Final ENVIRONMENTAL ASSESSMENT
South Summit II Forest and Fuels Project

USDA Forest Service
Okanogan-Wenatchee National Forest
Methow Valley Ranger District
Okanogan County, Washington
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Chapter 1: Purpose and Need for Action

Chapter 1 of this Environmental Assessment (EA) describes the relevant management direction, and Purpose and Need of the project, as well as the scope of the decision to be made. This chapter also summarizes public involvement and consultation with regulatory agencies for this project. This project is subject to the pre-decisional objection regulations at 36 CFR 218, described in more detail in section 1.5.

1.1 Project Location

The South Summit II Forest and Fuels Project area is located within the Lower Beaver Creek, Frazer Creek, Summit Creek, Chiliwist Creek, Benson Creek, Alder Creek-Methow River, Texas Creek-Methow River, French Creek and Swamp Creek sub watersheds east of Twisp, Washington. The project area, approximately 50,000 acres, lies mostly within T34N, R23E; T33N, R23E; T33N, R24E; T32N, R23E; T32N, R22E; and T31N, R23E, W.M. Refer to the Project Vicinity Map in Appendix J.

1.2 Relationship to Other Planning Documents and Analyses

This document and analysis tier to the *Final Environmental Impact Statement* (FEIS) for the *Okanogan National Forest Land and Resource Management Plan (ONFLRMP)*, as amended (USDA Forest Service 1989a) (hereafter referred to as the Forest Plan). The South Summit II Forest & Fuels planning area includes Forest Plan Management Areas (MA) 5, 14, 17, 25, and 26, defined as follows:

- MA 5: Recreation and Scenery—provide opportunities for recreation and viewing scenery in a roaded natural setting with a visual quality objective of retention or partial retention.
- MA14: Wildlife–provide a diversity of wildlife habitat, including deer winter range, while growing and producing merchantable timber.
- MA 17: Developed Recreation—provide a variety of developed recreation opportunities in a roaded setting.
- MA 25: Intensive Timber and Range Management—intensively manage the timber and range resources using both even-aged and uneven-aged silvicultural practices. Manage to achieve a high present net value and a high level of timber and range outputs while protecting the basic productivity of the land and providing for the production of wildlife, recreation opportunities and other resources.
- MA 26: Deer Winter Range-manage deer winter range and fawning habitats to provide conditions which can sustain optimal numbers of deer indefinitely, without degrading habitat characteristics such as forage, cover, and soil.

The Interim Management Direction Establishing Riparian, Ecosystem and Wildlife Standards for Timber Sales Regional Forester's Forest Plan Amendment #2 (Eastside Screens) amended the Forest Plan to provide direction to minimize impacts of timber sales to riparian, stand structure and wildlife resources (USDA Forest Service 1995).

The Forest Plan was also amended by the *Record of Decision* (ROD) *for the Final Environmental Impact Statement for the Pacific Northwest Region Invasive Plant Program Preventing and Managing Invasive Plants* (USDA Forest Service 2005). The ROD provides a framework for preventing the introduction, establishment and spread of invasive plants and protecting ecosystems and human health.

The Okanogan-Wenatchee National Forest Restoration Strategy: adaptive ecosystem management to restore landscape resiliency (Restoration Strategy) (USDA Forest Service 2010 and 2012) provides interim guidance for the management of large and old trees in dry and mesic forest restoration projects on the Okanogan-Wenatchee National Forest.

This EA incorporates by reference the recommendations and analysis in the 1997 Middle Methow Watershed Analysis and the 1999 Lower Methow Watershed Analysis.

Travel Analysis process guidance is provided in Chapter 20 of the Travel Planning Handbook (FSH 7709.55, USDA Forest Service 2009). A Travel Analysis for all roads in the project area was completed as part of South Summit II Forest and Fuels project analysis. The South Summit II Travel Analysis Report is available in the project record.

This EA incorporates by reference the Project Record (40 CFR 1502.21). The Project Record is available for review at the Methow Valley Ranger District Office, 24 West Chewuch Road, Winthrop, WA 98862.

1.3 Purpose and Need for Action

1. Improve or maintain the resiliency of mixed conifer forests to disturbances including insects, diseases, and wildfire. Maintain and restore mixed conifer forest conditions that more closely reflect historical tree density, spatial patterning, species composition, and size classes, including large fire-resistant trees.

   Maintain and develop sustainable vegetation and fuels conditions in Forest Plan Old Growth stands that limit the likelihood of losing mature forest stands during wildfires and other natural disturbances, including insect and disease outbreaks.

   Reduce fire hazard on National Forest lands within the wildland-urban interface.

   <u>Existing Conditions</u>
   The Carlton Complex wildfire burned through some portions of the project area with moderate to high severity, damaging or consuming the existing stand structure with a combination of fire and super-heated air. In other locations within the project area, however, the fire either underburned through stands with low intensity or did not burn at all, leaving the vegetation structure relatively unchanged. In these areas, past management practices such as harvest, fire exclusion, and grazing over the past century have caused extensive changes in forest vegetation, resulting in unhealthy stands that are susceptible to insects,

disease, and uncharacteristically severe wildfire behavior and effects. These conditions increase hazards in the Wildland Urban Interface by increasing wildfire risks to existing infrastructure and adjacent private and public lands.

Desired Conditions:
Mixed conifer forest stands would more closely reflect historical tree stocking levels, canopy structures, and predominant tree size classes. The majority of existing large trees would be maintained and stand conditions would be favorable for the development of additional large trees. Tree species composition would more closely reflect historical conditions, and the proportion of early seral species including ponderosa pine, western larch and aspen generally would increase from current levels. Susceptibility to forest insects and diseases would be restored to endemic levels associated with historical stand structures and disturbance patterns. Large trees and other sustainable structure elements of timber stands currently classified as Forest Plan old growth would be maintained. Wildfire risk would be reduced in treated areas within the Wildland Urban Interface on National Forest lands. Fire regimes would be moved towards historic conditions and fire resiliency of forest vegetation would be improved from the current undesirable levels.

2. Maintain and restore the species composition (including large-diameter broadleaf trees such as aspen), structural diversity, and natural disturbance patterns of plant communities found within RHCAs to provide large conifers and maintain and attain riparian management objectives.

Existing Conditions
The Carlton Complex wildfire burned through some Riparian Habitat Conservation Areas (RHCAs) in the project area, damaging or consuming the existing vegetation. In other locations within the project area, however, the RHCAs were untouched by fire or experienced low-intensity fire that consumed some surface fuels but left the stand structure relatively unchanged. In these areas, past timber harvest has removed many of the large trees and competition from understory trees is suppressing development of large tree structure for wildlife. Understory conifer development in these areas also increases the risk of high-intensity wildfire behavior that would negatively affect stream shading and sediment.

Desired Conditions:
Forest stands in RHCAs would more closely reflect the species composition and structural diversity associated with historical disturbance regimes. Large trees, snags, and down logs would be present at sustainable levels to provide habitat for riparian dependent species.

3. Modify the current transportation system to provide for long-term sustainable resource management, safe recreation use, reduced maintenance costs, and reduced impacts on aquatic habitat, wildlife habitat and hydrological function.

Existing Conditions
The roads within the project area were constructed over the past 90 years, mostly to provide access for timber harvest, developed campgrounds, and the Loup Loup ski area and to access the power line for construction and maintenance. Some roads within the project area do not meet current safety and design standards or are now in excess to management needs because of changes in logging system practices. Some existing roads are located in areas where they impact aquatic habitat and hydrological function. The effects of the Carlton

Complex fire and subsequent weather events impacted the transportation network in several areas. These impacts are ongoing and future storm events are likely to cause additional impacts to the transportation network in the project area that would be addressed with appropriate measures.

Desired Conditions
Detrimental effects of the transportation system to aquatic habitat and hydrological function, such as sediment production and transport to fish-bearing streams, would be minimized. The transportation system would provide adequate access for sustainable resource management and recreation use. Miles of open roads and associated maintenance costs would be reduced.

4. Maintain or improve the overall health of trees within and adjacent to Loup Loup and JR Campgrounds by reducing tree competition and susceptibility to attack by insects and diseases.

   Reduce ladder fuels between ski runs at the Loup Loup Ski Area to improve forest health and reduce the threat of wildfire.

   Reduce the risk of hazard trees that pose a threat to public safety along Highway 20 and in the campgrounds.

   Reduce mortality of large Douglas-fir trees caused by beetles.

   Existing Conditions
   The Carlton Complex fire did not burn the two campgrounds in the project area, and burned only the outer fringes of the Loup Loup ski area, leaving the stands between ski runs untouched. Current forest conditions in and adjacent to some of these areas and the unburned portion of the Highway 20 corridor in the project area lack the resiliency and health to maintain existing trees and develop large trees in the future. In addition, the Carlton Complex fire caused widespread mortality along portions of Highway 20 in the project area, possibly increasing the need for hazard tree removal to reduce risks to the public.

   Desired Conditions
   In the Campgrounds, Ski Area, and Highway Corridor, forest vegetation health and resiliency would be improved. Risk of hazard trees that pose a threat to public safety would be reduced.

5. Provide commercially valuable timber and other forest products that are economically viable and sustainable.

   Existing Conditions
   The Forest timber sale program contributes to the stability of Northwest economies. The Methow Valley Ranger District provides sawtimber and non-sawtimber volume as part of the total Forest program.

   Desired Conditions
   Commercially valuable forest products would continue to be provided on a sustainable basis to promote economic stability.

6. Ensure reforestation occurs in areas where stand-replacement wildfire eliminated reliable seed sources for natural conifer regeneration.

   Existing Conditions
   The Carlton Complex wildfire burned approximately 35,000 acres in the project area. High-severity stand-replacement fire killed all or most of the trees on approximately 16,000 acres. The widespread degree of tree mortality eliminated a reliable seed source for post-fire natural regeneration of conifer forests.

   Desired Conditions
   Forest stands within the project area that experienced high-severity stand-replacement wildfire would be re-stocked with a mix of desired species, including ponderosa pine, Douglas-fir, western larch, Engelmann spruce, and aspen. Reforestation would be accomplished through planting a mix of conifer seedlings and natural suckering of aspen stems from clones. Stands would be monitored to ensure reforestation occurs.

7. Provide camping opportunities specific to horseback riders in the North Summit area.

   Existing Conditions
   There are few horse camps available state-wide and the one horse camp located on the District is often filled to capacity during the summer, demonstrating additional need for this type of facility. The North Summit area provides easy access to horseback riding opportunities with relatively easy routes, a longer riding season, and convenient access from both the Okanogan and Methow Valleys.

   Desired Conditions
   A horse camp would be built to provide increased horse-camping opportunities in the North Summit area.

1.4 Decision to Be Made

Based on the analysis documented in this Environmental Assessment, the Forest Supervisor of the Okanogan-Wenatchee National Forest will decide the following:

- To implement the project as proposed (Alternative 2) or to not implement the project at this time (Alternative 1);
- To implement a lesser version of the proposed action;
- Whether there is a significant effect on the human environment that would require preparation of an Environmental Impact Statement.

1.5 Public Involvement and Consultation

Public involvement for the South Summit II Forest and Fuels Project began by publishing the project in the December 2014 Schedule of Proposed Actions (SOPA) for the Okanogan-Wenatchee National Forest. Tribal governments (Confederated Tribes of the Colville Reservation and the Yakama Nation) and Okanogan County Commissioners were sent a letter describing the project and soliciting issues on December 18, 2014. No concerns about the project were raised by the tribes or county governments.

A scoping notice describing the project components and querying comments were sent to approximately 150 members of the public on December 29, 2014, which initiated the scoping period. The Forest Service received a total of five comments by letter and email. The 30-day comment period began on March 6, 2015 with the publishing of a legal notice in the Wenatchee World. This comment period ended on April 6, 2015. The Forest Service received a total of five comments by letter and email.

The Preliminary South Summit II Forest and Fuels Environmental Assessment (EA) was mailed on March 6, 2014 to groups and individuals who provided comments in response to the scoping letter or who requested a copy. A notice of EA availability for a 30-day comment period was published in the Wenatchee World newspaper on March 6, 2015. We received comments from five parties. Comments were considered in the development of the final EA, with specific consideration of comments available in Appendix J .

The South Summit II Forest and Fuels project record contains a description of Forest Service outreach efforts, a summary of scoping comments received, and how the Forest Service addressed scoping comments in the South Summit II Forest and Fuels Project EA.

Per regulations on interagency cooperation pursuant to Section 7 of the Endangered Species Act (1973), as amended, the Forest Service will submit a Biological Assessment (BA) to the **US Fish and Wildlife Service and NOAA National Marine Fisheries Service** to initiate formal consultation for the South Summit II Forest and Fuels project. The BA is required for federal actions where listed species or their critical habitat may be present, to ensure the proposed management will not jeopardize the continued existence of these species or adversely modify critical habitat.

1.6 Issues and Concerns

The preliminary EA underwent 30-day public comment on March 6, 2015. Comments spanned a range of topics, and the interdisciplinary team responded as appropriate (Appendix J). Based on those comments, we revised the EA to clarify analyses and mitigation measures. Concurrently, the project soil specialist reviewed the need for a Forest Plan amendment to allow implementation in areas with detrimental soil disturbance, and found that these areas had been dropped from the proposed action. Therefore, there is no need for this amendment and it has been dropped from the final EA. Aside from this change, the Proposed Action, effects analyses, and overall findings did not substantially change during this revision.

1.7 Project Implementation

Should Alternative 2 be selected, the Forest Service would implement the timber harvest, fuels treatments and road work through timber sale contracts and other contract types as needed. In the course of implementing complex projects, minor changes may be needed to better meet on-site resource management and protection objectives. Minor changes are likely, will be documented, will comply with applicable laws, and follow agency handbook direction (FSH 1909.15, Sec. 18).

Chapter 2: Alternatives

The National Environmental Policy Act (NEPA) requires analysis of a proposed action and other reasonable alternatives, including no action. The no action alternative (Alternative 1) provides a baseline for estimating environmental effects and the Proposed Action (Alternative 2) was developed to meet the Purpose and Need. These two alternatives for the South Summit II Forest and Fuels project are considered in detail in this EA.

2.1 Alternatives Considered, But Eliminated From Detailed Study

Federal agencies are required by NEPA to explore and objectively evaluate all reasonable alternatives and to discuss the reasons for eliminating any alternatives not developed in detail (40 CFR 1502.14). Scoping comments received, as well as preliminary effects analysis conducted by the interdisciplinary team suggested alternative methods for achieving the purpose and need. Some alternatives were outside the scope of this analysis, did not meet the purpose and need for action, were not reasonably feasible or viable, were duplicative of alternatives considered in detail, or were determined to cause unnecessary environmental harm. Alternatives that were considered but eliminated from further analysis included the following:

1. Include post-fire repair and rehabilitation work at the Pole Pick Seed Orchard (i.e. fence rebuilding, pollen buffer and fuel break establishment, and storage shed reconstruction) in the project proposal. An alternative was considered but dropped from further analysis because proposed activities were not fully developed at the time of this analysis, and because maintenance and repair of administrative sites such as the orchard is generally considered to be part of a category of actions ("Categorical Exclusion") not requiring documentation in an EA, EIS, or Decision Memo.

2. Include hazard tree felling adjacent to system roads for public, personnel, and contractor safety in the proposed action. An alternative was considered but dropped from further analysis because Forest Service Manual direction allows for hazard tree removal along roads used for timber hauling described below as "Hazard Tree Removal along Haul Routes." Hazard tree felling along the Highway 20 corridor is included and analyzed in this document. Public firewood gathering is anticipated to remove hazard trees along open system roads where consistent with the current firewood policy. Remaining hazard trees would be felled at up to 2 trees per mile of road. These actions are expected to be sufficient to remove hazard trees where firewood gathering is not allowed along open roads.

3. Address the anticipated long-term increase in large-diameter fuels created by eventual collapse of fire-killed trees in the burned portion of the project area by creating strategic fuel breaks in moderate- to high-burn severity areas. This alternative was considered but dropped from further analysis because it is beyond the temporal scope of the identified purpose and need for this project. The interdisciplinary analysis team agreed that the need for soil stabilization and vegetation recovery more immediate and tractable given current conditions and available funding than long-term fuel reduction.

4. Include additional analysis and restoration of wetland and aspen communities within the project area in the proposal. An alternative was considered in response, but eliminated

from detailed study because aspen regeneration (a suggested component of wetland restoration) is anticipated to be rapid and abundant in many areas of the project area due to recent fire activity. In addition, further wetland restoration could not be evaluated with current staffing for this project.

5. Include salvage harvest in the proposal. An alternative was considered in response, but eliminated from detailed study because fire-killed ponderosa pine would have little commercial value by the time harvest occurred, and areas with sufficient Douglas-fir salvage opportunities were scarce.

The planning team is unaware of unresolved conflicts concerning alternative uses of available resources and thus this EA only analyzes the no-action and proposed action alternatives.

