native grass seeding.

The FS Road 18 system in the watershed is the main travel route along which infestations are moving. Road maintenance activities occur in this watershed on an as needed basis depending upon level of use. There are 483 miles (approximately 1,463 acres) of open roads in the watershed. Refer to Appendix B for the history of the development of the road system in the Fall Creek watershed and past, present and foreseeable future activities. No new roads are proposed for Forest Service currently or in the foreseeable future.

Alternative 1 (No Action) - This alternative would not reduce the open road system and would not create any additional habitat (zero percent), so this alternative would contribute no additional cumulative effects. Weeds are spread through a combination of human and wildlife activities, and natural events including wind and rain. Foreseeable activities within the project area are expected to be similar to past and current activities. Human activities that would vector weeds onto and within federal and non-federal lands in the watershed such as recreational use (such as off road vehicle traffic, etc.), road travel, road construction and maintenance, and special forest product collection would all continue to occur regardless of whether or not any of the action alternatives

occur. Incremental increases in weed infestation, whether by human or natural disturbances, cannot be accurately predicted because of all the variables involved in vectoring weeds.

The cumulative effect on weeds by alternatives that include ground disturbing activities would be to increase the overall amount of area infested because more area would be disturbed.

Alternative 2 - Activities that would perpetuate or increase habitat for weeds include approximately 102.1 miles of road that would be maintained, representing about 309.3 acres of open weed corridor, or 0.4 percent of the watershed. Stand treatment activities associated with this alternative would create approximately 3,383 acres of additional habitat (4 percent of the watershed).

Alternative 3 (Proposed Action) - Approximately 115.3 miles of road would be maintained, representing about 349.43 acres of open weed corridor, or 0.5 percent of the watershed. Stand treatment activities associated with this alternative would create approximately 4,181 acres of additional habitat (5 percent of the watershed).

Alternative 4 - Approximately 127 miles of road would be maintained, representing about 386.4 acres of open weed corridor, or 0.5 percent of the watershed. Stand treatment activities associated with this alternative would create approximately 5,888 acres of additional habitat (8 percent of the watershed).

Botanical Threatened, Endangered and Sensitive (TE&S) Species and Survey and Manage (S&M)

Non Significant Issue - Known sites for certain botanical TE&S species do occur within the project area and potential habitat exists for other species that are suspected to occur. Harvest associated activities could affect TE&S species and their habitats within, adjacent to and downstream of the project area.

Management Direction - Botanical TE&S Species and Survey and Manage and protection Buffer Species

Forest Service Manual (FSM) 2670 direction is to ensure the viability of sensitive botanical species and to preclude actions that would contribute to the federal listing of a species. To ensure compliance with this direction, a biological evaluation is required for forest management activities that may alter habitat for proposed, endangered, threatened or sensitive species (*FSM 2671.44*) in order to determine the possible effects of the proposed activities on these species.

Northwest Forest Plan (USDA, 1994) established survey and manage guidelines that provided an adaptive-management process for acquiring information and managing rare and uncommon and poorly understood old-growth forest related species. In January 2001, the Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines (USDA, USDI, 2001) adopted new

standards and guidelines for survey and manage and protection buffer species, and other mitigating measures. Species in Categories A and C are required to have pre-disturbance surveys conducted for them. Some Category B species are also required to have pre-disturbance surveys conducted because strategic surveys have not been completed as of fiscal year 2006 (USDA, USDI, 2001).

Existing Conditions – Botanical T,E,&S Species and Survey and Manage and protection Buffer Species

Habitat exists for 47 of the 72 botanical species listed as sensitive on the Willamette National Forest. Documented sensitive and survey and manage species sites in the Fall Creek watershed but not within proposed thinning areas include: *Cimicifuga elata, Romanzoffia thompsonii, Nephroma occultum, Pseudocyphellaria rainierensis,* and *Usnea longissima*. Surveys were conducted in June, July, and August and September of 2003, 2004, and 2006 for vascular, bryophytes and lichens. No sensitive vascular plants were found. Three survey and manage lichen species requiring management of sites were discovered within proposed thinning stands during the course of surveys, two of which are also listed as sensitive.

Surveys identified three sensitive lichens species. *Peltigera paci*fica (Category E species) was located in Unit #3557 on boulder substrate on August 17, 2003, and Unit #164 on conifer trunk and rotten wood on August 19, 2003. *Usnea longissima* (Category F species) was found in Unit# 212 on a cherry branch on September 23, 2003. *Nephroma occultum* (Category B) was recorded at the northeast corner tip of Unit #3556 adjacent to 1831-386 past 1831-390 in 1996.

No surveys were conducted for the 17 fungi species because single pre-disturbance surveys for these species have been deemed impractical (USDA 1998, USDA 2000, USDA 2004) because fungi fruit inconsistently and would require multiple year surveys to determine their presence.

Direct and Indirect Effects – Botanical TE,&S and Survey and Manage Species

Summary of Effects

In summary, because no surveys were completed to determine effects on fungi, all action alternatives were given a May Impact Individuals or Habitat (MIIH), But Will Not Likely Contribute to a Trend Towards Federal Listing or Loss of Viability for the Population or Species rating.

For the rest of the species, all action alternatives were given a No Impact (NI) conclusion because either no populations were found, or the documented populations and associated habitat is sufficiently buffered or located away from the impacts of project activities.