2.2 Alternatives Considered In Detail

2.2.1 Alternative 1: No Action

Under Alternative 1, no harvest treatments, fuels treatments, road decommissioning, culvert replacement, or road closing would occur. No treatments to maintain or restore Forest Plan Old Growth (FPOG) or Riparian Habitat Conservation Areas (RHCA) would occur. Sediment production from the current road system would remain at high levels or increase as road conditions continued to degrade. No project-related ground-disturbing activities would take place and no timber would be offered for sale. No post-fire reforestation activities would take place. No horse camp would be built. Ongoing and future activities, such as routine road maintenance, recreation use, firewood gathering, cattle grazing, and noxious weed control would be expected to occur.

2.2.2 Alternative 2: Proposed Action

The proposed action was developed to meet the South Summit II Forest and Fuels project purpose and need. It includes thinning (commercial and noncommercial) of forest stands, regeneration cutting, tree planting, machine and hand piling, prescribed burning, and changing the transportation system to balance access needs, environmental risks, and maintenance costs. It would also comprehensively manage JR and Loup Loup Campground, and Loup Loup Ski Area vegetation, treating hazard trees and fuels along Highway 20 and powerline corridor. Additionally, it would include the construction of a horse campground adjacent to the North Summit SnoPark. Forest Plan amendments are proposed to facilitate several elements of the proposed action.

VEGETATION TREATMENTS

A variety of sawtimber and non-sawtimber (small tree) harvesting treatments are proposed to meet silvicultural prescriptions as summarized in Figure 2.1. Further details on thinning treatments by unit are available in Appendix B. Detailed descriptions of each treatment type are available in Appendix C. Treatments are displayed in the Proposed Treatment Units Map in Appendix J.

Figure 2.1 Proposed Forest Treatments

Vegetation Treatment Types	Acres
Commercial Thinning	1,625
Commercial Thinning with Dwarf Mistletoe Treatment	560

Regeneration Harvest Thinning	70
Quaking Aspen Maintenance Thinning	60
Campground Thinning	35
Tree Planting	8,285
Non-Commercial Thinning (NCT)	1,000
Total Treatment Area Proposed	**11,635**

The estimated sawtimber volume for South Summit II is 7 million board feet. Field layout of units in preparation for sale typically results in some adjustment of unit boundaries and could result in lower acres and volume than estimated in this EA.

Up to 1,850 acres of harvest in the South Summit area would be restricted to winter logging conditions using whole-tree-yard equipment to minimize compaction and displacement of ash cap soils. Summer logging with cut-to-length equipment designed to protect soils would be used on 498 acres, thereby avoiding impacts to winter recreation. In the remaining 2 acres of harvest, logging could occur in summer or winter using equipment appropriate to soil conditions.

Approximately 70 acres of tree planting would be done within regeneration harvest units to ensure prompt reforestation with desired tree species and stocking levels. Underburning would occur to diminish slash and prepare the sites for replanting. No trees would be planted within aspen patches.

Regeneration harvest units would be thinned for the purposes of removing heavily diseased trees and restocking with healthy, desirable species composition. Reforestation would be accomplished by hand, planting a combination of ponderosa pine seedlings and natural regeneration of primarily Douglas-fir seedlings. Approximately 150 pine seedlings per acre would be planted to ensure that minimum tree stocking levels are established.

Approximately 8,285 acres that experienced high levels of tree mortality from the Carlton Complex outside of harvest areas would be reforested by hand. A species mix including ponderosa pine, western larch, Douglas-fir, and Engelmann spruce would be planted where appropriate for the site in post-fire tree planting units. Approximately 150 seedlings per acre would be planted. Natural regeneration of aspen and all conifer species including lodgepole pine would be encouraged as well.

Approximately 1000 acres of non-commercial thinning would occur in planting units. Trees less than 7 – 9” DBH (diameter at breast height) would be thinned with chainsaws to reduce inter-tree competition, promote the desired tree species composition, maintain existing overstory trees, and reduce disease infection of residual trees.

Highway 20

Comprehensive vegetation management would occur along Highway 20 within the project area including thinning, fuels reduction, and assessment and removal of hazard trees based upon *Field Guide for Danger Tree Identification and Response* (Toupin and Barger 2008). Along the two miles of highway in the project area burned by the Carlton Complex, an estimated 200 trees would be felled and the resulting debris would be chipped, left on site, or removed off site depending on residual fuel loading. Along the unburned portion of the highway, incidental hazard trees would be removed as needed to enhance public safety.

VEGETATION TREATMENTS IN SPECIFIC AREAS

The following information describes how the treatments described above are integrated into the specific areas below. Acres listed are already included in treatment descriptions above.

Forest Plan Old Growth (FPOG)
Approximately 186 acres defined by the Forest Plan as old growth would receive harvest treatments requiring a Forest Plan amendment. Approximately 83 acres of commercial thinning with dwarf mistletoe treatment, 60 acres of commercial thinning, 34 acres of campground thinning, and 9 acres of aspen maintenance treatment areas are within Forest Plan Old Growth. Harvest treatments within Forest Plan Old Growth (FPOG) would be for the benefit of the stand and would be consistent with the 2010 and 2012 Okanogan-Wenatchee National Forest Restoration Strategy guidelines.

Riparian Habitat Conservation Areas (RHCAs)
Approximately 34 acres of proposed harvest units lie within RHCAs. Treatments in RHCAs would maintain and restore historic vegetation characteristics by managing for large trees and historic hardwood/aspen components, and increasing resiliency to disturbance by fire, insects, and disease. All harvest activities within RHCAs have the objective of attaining riparian management objectives for water temperature, sediment regime, large woody debris, and bank stability. No-treatment buffers of 50 to 300 feet would be established within RHCAs depending on stream or wetland type, adjacent hillslopes, road locations, and soil sensitivity to ensure that Forest Plan and PACFISH standards and guidelines are met. Heavy equipment use and harvest would not occur in areas that are perennially wet or where vegetation cover is dominated by riparian species. No harvest is proposed in RHCAs that burned in the Carlton Complex.

Proposed treatments within RHCA boundaries include about 13 acres of commercial thinning and 4 acres of commercial thinning with dwarf mistletoe treatment. About 16 acres of aspen maintenance treatment in RHCAs would occur where commercial thinning removed competing conifers.

Project design criteria include required winter logging of all harvest units within RHCAs to limit impacts of soils and habitat, as well as a range of standard best management practicess to protect water quality and aquatic life that are listed in the Appendix A.

JR and Loup Loup Campgrounds
Comprehensive vegetation management would be completed in approximately 35 acres within JR and Loup Loup Campgrounds. Treatments would include thinning, felling diseased and hazardous trees, felling trees that are competing with adjacent large trees, and treating fuels by piling and burning. Hazardous would be identified using the criteria from Long-Range Planning for Developed Sites in the Pacific Northwest: The Context of Hazard Tree Management (Harvey and Hessburg 1992). An insect anti-aggregation pheromone would be applied in the campgrounds to prevent Douglas-fir beetle attacks on large Douglas-fir trees for a period of three to five years starting in 2015.

FUELS TREATMENTS

Fuels would be treated through a variety of thinning, prescribed fire, and mastication mechanisms as summarized in Figure 2.2. Fuels treatment methods and areas are detailed further in Appendix D and displayed on the Proposed Treatment Units Map in Appendix J.

Figure 2-2 Proposed Fuels Treatments

Treatment Unit Type and Fuels Treatments	Acres	Number, Size
Harvest Unit: LFR** Thinning, Machine Pile/Burn, Burn Landing Piles	1,575 acres*	Machine piles: average 10 piles/acre, 10' x 10' Landing Piles: average 1 pile per 10 acres of harvest
Harvest Unit: Burn Landing Piles LFR Thinning + Hand Pile / Burn	675 acres*	Hand piles: average 20 piles/acre, 4' x 4' Landing Piles: average 1 pile per 10 acres of harvest
Harvest Unit : Underburn for planting site preparation	70 acres*	
Campground Unit: LFR Thinning, Machine Pile / Burn	35 acres*	Machine piles: average 10 piles/acre, 5' x 5'
Non-Commercial Thin Unit: Hand Pile / Burn	1,000 acres	Hand piles: average 20 piles/acre, 4' x 4'
Fuels Unit: LFR + Hand Pile / Burn	6,300 acres	Hand piles: average 20 piles/acre, 4' x 4'
Fuels Unit: LFR Thinning, Mastication	300 acres	
Total Fuels Treatments Proposed	**9,955 acres**	

**Maximum potential acreage, depending upon harvest method and utilization. Landing piles may be utilized for biomass if economically feasible.*
*** LFR: Ladder fuel reduction*

One to two prescribed fire treatments are proposed within treatment units, with the number of entries dependent on existing fuel loading, stand density, options selected by the timber sale purchaser, and the need for fuels to cure between thinning/ladder fuels reduction and prescribed burning. The need for prescribed fire treatments would be evaluated after completion of thinning and reduction of debris levels through biomass removal or firewood utilization.

Prescribed fire treatments include burning piles (landings, machine piles, or hand piles) and underburning. Machine piles within harvest units would be built by equipment that picked up debris (i.e. excavators). Piles and underburns would be ignited by hand using a drip torch, propane torch, or fusee.

Ladder Fuel Reduction and Associated Fuels Treatments
Approximately 6,600 acres of ladder fuel reduction (LFR) treatments would occur in fuels treatment units outside of harvest units where small-diameter trees provide a path for surface fire to climb into the overstory tree canopy.

- On 300 acres, understory trees from 2 feet high to 5 inches DBH within 20 to 30 feet of overstory trees would be felled by chainsaws or by a masticator. The debris from this treatment would be masticated and scattered onsite.

- On the remaining 6,300 acres, understory trees from 2 feet high to 7 inches DBH within 20 to 30 feet of overstory trees would be felled with chainsaws. The debris from this treatment would be hand-piled and burned.

Adaptive management strategy: Where mastication is proposed on 300 acres, debris may be hand-piled and pile burned if mastication equipment is not readily available or uneconomical, or if soil conditions have not stabilized from recent wildfire effects.

Fuels Treatments in Noncommercial Thinning Units
Debris within the 1000 acres of NCT units would be hand-piled, with an average of 20 piles per acre and an average pile size of 4 feet by 4 feet. These piles would be burned after curing for about one year.

Fuels Treatments in Harvest Units
If small diameter trees are left standing (standing biomass) in harvest units or if harvest units are dropped from consideration, ladder fuel reduction thinning would occur where understory trees greater than 2 feet tall and up to 7 inches DBH within 20 to 30 feet of overstory trees would be felled. These trees would be cut by chainsaws and the debris would be added to existing machine piles and burned after curing. If machine piles were not created in the harvest unit, the debris would be hand-piled and burned after curing.

Up to approximately 1,575 acres of harvest-related fuels may be treated through machine piling debris within harvest units. The amount of this treatment would depend on post-harvest fuel loading. Machine piling would create an average of 10 piles per acre with an average size of 10 feet high by 10 feet wide. Piles would be burned by hand after curing. Additionally, up to about 675 acres of harvest units may be treated through hand-piling debris, creating an average of 20 piles per acre with an average size of 4 feet high and 4 feet wide.

Adaptive management strategy: If machine piles are burned before ladder fuel reduction thinning occurs in harvest units, then the debris from LFR thinning would be hand-piled and burned after curing. This would affect up to 1575 acres.

Harvest debris of approximately 35 acres within Loup Loup and J.R. Campgrounds would be treated through machine-piling and burning. Some material may be utilized as firewood in the campgrounds. Piling debris would create 8-10 piles per acre at an average size of 5 feet high by 5 feet wide.

An additional 70 acres of regeneration commercial harvest units would be underburned following timber harvest. In these units, fireline would use existing roads and trails wherever possible to minimize ground disturbance. An additional 0.5 miles of hand fireline and 1.8 miles of machine fireline would be needed to secure burn unit boundaries.

In addition, harvest could generate up to 235 slash piles at landings (an average of one landing pile per ten acres of harvest) which would be removed through commercial biomass utilization, depending upon economic feasibility.

Adaptive management strategy: If market conditions make biomass removal uneconomical, landing piles would be burned within about two years of harvest, after adequate time for the material to be utilized as firewood where open road access is allowed.

Fireline
Approximately 2.3 miles of fireline, including 1.8 miles of dozer line (three to five feet wide) and 0.5 miles of hand fireline (up to 18 inches wide), would be constructed to contain underburns. Wherever possible, burn-unit boundaries would use existing roads and trails to minimize ground disturbance. Surface fuels and vegetation would be removed during fireline construction to expose mineral soil.

FUELS TREATMENTS IN SPECIFIC AREAS
The following information describes how the treatments described above are integrated into the specific areas below. Acres listed are included in treatment descriptions above.

Loup Loup Ski Area
This part of the project would entail treatment of ladder fuels within vegetated strips between ski runs within the Loup Loup ski area special use permit area. For treatment or removal of hazard trees between ski runs, removal would be required over snow. Loup Loup ski area would be responsible for implementing treatments with the exception of burning, which would be completed by Forest Service personnel.

Wildland Urban Interface
The project area is entirely contained within the Wildland Urban Interface (WUI) as defined by the Okanogan County Community Wildfire Protection Plan (CWPP). About 650 acres of proposed treatment units lie within the Highway 20 Corridor and Benson Creek priority treatment areas identified by the CWPP; these areas would be treated with a combination of thinning, hand-piling, and pile burning to reduce wildfire risks to private and state lands and developments.

Forest Plan Old Growth
Approximately 500 acres that meet the definition of old growth in the Forest Plan would receive fuels treatments requiring a Forest Plan amendment as discussed later in this document. Approximately 187 acres of this total are within proposed harvest units; if the purchaser opted to leave small-diameter trees standing, these acres would receive post-harvest LFR treatment where understory trees from 2 feet high to 7 inches DBH within 20 to 30 feet of overstory trees would be felled. Harvest debris would then be machine-piled and burned, and follow-up LFR debris would be treated by hand-piling and pile burning, or would remain onsite if this debris was less than about 10 tons/acre. The remaining acres within FPOG lie in proposed fuels treatment units where LFR thinning would occur. The resulting debris would be hand-piled and piles would be burned after curing.

Riparian Habitat Conservation Areas
Approximately 274 acres of proposed treatments lie within RHCAs (including areas where harvest is proposed). Of those, approximately 34 acres lie inside proposed harvest units; within these areas, about 22 acres of RHCAs would be machine-piled at their outer edges; the inner

half or more and RHCAs in other treatment units would have no piling treatments. In the 210 acres of RHCAs within fuels units, LFR thinning would remove coniferous trees up to 7" DBH; this debris would be hand-piled. The remaining 32 acres would receive NCT treatments as described above; this debris would also be hand-piled. Hand- or machine-piling in all of these units would occur on the outer edges of the RHCA where debris created by thinning warranted reduction; otherwise debris would be left in place. No underburning would occur in RHCAs.

TRANSPORTATION SYSTEM CHANGES

The transportation plan detailed in Appendix E identifies roads within the project area, current status, and management activities proposed for each road. These roads are displayed in Appendix J on the Proposed Transportation System map. Travel analysis has been completed to support these proposed actions and is available in the project record. The transportation proposal covers both National Forest System and unauthorized roads in the project area as described below.

National Forest Service System Roads

Currently there are approximately 240 miles of NFS system roads in the project area in open or closed status. Harvest operations would use approximately 93 miles of NFS roads. Some currently unauthorized roads would be converted to the NFS road system because they have legal easements, are needed for current and future land management activities, or are regularly used by permittees in the course of maintaining and inspecting facilities or developments. Some NFS roads would be decommissioned either post-harvest or as funding became available because they are no longer needed or are degrading water quality. NFS roads would be closed because there is no management need for their use in this project or in the immediate future. Approximately 0.5 miles of new road would be built in a proposed horse camp, and 200 feet of road with a drivable ford across Frazer Creek would be built to provide access to Okanogan PUD powerline structures, allowing decommissioning of one mile of road within an adjacent riparian area. Four gates would be installed at key locations along PUD roads in the Frazer Creek drainage to limit sediment production and help control illegal firewood cutting along the stream. NFS system roads would be converted to Nordic ski trails in lieu of decommissioning to allow for access by trail grooming equipment. Refer to Figure 2.3 for the summary of proposed changes to NFS roads.

Adaptive management strategy: If 200 feet of road with a drivable ford cannot be built across Frazer Creek to provide Okanogan PUD access to the powerline, approximately 0.9 miles of road that currently provides PUD access to this area would not be decommissioned and would be used as an access road.

Figure 2-3 Proposed Changes to NFS System Roads (miles)

Current	Unauthorized Roads Converted to NFS Road System	New Construction	Decommission	Convert to Trail	Post-Project
240	24.5	0.5	17.7	0.2	246.6

This project would move NFS system roads from open status to closed status as shown in Figure 2-4 below.

Figure 2-4 Proposed Changes to NFS System Roads Open or Closed Status

Status	Current Miles	Post-Project Miles
Open	151.7	132.1
Closed	88.3	114.5
Total	**240**	**246.6**

Unauthorized Roads

The project area contains approximately 89.9 miles of unauthorized roads. In contrast to NFS roads, unauthorized roads are not inventoried in the agency road system and are not currently maintained by the Forest Service. Many of these roads were built for past land management needs, then closed or decommissioned to old standards and were never added to the road system inventory. Some of these roads were built by forest users to access firewood or for recreation. Four miles of unauthorized roads were built to access the Okanogan PUD powerline in the project area. During harvest, about 21 miles of unauthorized roads would be opened to facilitate harvest activities and would subsequently be decommissioned, added to the NFS road system, or converted to a Nordic ski trail at the close of harvest operations. Additional unauthorized roads not used for project implementation would also be added to the NFS system as described above, decommissioned, or converted to Nordic ski trails. Refer to Figure 2-5 for the summary of proposed changes to unauthorized roads.

Figure 2-5 Proposed Changes to Unauthorized Roads in Project Area

Current Miles	Add to NFS Road System	Decommission	Convert to Trail	Post-Project Unauthorized Road Miles
89.9	24.5	63.8	1.6	0

Temporary Roads

Timber harvest activities would require construction of 0.4 miles of temporary roads to minimum standards necessary for safe use. Temporary roads would be decommissioned following completion of harvest activities

SPECIFIC TRANSPORTATION ACTIVITIES

Pre-Disturbance Road Decommissioning

The proposal includes decommissioning approximately 0.8 miles of road in Benson Creek sub-watershed and 1.45 miles of road in Frazer Creek sub-watershed (these miles are included in the summaries above). These roads occur within RHCA designations and were selected by the project Fish Biologist because they currently retard attainment of Riparian Management Objectives. Decommissioning would occur before any ground-disturbing project activities to provide an immediate net reduction of sediment to a level below what is currently occurring in the project area. Sediment production is expected to further decrease a result of all subsequent project activities.

Hazard Tree Removal along Haul Routes

As required by agency direction, hazardous trees along roads that would be used as haul routes would be assessed and removed if they are determined to be a risk to contractors, Forest Service employees, and the public (FSM 7700, Chapter 30). Assessment and removal criteria

would be based upon *Field Guide for Danger Tree Identification and Response* (Toupin and Barger 2008). Debris from this activity would be left onsite.

Culvert Replacement and Upsizing
The Carlton Complex wildfire and subsequent storm events resulted in overland debris flows that impacted the transportation system within the project area. As a result, several stream crossings were damaged and require either culvert upsizing or culvert replacement. In the Finley Canyon and Benson Creek drainages, a total of six culverts would be upsized and two would be newly installed. These culverts would be installed to engineering specifications adequate for anticipated stream and debris flows.

Easements
Approximately 5 miles of roads within the project area cross lands managed by the Washington Department of Natural Resources (DNR) and provide necessary access to Forest Service lands for this and future projects. As part of a cooperative road use agreement, the Forest Service has requested easements from DNR for these roads. These road segments are already NFS roads. Roads with easements requested are listed in Appendix E.

Administrative-Use Access Trails
Within the project area, administrative-use access routes would be established on approximately 23.5 miles of closed roads (ML 1), and on 2 miles of roads that are proposed for decommissioning in this project. These routes would be designed to provide occasional access for OHVs and/or horses for maintenance of stock tanks, fences, or other administrative functions, or would provide access routes for cattle between allotment pastures. This access would be for authorized individuals only.

Roads to Ski Trails
Approximately 2 miles of unauthorized or NFS roads would be converted to Nordic ski trails for winter recreation in lieu of decommissioning to allow for continued access by trail grooming equipment and use by cross-country skiers. Motorized access would be restricted to trail maintenance and grooming equipment only.

CAMPGROUND CONSTRUCTION

A 14-site horse campground would be constructed on 15 acres near the North Summit SnoPark for public use. The campground would also require the construction of a 0.5- mile long loop road as discussed in the transportation section.

2.3 Forest Plan Amendments

Implementation of the proposed action would require eight project-specific non-significant amendments to the Forest Plan. Non-significant amendments are defined in FSM 1926.51 and include the following components that pertain to the proposal: minor changes to standards and guidelines, and actions that do not significantly alter the multiple use goals and objectives for long-term land and resource management. The first amendment listed below would be permanent; the remaining amendments are required for the life of the project in order to allow operations that will make the ecosystem more resilient in the long-term.

Resource Objective: Campground Management

The location of the proposed 15-acre campground is currently divided between MA5 and MA17. The project would permanently adjust the adjacent MA17 boundary so the entire

campground falls within MA17, which is the appropriate management area for a developed campground.

Resource Objective: Soil Protection

Winter harvest on frozen or snow-covered ground would help protect sensitive ash cap soils from compaction, rutting, displacement or other disturbance. To implement winter harvest, the following standards and guidelines would be amended:

Forest wide Standard and Guideline Access 17-6:
Winter logging operations shall be coordinated with winter sports activities. The following roads shall not be snowplowed and shall be closed to motorized wheeled vehicles from Dec.1 to Apr 1: Road 41 from South Summit Snopark to the junction with road 4100450 (and many others that are not in the project area or that would not be needed for proposed winter logging.)

Amend to allow temporary snow plowing on a portion of this road segment for the purpose of implementing harvest activities in winter conditions favorable to soil protection. The South Summit Snopark and the initial 2.1 miles of this road segment between Highway 20 and Road 4100500 would remain open for snowmobile and Nordic ski grooming and use. Plowing 1.3 miles of this road segment between the junctions with Roads 4100500 and 4100450 under this amendment would facilitate winter logging of many units along this road and along spur roads leading from it. Plowing on this road would essentially preclude snowmobiling on Road 41 from this point south for up to three seasons. Groomed snowmobile and cross-country ski routes are available in adjacent areas to provide continued opportunities for these activities.

Management Area Prescription MA5-17E & MA14-17B:
On deer winter range, access for motorized vehicles shall be prohibited December 1 through March 31 except for designated through routes. Winter haul may be permitted provided the goals of the Management Area are met.

Amend to allow access for motorized vehicles between December 1 and March 31 for the purpose of implementing harvest activities in winter conditions favorable to soil protection. Disturbance to deer would be temporary and short-term. Adjacent undisturbed areas at lower elevations are usually favored by deer during the winter and are available for animals to use. Previous experience in the North Summit area has demonstrated that deer may not be displaced from an area by logging, but may remain in the area to forage on lichens found on logging slash. In the longer term, harvest will encourage growth of shrubs used as forage, providing more food resources. The goals of the Management Areas would be met.

Resource Objective: Forest Health

Management Area Prescription Wildlife MA5-6A, MA14-6A:
All identified deer winter range should be managed for well-distributed cover as shown below:

Figure 2-6 Deer Winter Range Cover

Winter Range Cover	Applicable to Methow Valley Ranger District
Snow Intercept Thermal	>15%
Winter Thermal	>25%
Hiding	>0%

Total	>40%

Amend to allow for thermal cover percentage levels below prescription for deer winter range. Currently, this standard and guideline is not being met and there is no potential for meeting it for several decades due to the fire in MAs 5 and 26. In MA 14, around half of the thermal cover was destroyed in the wildfire. Proposed treatments would reduce the total winter thermal cover by 1% in one management area. Recent science suggests that providing for thermal cover was over-emphasized in the current plans. Thermal cover is not as critical as other factors such as forage quality and quantity, and human disturbance (Cook et al. 1996, 1998). Treatments proposed in these stands would increase forage and create a more sustainable cover component and would be consistent with the 2010 and 2012 Forest Restoration Strategy. To reduce the impact of proposed treatments, thinning in fuels and NCT units would leave 20% of the area untreated in patches from 0.1 acre to several acres in size. Fuels treatments in proximity to the moderate to high severity burned areas would be deferred until 2017, and then reviewed to assess cover needs.

Resource Objective: Protection, Restoration, and Maintenance of Old Growth Stands

Forest wide Standard and Guideline Old Growth 5-1:
No scheduled or non-scheduled timber harvest or firewood collection shall be permitted in mixed conifer old growth stands.

Forest wide Standard and Guideline Protection (Fire and Fuels) 19-8: *Treatment of natural fuels shall be prohibited in identified old growth stands.*

Amend to allow harvest thinning and fuels treatments within old growth stands. Fire exclusion has changed the character of some mixed conifer old growth stands. Multi-story stand canopy conditions have developed with a general absence of natural fire disturbance for nearly a century. Canopy and surface fuel loading has increased from pre-settlement levels due to past fire exclusion. Existing tree stocking and fuel levels have increased the risk of insect outbreaks and crown fires which could eliminate the larger overstory tree component of mixed conifer Forest Plan old growth. Tree stocking levels are hindering the development of future large trees to maintain the old growth stand structure. There is a need to treat some Forest Plan old growth stands with harvest and fuels treatments to maintain long-term old growth characteristics and improve resiliency to natural disturbances. These proposed treatments would be consistent with the 2010 and 2012 Okanogan-Wenatchee National Forest Restoration Strategy guidelines.

Resource Objective: Limit Wildlife Disturbance

Management Area Prescription Roads MA5-17C, MA14-17A, MA25-17C:
To limit wildlife disturbance, local road density shall be limited to three miles of road open to motorized use (not including snow machines) per square mile of discrete individual Management Area.

Amend standards to temporarily allow for increased open road density during project implementation. Current open road density and proposed post-project open road density in discrete Management Areas 5-08, 14-07, and 25-10 are expected to remain within the Forest Plan standards. During project activities, it is possible that open road density may exceed the standards if all closed roads were opened at the same time.

Resource Objective: Restoration and Maintenance of Connectivity Corridors

Revised Interim Management Direction Establishing Riparian, Ecosystem and Wildlife Standards for Timber Sales (Regional Forester's Forest Plan Amendment #2) Scenario A 3a) 2:

Connectivity Corridors are those in which medium diameter or larger trees are common, and canopy closures are within the top one-third of site potential.

Amend standard to reduce canopy closures within connectivity corridors below the top one-third of site potential through harvesting and ladder fuel reduction thinning. The Carlton Complex wildfire caused high levels of tree mortality in a four-mile-wide swath of the central portion of the planning area, truncating pre-fire connectivity corridors established to meet Eastside Screen requirements in the initial South Summit analysis. At this time there is no potential for delineating alternate connections between the northern and southern parts of the analysis area due to the truncation in the middle portion, and this standard cannot be met. Connectivity corridors within the northern (north of Highway 20) and southern portions are fairly intact, although in many areas they are no longer connecting late/old structure stands, as approximately 40% of those features were burned with moderate/high severity.

In the remaining connectivity corridors and late/old structure stands, management activities in the last century caused extensive changes in forest vegetation, including increased tree density, decreased average tree size, increased proportion of shade tolerant Douglas-fir forest cover, increased proportion of multiple canopy layer stands, and increased vulnerability to forest insects and diseases and wildfire compared to historic pre-settlement conditions. Stands of large trees with a high proportion of ponderosa pine and western larch stocking currently are less common in the project area than historically. Treatments would release or maintain larger and medium sized trees. Allowing harvest treatments on approximately 19 acres in connectivity corridors spread over 14 proposed harvest units (approximately two percent of the remaining connectivity corridors) would reduce canopy closure below the top one-third of the site potential. Beneficial effects include reducing fuel ladders from surface through understory to overstory, which lowers the risk of crown fire initiation and spread and improves resiliency to natural disturbances. Increasing resilience helps provide sustainable forested landscape connections between late and old structure, old growth, and management requirement habitats.

These proposed treatments would be consistent with management direction applicable under Scenario A of the Regional Forester's Forest Plan Amendment #2 direction (Goodman 2003) to utilize site-specific Forest Plan amendments to provide flexibility implementing eastside screens direction in order to better meet late and old structure (LOS) and other screens objectives and Okanogan-Wenatchee National Forest Restoration Strategy guidelines. No trees greater than or equal to 21 inches DBH would be prescribed for removal with this project.

2.4 Design Details and Mitigations

Specific features are incorporated into the design of the proposed action to prevent potential resource impacts. The design criteria are an integral part of the proposed action and effects analyses presented in Chapter 3 are based on these measures being implemented. South Summit II Design Criteria are in Appendix A.

2.5 Monitoring Plan

Monitoring would be done to assess impacts caused by project activities. Depending on the impacts observed, specific actions would be implemented to reduce negative effects. Monitoring requirements are described below and listed in Appendix A.

Forest Vegetation and Reforestation

District Silviculture and Reforestation staff would monitor post-harvest reforestation progress within seed-tree regeneration harvest units and planting units. Survival surveys would be conducted to assess survival of planted seedlings during the first and third growing seasons following tree planting. District Silviculture and Reforestation staff would also conduct a stocking survey during the third growing season following tree planting to assess the condition and total number of planted and natural seedlings established in each unit. A decision to certify whether or not the desired number of vigorous tree seedlings have become established in each regeneration unit would be made based on the third year stocking survey results. Areas with inadequate first year planting stock survival or third year stocking levels would be assessed and replanted as needed to ensure that minimum acceptable tree stocking levels are attained.

Following completion of forest vegetation management treatments, District Silviculture staff would conduct field reviews of treated units to evaluate accomplishment of silvicultural treatment objectives and confirm planned follow-up treatment needs. This review would be conducted prior to implementation of reforestation or fuels treatments in order to make minor modifications to planned treatments as needed to accomplish project vegetation and fuels treatment objectives.

Sensitive Plants

District Botany staff would monitor all known Sensitive Plant sites within the project area to access response to treatments within the immediate area.

- Prior to implementation of this project, all known sensitive plant sites occurring in or near treatment units will be clearly flagged by a botanist. Site conditions prior to implementation will be recorded.
- After implementation, all known sensitive plant sites occurring in or near treatment units will be monitored over two seasons, within five years after implementation.
- Selected aspen stands will be monitored by botanists in cooperation with wildlife biologists and silviculturist.
- A population of *Mimulus patulus* exists within the project area. The District Botanist will work with other District staff to identify *Mimulus* habitats to be excluded from tree planting activities.

Fuels

Prior to implementation of prescribed fire treatments, the Fuels Planner would assess fuel loadings and if needed, apply the adaptive management strategies described in the Proposed Action to meet resource objectives.

During implementation of ladder fuel reduction or prescribed fire activities, the Contracting Officer's Representative (COR) or burn boss would monitor the treatments' immediate impacts to fuel loading, tree mortality, and other objectives as defined in the contract or burn plan prescription. Treatment methods would be adjusted as needed to meet the objectives.

After prescribed fire treatments, fuels staff would assess burn units to evaluate how well the burn achieved the resource objectives of the treatment burn plan. Information from post-burn monitoring would be provided to burn planners and others who had specific objectives for the fuels treatment.

During prescribed burn implementation, the burn boss would monitor the volume and direction of smoke produced to assess potential air quality impacts. Smoke drifting towards populated areas with no indications of atmospheric movement or mixing would be mitigated by stopping or reducing burning in that area until such time as mixing improved.

Riparian Habitat Conservation Areas

Fisheries and hydrology staff would monitor activities within RHCAs to determine if the South Summit II project is being implemented as planned and if the design details and design criteria were effective in achieving the desired goals for resource protection. National Oceanic and Atmospheric (NOAA) Fisheries and US Fish and Wildlife Service (USFWS) representatives would be invited to visit the sites during the monitoring process.

During the first year of harvest operations, activities in RHCAs would be reviewed to see if planned protection measures such as protection buffer widths and skid trail spacing were followed (implementation monitoring). Effectiveness monitoring photo points would be set up on a few representative skid trails and harvester-forwarder trails where bare soil is exposed and on different slopes to monitor sediment movement over time.

During year three, effectiveness monitoring photo points and sediment sites would be re-visited to determine if the design details and design criteria were effective at protecting streams. According to the project hydrologist, sediment erosion from timber removal generally lasts about 2-3 years, depending on how rapidly vegetative cover re-establishes. Monitoring items would include: the rate of vegetation establishment on bare soil areas, a determination of whether soil movement occurred, and if so, an estimation of the volume and distance that movement occurred. Additional monitoring items include determining effectiveness of the prescribed protection buffers in filtering and trapping sediment before it reached an adjacent stream, and determining whether slash placed on harvester-forwarder trails is effective at minimizing the amount of bare soil and rutting. Results of monitoring would be incorporated into future planning projects.

If a heavy precipitation event occurs, sites would be visited soon after the event to assess sediment movement. Photos would be re-taken and if any sediment movement occurs, movement distance, particularly whether sediment reached adjacent streams would be documented.

Northern Goshawks

District wildlife staff would monitor goshawk nesting activity in the project area until project activities are completed. This would include surveying for new nest locations to ensure protections are site-specific, because goshawks often use alternate sites. If goshawks are found during surveys, protections would be instituted consistent with the Okanogan Forest Plan, in coordination with Washington Department of Fish and Wildlife and the sale purchaser.

Western Gray Squirrels

The project biologist will conduct field reviews of areas where gray squirrels are documented or suspected to be found until management activities are completed. If nests are located:

1. Protect all nests and nest trees suspected to contain natal nests, with a 50' no-cut buffer, and retain a 50% or greater canopy closure within 350' of a nest.
2. Provide stringers of trees with interlocking crowns between natal nest sites, forage areas, and water.
3. Avoid disturbance between March 1 and August 31 within 400' of natal nests.