Table 29 - Sensitive Plants Summary of Effects Determination by Alternative

Species	Alternative 1 – No Action	Alternative 2	Alternative 3 (Proposed Action)- Proposed Action	Alternative 4
Botrychium minganense	NI	NI	NI	NI
Botrychium montanum	NI	NI	NI	NI
Bridgeoporus nobilissimus	NI	NI	NI	NI
Carex livida	NI	NI	NI	NI
Cimicifuga elata	NI	NI	NI	NI
Corydalis aqua-gelidae	NI	NI	NI	NI
Dermatocarpon luridum	NI	NI	NI	NI
Eucephalis(Aster) vialis	NI	NI	NI	NI
Hypogymnia duplicata	NI	NI	NI	NI
Iliamna latibracteata	NI	NI	NI	NI
Leptogium burnetiae var. *hirsutum*	NI	NI	NI	NI
Lycopodium complanatum	NI	NI	NI	NI
Montia howellii	NI	NI	NI	NI
Mycorrhizal Fungi	NI	MIIH	MIIH	MIIH
Nephroma occultum	NI	NI	NI	NI
Pannaria rubiginosa	NI	NI	NI	NI
Peltigera neckeri	NI	NI	NI	NI
Peltigera pacifica	NI	NI	NI	NI
Pseudocyphellaria rainierensis	NI	NI	NI	NI
Ramalina pollinaria	NI	NI	NI	NI
Saprophytic on Litter fungi	NI	MIIH	MIIH	MIIH
Romanzoffia thompsonii	NI	NI	NI	NI
Saprophytic on wood fungi	NI	MIIH	MIIH	MIIH
Scouleria marginata	NI	NI	NI	NI
Tetraphis geniculata	NI	NI	NI	NI
Usnea longissima	NI	NI	NI	NI

NI=No Impact

MIIH=May Impact Individuals or Habitat, But Will Not Likely Contribute to a Trend Towards Federal Listing or Loss of Viability for the Population or Species

Effect of Alternatives

Vascular Plants

No direct or indirect impacts to sensitive vascular species are anticipated in any of the Alternatives because no TE&S or S&M species were found.

Lichens and Bryophytes

Alternative 1 (No Action) – No direct or indirect effects are anticipated because no actions would take place.

Effects Common to Action Alternatives 2, 3 and 4

Changes in hydrology, including water temperature and sediment may affect aquatic lichens found on submerged rocks in clear, cold streams (USDA, USDI 2003). Persistence of the other lichen species may be threatened by host tree removal, wind throw, changes in microsite conditions, changes in epiphyte ecology and competition in more open stands, and by dispersal limitations in more widely spaced stands (USDA, USDI 2003). The variable thinning prescriptions would, in the long-term, enhance habitat for most survey and manage species. In some cases, thinning may be beneficial to these epiphytes by enhancing tree species diversity, including Pacific yew and hardwoods such as bigleaf maple, two tree species known for their abundant lichen communities. Larger diameter trees, retention areas, dominant tree release, and the retention of minor tree species would add complexity to the forest. Late-successional forest provides better habitat for sensitive lichens through retention of mature and old-growth trees providing long-term substrate and microclimates. All alternatives propose riparian thinning which increases potential impacts to many species more typically associated with riparian habitat.

Prescribed burning could cause direct loss of individuals from radiant heat and smoke, especially when plants are moist and physically active (USDA, USDI 2002).

Fungi

Effects Common to Action Alternatives 2, 3 and 4

There would be direct effects to fungi under all action alternatives, but severity and amount of habitat disturbance differs by prescription. Most fungi form mycorrhizal relationships with conifers, and thinning has been shown to have negative short-term (5-7 years) impacts to fungi (Pilz et al 2003). Stand treatments would result in the disruption of mycelial networks (Kranabetter and Wylie, 1998; Amaranthus and Perry, 1994). It is likely that individual sites of fungi may be negatively affected in the short-term by host tree removal, physical disturbance, soil compaction, and disruption of mycelial networks if the fungi are present (Kranabetter and Wylie 1998, Amaranthus and Perry 1994). Reductions in the number of fruiting bodies of chanterelles, a common mycorrhizal species, were noted after initial thinning in similar second growth stands but appear to rebound after several years (Pilz et al 2003).

Indirect effects to survey and manage and sensitive species and their habitats vary. Two studies have shown that fungal species richness declines in forest openings (Durall, et al, 1999, Kranabetter and Wylie 1998). Therefore, in the short-term, thinning prescriptions may reduce habitat for sensitive mycorrhizal fungi. The prescriptions in all action alternatives would take place in such a way to enhance late-successional characteristics over the long-term. This includes greater diversity in stand structure and stand species. The addition of understory trees and shrubs may benefit the sensitive mycorrhizal species. Duff retention and coarse woody debris creation would benefit the sensitive saprophytic species and would lead to an increase in habitat complexity over the long-term (20-100 years).

Reducing heavy equipment yarding through forested stands is assumed to be beneficial to forest vegetation. Skyline yarding causes fewer disturbances to the top soil horizons than tractor yarding; soils are less likely to become compacted with partial (or full suspension) skyline yarding than ground based systems. Cable yarding of trees causes localized soil compaction and disturbance along yarding corridors. This causes a loss of ectomycorrhizal root tips (Amaranthus et al, 1996) and can disturb litter-dwelling and saprophytic fungi within the logging corridors. All action alternatives propose skyline yarding, helicopter yarding to landing areas, and grapple piling. These activities would potentially create soil compaction and disturbance that would affect fungi habitat.

Culvert replacement may cause some disturbance to soil-dwelling fungi through direct disturbance and potential removal of habitat, but in small localized area. Development of temporary access roads and helicopter landing areas would have a similar localized direct effect on fungi in the soil.