Invasive Plants
District Invasive Plants specialist would survey the year following project completion for new invasive plant infestations. Early detection increases treatment options. In addition, the Invasive Plant specialist would monitor the effectiveness of invasive plant treatments and revegetation of heavily disturbed soils on landings, main skid trails, decommissioned temporary roads, and constructed road cut and fill slopes. This monitoring would survey and use professional judgment to determine if additional treatments are needed. Treatments would be implemented in accordance with the existing *Okanogan National Forest Integrated Weed Management Environmental Assessments* (USDA Forest Service 1997 and USDA Forest Service 2000).

Soils
Soil specialists would conduct implementation and effectiveness monitoring to assess the extent of detrimentally disturbed soil during harvest operations. If compaction levels in harvest units exceed the 15% Forest Plan threshold or displacement is greater than 6 inches, active soil restoration measures would be implemented as described in Appendix A.

Heritage Resources
Cultural Resource Technicians or an Archaeologist will monitor the construction of the North Summit Horse Campground to assess the presence of cultural resources at this site. If sites or artifacts are found, appropriate evaluation and clearance through SHPO will occur and the resulting recommendations would be carried out before implementation continues.

Chapter 3: Existing Conditions and Environmental Consequences

3.1 INTRODUCTION

This chapter presents information about current resource conditions, and the direct, indirect and cumulative effects of implementing the proposed action. The information presented in this chapter updates, and in some cases replaces the specialists' reports completed immediately before the 2014 Carlton Complex wildfire (hereafter referred to as the Carlton Complex). Specialists' reports are available in the project file at the Methow Valley Ranger District office in Winthrop, Washington.

Each resource area discloses the direct, indirect and cumulative effects for that resource area. Direct effects are those caused by the action, occurring at the same time and place. Indirect effects are caused by the action with subsequent effects later in time or further removed in distance, but are still reasonably predicted. Cumulative effects are the incremental effects of the South Summit II Forest and Fuels proposed action, when considered with the overall effects of past, present, and reasonably foreseeable future actions. Resource specialists addressed issues that were chosen for analysis because they represent cause-effect relationships between the implementation of the alternatives and resource-related concerns, and serve to highlight impacts and trade-offs for the decision maker. For each issue analyzed, indicators have been selected that provide understandable, quantifiable and responsive measures of the degree of impact that would result from implementing the alternatives.

PAST, PRESENT, AND REASONABLY FORESEEABLE FUTURE ACTIONS

The interdisciplinary team (IDT) identified past, present, and reasonably foreseeable future actions that might have cumulative impacts with the proposed actions early in the analysis process. Those actions are described below. Each resource area considered different mixes of these actions, depending on the cumulative effects boundary for the resource area and the resource affected. Only those past, present and reasonably foreseeable actions that overlap the geographic analysis area boundary for each particular resource are considered, and only if those other actions have or are expected to have overlapping effects with the South Summit II Forest and Fuels Project. Some past projects may still be having effects on one resource, but not another.

Past Actions

In order to understand the contribution of past actions to the cumulative effects of the proposed action, this analysis relies on current environmental conditions as a proxy for the impacts of past action. This is because existing conditions reflect the aggregate impact of all prior human actions on natural events that have affected the environment and might contribute to cumulative effects.

The cumulative effects analyses do not attempt to quantify the effects of past human actions by adding up all prior actions on an action-by-action basis. There are several reasons for not taking this approach. First, a catalog and analysis of all past actions would be impractical to compile and unduly costly to obtain. Current conditions have been impacted by innumerable actions over the last century and beyond, and trying to isolate the individual

actions that continue to have residual impacts would be nearly impossible. Second, providing the details of past actions on an individual basis would not be useful to predict the cumulative effects of the proposed action. In fact, focusing on individual actions would be less accurate than looking at existing conditions, because there is limited information on the environmental impacts of individual past actions, and one cannot reasonably identify each and every action over the last century that has contributed to current conditions.

Additionally, focusing on the impacts of past human actions risks ignoring the important residual effects of past natural events that may contribute to cumulative effects as much as human actions. By looking at current conditions, residual effects of past human actions and natural events are captured, regardless of which particular action or event contributed those effects. Finally, the Council on Environmental Quality (CEQ) issued an interpretive memorandum on June 24, 2005 regarding analysis of past actions, which states, " agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions."

The cumulative effects analysis in this EA is also consistent with Forest Service National Environmental Policy Act Regulations (36 CFS 220.4(f)) July 24, 2008, which state in part: "CEQ regulations do not require the consideration of the individual effects of all past actions to determine the present effects of past actions."

For these reasons, the analysis of past actions in the cumulative effects analysis is based on current environmental conditions.

Past and on-going actions affecting resources may be described as part of the existing condition information for specific resources later in this chapter.

Present and On-Going Actions

The following list describes most of the current and ongoing actions considered during analysis. Individual resource reports in the following sections may list other resource-specific actions.

Fire Suppression

Active fire suppression continues in the project area because of its proximity to private and state lands and associated developments. Suppression activities have contributed to changing the natural fire cycle from frequent, low-intensity fires across most of the project area to much less frequent, smaller fires, which in turn has contributed to higher tree density than existed historically.

Timber Harvest and Associated Activities

Harvest in the Brimstone Salvage sale area was completed in February 2015; slash treatments and road closures associated with this project are scheduled to be completed by the end of 2015.

Transportation System

Maintenance of system roads continues and includes danger tree removal along roads when needed.

Livestock Grazing
Grazing will continue on the Frazer, Finley, Benson, and Texas allotments, allowing for post-fire recovery as described in the Range section of this chapter. Active permittee cattle management would continue to be implemented through annual coordination between the District Rangeland Management Specialists and the permittee (rancher).
Allotment pastures in the unburned portion of the project area will continue to be grazed with modifications and mitigation measures in place.

Invasive Plant Treatments
Various weed populations continue to be treated annually by spot-spraying with herbicide, hand-pulling, or bio-control agents. The 1997, 1999, and 2000 Noxious Weed Integrated Weed Management EAs cover portions of the project area.

Recreation
Activities include: campground management, including hazard tree removal, road and other infrastructure maintenance; snowmobiling and snowmobile trail grooming; hunting; camping in dispersed sites and campgrounds; firewood gathering; Off-Highway Vehicle (OHV) use; pleasure driving; mountain and road biking; hiking; horseback riding; cross-country skiing and cross-country skiing trail grooming; and downhill skiing.

Reasonably Foreseeable Future Actions
Future projects not covered by a decision at this time will be thoroughly analyzed and documented in separate environmental documents. The interdisciplinary team made assumptions about the environmental effects of the future projects, because the effects of many of the projects are unknown at this time. The basic assumption for every project is that it will meet amended Forest Plan standards and guidelines. These assumed effects were used in the cumulative effects analyses at the end of each resource section. The reasonably foreseeable future actions used in this analysis are listed below:

Burned Area Emergency Rehabilitation (BAER) and Related Activities
Damage to transportation and range infrastructure caused by the 2014 Carlton Complex wildfires is planned for 2015. BAER work involves rebuilding road failures, re-establishing road surfaces and ditch lines, and repairing damage to cut and fill slopes. Other work fire-repair work planned aside from BAER road work includes repairing and replacing range fences burned in the Carlton Complex; riparian tree felling as described above to directionally fell burned trees across streams to add large woody debris to 12 miles of burned and severely eroded streams; and constructing approximately two miles riparian temporary electric fence within the Carlton Complex to restrict cattle access to riparian areas and increase the potential to trap sediments.

Wildfire Suppression
Wildfires are expected to continue to occur periodically in the project area. Active fire suppression will continue in the project area because of proximity to private and state lands and associated developments.

Transportation System and Travel Management
Maintenance of system roads will continue and will include danger tree removal when needed along roads.

The Forest is conducting an environmental analysis for travel management planning that will designate motorized public access routes in this area. Within the South Summit II Forest and Fuels project area, the proposed alternative would not include new motorized travel routes, motorized trails, or authorization of unlicensed vehicles on open roads.

Livestock Grazing
Grazing will continue on the Frazer, Finley, Benson, and Texas allotments, allowing for post-fire recovery as described in the Range section of this chapter. Active permittee cattle management would continue to be implemented through annual coordination between the District Rangeland Management Specialists and the permittee (rancher).

Invasive Plant Treatments
Integrated weed management (IWM) would continue to reduce or eliminate New Invader weed infestations. This includes the combination of all the control methods available with emphasis on early detection of new infestations, rapid treatment response, and prompt revegetation. The combination of herbicide, manual, and cultural treatment together would be conducted by the District Weed program with herbicide treatments authorized under the 2000 Okanogan National Forest Integrated Weed Management EA Decision Notices.

Recreation
Recreational activities are expected to occur as described in Present Actions.

Washington Department of Natural Resources Activities
The Washington Department of Natural Resources proposes two salvage sales on DNR lands within and adjacent to the project area that would occur in spring 2015. These sales include 1300 acres in Township 31N Range 22E, Township 32N Range 22E, and Township 33N Range 23E.

3.2 FOREST VEGETATION

3.2.1 Issues for Analysis

The following issues were chosen for analysis because they represent cause- effect relationships between the implementation of the alternatives and forest vegetation and serve to highlight impacts and trade-offs for the decision maker. For each issue analyzed indicators have been selected that provide understandable, quantifiable and responsive measures of the degree of impact that would result from the implementation of the alternatives.

Forest Vegetation Conditions: Departure from Historic Stand Structures and Lack of Resilience to Natural Disturbance (Purpose and Need #1)

Management activities in the project planning area have caused extensive changes in forest vegetation over the past century, including increased tree density, decreased average tree size, increased proportion of shade tolerant Douglas-fir forest cover, increased proportion of multiple canopy layer stands, and increased vulnerability to natural disturbance including forest insects and diseases and wildfire compared to historic pre-settlement conditions. The Carlton Complex wildfire of 2014 affected approximately 30,500 acres (approximately 67%) of forest vegetation in the project area. The fire demonstrated how vulnerable forest vegetation conditions were to this type of disturbance by burning with stand-replacement intensity on an estimated 15,300 acres in the project area (approximately 34% of total forest vegetation) including an estimated 12,900 acres of dry forest vegetation which historically would have rarely experienced stand replacement fires. An estimated 15,100 acres (approximately 33%) of project area forest vegetation affected by the fire experienced low intensity burning resulting in low levels of tree mortality and little or no change to forest stand structures. The remaining 14,800 acres (approximately 33%) of project area forest vegetation was not affected by the Carlton Complex wildfire.

Important forest vegetation components currently are departed from historic levels and in decline. Late and old structure forest stands comprised of large conifer trees with a single canopy layer currently are far less common in the project area when compared to estimated historic levels. Forest vegetation in many areas not affected by the fire or where low intensity burning occurred remains vulnerable to natural disturbances and is not likely to develop into late and old structure single canopy layer conifer stands without management intervention. Many aspen stands not affected by the fire or where low intensity fire occurred are declining when compared to conditions at the turn of the twentieth century. Conifer encroachment has been identified as one of the primary factors that have contributed to the decline of aspen stands not changed by the fire in the project area. There is a need to treat forest vegetation not affected by the Carlton Complex wildfire or where low intensity burning occurred to maintain and restore forest conditions that reflect historical tree densities, species composition, canopy structures, and size classes, including large and old trees, to improve resilience of remaining post-fire forest vegetation to natural disturbances.

Indicator:
Acres treated to maintain and restore forest vegetation conditions that reflect historical tree densities, species composition, canopy structures, and size classes, improving resilience of forest vegetation to natural disturbances.

Analysis Methods:
Data sources used in this analysis to describe existing forest vegetation conditions, identify potential treatment opportunities, and predict forest vegetation response to proposed management activities include plant association models, aerial photographs, aerial pest management survey data, post-fire satellite imagery data, and pre and post-fire field reconnaissance. Following the Carlton Complex wildfire, forest stand structures were reclassified using Burned Area Reflectance Classification (BARC) satellite derived data of post-fire vegetation conditions interpreted by the Remote Sensing Application Center (RSAC). Post-fire vegetation conditions and stand structures in areas affected by the fire were spot checked in the field by Methow Valley Ranger District personnel to verify the accuracy of BARC data and the forest stand structure reclassification process. Details on data are available in the Vegetation Specialists Report (Daily 2015).

An assessment of existing forest stand structures was conducted based on direction provided by the interim ecosystem standard of the Regional Foresters Forest Plan Amendment # 2 of 1995. Forest vegetation polygons were photo interpreted in 2012 and reevaluated in 2014 using BARC post-fire vegetation conditions data. Field verification of structural stage classification was conducted throughout the project area during the 2012 and 2013 field seasons and during the fall of 2014 in areas affected by the Carlton Complex wildfire. Post-fire forest vegetation polygons (stands) were classified into one of seven canopy structural stages which are described in Appendix D of the project forest vegetation specialist report (Daily 2015). Percent composition of current structural stages was compared with the Historic Range of Variability (HRV) which is an estimate of conditions in the pre-settlement era. Current structural conditions that are outside HRV conditions were identified to determine potential treatment areas.

Western spruce budworm susceptibility for the project area was analyzed with a western spruce budworm hazard rating model which was developed for the Methow Valley Ranger District Western Spruce Budworm Landscape Assessment (USDA Forest Service 2012). The model was updated using BARC post-fire vegetation conditions data for the Carlton Complex wildfire area to provide a current assessment of budworm susceptibility in the project area. The hazard rating system is based on a combination of vegetation attributes (including forest cover type, tree canopy closure, predominant tree size classes, and stand canopy structures) and plant associations to estimate susceptibility. Higher ratings indicate greater susceptibility to budworm defoliation.

Proposed vegetation management treatment units were identified based on aerial photograph interpretation, 20-plus years of local knowledge and previous management experience in the project area, and results of the stand structure HRV assessment. Proposed treatment units were subsequently verified following field review in 2012 and 2013, and post-fire review in 2014. Site conditions including road access, slope, soils, tree species composition and size classes, and forest vegetation conditions were observed during these -site visits. Post-fire vegetation and soils conditions in all proposed harvest treatment units affected by the Carlton Complex wildfire were field-verified by Methow Valley Ranger District personnel during late summer and fall of 2014.

Analysis Area:
The area analyzed for this indicator includes all land on National Forest System (NFS) lands within the South Summit II Forest and Fuels project planning area. The forest vegetation analysis area includes approximately 45,200 acres of land which currently is forested or supported forest vegetation prior to the Carlton Complex wildfire.

Forest Plan Old Growth (Purpose and Need #1)
Vegetation and fuels conditions in stands which currently meet the definition of Okanogan Forest Plan mixed conifer old growth were not affected by or experienced low-intensity burning during the Carlton Complex wildfire. Canopy and surface fuel loading has increased from pre-settlement levels due to past fire exclusion. Increased levels of Douglas-fir forest cover, canopy layering, and fuel loading have increased the risk of insect outbreaks and crown fires which could eliminate the large overstory tree component of Forest Plan mixed conifer old growth. Existing conditions are not sustainable over the long term and there is a need to maintain and restore sustainable vegetation and fuels conditions in Forest Plan old growth stands.

Indicator:
Acres of Forest Plan old growth treated to maintain and restore sustainable vegetation and fuels conditions and reduce the likelihood losing old growth stands to natural disturbances including wildfire and insect or disease attacks.

Forest Plan Amendments
There is a need to treat Forest Plan old growth stands to reduce susceptibility to insect attacks, stress-related tree mortality, and stand replacing wild fire that could eliminate the existing old growth stand structure. The Okanogan Forest Plan prohibits timber harvest and the treatment of natural fuels in mixed conifer old growth. A project-specific Forest Plan amendment is proposed to allow harvest and fuels treatments that would reduce tree stocking and hazardous fuels levels to reduce stress on large trees, improve resiliency to natural disturbances, and provide sustainable mixed conifer old growth stand conditions.

There also is a need to treat a portion of the connectivity corridors located between late and old structure (LOS) stands and between Forest Plan designated “old growth and Management Requirement” habitats to reduce susceptibility to insect attacks, stress-related tree mortality, and stand-replacing wildfire that could eliminate the existing forested connection between these habitat features. The Okanogan Forest Plan, as amended by the Regional Forester’s Forest Plan Amendment #2, permits harvesting within connectivity corridors providing that stands in which medium or larger diameter trees are common and canopy closures are within the top one-third of site potential. Proposed harvest treatments would restore and maintain medium and larger diameter trees, however they would reduce canopy closure below the top one third of site potential in order to be lasting and effective. A project specific Forest Plan amendment is proposed to allow harvest and ladder fuel reduction treatments on a small portion of connectivity corridors to reduce canopy closure below the top one-third of site potential in order to reduce canopy fuels, improve resiliency to natural disturbances, and provide sustainable forested landscape connections between LOS, old growth, and management requirement habitats.

Analysis Methods:
The process utilized to identify and analyze late and old structure and Forest Plan old growth stands is described in Appendix E of the project Forest Vegetation Specialist report (Daily 2015). Proposed vegetation management treatment units were identified based on aerial photograph interpretation, and results of the stand structure HRV assessment. Proposed treatment units were subsequently verified during field reviews in 2012 and 2013 and once again in 2014 following the Carlton Complex wildfire.

Analysis Area:
The area analyzed for this indicator includes approximately 2,400 acres of identified Forest Plan mixed conifer old growth stands that occur on NFS lands in the project planning area.

Riparian Habitat Conservation Areas (Purpose and Need #2)
Management activities during the twentieth century have altered the species composition, structural diversity, and natural disturbance patterns of plant communities found within the project-area Riparian Habitat Conservation Areas (RHCAs). Large trees currently are less common compared to historic levels and tree stocking levels are sufficiently high in many RHCA stands not affected or changed by the Carlton Complex wildfire to hinder development of large tree structure for wildlife habitat, stream shade, and large woody debris. Aspen stands and other hardwood plant communities that occur within RHCAs not affected or changed by the fire are in decline compared to conditions that were prevalent at the turn of the twentieth century.

Indicator:
Acres treated within RHCAs to maintain and restore the tree species composition (including broadleaf trees such as aspen), structural diversity, and historical disturbance regimes to provide sustainable levels of large trees, snags, and down logs for riparian dependent species habitat.

Analysis Methods:
GIS data including RHCA boundaries and proposed vegetation and fuels treatments were used to determine where proposed treatments intersected with RHCAs. Proposed vegetation treatment units in RHCAs were verified by field review in 2012, 2013, and again in 2014 following the fire.

Analysis Area:
The area analyzed for this indicator includes approximately 2,800 acres of RHCAs that occur on NFS lands in the project planning area.

JR and Loup Loup Campgrounds (Purpose and Need #4)
Forest vegetation in JR and Loup Loup Campgrounds was not affected by the Carlton Complex wildfire. However, undesirable conditions have developed in the campgrounds due to management practices during the past century. Douglas-fir forest cover has expanded, tree stocking levels have increased, and susceptibility to insects and disease has increased to undesirable levels. These conditions are not conducive to maintaining the existing large trees or developing large trees in the future. Large Douglas-fir trees within the campgrounds are vulnerable to fatal bark beetle attacks associated with stress caused by competition with understory trees, western spruce budworm defoliation, and dwarf mistletoe infection. Large ponderosa pines in the campgrounds also are vulnerable to fatal pine bark beetle attacks associated with stress caused by competition with understory trees. The campgrounds are located within one-quarter mile of the Carlton Complex wildfire perimeter. Douglas-fir and pine beetle populations are expected to increase within the fire area for the next three to five years, increasing the likelihood of beetle attacks in the campgrounds and adjacent stands.

Indicator:
Acres treated within the campgrounds to maintain and improve the health of trees and reduce susceptibility to diseases and fatal insect attacks.

Analysis Methods:
The process used to identify and analyze proposed campground treatment units is identical to the process used to assess forest vegetation conditions for the entire project planning area.

Analysis Area:
The area analyzed for this indicator includes approximately 40 acres within the administrative boundaries of the JR and Loup Loup Campgrounds in the project planning area.

Reforestation of Areas Deforested by the Carlton Complex Wildfire (Purpose and Need #6)
As described above, the Carlton Complex fire created widespread tree mortality in the project area, eliminating a reliable seed source for post-fire natural regeneration of conifer forests on a large portion of the wildfire area. This is particularly uncharacteristic in the dry forest vegetation types which naturally regenerate from seed produced by live trees remaining after a fire. An estimated 14,000 acres for dry forest vegetation experienced stand-replacement fire which eliminated most or all seed producing conifers across extensive portions of the project area. Natural establishment of conifer regeneration in a large portion of areas deforested by the fire is expected take up to 30 or 40 years to attain the desired tree stocking levels and species mix needed to meet Okanogan Forest Plan standards and guidelines and management area goals. Planting conifers in areas which lack a reliable seed source for natural regeneration and are accessed by roads would ensure that timely reforestation and recovery of conifer forests would occur in a large portion of the project area that was deforested by the Carlton Complex wildfire.

Indicator:
Acres treated to reforest areas deforested by the Carlton Complex wildfire.

Analysis Methods:
Following the Carlton Complex wildfire, post fire forest vegetation conditions were evaluated using Burned Area Reflectance Classification (BARC) burn severity data. Methow Valley Ranger District personnel field reviewed areas affected by the fire to verify the accuracy of BARC data and identify post-fire vegetation conditions. During this process District personnel determined that high levels of tree mortality associated with stand replacement fire had occurred primarily in areas classified as moderate and high severity in the BARC data set.

Contiguous areas of high and moderate BARC severity were mapped and field verified to identify deforested areas and assess reforestation needs and operational limitations. Deforested areas on continuous slopes exceeding 50 percent or rocky unplantable soils were identified as natural recovery areas. Contiguous deforested areas with high natural regeneration potential, including areas which supported primarily lodgepole pine or deciduous (broadleaf) tree cover prior to the fire, were identified as natural recovery areas. Contiguous burned areas supporting ten or more viable seed-producing conifers per acre were identified as natural regeneration recovery areas. For the purpose of this analysis, viable seed-producing conifers would be 12 inches dbh and larger and have 30 percent or greater post-fire live crown ratios. Deforested areas located more than one half mile from existing roads also were identified as natural recovery areas due to operational limitations associated with tree planting. Tree planting units were then identified in remaining deforested areas with low natural regeneration potential located outside of natural recovery

areas. Proposed tree planting units include contiguous deforested areas located within one half mile of existing roads, on 50 percent or less slopes, with generally fewer than ten live seed-producing conifers per acre. Some deforested conifer plantations which include areas with slopes in excess of 50 percent were included in proposed tree planting units.

Analysis Area:
The area analyzed for this indicator includes the estimated 15,300 acres of land in the project area that was deforested by stand replacement burning in the Carlton Complex wildfire.

3.2.2 Affected Environment

Environmental Zones (Biophysical Environments)
Environmental zones based on temperature and moisture gradients were developed to describe the predominant environmental conditions in the project planning area. Environmental zones are synonymous with biophysical environments which are used later in this analysis to compare current stand structural stages to the Historic Range of Variability (HRV). Plant association modeling information, forest inventory and vegetation data, and field reconnaissance were used to develop this forest landscape classification system. Four separate zones were defined based on relative temperature and precipitation levels in order to broadly group those portions of the project area with similar ecological conditions. The Forest Vegetation Specialist report (Daily 2015) (Appendix F) provides a description of each environmental zone including the predominant forest vegetation types and natural disturbances (including fire, insects, and diseases, which typically occur in each zone). Figure 3.2-1 displays the estimated area of each environmental zone in the project planning area.

Figure 3.2-1: Environmental Zones in the South Summit II Forest and Fuels Project Area

Environmental Zone	Estimated Area	Portion of Project Area
Hot-Dry	12,900 acres	26%
Warm-Dry	28,300 acres	57%
Cool-Dry	6,100 acres	12%
Cool-Mesic	2,800 acres	6%

The hot-dry, warm-dry, and cool-dry environmental zones combined comprise approximately 94 percent of the project planning area. These three environmental zones support primarily dry Douglas-fir and ponderosa pine plant associations which collectively will be referred to as dry forest vegetation in this analysis. The cool-mesic environmental zone comprises approximately six percent of the total project area. The cool-mesic zone is moister than the dry forest zones and it supports mesic Douglas-fir and subalpine fir plant associations. A list of the primary forested plant associations found in all project area environmental zones is provided in Figure C-2 of Appendix C.

Forest Vegetation Conditions: Departure from historic stand structures and lack of resilience to natural disturbance
Forest management activities during the twentieth century have contributed to extensive changes in dry (Douglas-fir/ponderosa pine) and mesic forest vegetation conditions in the analysis area. Approximately 88 percent of the project planning area had been altered from

historical conditions based on fire regime condition class estimates prior to the Carlton Complex wildfire (Trebon 2014). Fire regime condition classes measure the level of departure from historic reference conditions for vegetation characteristics, fuel composition, and associated disturbances (Hann et al. 2004). Fire exclusion and timber harvest have altered project area forest stand structures with regard to tree species composition, tree stocking levels, size class distribution, and canopy layers that were prevalent at the beginning of the twentieth century. In general, the following changes to forest vegetation occurred in the analysis area during the twentieth century: 1) the proportion shade tolerant trees (primarily Douglas-fir) increased; 2) stands had become more densely stocked with trees; 3) stands comprised primarily of small trees had become more common; and 4) stands with multiple canopy layers had become more common.

Management activities during the twentieth century, including fire exclusion and selective harvesting of large trees, and the Carlton Complex wildfire have changed analysis area forest conditions to the point where existing proportions of early, middle, and late and old structure forest stands are substantially departed from estimated historic levels. An assessment of stand structural stages in the analysis area indicates that the percent composition (proportion) of current stand structures is outside the historic range of variability (HRV) for most of the structural stage/biophysical environment categories. Late and old structure stands (LOS) in particular are substantially departed from HRV. Currently there are approximately 2,730 acres of LOS stands in the analysis area which includes approximately 130 acres of single stratum with large trees (SSLT) stands and approximately 2,600 acres of multi-stratum stands with large trees (MSLT) stands. Single stratum stands with large trees (SSLT), comprised primarily of large conifers with a single tree canopy layer, currently are far less common in the analysis area when compared to historic levels and are below HRV in all biophysical environments. Conversely, the proportion of multi-stratum stands with large trees (MSLT), comprised of primarily large trees in the overstory canopy layer and smaller trees in the understory canopy layers, is higher compared to estimated historic levels and exceeds (is above) HRV in the analysis area dry forest biophysical environments. Due to the effects of the Carlton Complex wildfire (which caused an estimated 15,300 acres of stand replacement fire) early stand structures, particularly stand initiation, currently are far more common in the project area and exceed HRV in all biophysical environments. Another outcome of the fire is that the proportion of forest stands in the middle stages of structural development currently are below HRV in all biophysical environments. Scenario A of the Regional Forester's Forest Plan Amendment #2 applies to timber management activities in the analysis area because SSLT stands are below HRV in all biophysical environments. Appendix D in the project forest vegetation specialist report (Daily 2015) provides a detailed summary of the project area stand structural stage HRV assessment.

Tree species composition changes and widespread establishment of multiple tree canopy layers over the past century have greatly increased forest vegetation vulnerability to forest insects and diseases in the forested portions of the project planning area which were not affected by or experienced low-intensity burning during the Carlton Complex wildfire (Carlson et al. 1985, Hessburg et al. 2000, Hessburg et al. 2005). Shade-tolerant Douglas-fir is the predominant tree species throughout the remaining post-fire forested land in the analysis area, and this species shift has become one of the primary causal factors for increased levels of insect and disease susceptibility. Douglas-fir is more susceptible to damage caused by dwarf mistletoe, defoliators, and root disease than ponderosa pine, western larch, and lodgepole pine. Remaining forest stand structures generally have become more homogenous over the past century and large contiguous areas which are

susceptible to similar forest insect and disease complexes occupy a large proportion of the project area. Connectivity of areas vulnerable to dwarf mistletoe, defoliators, and root disease has increased primarily as a result of increased cover and connectivity of remaining Douglas-fir patches in the project area.

Susceptibility to insect defoliators including the western spruce budworm and Douglas-fir tussock moth has increased over the past century in the forested portions of the project planning area that were not affected by or experienced low intensity burning during the Carlton Complex wildfire. Repeated defoliation of host trees causes reduced tree growth, top-kill, and tree mortality. Western spruce budworm defoliation predisposes large Douglas-fir trees to often fatal Douglas-fir beetle attacks. Western spruce budworm susceptibility for the analysis area was estimated with a hazard rating model that was developed for the Methow Valley Ranger District Western Spruce Budworm Landscape Assessment. Figure 3.2-2 displays a summary of spruce budworm susceptibility throughout the project analysis area. Modeling indicates approximately 21 percent of the project area currently has high susceptibility to budworm defoliation and approximately 64 percent of the area has no estimated vulnerability. Western spruce budworm defoliation has been observed in the project area over the past eight years and is expected to continue on approximately 13,600 acres of forested land with high and moderate susceptibility ratings.

Figure 3.2-2: Western Spruce Budworm Susceptibility in the Project Analysis Area

Budworm Hazard Rating	Estimated Area	Portion of Analysis Area
High	10,600 acres	21%
Moderate	3,000 acres	6%
Low	4,300 acres	9%
None	32,200 acres	64%

Changes in forest structure and tree species composition in project area forest vegetation remaining following the Carlton Complex wildfire have generally led to increased tree stocking levels and increased competition among trees for water, nutrients, and growing space when compared to typical historic conditions. Stocking levels in many stands currently exceed density thresholds where ponderosa and lodgepole pines become highly susceptible to pine bark beetle attacks (Cochran et al. 1994, Cochran and Barrett 1998). Large ponderosa pines in particular are vulnerable to fatal bark beetle attacks due to elevated tree stocking levels in portions of the project area that were not affected by or experienced low intensity burning during the fire.

There are an estimated 600 total acres of aspen stands in the analysis area. Prior to the Carlton Complex wildfire, aspen stands in the project area were in decline when compared to the turn of the twentieth century. Conifer encroachment has been identified as one of the primary factors that contributed to the decline of aspen dominated stands in the project area. Approximately 180 acres of aspen stands were affected by high and moderate severity burning, and these stands are expected to benefit from the fire. Conifer encroachment has been eliminated or greatly reduced and ample regeneration of aspen stems from root suckering is expected to occur in high and moderate severity burned aspen stands. Approximately 420 acres of aspen stands were not affected by the fire or experienced low intensity fire which did not substantially reduce conifer encroachment from pre-fire levels. Conifer canopy cover exceeds 25 percent in many aspen stands which were unaffected by the fire or experienced low intensity fire. These unaffected and relatively unchanged aspen stands are classified as “successional to conifers” (Bartos and Campbell 1998; Hadfield and

Magelssen 2004) and are expected to shrink in size due to conifer encroachment. The majority of existing aspen stands in the project area are between 1 and 10 acres in size with approximately one third of stands being greater than 10 acres. The small size of many project area aspen stands puts them at risk of being extirpated, especially from conifer competition. Stands less than one acre in size are at the greatest risk (Hadfield and Magelssen 2004).

Forest Plan Old Growth

There currently are approximately 2,400 acres of Okanogan Forest Plan mixed conifer old growth in the analysis area. Vegetation and fuels conditions in these stands are similar to the majority of forested stands remaining in the analysis area following the Carlton Complex wildfire. Densely stocked multi-story stand canopy structures have developed with a general absence of natural fire disturbance for nearly a century prior to 2014. Canopy and surface fuel loading have increased from historic pre-settlement levels. Increased Douglas-fir cover, canopy layering, and fuel levels have increased the risk of insect outbreaks (including defoliators and bark beetles) and crown fires which could eliminate the large tree component of Forest Plan mixed conifer old growth. Dwarf mistletoe infection has spread from infected overstory trees into lower canopy layer trees. Bark beetles have killed large trees weakened by stress attributed to defoliation, dwarf mistletoe infection, and inter-tree competition and there is an increased risk of losing additional large trees to insect attacks following the fire. Tree stocking levels are hindering the development of future large trees (especially shade intolerant ponderosa pines and western larch) to maintain old growth stand structure. Existing old growth conditions generally are not sustainable over the long term due to increased tree stocking levels and fuel loading remaining after the fire.

Forest Plan old growth stands in the analysis area appear to be more susceptible to the western spruce budworm than the remainder of forest stands in the analysis area. Figure 3.2-3 displays a summary of project area Forest Plan old growth spruce budworm susceptibility. The spruce budworm hazard rating model indicates that forest vegetation conditions in old growth stands are more susceptible to budworm defoliation and subsequent tree damage, including bark beetle caused mortality, than other forest stand conditions in the project area. Approximately 63 percent of old growth vegetation is highly or moderately susceptible to budworm defoliation compared to approximately 24 percent of non-old growth forested stands in the analysis area.

Figure 3.2-3: Forest Plan Old Growth Western Spruce Budworm Susceptibility

Budworm Hazard Rating	Estimated Area	Portion of Analysis Area Old Growth
High	1,160 acres	48%
Moderate	350 acres	15%
Low	260 acres	11%
None	640 acres	26%

Riparian Habitat Conservation Areas

There are approximately 2,800 acres in RHCAs within the project planning area. An estimated 800 acres of planning area RHCAs were affected by high and moderate severity burning in the Carlton Complex wildfire, causing substantial changes to forest vegetation. An estimated 1,300 acres of project area RHCAs were not affected by the fire and 700 acres of RHCAs were affected by low intensity burning with little or no change to forest vegetation conditions.

Vegetation and fuels conditions currently found in project area RHCAs not affected or changed by the Carlton Complex wildfire have been extensively altered from historical conditions. Management activities during the twentieth century have altered the stand structures and natural disturbance patterns of forest vegetation RHCAs not affected or changed by the fire. Fire exclusion and timber harvest have altered tree species composition, tree stocking levels, and size class distribution of many RHCA forest stands, especially in the dry forest environmental zones. Shade tolerant Douglas-fir forest cover has expanded, tree stocking levels have increased, forest canopy layering has increased, and average tree size has decreased in response to these management practices. Large trees currently are less common compared to historic levels and tree stocking levels are sufficiently high in many RHCA stands to hinder the maintenance and development of large trees.