Effects of burning on fungi have been the subject of many scientific investigations. Loss of large downed woody debris that can act as moisture reservoirs and refugia is a concern (Penttila and Kotiranta, 1997). Prescribed burning in the analysis area would cause loss of litter, so it could reduce substrates for litter-dwelling fungi. Bruns (2002) studying short-term effects of ground fire in the Sierra Nevada found a short-term reduction in the biomass of ectomycorrhizal fungi correlated with incineration of the litter layer, but that lower layers, where the greatest specie richness occurs, were preserved. Stendell et al.(1999) found a similar pattern in a Sierra Nevada ponderosa pine forest after prescribed fire where litter/organic species biomass decreased eightfold but no difference was detected in mineral layers.

Alternative 1 – No Action - Under this alternative, no acres would be thinned and the stands would undergo a slow decline before opening up enough to provide an understory. An indirect effect of no action would be natural succession which may change the underground species composition. Windthrow, snowdown (which are both prevalent in the watershed), and insect and disease pockets would create openings. Coarse woody debris would be abundant as trees die due to overcrowding. Indirect effects to sensitive fungi would likely be minimal. As stands get older,

the underground species composition also gets more diverse (Visser, 1995; Bradbury et al, 1998; Smith et al, 2002).

The stands do provide potential habitat for many sensitive botanical species. Potential habitat for some of these plants would deteriorate as the dense canopies of Douglas-fir close in and darken the forest floor. Some species may be negatively affected by development of a dense closed canopy. These species must have adequate light to photosynthesize; also, a deep dark canopy tends to favor greater moss cover, which can out compete the lichens. Species associated with shrubs and hardwoods such as bigleaf maple would likely drop out of the stand unless thinning takes place.

Alternative 1 would result in no soil disturbance and compaction from harvesting methods, new road construction or any fuels treatments that would affect fungi or other species habitat.

Conversely, because no fuels treatments would occur, potential sensitive plant habitat could be indirectly affected by risk of stand replacing fire disturbance due to heavier unmanaged fuel loads.

Alternative 2 - This Alternative has the least amount of acres potentially containing fungi that would be subject to short-term impacts through thinning.

This alternative also would result in the least amount of acres subject to short-term impacts on lichens through removal of current substrate. The *P. pacifica* site in Unit #164 lies within a no cut riparian buffer and no burn protection area. The *P. pacifica* site in Unit #3557 has been protected with a 50 foot no cut and no burn protection buffer to protect it from mechanical damage and yarding would be directed away from the no cut area. Buffer prescriptions would help to protect species and substrate from damage and help maintain microclimatic conditions of each site. The *U. longissima* site adjacent to Unit # 212 is associated with a mapped special habitat which would be avoided during yarding activities; the site is outside any alternative thinning prescriptions and would not require a protection buffer. The *N. occultum* found in litterfall near Unit # 3556 does not appear to require buffering in any alternative to mitigate for potential adverse effects

Post-thinning fuels would be mitigated by yarding tops and machine piling at landings on about 1,996 acres. About 141 acres would be machine piled and burned within 40 feet of open roads and landings in or adjacent to thinning areas. This represents a 35 % to 43 % increase in the amount of acres included in higher intensity pile burning and additional machinery disturbance than alternative 3 and 4.

Alternative 3 (Proposed Action) -This alternative proposes 576 additional thinning acres and 580 additional acres of skyline yarding that would likely have direct short-term impacts on fungi if they occur in these stands.

Post-thinning fuels would be mitigated by yarding tops and machine piling at landings on about 3,660 acres, potentially creating 45% additional acreage subject to potential mycelium disturbance from fine fuels mitigation. About 81 acres would be machine piled and burned within 40 feet of open roads and landings in or adjacent to thinning areas. This alternative also includes 281 acres of prescribed underburning. Broadcast burning in occupied sites may cause mortality to lichen individuals from radiant heat and smoke. Buffers for the sensitive lichens would be as described in Alternative 2, thus no impacts are anticipated.

Alternative 4 - Log removal would be accomplished by yarding 2,926 acres (70 %) with skyline and 1,253 acres with helicopters. Given this, Alternative 4 would have more total thinning acres directly affected by ground compaction from the additional skyline yarding, which would increase the amount of compaction on mycelial networks. This alternative has the highest amount of acreage subject to short-term impacts through thinning, 10% more than Alternative 2, and 24% more than Alternative 3.

Post-thinning fuels would be mitigated by yarding tops and machine piling at landings on about 4,101 acres, which represents the highest amount of potential mycelium disturbance through fine fuels mitigation. About 92 acres would be machine piled and burned within 40 feet of open roads and landings in or adjacent to thinning areas. This Alternative also includes about 362 acres of prescribed under-burning, and about 1, 196 acres of supplemental hand piling and burning to mitigate for fuel loading, increasing localized litter loss under higher intensity burn piles. Broadcast burning in occupied sites may cause mortality to lichen individuals from radiant heat and smoke. Buffers for the sensitive lichens would be as described in Alternative 2, thus no impacts are anticipated.

Cumulative Effects – Botanical TE&S and Survey and Manage Species

The area analyzed for cumulative effects to botanical T,E&S and Survey and Manage resources is the Fall Creek watershed, which contains additional sensitive and survey and manage species and sites similar to those suspected to be in the Hehe project. This increases the likelihood of such species existing in project area stream drainages. For known sites in the project area, information about species elsewhere in the watershed helps further define the local relative degree of rarity of species. The Fall Creek Watershed Analysis (USDA, 1995) and Fall Creek LSR Assessment (USDA 1996) contain background information regarding known species sites, though new sites have been identified through other projects that have since been surveyed for botanical species including those associated with the Hehe project, the Clark fire, Survey and Manage Regional Random Grid surveys, and various stream, trail and campground projects. Some of these survey efforts have resulted in identification of new sites in the watershed for vascular and non-vascular species.