Forest vegetation resilience to natural disturbances including insects, diseases, and wildfire has decreased compared to historical conditions in project area RHCAs not affected or changed by the Carlton Complex fire. Douglas-fir dwarf mistletoe infection and insect defoliation levels have increased due to the expanded area of Douglas-fir cover, increased canopy layering, and increased contiguity (connectivity) of host patches. Existing large ponderosa pines and Douglas-firs are vulnerable to fatal bark beetle attacks due to elevated tree stocking levels and increased competition among trees for water, nutrients, and growing space within dry and mesic forest vegetation zone RHCAs. These conditions are compounded by an increased risk of stand replacing wildfire within RHCAs and adjacent upland dry forest areas caused by high levels of surface, ladder, and canopy fuel loading that have developed over the past century. Aspen stands and other broadleaf plant communities that occur within RHCAs not affected or changed by the fire also are in decline compared to conditions that were prevalent at the turn of the twentieth century.

JR and Loup Loup Campgrounds

Forest vegetation conditions in JR and Loup Loup Campgrounds are similar to the prevailing conditions found in project planning area Forest Plan old growth. Douglas-fir forest cover is predominant, tree stocking levels have increased, and susceptibility to insects and disease has increased to undesirable levels. These conditions are not conducive to maintaining the existing large trees, which are an important element of the campground user recreation experience, or developing large trees in the future. Large Douglas-firs are vulnerable to fatal bark beetle attacks associated with stress caused by competition with understory trees, western spruce budworm defoliation, and dwarf mistletoe infection. Douglas-fir beetles have killed a substantial number of large Douglas-fir trees in and adjacent to Loup Loup and JR Campgrounds over the past three years. Remaining large ponderosa pines are vulnerable to fatal bark beetle attacks associated with stress caused by competition with understory trees. Both campgrounds are located within one quarter mile of the Carlton Complex wildfire perimeter and Douglas-fir and pine beetle populations are expected to increase within the fire area for the next three to five years increasing the likelihood of beetle attacks in the campgrounds and adjacent stands.

3.2.3 Environmental Consequences

3.2.3.1 No Action Alternative

Forest Vegetation Conditions: Departure from Historic Stand Structures and Lack of Resilience to Natural Disturbance

Expected future conditions without treatment would not meet Purpose and Need #1 to improve or maintain the resiliency of mixed conifer forests to natural disturbances. Forest vegetation resiliency to natural disturbances including insects, diseases, and wildfire would decline in the forested portions of the project area which were not affected by the Carlton Fire or experienced low intensity fire and remain relatively intact compared to pre-fire conditions. Forest stand structures which have been altered with regard to historic tree species composition, stocking levels, size classes, and canopy layers would remain vulnerable to insect defoliators, bark beetles, dwarf mistletoe infection, and ultimately wildfire.

Forest stands currently dominated by large and old trees and remnant large trees in mature and young stands would continue to decline. Douglas-fir forest cover and tree canopy layering would continue to expand, increasing the amount and connectivity of area that is susceptible to dwarf mistletoe infection and insect defoliation. Chronic insect defoliation coupled with increased tree stocking levels would be expected to increase bark beetle attacks and mortality of large Douglas-fir trees on an estimated 10,600 acres (approximately one third of post-fire forested land) in the project area. Elevated tree stocking levels would predispose ponderosa and lodgepole pines to fatal bark beetle attacks. Large ponderosa pines and western larch trees and ponderosa pine, western larch, and lodgepole pine forest cover would continue to decline as shade tolerant Douglas-fir forest cover increases in forested areas that were not affected by the Carlton Fire or remain relatively unchanged from pre-fire conditions.

The proportion of late and old, middle, and early stand structural stages in the analysis area would remain departed from the historic range of variability (HRV) for most of the stand structural stage/biophysical environment categories. Late and old stand structures would trend toward higher levels of departure from HRV, compared to current conditions, for all dry forest biophysical environments in the analysis area. Single canopy stands with large trees (SSLT) would be expected to decline and remain well below HRV in all biophysical environments. The proportion of multi-stratum stands with large trees (MSLT) would be expected to increase slightly as some SSLT stands in the project area develop into MSLT, and MSLT stands would remain well above HRV in all dry forest biophysical environments. The proportion of early structure stands, primarily stand initiation, would remain well above HRV in all forest biophysical environments. The proportion of middle structure stands would remain below HRV in all biophysical environments.

Aspen forest cover not affected or relatively unchanged by the Carlton Fire would continue to decline due to increased levels of conifer encroachment, especially in small aspen stands which are less than one acre in size. Expanding, primarily Douglas-fir, forest cover would increase levels of competition for sunlight and soil moisture, contributing to aspen decline.

Forest Plan Old Growth

Expected future conditions without treatment would not meet Purpose and Need #1 maintain and develop sustainable vegetation and fuels conditions in existing Forest Plan old growth stands and limit the likelihood of losing late and old structure stands during wildfires and

other natural disturbances, including insect and disease outbreaks.

Forest vegetation and fuels conditions that have developed in the absence of natural fire disturbance for nearly a century prior to 2014 would be retained. Existing tree stocking levels, tree species composition, and canopy layering would maintain an elevated risk of insect outbreaks (including defoliators and bark beetles) and high severity fire that could eliminate the large and old tree component of Forest Plan mixed conifer old growth. Tree stocking levels would contribute to competitive stress on existing large trees and hinder the development of future large trees (especially shade intolerant ponderosa pines and western larch) to maintain old growth stand structure. Dwarf mistletoe infection would increase, primarily in the lower canopy layers, increasing canopy fuels and vertical fuel connectivity. Fire resiliency would remain compromised due to multiple tree canopy levels and connectivity of surface and canopy fuels.

Riparian Habitat Conservation Areas

Expected future conditions without treatment in Riparian Habitat Conservation Areas (RHCAs) not affected or changed by the Carlton Complex wildfire would not meet Purpose and Need #2 to maintain and restore the historic species composition (including broadleaf trees such as aspen), structural diversity, and natural disturbance regimes required to provide sustainable levels of large trees, snags, and down logs for riparian dependent species habitat.

Stand structures and fuel loading in RHCA forest stands not affected or changed by the fire would remain altered from historic levels. Densely stocked stands of predominantly small diameter, shade tolerant conifers would remain susceptible to uncharacteristic levels of damage caused by insects, diseases, and wildfire. High levels of surface, ladder, and canopy fuel loading would remain within RHCAs and adjacent upland forest areas.

Inter-tree competition levels would remain elevated and existing large trees would continue to be vulnerable to fatal bark beetle attacks in RHCAs not affected or changed by the fire. Tree stocking levels would impede the development of additional large trees, and large conifers would become less common. Aspen and other broadleaf trees would decline due to competition with encroaching conifers. Fire resiliency would decline as large fire resistant conifers become less prominent, small diameter fire intolerant trees become more prevalent, and fuel loading increases in RHCA timber stands. Large wood recruitment and natural disturbance regimes for forest insects, diseases, and wildfire would not be restored to historic levels.

JR and Loup Loup Campgrounds

Expected future conditions without treatment would not meet Purpose and Need #4 to maintain and improve overall health of trees within and adjacent to Loup Loup and JR Campgrounds by reducing tree competition and susceptibility to attack by insects and diseases.

The health and resiliency of trees growing in and adjacent to the campgrounds would continue to decline. Tree stocking and Douglas-fir forest cover would be maintained at current levels which are undesirable for insect and disease resistance. Large trees would continue to be subjected to competitive stress and susceptibility to fatal bark beetle attacks which are likely to increase for the next three to five years following the Carlton Complex fire. Tree stocking levels in some areas would hinder the development of additional large trees and ponderosa pine and western larch tree cover would be expected to decline. Dwarf

mistletoe infection levels would be expected to increase, especially in understory trees, and large trees with heavy infections would be expected to decline in health and eventually die.

Reforestation of Areas Deforested by the Carlton Complex wildfire
Expected future conditions with no action would not meet Purpose and Need #6 of ensuring timely reforestation in areas deforested by the Carlton Complex wildfire where a reliable seed source for conifer regeneration was eliminated by the fire. Approximately 14,000 acres of dry forest vegetation experienced stand replacement burning which eliminated all or most seed producing conifers needed to naturally regenerate the dry forest tree species that were present prior to the fire. Seed dispersal from surviving trees within and adjacent to the perimeter of deforested areas would be relied on to establish seedlings and restock dry forest vegetation stands. Based on the wide extent of stand replacement burning and estimated seed dispersal rates of 200 to 300 feet from surviving trees within and adjacent to burned areas, desired levels of conifer natural regeneration most likely would become established on an estimated 10 percent (approximately 1,400 acres) of deforested dry forest land within 10 to 20 years following the fire. Desired levels of dry forest conifer natural regeneration (100 or more trees per acre) most likely would become established on an additional 80 percent (approximately 11,200 acres) of deforested dry forest land within an estimated 30 to 40 years following the fire. Desired levels of conifer regeneration would require 50 or more years to become established on the most severe dry forest sites deforested by the fire.

Approximately 1,300 acres of cool-mesic forest vegetation experienced stand replacement burning during the fire. Lodgepole pines with serotinous cones were present in a large portion of cool-mesic forest areas prior to the fire and are expected to provide a reliable seed source for lodgepole pine following the fire. Lodgepole pine regenerates primarily from seeds stored in serotinous cones which are dispersed when the cones open during stand replacement fires. Surviving trees, other than lodgepole pines, within and adjacent to deforested areas would also disperse seed and supplement natural regeneration establishment on burned cool-mesic sites which are highly favorable for seedling establishment. Desired levels of conifer natural regeneration (200 or more trees per acre) most likely would become established on all deforested cool-mesic forest land within 10 to 20 years following the fire.

3.2.3.2 Proposed Action

Forest Vegetation Conditions: Departure from historic stand structures and lack of resilience to natural disturbance
Proposed vegetation and subsequent fuels management treatments would improve or maintain the resiliency of mixed conifer forests to natural disturbances including insects, diseases, and wildfire. Vegetation management treatments would be implemented on approximately 3,310 acres to maintain and restore mixed conifer forest conditions that reflect historical tree density, spatial patterning, species composition, and size classes, including large fire-resistant trees.

Approximately 2,350 acres of commercial harvest and 960 acres of noncommercial thinning treatments would be applied to address undesirable changes in forest structure and composition which have occurred over the past century and reduce forest vegetation vulnerability to forest insects and diseases and wildfire. Proposed harvest and

noncommercial thinning treatments would retain all existing large trees 21 inches dbh and larger and promote the development of additional large trees. No broadleaf trees including aspen would be harvested. Appendix B provides a detailed list of all proposed vegetation management treatment units including harvest and non-harvest treatment descriptions, environmental zones, current stand structures, and other site information. Detailed descriptions of proposed vegetation management treatments including desired tree retention objectives are provided in Appendix C. Proposed commercial harvest and noncommercial thinning treatments would occur on approximately five percent and two percent respectively of forest vegetation in the project planning area.

Harvest treatment units would avoid extensive areas (larger than one acre) which experienced high levels of tree mortality associated with high or moderate BARC burn severity during the Carlton Complex wildfire. Approximately 68 % of proposed harvest treatment acres are located outside of the wildfire area. Approximately 15% of proposed harvest acres are located in unburned areas within the fire perimeter. Approximately 17% of harvest acres are located in low severity burned areas. Less than 1% of proposed harvest acres are located in moderate or high severity burned areas. Fire-killed trees within harvest units which are standing or down at the time of timber marking will not be designated for removal during harvest operations. Snags in harvest units will be protected in the timber sale contract with the Leave Dead Standing contract provision. Snags felled to mitigate danger tree safety hazards associated with timber harvest operations would remain on site and not be removed from timber harvest units. Fire created openings within harvest thinning units would be considered canopy gaps which are a treatment objective of restoring the historic spatial pattern of trees. Live tree retention levels of harvest thinning units with fire created openings would not be reduced. The desired number of live trees per acre retained would be based on the total acres in each unit including fire created openings.

Figure 3.3-4 provides a summary of vegetation management treatments that would occur within each environmental zone of the project area. Approximately 98 percent of all harvest treatments would occur within the hot-dry, warm-dry, or cool-dry environmental zones. Approximately 89 percent of all proposed noncommercial thinning would occur within these same dry forest environmental zones.

Figure 3.3-4. Vegetation Management Treatments within Project Area Environmental Zones.

Vegetation Management Treatment	Hot-Dry Environmental Zone Forest Vegetation (9,800 acres)		Warm-Dry Environmental Zone Forest Vegetation (26,700 acres)		Cool-Dry Environmental Zone Forest Vegetation (6,000 acres)		Cool-Mesic Environmental Zone Forest Vegetation (2,800 acres)		Total Treatment Acres
	Acres treated	Portion treated	Acres treated	Portion treated	Acres treated	Portion treated	Acres treated	Portion treated	
Commercial thinning	180	2%	1,410	5%	0	0%	0	0%	1,590
Commercial thinning with dwarf mistletoe treatment	52	< 1%	528	2%	0	0%	32	1%	612

Vegetation Management Treatment	Hot-Dry Environmental Zone Forest Vegetation (9,800 acres)		Warm-Dry Environmental Zone Forest Vegetation (26,700 acres)		Cool-Dry Environmental Zone Forest Vegetation (6,000 acres)		Cool-Mesic Environmental Zone Forest Vegetation (2,800 acres)		Total Treatment Acres
	Acres treated	Portion treated	Acres treated	Portion treated	Acres treated	Portion treated	Acres treated	Portion treated	
Quaking aspen maintenance w/ commercial thinning	0	0%	32	< 1%	0	0%	9	< 1%	41
Campground thinning	0	0%	35	< 1%	0	0%	0	0%	35
Seed tree regeneration	0	0%	70	< 1%	0	0%	0	0%	70
Noncommercial thinning	0	0%	689	3%	173	3%	102	4%	964
Total	232	2%	2,764	10%	173	3%	143	5%	3,312

Harvest Thinning

A combined total of approximately 2,280 acres of harvest thinning treatments (including commercial thinning, commercial thinning with dwarf mistletoe treatment, quaking aspen maintenance with commercial thinning, and campground thinning) would be implemented to maintain and restore forest vegetation conditions that reflect historical tree densities, species composition, canopy structures, and size classes including large and old trees. In addition, harvest thinning would maintain and restore historical spatial patterning of trees including individual trees, clumps, and canopy gaps (Churchill et al. 2013a, Larson and Churchill 2012, Larson et al. 2012). Harvest thinning treatments would reduce tree stocking levels, reduce understory tree canopy layering, reduce the proportion of shade tolerant tree cover, maintain existing large and old trees, and promote the development of additional large trees on approximately five percent of forest vegetation in the analysis area.

Harvest thinning and subsequent post-harvest ladder fuel reduction treatments would improve forest vegetation resilience to insect and disease attacks and long term sustainability of treated stands. Tree stocking levels would be reduced to decrease competitive stress, prevent bark beetles from killing existing large ponderosa pines (Cochran and Barrett 1998, Fiedler 1996, Skov et al. 2004, Stone et al. 1999), and maintain vigorous large diameter Douglas-firs (Jenkins et al. 2008) and western larch. Harvest thinning would reduce susceptibility to insect defoliators and dwarf mistletoe infection by reducing the proportion of Douglas-fir stocking and removal of shade tolerant understory tree canopy layers in treated stands. Harvest thinning would reduce dwarf mistletoe infection levels and confine heavy infections to individual or groups of larger trees following treatment.

Harvest thinning treatments would create less hospitable environmental conditions for insect defoliators like the western spruce budworm (Fellin et al. 1984). Thinning would reduce Douglas-fir forest cover and tree canopy layering. The proportional composition (percentage) of early seral tree species including ponderosa pine, western larch, quaking aspen, and lodgepole pine would increase in treated stands. Resilience to defoliation of thinned stands, including tree survival and recovery following relief of insect feeding pressure, would improve due to reduced competition for site resources between residual trees. The proposed action would reduce the amount and connectivity of area that is

susceptible to insect defoliation. Figure 3.3-5 displays a summary of current western spruce budworm susceptibility in proposed harvest thinning units. The proposed action would reduce western spruce budworm vulnerability on an estimated four percent of forest vegetation in the analysis area. Western spruce budworm susceptibility would be reduced on an estimated 900 acres with a high budworm hazard rating which represents approximately eight percent of all land in the analysis area with a high hazard rating.

Figure 3.3-5: Western Spruce Budworm Susceptibility in Proposed Harvest Thinning Treatment Areas

Budworm Hazard Rating	Area Treated	Portion of Analysis Area Forest Vegetation
High	910 acres	2%
Moderate	290 acres	<1%
Low	440 acres	1%
None	640 acres	1%

Harvest thinning treatments would maintain and restore approximately 26 acres of aspen stands and reverse the current trend of aspen decline in the project area. Approximately four percent of aspen stands in the analysis area would be treated in harvest units to provide favorable conditions for the maintenance and expansion of treated aspen stands. Three harvest units totaling 41 acres would apply the Quaking aspen maintenance with commercial thinning treatment, and aspen stands greater than one quarter acre in size located within 16 additional harvest treatment units would also be treated to remove encroaching conifers. Figure B-1 of Appendix B displays estimated aspen treatment acres within each harvest unit. Conifer removal would occur within aspen stands and a 50 foot buffer located adjacent to treated aspen stand perimeters to reduce competition for sunlight and soil moisture from invading conifers to maintain existing aspen trees and stimulate aspen regeneration and clonal expansion (Shepherd, et al 2006; Swanson, et al. 2010). Desired treatment objectives include ten percent or less conifer canopy closure following conifer removal in treated aspen stands and the 50 foot buffer (Swanson, et al. 2010). The largest conifers present would be retained up to a maximum of ten conifers per acre. All large conifers 21 inches dbh and larger would be retained even if residual conifer stocking exceeds the desired maximum level. Aspen stands, including vulnerable stands less than one acre in size, would benefit from proposed quaking aspen maintenance treatments for approximately 40 to 50 years before conifer reinvasion and encroachment would increase to undesirable levels.