The project area is designated as Late-Successional Reserve (LSR) under the Northwest Forest Plan and approximately 38 percent of native stands are in old-growth forest conditions. These

stands serve as refugia for many survey and manage and sensitive species that would be able to re-colonize the younger stands as they mature and become more complex in structure and diversity. The watershed has abundant lichen and bryophyte populations, especially evident in the lower elevation mixed hardwood/conifer stands. Nearly half of the project area has been previously harvested. Those previous native old growth forests likely contained multiple populations of survey and manage and sensitive botanical species prior to the creation of younger managed stands through multiple human caused fires, wildfires and intense harvest activity. Fungal diversity declines with clear-cutting and fire (Byrd, et al 2000, Bruns, et al 2002) and stands were typically burned after harvest. It is probable that there has been some recovery of mycorrhizal diversity in stands over 20 years of age following clearcut activity which has the most severe effects on mycorrhizal diversity within the project area by harvesting the host species they depend upon. In the long-term (20-100 years), habitat for survey and manage and sensitive botanical species would be enhanced in the action alternatives.

Wildlife

Big Game Habitat

Non-Significant Issue - All or portions of 4 big game emphasis areas occur within the project planning area. NW Forest Plan Standards and Guidelines for large LSR conflict with Willamette S&Gs for big game management LSR objective is to protect and enhance conditions of late-successional and old-growth forest ecosystems. Management of these elk emphasis areas are based on a set of habitat effectiveness indices as identified in the Willamette Forest Plan, which encourages clearcutting and broadcast burning approach to providing optimal habitat conditions for big game.

Existing Conditions – Big Game Habitat

The Fall Creek LSR Thinning project area has portions of four Big Game Emphasis Areas (BGEAs) namely Alder (Mod), Sunshine-Pernot (Mod), Platt (Low) and Logan (Low). All are either low or moderate emphasis areas under the Forest Plan. The majority of big game usage occurs in the lower portions of the project area, in the lower Hehe Creek area and along the divide between Little Cowhorn Mtn. and Symbol Rock.

Management activities proposed by the Hehe LSR Thin Project have been evaluated for effects to habitat in these four BGEAs according to Forest Plan Standards and Guidelines (S&G) (FW-137). Recent analysis of the Habitat Effectiveness Index (HEI) (Wisdom et al. 1986) on Alder, Sunshine/Pernot, and Logan BGEA's all indicate that current individual values for forage quality (HEf) and open road density (HEr) are below Forest Plan S&Gs (Table 32, and Table 33). Individual effectiveness values for habitat patch size and spacing (HEs) and cover quality (HEc) are currently above Forest Plan S&Gs. Because of the low HEf and HEr values in the Alder and

Sunshine/Pernot BGEAs the overall HEI value also falls below current S&Gs for a moderate level BGEA. Recent analysis for Platt BGEA shows that current habitat quality for all individual indices, and overall HEI, exceeds S&Gs for a low level BGEA.

The Forest acknowledges that the HEI model cited in the Forest Plan standards and guidelines is not the most recent science concerning big game habitat. Holthausen et al. (1994) concluded that expert opinion may exceed accuracy of model output when cover:forage ratios exceed 80:20. Current cover forage ratio for the moderate BGEAs, such as Alder (69/16) and Sunshine/Pernot (71/15) clearly show that the most limiting factor is forage at this point time. Model output is insensitive to small differences between alternatives in how they affect the overall amount of forage habitat in the BGEA. The model is also considered insensitive to the potential quantity and quality of native forage habitat restored under all Action Alternatives relative to the proposed silvicultural prescription and subsequent sale area improvement plans.

District Watershed Analysis (USDA 1995) and other documents (ODFW 2003, Cook 2002) have included discussion that identified a projected downward trend in local HEI due to the loss of forage habitat as it develops into cover habitat based on effects from shifts in management practices under the Northwest Forest Plan.

Current ODFW biological data are not sufficient to provide an accurate estimate of the black-tailed deer population in western Oregon (ODFW 2002). Despite a perceived overall decline, ODFW has identified areas such as those in the vicinity of the project area as being more productive and achieving higher population densities than elsewhere in northwestern Oregon.

Because of a declining forage base, ODFW (2005) has proposed a 4% reduction in the target population management objective for elk in the McKenzie Wildlife Management Unit (WMU) surrounding the Hehe LSR Thin Project area. Nevertheless, recent ODFW population estimates indicate elk are at 96% of their current management objectives for the McKenzie WMU (Bill Castillo pers com; ODFW 2003; ODFW 2005).

No specific data are available for the local deer/elk population within any of the project area BGEAs. Sightings of individuals, and particularly their sign, are common throughout the area.

Direct and Indirect Effects – Big Game Habitat

Summary of Effects

Habitat modification associated with the Hehe LSR Thin Project as described previously can be summarized as having the following direct and indirect effects on deer/elk:

- Approximately 4.5 -39.00 miles of currently open roads would be closed throughout the planning area, predominantly in the Sunshine –Pernot and Alder BGEAs.
- Proposed action activities of thinning in dense, managed units, while maintain legacy structure (J. Hagar Pers. Comm.. 2007) would elevate all aspects of habitat quality for numerous early seral species, especially black-tailed deer and elk in within all BGEAs. It would have the greatest effect in the Sunshine/Pernot BGEA because this is the largest

BGEA, would have most of the thinned units and has the highest number of miles of road closures.

- Alternative 4 has a slight qualitative advantage over Alternative 3 by creating and enhancing an additional 81 acres (281ac. proposed for under burning in Alt 3 –vs-362 ac.in Alt 4) of forage habitat created by prescribed under burning. Otherwise overall effects are considered similar between all Action Alternatives.

Given what is currently known about local deer and elk populations, the future viability of these species in this area should be assured as long as habitat management opportunities continue to be implemented, and adequate protection measures such as Standards and Guidelines governing activities proposed by the Hehe LSR Thin Project continue to be implemented.

Effects of Alternatives

Table 30 -Table 33 displays projected effects of the Hehe LSR Thin Project alternatives against the current habitat effectiveness baseline (No Action - Alternative 1) resulting from model output (Wisdom et al. 1986) for each affected BGEA. The tables also displays HEI conditions over the past decade, and reveals the downward trend in forage habitat and subsequent decline in overall big game habitat quality in these areas. This trend has been validated elsewhere in the Middle Fork Ranger District in other recent project analyses, and across the Forest. Values from 2003 are based on model output presented in the preliminary Hehe Density Management Project wildlife current conditions (Lunstrum 2003).

Table 30 - HEI for Alder BGEA

HEI Modeling Outputs	Alder – Moderate BGEA				
	Individual Indices				Overall Index
	HEs	HEr	HEc	HEf	HEI
Alternative 1 (No Action)	0.76	0.40	0.69	0.18	0.43
Alternative 2	0.78	0.45	0.69	0.16	0.44
Alternative 3 (Proposed Action)	0.78	0.48	0.66	0.19	0.48
Alternative 4	0.78	0.51	0.69	0.16	0.46

Table 31 - HEI for Platt BGEA

HEI Modeling Outputs	Platt Low BGEA				
	Individual Indices				Overall Index
	HEs	HEr	HEc	HEf	HEI
Alternative 1 (No Action)	0.87	0.25	0.72	0.21	0.42
Alternative 2	0.87	0.28	0.73	0.20	0.43
Alternative 3 (Proposed Action)	0.88	0.32	0.73	0.20	0.45
Alternative 4	0.88	0.32	0.73	0.20	0.45

Table 32 - HEI for Sunshine-Pernot BGEA

HEI Modeling Outputs	Sunshine-Pernot- Moderate BGEA				
	Individual Indices				Overall Index
	HEs	HEr	HEc	HEf	HEI
Alternative 1 (No Action)	0.87	0.27	0.64	0.20	0.41
Alternative 2	0.92	0.48	0.69	0.15	0.46
Alternative 3 (Proposed Action)	0.92	0.55	0.71	0.15	0.48
Alternative 4	0.92	0.55	0.71	0.15	0.48

Table 33 - HEI for Logan BGEA

HEI Modeling Outputs	Logan – Low BGEA				
	Individual Indices				Overall Index
	HEs	HEr	HEc	HEf	HEI
Alternative 1 (No Action)	0.84	0.39	0.66	0.19	0.45
Alternative 2	0.84	0.44	0.66	0.19	0.47
Alternative 3 (Proposed Action)	0.84	0.48	0.66	0.19	0.48
Alternative 4	0.84	0.48	0.66	0.19	0.48

The overall effects of commercial thinning and associated activities proposed by Hehe LSR Thin Project such as road closure and seeding of closed roads would result in overall positive changes to habitat effectiveness values. However current modeling methods may not be sensitive enough to accurately reflect changes to big game habitat in the area resulting from proposed activities.

The Wisdom model was developed to evaluated landscape areas where quality forage areas were provided primarily by clearcutting and associated post-harvest burning and fertilization. With the decline in regeneration timber harvest under the Northwest Forest Plan, there has been a corresponding decline in high-quality elk forage habitat. This trend, coupled with recent studies, has increased the importance of providing forage habitat for elk on the Forest. A drawback of the Wisdom model is that forage is evaluated based on the average value of defined forage areas and

does not consider the amount of forage provided. Areas that do not provide meaningful forage are not considered in the forage effectiveness calculations. Consequently, providing substantial acres of temporarily improved elk and deer forage conditions by commercial thinning may result in a lower forage score in the Wisdom model if these acres lower the average value for forage areas in the landscape. Published research support the idea that increasing the amount of available forage by commercial thinning should improve the overall habitat conditions for elk and deer within the analysis area regardless of the average forage value derived from the Wisdom model.

In similar habitat, thinning has been shown to immediately stimulate the development of understory vegetation – much of which contributes to foraging habitat for deer and elk (Hagar et al. 2004, Suzuki and Hayes 2003). Understory vegetation data associated with a study of thinning effects on habitat similar to Hehe LSR Thin Project showed an average 46% increase in grass, forbs, and shrub coverage between thinned and unthinned stands (Artman 2003). Increases such as this can be expected to occur within thinned stands throughout much of the planning area.

As evidenced by the positive growth response of native forage species to reduction in forest overstory cover associated with previous commercial thinning activity in portions of the project area, an increase in forage quantity would occur in areas associated with thinning proposed by Hehe LSR Thin Project. Declines in forage quality (digestibility) are known to occur in conjunction with increases in forage quantity responding to growth stimulated by overstory removal (Cook 2002). However this relationship appears to be variable between study sites and across regions. Dynamic shade patterns resulting from buffered Riparian Reserves and variable density thinning should mitigate potential negative responses discussed by Cook (2002) in forage quality against positive responses in forage quantity. Evidence suggests the diversity of tree, shrub, grass, and forbs species throughout the project area would increase from restoration activities thereby adding to overall quality of habitat for big game.