Immediately following completion of all proposed vegetation and subsequent fuels treatments the proportion of late and old, middle, and early stand structures in the analysis area would remain departed from HRV. Over the long term, approximately, 20 to 30 years after treatment, levels of departure from HRV for most of the stand structural stage/biophysical environment categories would decline. Late and old structure (LOS) stands in particular would trend toward lower levels of departure from HRV, compared to current conditions in the analysis area. Harvest thinning treatments would be applied to approximately 190 acres of multi-stratum with large trees (MSLT) stands to eventually restore single stratum with large trees (SSLT) structure on about seven percent of LOS stand acreage in the analysis area. This would reduce the current surplus of MSLT forest acres and reduce the existing deficit of SSLT acres in the analysis area. Proposed harvest treatments in MSLT and other stand structures are displayed in Figure B-1 of Appendix B. Figure 3.3-6 displays a summary of proposed harvest treatments in LOS stands. Harvest

thinning treatments in early and middle structure stands in dry forest vegetation biophysical environments would promote the restoration of LOS stand proportions to HRV over the long term. Harvest thinning treatments on approximately 60 acres of early structure stands (stem exclusion closed canopy) and approximately 2,090 acres of middle structure stands (76 acres of understory reinitiation and 2,015 acres of young forest multistory) would maintain existing large trees and promote the development of historic LOS stand conditions on approximately five percent of forest vegetation in the analysis area.

Figure 3.3-6. Proposed Harvest Treatments in Late and Old Structure (LOS) Stands in Project Area Environmental Zones.

Harvest Treatment	Hot-Dry Environmental Zone (313 acres total LOS)		Warm-Dry Environmental Zone (1,429 total acres LOS)		Cool-Dry Environmental Zone (678 total acres LOS)		Cool-Mesic Environmental Zone (313 total acres LOS)		Total Treatment Acres
	Acres treated	Portion of LOS treated	Acres treated	Portion of LOS treated	Acres treated	Portion of LOS treated	Acres treated	Portion of LOS treated	
Commercial thinning	0	0%	62	20%	0	0%	0	0%	62
Commercial thinning with dwarf mistletoe treatment	0	0%	55	4%	0	0%	32	10%	87
Quaking aspen maintenance w/ commercial thinning	0	0%	0	0%	0	0%	9	3%	9
Campground thinning	0	0%	35	2%	0	0%	0	0%	35
Total	0	0%	152	11%	0	0%	41	13%	193

Proposed harvest thinning and post-harvest fuels management treatments would improve fire resiliency of treated stands (Agee and Skinner 2005, Hessburg et al. 2005). Harvest thinning would promote the development of fire resilient stand structures by reducing tree density and forest canopy cover, removing smaller less fire resistant trees, restoring single canopy stand structures, and retaining larger fire resistant trees. Post-harvest fuels treatments, including ladder fuel reduction and piling and burning, would reduce surface and ladder fuels to complete the task of creating fire resilient forest conditions in harvest thinning units (Agee and Skinner 2005, Graham et al. 2004, Peterson et al. 2005). Treated timber stands would benefit from proposed vegetation and fuels reduction treatments for approximately 15 to 20 years before tree stocking levels and fuels increase to undesirable levels.

Seed Tree Regeneration

Approximately 70 acres of seed tree regeneration harvest would occur in stands stocked primarily with dwarf mistletoe infected or suppressed Douglas-fir trees which have become

established following fire exclusion during the twentieth century. Current conditions in these stands, including the extent of diseased and susceptible trees, precludes the option of thinning to maintain and restore large trees and forest vegetation resilience to natural disturbances. No regeneration treatments would occur in late and old structure stands. Proposed regeneration treatment units comprise approximately 0.2 percent of the total forest vegetation in the analysis area. This treatment would remove fell and remove the majority of merchantable trees to reduce Douglas-fir stocking and dwarf mistletoe infection levels and create site conditions that are favorable for the regeneration of early seral tree species including ponderosa pine and aspen. No aspen or other broadleaf trees would be harvested.

Seed tree treatment objectives include retention of approximately ten conifer trees per acre average for structural and biological diversity. All conifers 21 inches dbh and larger would be retained. In addition, ponderosa pines and dwarf mistletoe free Douglas-firs which are among the largest trees remaining in these units (generally 16 inches dbh and larger) would also be retained as individual trees and in clumps to achieve the desired tree retention numbers. Following harvest, all remaining diseased, damaged, or suppressed conifers less than nine inches dbh would be felled to prepare the site for prescribed burning and reforestation. Dwarf mistletoe infected Douglas-fir trees 21 inches dbh and larger with an estimated age of less than 150 years (based on criteria described in Van Pelt 2008) may be girdled or felled and retained on site in order to prevent infection of Douglas-fir natural regeneration that becomes established following harvest. Reforestation would be accomplished by planting of ponderosa pine seedlings grown from locally adapted seed to ensure prompt establishment of ponderosa pine regeneration, natural seeding of Douglas-fir and other conifers, and suckering of aspen stems from clones within regeneration harvest units

Regeneration harvest would restore elements of historic Douglas-fir/ponderosa pine forest conditions including tree species composition and eventually predominant size classes. Resiliency to diseases and insects that affect Douglas-fir forests would improve in and adjacent to treated stands. Current and future dwarf mistletoe infection levels would be reduced by removing the majority of infected trees and susceptible hosts and changing the tree species composition to a mix of primarily non-host species including ponderosa pine. Proposed regeneration treatments would break up the continuity of dwarf mistletoe susceptible hosts across the landscape and prevent or reduce disease spread into adjacent uninfected stands. Regeneration harvest treatments would reduce susceptibility to western spruce budworm defoliation by changing the tree species composition to a high proportion of ponderosa pine and other non-host tree species which provide low quality budworm habitat (Carlson et al. 1985). Seed tree regeneration harvest would be expected to have beneficial effects on forest vegetation conditions for approximately 20 to 30 years following treatment completion before tree stocking and species composition would begin to change from desired levels.

Noncommercial Thinning

Approximately 960 acres of noncommercial thinning would occur in young conifer stands stocked primarily with seedlings, saplings, and pole sized trees less than nine inches dbh. The majority of noncommercial thinning treatments would occur in stands where trees were planted or naturally regenerated approximately ten to 30 years ago. Conifers (less than seven to nine inches dbh) would be thinned with chainsaws to improve or maintain the vigor of residual trees, promote a mix of early seral conifer and broadleaf tree species composition, maintain existing overstory trees, and reduce disease infection of understory

trees. Small conifers growing in close proximity to aspen stems would be felled to maintain aspen clones in treated stands. Approximately 20 acres of aspen stands (about two percent of all analysis area aspen stands) would be treated to remove competing conifers. Appendix B displays estimated aspen treatment acres within noncommercial thinning units. Slash created by thinning would be lopped and scattered or hand piled and burned as needed.

Noncommercial thinning would maintain or restore the historic tree species composition and provide tree stocking levels that would promote the development of historic Douglas-fir/ponderosa pine forest conditions in treated stands. Tree stocking levels would be reduced to maintain or improve the vigor of residual trees and provide growing space to foster the development of larger trees. Existing overstory trees would be retained to promote structural diversity in these immature stands. Susceptibility to forest insects and diseases would be reduced following thinning. Forest vegetation conditions would benefit from proposed noncommercial thinning treatment for approximately 30 to 40 years before tree stocking and inter-tree competition increase to undesirable levels.

Forest Plan Old Growth

The proposed action would meet Purpose and Need #1 by implementing vegetation and subsequent fuels management treatments approximately 185 acres to maintain and develop sustainable vegetation and fuels conditions in Forest Plan old growth stands and limit the likelihood of losing late and old structure stands during wildfires and other natural disturbances, including insect and disease outbreaks. The proposed action meets PHarvest thinning and post-harvest fuels management treatments would occur on approximately eight percent of Forest Plan mixed conifer old growth acreage in the analysis area to reduce understory tree canopy layering, reduce the proportion of shade tolerant tree cover, maintain existing large and old trees, and promote the development of additional large trees. Proposed Forest Plan old growth harvest treatments would be identical to the description of late and old harvest treatments previously displayed. All proposed Forest Plan old growth harvest treatments would occur in multi-strata with large trees (MSLT) late and old structure stands. Figure B-1 of Appendix B of the vegetation specialist's report (Daily 2015) displays which proposed harvest units are located in MSLT late and old structure stands and Forest Plan old growth treatment acres.

The following treatment objectives would be implemented to retain Forest Plan old growth structural components:

- Maintain live trees 18 inches dbh and larger at an average rate of 15 or more per acre (except where aspen maintenance thinning harvest treatment is proposed on an estimated two acres).
- Retain at least 90 percent of live trees 20 inches dbh and larger where prescribed fire is applied.

Proposed harvest and post-harvest fuels management treatments would improve fire resiliency of treated old growth stands. Harvest thinning would promote a fire resilient stand structure by reducing tree density and forest canopy cover, removing smaller less fire resistant trees, and retaining larger fire resistant trees. Post-harvest fuels treatments would reduce surface and ladder fuels to complete the task of creating fire resilient conditions in old growth stands (Agee and Skinner 2005, Graham et al. 2004, Peterson et al. 2005). Benefits from proposed vegetation and fuels reduction treatments would last for approximately 15 to 30 years before tree stocking levels and fuels increase to undesirable levels.

Harvest thinning and post-harvest fuels management treatments would occur on approximately 19 acres of connectivity corridors located between late and old structure (LOS) stands and Forest Plan designated “old growth and Management Requirement” habitats. Connectivity corridor harvest treatments would occur on the fringe or outer edges of approximately 14 proposed harvest thinning units located throughout the analysis area. Figure B-1 of Appendix B in the specialist’s report displays proposed connectivity corridor harvest treatment acres. Proposed harvest and fuels treatments would restore and maintain medium and larger diameter trees and reduce canopy fuels on approximately two percent of the analysis area connectivity corridor acreage. Proposed harvest and post-harvest fuels treatments would improve resiliency to natural disturbances (including insect and disease attacks and stand replacing fire) and promote sustainable landscape connectivity between late and old structure (LOS) stands and Forest Plan designated “old growth and Management Requirement” habitats.

Riparian Habitat Conservation Areas

The proposed action would meet Purpose and Need #2 by implementing vegetation management treatments on approximately 246 acres to maintain and restore the species composition (including broadleaf trees such as aspen), structural diversity, and natural disturbance patterns of plant communities found within Riparian Habitat Conservation Areas (RHCAs) to provide large conifers and attain riparian management objectives. Harvest thinning, noncommercial thinning, and subsequent post thinning fuels management treatments would be applied on approximately 64 acres. Post-fire tree planting of conifer seedlings would occur on approximately 182 acres to reforest RHCAs burned by the Carlton Complex wildfire. Vegetation management treatments in RHCAs would be implemented exclusively on dry or mesic forest sites; wetlands and areas with riparian vegetation would be avoided. Harvest and non-harvest treatment buffers which are part of the Design Criteria for the proposed action (described in Appendix A) would be employed to protect wetlands, streams, and other riparian features. All proposed RHCA harvest treatments (approximately 33 acres total) would be located on the uphill side of existing roads in areas not burned by the Carlton Complex wildfire. Proposed RHCA harvest would be conducted during the winter logging season as described in the Design Criteria for soil protection. Appendix B displays RHCA treatment acres in proposed harvest and non-harvest vegetation management treatment units. Figure 3.3-7 provides a summary of all forest vegetation management treatments that would be applied in RHCAs with the proposed action.

Figure 3.3-7: Riparian Habitat Conservation Area Forest Vegetation Management Treatments

Vegetation Management Treatment	Acres Treated	Portion of Total RHCA Acres
Commercial Thinning	17	<1%
Commercial Thinning with Dwarf Mistletoe Treatment	3	< 1%
Quaking Aspen Maintenance with Commercial Thinning	13	<1%
Noncommercial Thinning	31	1%
Tree Planting	182	7%
Total	246	9%

Vegetation and subsequent fuels management treatments would be implemented to restore historic tree species composition, structural diversity, and natural disturbance regimes for

forest insects, diseases, and wildfire. Tree stocking levels would be reduced and tree species composition adjusted in densely stocked stands of predominantly small diameter, shade tolerant conifers. Large conifers would be maintained and restored in RHCAs to provide large woody debris in both the short term and long term. Tree stocking levels in overstocked stands would be reduced to decrease competitive stress and prevent bark beetles from killing existing large ponderosa pines and Douglas-firs and promote the development of future large trees. Removal of encroaching conifers would maintain and restore aspen stands and other broadleaf trees. Fire resilient forest conditions would be restored by reducing fuel loading to levels consistent with pre-settlement fire regimes and maintaining and restoring large fire resistant conifers and aspen stands in treated RHCA areas.

JR and Loup Loup Campgrounds

The proposed action would meet Purpose and Need #4 by implementing vegetation management treatments to maintain and improve overall health of trees within and adjacent to Loup Loup and JR Campgrounds by reducing (inter-) tree competition and susceptibility to attack by insects and diseases. The campground thinning harvest treatment would be applied on approximately 35 acres total within the administrative boundaries of both campgrounds. No vegetation management treatments would occur in RHCAs located within the campgrounds. Tree stocking levels would be reduced to maintain existing large trees and provide for the development of future large trees. Competitive stress on existing large trees and susceptibility to fatal bark beetle attacks would be reduced following treatment. Douglas-fir forest cover would be reduced primarily in the understory canopy layer. Dwarf mistletoe infection levels would be reduced including the proportion of heavily diseased trees following treatment. Susceptibility to future dwarf mistletoe infections would be reduced by the removal of Douglas-fir understory trees which are potential disease hosts. Vigorous ponderosa pines and western larch would be retained to improve resistance to disease and promote species diversity in the campground.

The insect anti-aggregation pheromone commonly referred to as MCH (3-methylcyclohex-2-en-1) would be applied in the campgrounds to prevent Douglas-fir beetle attacks on large Douglas-fir trees for a period of three to five years starting in 2015. MCH is a compound produced by male Douglas-fir beetles which signals that a particular tree has been fully colonized, causing other male and female Douglas-fir beetles to avoid that tree. MCH would be applied in a bubble capsule form which is a thin flexible plastic device about one by two inches in size with a bubble near one end containing MCH. Bubble capsules would applied two times per year prior to the emergence of adult Douglas-fir beetles which depending on weather conditions occurs in the spring (April-early May) and summer (July-early August) to prevent beetle attacks. The bubble capsules would be hand stapled to trees in the campgrounds approximately 40 feet apart, which would result in a distribution of 30 “bubble caps” per acre. The bubble caps would be positioned approximately six to ten feet off the ground on standing trees located outside of the flood plain of streams. Bubble caps are brown in color so that they blend in with tree color.

MCH in a bubble capsule formulation is registered with the EPA. When properly applied MCH is very effective at preventing Douglas-fir beetle attacks. Each year since the spring of 2000, several thousand acres of high-value Douglas-fir stands have been treated with MCH throughout the western United States to prevent Douglas-fir beetle attacks (Ross et al. 2006). To date, there have been no reports of unsatisfactory results, including evidence of increased tree mortality in areas directly adjacent to those treated with MCH.

Reforestation of Areas Deforested by the Carlton Complex wildfire
Expected future conditions with the proposed action would meet Purpose and Need #6 of ensuring timely reforestation in areas deforested by the Carlton Complex wildfire where a reliable seed source for conifer regeneration was eliminated by the fire. Approximately 8,300 acres of tree planting would occur primarily in dry forest vegetation areas that experienced stand replacement burning which eliminated the seed source for conifer natural regeneration. This represents approximately 54 percent of all forest land deforested by the fire. Appendix B provides a list of all proposed tree planting treatment units located in the fire area. Tree planting would ensure that desired levels of conifer regeneration would become established on treated areas within 10 years following the fire.

A species mix of conifer seedlings including ponderosa pine, western larch, Douglas-fir, and in very limited situations Engelmann spruce would be planted where appropriate for each proposed tree planting unit. Ponderosa pine would be the primary species planted on most sites particularly on dry southerly and westerly aspects and low elevation sites. Western larch and Douglas-fir seedlings would be planted primarily on northerly aspects and to a lesser extent on other sites where they existed prior to the fire to promote species diversity. Engelmann spruce seedlings would be planted only in moist areas where they existed prior to the fire and would be expected to survive. Seedlings would be hand planted in microsites associated with tree stumps down logs and other shade providing woody debris at an approximate rate of 150 seedlings per acre. Natural regeneration of aspen and all conifer species would be promoted. Seedlings would not be planted in the vicinity of existing live conifers, aspen clones, and other deciduous trees. Regeneration establishment and survival would be monitored for a period of five years following planting to ensure that desired levels (100 or more trees per acre) of conifer regeneration become established. Replanting would occur within operational and economic limitations to attain desired tree stocking levels.