The effectiveness of increasing big game forage habitat under all action alternatives would be further enhanced by implementing proposed road closures. Open road density would be reduced under all of the Action Alternatives by implementing the road closures. Road closures proposed by Action Alternatives are about 4.5 miles under Alternative 2 and about 39 miles in both Alternatives 3 and 4. All or portions of roads scheduled for closure would be treated for soil compaction, seeded, and fertilized.

Any increase in the amount and extent of forage habitat would benefit deer and elk within any of the above listed BGEAs affected by proposed thinning treatments. The potential to increase forage habitat is considered slightly higher under Alternative 4, than Alternative 3 due to a slight increase in the numbers of acres treated. High quality forage habitat would exist in these areas until seedlings grow to height that would out compete other forage vegetation.

The effects of the proposed activities are considered in the context of disturbance and habitat modification. Individuals that are within close proximity to proposed activities are likely to leave the area while the disturbance is underway. Disturbance may include falling, yarding, hauling, fuels treatment, and other prescribed activities. However those activities are expected to occur at a spatial and temporal extent such that they should not result in negative direct or indirect effects to individuals or the local population.

Cumulative Effects – Big Game Habitat

The cumulative effects analysis areas for big game are the BGEAs. In a general context, cumulative effects of the Hehe LSR Thin Project on deer/elk would be positive in the short-term (<7-10 years) yet inconsequential in the long-term and relative to overall cumulative effects from past actions. No other foreseeable future actions are currently planned that would additionally modify habitat in these BGEAs.

Terrestrial Fauna Threatened, Endangered and Sensitive (TE&S) Species

Non Significant Issue - Known sites for certain TE&S species do occur within the project area and potential habitat exists for other species that are suspected to occur. Harvest associated activities could affect TE&S species and their habitats within, adjacent to and downstream of the project area.

Summary of Effects - Terrestrial Fauna Threatened, Endangered and Sensitive (TE&S) Species

Table 34 – Summary of Biological Evaluation Process with Effects Determinations

	STEP 1	**STEP 2**	**STEP 3**	**STEP 4**	**STEP 6**
	Prefield Review	***Field Reconn.***	***Risk Assessment***	***Analysis of Significance***	***USFWS Review***
SPECIES	**Habitat Present (B,R,F,D) ***	**Occupancy Status**	**Conflicts? Action Alts**	**Effects / Impacts Action Alts**	**Consul-tation? BA[1]/BO[2]**
Northern Spotted Owl *Strix occidentalis caurina*	B,R,F,D	Occupied	Potential Conflict	NLAA	1-7-06-F-0179 09/22/06
Northern Bald Eagle *Haliaeetus leucocephalus*	B,R,F	Unoccupied	No Conflict	NE	NA
Least Bittern *Ixobrychus exilis*	No				
Bufflehead *Bucephala albeola*	No				
Harlequin Duck *Histrionicus histrionicus*	B,R,F,D	Unknown	No Conflict	NI	NA
American Peregrine Falcon *Falcon peregrinus anatum*	F,D	Unknown	No Conflict	NI	NA
Yellow Rail *Coturnicops noveboracensis*	No				

	STEP 1	STEP 2	STEP 3	STEP 4	STEP 6
	Prefield Review	***Field Reconn.***	***Risk Assessment***	***Analysis of Significance***	***USFWS Review***
SPECIES	**Habitat Present (B,R,F,D) ***	**Occupancy Status**	**Conflicts? Action Alts**	**Effects / Impacts Action Alts**	**Consul-tation? BA[1]/BO[2]**
ack Swift *Cypseloides niger*	No				
Baird's Shrew *Sorex bairdii permiliensis*	B,R,F,D	Unknown	Potential Conflict	NLCT	NA
Pacific Shrew *Sorex pacificus cascadensis*	B,R,F,D	Unknown	Potential Conflict	NLCT	NA
Wolverine *Gulo gulo*	No				
Fisher *Martes pennanti*	B,R,F,D	Unknown	No Conflict	NI	NA
Pacific Fringe-tailed Bat *M. thysanodes vespertinus*	R,F	Unknown	Potential Conflict	NLCT	NA
OR Slender Salamander *Batrachoseps wrighti*	B,R,F,D	Unknown	Potential Conflict	NLCT	NA
Cascade Torrent Salamander *Rhyacotriton cascadae*	B,R,F,D	Unknown	No Conflict	NI	NA
Foothill Yellow-legged Frog *Rana boylii*	No				
Oregon Spotted Frog *Rana pretiosa*	No				
Northwestern Pond Turtle *C. marmorata marmorata*	No				
Mardon Skipper *Polites mardon*	No				
Crater Lake Tightcoil *Pristiloma arcticum crateris*	B,R,F,D	Unknown	No Conflict avoid riparian	NI	NA

* B = breeding (nesting/denning) habitat R = roosting/cover habitat F = foraging habitat

D = dispersal habitat

[1] Date of Biological Assessment (BA) Consultation initiated with USFWS

[2] Date Biological Opinion (BO) or Concurrence issued from USFWS

NA = not applicable

NE = No Effect

BE = Beneficial Effect

NLAA[a] = May Affect, Not Likely to Adversely Affect

LAA[b] = May Affect, Likely to Adversely Affect

NI = No Impact.

NLCT = May impact individuals or their habitat, but the action will Not Likely Contribute to a Trend towards Federal Listing or loss of viability to the population or species.

MCT[c] =May impact individuals or their habitat, with a consequence that the action May Contribute to a Trend towards Federal Listing or a loss of viability to the population or species.

BI = Beneficial Impact

a. A NLAA determination requires informal consultation with the U.S. Fish and Wildlife Service.

b. For listed species, a LAA determination requires formal consultation with the U.S. Fish and Wildlife Service. For proposed species, a LAA determination requires conferencing with the U.S. Fish and Wildlife Service (WO Amendment 2600-91-3, Forest Service Manual 2671.45, March 31, 1991).

c. A MCT determination may require that an Environmental Impact Statement be written.

Alternative 1 (No Action) – This Alternative would have no effect on federally listed threatened, endangered, or proposed species, and is also expected to have no impact on sensitive species identified by the Regional Forester.

The No Action proposal would have no effect/impact on TES terrestrial wildlife species based on the following assumption – that habitat within and adjacent to the project area would continue to provide existing habitat for wildlife species that may be present as it evolves without human management. The evolution of habitat and associated dynamic nature of habitat suitability that may be subject to an unknown frequency and variety of stochastic events is considered beyond the scope of this evaluation. References used to support discussion, determinations, and recommendations are provided in Biological Evaluation (Quintana, 2007) located in the Project File.

Northern Spotted Owl – Refer to section on Spotted Owls.

Northern Bald Eagle

Although the Fall Creek river corridor offers potential food sources such as fish and waterfowl, concentrated northern bald eagle activity during the nesting season has not been observed within the action area. Occasional sightings of one or two bald eagles roosting or foraging within this corridor have been reported by District employees and the general public. Most eagle observations are associated with areas along the Middle Fork of the Willamette River west of the project area and around Dexter and Lookout reservoirs (west of the project area). The nearest known bald eagle nest site is located approximately 8 miles from the southwest edge of the planning area. No nesting activity is known to occur within the project area boundary.

Direct, Indirect and Cumulative Effects – Northern Bald Eagles

No management activities are proposed that would affect nesting, roosting, or perch habitat in the action area. No direct effects to bald eagles are anticipated as a result of activities proposed under any action alternative associated with the Hehe Project.

Nesting, roosting, or perch habitat would improve as a result of this project's activities as maturing second growth stands respond to commercial thinning and silvicultural objectives such as increasing growth, vigor, and structural diversity are realized. Indirect effects are considered equal between all action alternatives

The analysis area considered during review of cumulative effects to bald eagles was defined as the area within the project area boundary plus an area within 0.5 mile on either side of Road

#1800. There are no future State or private activities that are reasonably certain to occur within the analysis area that would result in cumulative effects to bald eagle habitat.

Because the Hehe LSR Thin Project does not propose potential disturbance activities within a known nest area or key wintering area for bald eagles, or propose activities under any action alternative that would affect the integrity of potential nesting, roosting, or perch habitat, it is determined this project would have no effect on bald eagles.

Harlequin Ducks

Harlequin duck sightings have been reported during the breeding season on all the Districts of the Willamette National Forest, including the previously mentioned reports around Puma Campground on the southwest portion of the planning area. Other records of sightings include pairs, singles, and females with young in adjacent or nearby watersheds such as Salmon Creek, Salt Creek, Hills Creek, Lower Middle Fork, Winberry Creek, and Fall Creek on the Middle Fork District.

No formal harlequin duck surveys have been conducted on the Middle Fork Ranger District, and no harlequin observations have been reported by project personnel anywhere along the Fall Creek River corridor during field reconnaissance in support of the Hehe Project. In previous documents such as the Clark Fire analysis, the biological analysis made reference to several sighting of harlequin ducks in the Fall Creek drainage.

Direct, Indirect and Cumulative Effects – Harlequin Ducks

No management activities are proposed that would modify or otherwise disturb breeding, loafing, foraging, or dispersal, habitat located in a limited portion of the project area for harlequin ducks. No direct effects to this species are anticipated as a result of activities proposed under either action alternative associated with the Hehe Project.

The quality of suitable foraging habitat in Fall Creek drainage for harlequin ducks may improve as a result of this project's influence on upslope riparian habitat responding to silvicultural objectives such as increasing growth, structure, and overall diversity.

The Hehe Project may generate funds to support in-stream placement of large woody debris in the upper portions of Hehe Creek, Alder Creek and Tiller Creeks to improve fish habitat. These activities would not occur in or near suitable harlequin duck nesting habitat where it has the potential to disturb the species. If any change in location for instream placement should occur the seasonal restriction to avoid disturbance would be implemented with a restriction period from March 15 through July 15.

Potential effects to habitat for harlequin ducks from activities proposed under any action alternative are considered limited to a portion of the project area which is adjacent to the Fall Creek River. Numerous sighting have occurred on Fall Creek between the Puma and west to the

Forest boundary (southwest corner of the planning area). All of this area is located in riparian reserve and some thinning is planned along this area, but well outside the zone of influence for this species. Suitable breeding habitat for harlequin ducks exists within riparian reserve habitat along portions of the Fall Creek River in the project area, as previously described. However, no known nests are located in the project area. Along with aquatic habitat, this area provides nesting, loafing, foraging, and dispersal opportunities for harlequins.

There are no activities that are reasonably certain to occur within the project area that would result in cumulative effects to habitat for harlequin ducks.

Cumulative effects from the Hehe LSR Thin Project would be positive on the limited amount of habitat in the project area as overall biodiversity increases in and near areas responding to the silvicultural treatments proposed. These treatments would encourage a long-term increasing trend in the quality of riparian and/or aquatic habitat that may support harlequin ducks in the Fall Creek drainage.

Because suitable habitat for harlequin ducks exists in only a very small portion of the project area and would not be modified or disturbed by activities associated with proposed thinning under any action alternative, it is determined this project would have no impact on harlequin ducks or their habitat.

American peregrine Falcon

Suitable peregrine nesting habitat is extremely limited in the Hehe planning area. Gibraltar Rock and Symbol Rock occur within the area; however, after conferring with District Wildlife Biologist Dick Davis, (Pers. Comm. 2006) these areas have low probability of providing sufficient nesting for Peregrine Falcons. The southwest corner of the project area is however adjacent to the outer edge of tertiary management zone for one known nearby peregrine nest site.

Effects from proposed activities are normally considered in relation to a management area delineated around each of these nest sites. This area encompasses approximately 18,500 acres within roughly a 3-mile radius around each site. Each management area consists of three concentric zones (primary, secondary, tertiary) extending outward from a nest site. Effects from the Hehe LSR Thin Project proposal are considered relative to the nearby nest site, but address how habitat within the project area may be used by peregrines.

Although the Hehe LSR Thin Project area is not within the management area considered for nest site, peregrines regularly forage beyond three miles from a nest site, so it is likely that on occasion areas within the project area are used as foraging habitat by this species. It is also possible that young dispersing from the nearby nest site may utilize habitat within the planning area.

Proposed thinning activities under all action alternatives would not affect peregrines at a nest ledge. In some situations activity such as the operation of medium or heavy rotary wing aircraft

(helicopters) conducted in a tertiary zone could result in indirect disturbance to peregrines by influencing prey behavior and foraging success (USDA 2002). This disturbance is considered detrimental to peregrines if it occurs during the breeding season, which is identified as between January 15 and July 31 for the nearby nest site (Pagel 1992, USDA 2002). However, the likelihood of this occurring is relatively low due to geographic proximity of the OE-48 site and topographic breaks between potential helicopter flightpaths and the project area (Davis, Pers. Comm. 2007).

Direct, Indirect and Cumulative Effects – American peregrine Falcon

No management activities are proposed that would affect nesting habitat, nor influence foraging success or dispersal behavior in the planning area. No direct effects to peregrine falcons are anticipated as a result of activities proposed under any action alternative associated with the Hehe LSR Thin Project.

Foraging habitat would improve as habitat responds to silvicultural treatments by increasing growth, structure, and overall diversity, which would benefit a variety of birds known to be preyed upon by peregrines.

There are no activities that are reasonably certain to occur within the project area that would result in cumulative effects to peregrine habitat.

The changing trend in timber and habitat management that has occurred within the past decade, and is projected for the future, would positively influence utilization of foraging habitat for peregrines. More emphasis is placed on recruitment of key structural components missing from previously harvested stands and retention of key structural components present in unharvested stands. Also treatment in riparian systems to promote structure, and the restoration and maintenance of special habitats are key components of improving biodiversity at a landscape level.

Cumulative effects from the Hehe Project would be positive as overall biodiversity increases in response to silvicultural treatments. These treatments would encourage a long-term increasing trend in the quality of foraging and dispersal habitat for peregrine falcons that may utilize this area in association with the nearby nest site or potential nest site at Gibraltar Rock.

Because the Hehe LSR Thin Project does not propose potential disturbance activities within a management area established for a known nest site, or activities that would otherwise affect the integrity of potential nesting habitat, it is determined this project would have no impact on peregrine falcons

Baird's and Pacific Shrew

Both these *Sorex* species have documented occurrences on the Willamette National Forest in habitat similar to that associated with natural and older managed stands found throughout the

Hehe Project planning area. At least 38 specimens of *S. bairdi* are known to have been collected from sites in Lane County, most from locations on or near the Willamette National Forest (Verts and Carraway 1998). At least 65 specimens of *S. pacificus* are known to have been collected from sites in Lane County, most from locations on or near the Willamette National Forest including one location on the Middle Fork Ranger District (Verts and Carraway 1998). Based on life histories, documented occurrences and habitat associations, and locations of proposed thinning units, effects to these species from proposed activities are considered limited to within the project planning area.

Studies have shown that leaving small no-harvest streamside buffers (9-67m) is beneficial in maintaining riparian communities of small mammals at levels comparable to nearby undisturbed areas (Cross 1985, Anthony et al. 2003). The variable density thinning prescription proposed under all action alternatives includes a no-harvest buffer in riparian habitat averaging 15-30m on either side of all streams, seeps, and springs. In addition, the prescription incorporates a strategy designed to promote down wood plus herbaceous and shrub cover, as well as provide patches of closed-canopy conditions. Such a prescription positively addresses finer-scale habitat features important to these shrew species, and has been considered to have the highest probability of maintaining the diversity of indigenous ground-dwelling vertebrates within a stand (Garman 2000).

Proposed thinning activities would be limited to about 18 % of the planning area, and would be spread out over an estimated 2-7 year timeframe. Fire associated with fuels reduction (pile burning) and prescribed underburning would not occur within buffers established in Riparian Reserves, and combined would affect only about 1% of the planning area.

Specific field surveys for *S. bairdi* and *S. pacificus* have not been conducted within the Hehe LSR Thin Project project area. Garman (2000) analyzed survey data that documented the presence of these *Sorex* species during an intensive young stand study (YSS) on the Willamette National Forest that included conifer dominated managed stands adjacent to the northern portion of the Hehe LSR Project planning area.

It is assumed that *S. bairdi* and *S. pacificus* each have the potential to occur in natural and older managed stands throughout the planning area.

Given current knowledge on the locations, ecological associations, and needs of these species it appears that maintaining or promoting biological diversity as proposed under the silvicultural prescription would assure the short-term and long-term availability of habitat suitable for use by *S. bairdi* and *S. pacificus* throughout the Hehe LSR Thin