Tree planting would accelerate the rate of reforestation on approximately 59 percent of all dry forest areas deforested by the fire. Planted areas would be reforested with the desired tree stocking levels and species mix within 10 years following the fire.

Desired levels of conifer natural regeneration would become established on an estimated 10 percent (1,400 acres) of deforested dry forest land within 10 to 20 years following the fire. An additional 21 percent (2,900 acres) of deforested dry forest land would be expected attain desired levels of conifer natural regeneration within 30 to 40 years following the fire. Desired levels of natural regeneration would require 50 or more years to become established on the most severe dry forest sites deforested by the fire.

Approximately 1,300 acres of cool-mesic forest vegetation deforested by the fire would be naturally regenerated primarily with lodgepole pines and to a lesser extent other conifer species within 10 to 20 years following the fire.

3.2.3.3 Cumulative Effects of the Proposed Action

Present, Ongoing, and Reasonably Foreseeable Future Actions
The spatial boundary for discussion of cumulative effects on forest vegetation conditions (including Forest Plan old growth, Riparian Habitat Conservation Areas, and JR and Loup Loup campgrounds) is the estimated 45,200 acres of National Forest land in the South Summit II Forest and Fuels project planning area which currently is forested or supported

forest vegetation prior to the Carlton Complex wildfire. The temporal boundary for cumulative effects on forest vegetation conditions projects from 70 years in the past (when timber harvest activities began in earnest during the 1940s) to 50 years into the future when proposed vegetation treatment effects will have diminished. Effects of the Carlton Complex wildfire and past actions which have contributed to existing forest vegetation conditions are discussed in Sections 3.1 and 3.2 which provide general descriptions of historical and current forest vegetation conditions. A list of past major timber sales that have affected current forest vegetation conditions since the 1970s is available in the project file, as are descriptions of completed landscape prescribed fire treatments that contributed to cumulative effects of the proposed action.

Currently there are no present actions or reasonably foreseeable future actions that would contribute to cumulative effects of the proposed action on forest vegetation conditions in the project analysis area.

Summary of Cumulative Effects

The cumulative effects of the proposed action and past, present, and reasonably foreseeable future actions would be an improvement of forest vegetation and fuels conditions on approximately 18,700 acres in the cumulative effects analysis area. The proposed action would implement vegetation management and follow-up fuels management treatments on approximately 3,310 acres. An additional 6,590 acres of fuels management treatments outside of vegetation management units would be implemented on National Forest land in the proposed action. These vegetation and fuels management treatments would maintain and restore elements of historic dry Douglas-fir/ ponderosa pine forest and mesic mixed conifer forest conditions including tree density, species composition, canopy structures, and size classes, including large and old trees. Fuel loading would be restored to levels that are consistent with historic fire natural regimes, and an estimated 23 percent of the project planning area forest vegetation following completion of the proposed action. The cumulative effect of previously completed vegetation and fuels management projects, the proposed action, and reasonably foreseeable future actions would create improved forest vegetation resiliency to natural disturbances, including insects, diseases, and wildfire, on approximately 44 percent of national forest land in the South Summit II Forest and Fuels Project planning area.

3.2.3.4 Consistency Statement

National Forest Management Act of 1975

Proposed regeneration timber harvest and reforestation activities are consistent with the National Forest Management Act of 1976 (NFMA). NFMA states that “when trees are cut to achieve timber production objectives, the cuttings shall be made in such a way to assure that technology and knowledge exists to adequately restock the land within five years after final (regeneration) harvest.” All proposed regeneration harvest units would be planted with conifer seedlings to ensure that they would be adequately stocked within five years after harvest.

Okanogan Forest Plan

Proposed regeneration timber harvest and reforestation activities are consistent with the Okanogan Forest Plan standards and guidelines. Proposed regeneration harvest units 676, 844, and 698 are located adjacent to blocks of land which are not considered created openings according to management area 14 and 25 requirement tree stocking requirements.

Proposed regeneration harvest unit 668 is located adjacent to an existing opening; however, the combined size of the proposed harvest unit and the existing opening will not exceed 40 acres in size. Proposed reforestation treatments would be consistent with the forest wide reforestation standard and guideline to foster stands with mixed species composition. Ponderosa pine seedlings would be planted and natural regeneration of Douglas-fir and aspen would be encouraged in all regeneration harvest units. Ponderosa pine, western larch, Douglas-fir, and Engelmann spruce seedlings would be planted where appropriate for the site in all post-fire tree planting units and natural regeneration of aspen and conifer species including lodgepole pine would be encouraged as well.

Proposed commercial thinning with dwarf mistletoe treatments in Management Area 5 would be implemented to protect treated stands and be consistent with the management area standards and guidelines.

Proposed vegetation management treatments in JR and Loup Loup campgrounds and the Loup Loup Ski Area would accomplish vegetative management objectives and enhance scenic or recreation opportunities and be consistent with Management Area 17 standards and guidelines.

No timber harvest would be conducted in approximately 2215 acres of Forest Plan mixed conifer old growth stands in the analysis area. Harvest would be conducted on approximately 185 acres of mixed conifer old growth under a temporary Forest Plan amendment which is part of the proposed action.

Regional Forester's Forest Plan Amendment #2

The proposed action would be consistent with the following timber management direction applicable under Scenario A of the Regional Forester's Forest Plan Amendment #2:

> There would be no net loss of late and old structure (LOS) stands in the analysis area. All proposed timber sale harvest activities would occur within LOS stages that are within or above the historic range of variability (HRV). All timber sale activities in LOS would manipulate LOS stages which exceed or are within HRV to move stands into LOS stages which are currently are deficit (below HRV).
>
> Late and old structure (LOS) components would be maintained and/or enhanced in all stands subject to timber harvest. All remnant late and old seral and/or structural live trees ≥ 21 inches dbh that currently exist within stands proposed for harvest activities would be maintained.
>
> Timber sale activities would manipulate vegetative structure that does not meet LOS conditions in a manner that moves it toward meeting HRV.
>
> Open, park-like stand conditions would be maintained where this condition occurred historically. Timber sale activities would manipulate vegetation in a manner to encourage the development and maintenance of large diameter, open canopy structure.
>
> Timber harvest activities would maintain or enhance the current level of connectivity between LOS stands and between all Forest Plan designated "old growth/MR" habitats by meeting the following requirements:
>
> 1. All LOS stands and MR/old growth habitats would be connected with each other in a contiguous network pattern by at least 2 different directions.

2. Connectivity Corridor Stand Description – Stands in which medium diameter or larger trees are common and canopy closures within the top one-third of site potential on approximately 1,240 acres of connectivity corridors (approximately 98% of total connectivity corridor acreage in the project planning area). Canopy closure would be in the lower one-half to one-third of site potential on approximately 19 acres of connectivity corridors treated by timber sale activities.
3. Connectivity corridor lengths would be as short as possible.
4. Harvesting in connectivity corridors would meet all criteria in #2 above with a one-time Forest Plan amendment which would address a reduced level of canopy closure on 19 acres as part of the proposed action. The Forest Plan amendment would be consistent with Regional Forester direction (Goodman 2003) to allow flexibility in implementation of connectivity corridors to better meet LOS objectives by moving the landscape towards HRV and providing LOS for the habitat needs of associated wildlife species.

PACFISH

Proposed vegetation management activities in Riparian Habitat Conservation Areas (RHCAs) and adjacent uplands would be consistent with PACFISH Riparian Goals, Riparian Management Objectives (RMOs), and RHCA Standards and Guidelines. Proposed harvest and noncommercial thinning treatments would be implemented to maintain and restore the native tree species composition, structural diversity, and natural disturbance patterns of forested plant communities in RHCAs. RHCA vegetation management treatments would maintain existing large trees, large woody debris, and vegetation shading streams. They also would promote the development of additional large trees and maintain or improve future stream shading forest cover and large woody debris recruitment. Silvicultural practices in RHCAs would be applied to promote attainment of RMOs and avoid adverse impacts on listed anadromous or inland native fish.

Middle Methow Watershed Analysis and Lower Methow Watershed Analysis

The proposed action would follow timber management recommendations provided in the Middle Methow and Lower Methow Watershed analyses. Vegetation and fuels management treatments would be implemented to achieve the following forest restoration objectives:

- Excess understory stocking would be reduced to restore historic levels of stand canopy structures and species composition.
- Competition in overstocked stands would be reduced to provide adequate growing space which will allow (residual) trees to eventually reach large size.
- Early seral tree species including ponderosa pine, western larch, and aspen would be promoted by removing excess Douglas-fir stocking.
- Remnant large diameter trees would be maintained to enhance canopy structural diversity and move stands toward attainment of mature size more rapidly.
- Wildfire risk to mature overstory trees would be reduced by decreasing the density of understory stems and removing ladder fuels which extend into the overstory canopy level.
- Dwarf mistletoe infection in the understory would be reduced and confined primarily to large, mature trees which historically remained following periodic underburning (low severity fire).

Western Spruce Budworm Landscape Assessment

The proposed action would be consistent with vegetation management recommendations provided in the assessment. Approximately 3,310 acres of vegetation management

treatments would be implemented to maintain and restore dry (and mesic) forest conditions that reflect historical tree densities, species composition, canopy structures, and size classes, including large and old trees in the analysis area.

The Okanogan-Wenatchee National Forest Restoration Strategy

Proposed vegetation and fuels management treatments would be consistent with management guidance provided by the Okanogan-Wenatchee National Forrest Restoration Strategy. Vegetation and fuels management treatments would maintain and restore historical elements of forest vegetation including large and old trees, spatial patterning of trees, and density of young and understory trees. The proposed action would maintain existing large and old trees and younger large trees to achieve recommended large tree restoration objectives. Intra-cohort thinning within clumps of old trees (estimated age ≥ 150 years based on criteria described in Van Pelt 2008) would not occur. Historic spatial patterns of trees including individual trees, clumpiness, canopy gaps, and complex patches would be retained and restored with vegetation and fuels management treatments. Young and understory tree density of treated stands would be managed to maintain or restore historical spatial tree patterns and to maintain or promote the development of large trees as needed to attain recommended large tree density objectives.

3.3 FUELS AND FIRE BEHAVIOR

The following summarizes existing condition information along with the direct, indirect, and cumulative effects of the South Summit II Forest and Fuels Project, as analyzed in the South Summit II Forest and Fuels Project Fuels and Fire Behavior Report (Trebon 2015), available in the project record. Information added in this report tiers to the Fuels/Fire Behavior specialist's report prepared for the original South Summit Forest and Fuels project, and reflects changes caused by the 2014 Carlton Complex wildfire.

3.3.1 Issues for Analysis

Issue #1 (Purpose & Need #1): Past timber harvest and fire exclusion within the project area have contributed to extensive changes in forest vegetation over the last century, including increased tree density, decreased average tree size, and increased proportion of multi-story shade-tolerant Douglas-fir forest cover. In addition, the passage of time since past fuels treatments in the project area has diminished the effectiveness of these treatments. Increased understory tree density combined with dense overstory contributes to higher crown fire risks and more severe fire behavior in developed areas (the Wildland Urban Interface) adjacent to the project boundary. This issue was selected for analysis because these conditions have reduced the resiliency of dry mixed-conifer forest and Forest Plan old growth within the project area to wildfire and forest insects and diseases when compared to historic conditions. These conditions have also increased the hazards to existing infrastructure and adjacent private and public lands.

Indicator: This issue will be measured by changes in crown fire potential in acres treated and resulting effects on fire hazard and fire regimes.

Analysis Methods: Fire behavior will be analyzed using FlamMap and the Fuels Characteristics Classification System (FCCS) models and information.

Analysis Area: For these issues, the analysis area is bound by the proposed treatment areas in general and FPOG in particular to help support the need for a Forest Plan amendment.

Issue #2 (Purpose and Need #2): Increased stand density in and directly adjacent to Riparian Habitat Conservation Areas (RHCAs) contribute to increased risk of more severe damage by wildfires. This issue was chosen for analysis because higher-severity wildfires in RHCAs would create more severe soil and vegetation impacts that would damage habitat for riparian-dependent species.

Indicator: This issue will be measured by changes in crown fire potential in acres treated.

Analysis Methods: Fire behavior will be analyzed using FlamMap.

Analysis Area: For these issues, the analysis area is bound by RHCAs within treatment areas.

Issue #3 (Purpose and Need #4): Increased understory tree density combined with dense overstory contributes to higher crown fire risks and more severe fire behavior in developed areas within and adjacent to the project boundary, including portions of Highway 20, Loup Loup and J.R. Campgrounds, and the Loup Loup Ski Hill.

Indicator: These issues will be measured by changes in crown fire potential in acres treated.

Analysis Methods: Fire behavior will be analyzed using FlamMap.

Analysis Area: For this issue, the analysis area is bound by the Highway 20 corridor, campgrounds, and ski hill within the project area.

3.3.2 Affected Environment

South Summit II Existing Fire Regimes
Refer the South Summit II Forest and Fuels Environmental Zones and Fire Regimes in Appendix J for fire regimes within the project area.

The historical role of fire on the landscape is characterized fire frequency and fire severity, described below as Fire Regimes. These characteristics are closely linked to environmental zones and plant associations as shown in Figure 3.3-8. The South Summit II project area is dominated by Fire Regime I with minor amounts of Fire Regimes III and IV. Environmental zones are described further in the Vegetation portion of Chapter 3 in the EA.

Figure 3.3-8: South Summit II Fire Regimes & Environmental Zones

Fire Regime	Portion of Project Area	Fire Frequency	Historical Fire Severity	South Summit II Environmental Zone
I	82%	0-35 years	Low /Mixed (Mostly low-severity fires that replace < 25% of dominant overstory vegetation; may include mixed-severity fires that replace < 75% of the overstory).	Hot-dry shrub-steppe and ponderosa pine Warm-dry ponderosa pine and Douglas-fir
III	12%	35-200 years	Mixed/Low (Generally mixed-severity fires; may include low- severity fires)	Cool-dry Douglas-fir
IV	6%	35-200 years	Moderate/High (Generally high severity fires; may include moderate severity fires)	Cool-mesic Douglas-fir/ subalpine fir

Sources: Hann et al 2004; Agee 2003; USDA 1997; USDA 1999.

Fire Regime Condition Classes (FRCC) as shown in Figure 3.3-9 describe three levels of departure from historical ranges of variability for vegetation characteristics; fuel composition; fire frequency, severity, and pattern; and other associated disturbances (Hann et al. 2003). Departure from historical conditions (Condition Class 1) is usually associated with increases in fire size, intensity, severity, and/or landscape pattern homogeneity. This information provides a good reference when describing current conditions and how proposed treatments would move portions of the project area toward historic range of variability.

Figure 3.3-9 Fire Regime Condition Class (FRCC) Descriptions

Condition Class	Description	Potential Risk
1	Within the natural (historical) range of variability of: • vegetation characteristics • fuel composition • fire frequency, severity, and pattern • other associated disturbances.	Fire behavior, effects, and other associated disturbances (i.e. smoke production, hydrology, and soil function) within natural (historical) range, similar to those that occurred prior to fire exclusion (suppression) and other types of management that do not mimic the natural fire regime and associated vegetation and fuel characteristics. Insect and disease populations within natural (historical) range. Composition and structure of vegetation and fuels are similar to natural (historical) regime. Risk of losing key ecosystem components (e.g. native species, large trees, soil) is low.
2	Moderate departure from the natural (historical) range of variability of characteristics described above.	Fire behavior, effects, and other associated disturbances moderately departed (more or less severe). Smoke and soil erosion following fires typically greater; water flow typically decreases. Insect and disease populations moderately altered from their natural (historical) range. Composition and structure of vegetation and fuels moderately altered. Example: Forests/ Woodlands may exhibit moderate increases in density, encroachment of shade-tolerant tree species, or moderate loss of shade intolerant tree species caused by fire exclusion, logging, or exotic insects or disease. Surface shrub/ grass may be replaced with woody fuels and litter. Uncharacteristic conditions range from low to moderate. Risk of losing key ecosystem components is moderate.
3	High departure from the natural (historical) range of characteristics described above.	Fire behavior, effects, and other associated disturbances highly departed (more or less severe). Smoke production, hydrology, and soil substantially altered from their historical range. Insect and disease populations substantially altered from natural (historical) range; typically higher mortality or defoliation. Composition and structure of vegetation and fuels highly altered. Example: Forests/ Woodlands may exhibit high increases in density, encroachment of shade tolerant tree species, or high loss of shade intolerant tree species caused by fire exclusion, logging, or exotic insects or disease. Surface shrub/grass may be replaced with woody fuels and litter. Uncharacteristic conditions range from moderate to high. Risk of losing key ecosystem components is high.

Pre-Settlement Fire Behavior

Before European settlement, fire regimes are considered to be within their historic range of variability. Frequent human and lightning-caused fires had a major influence on the vegetation patterns and processes in forests along the eastern slope of Washington's Cascade Range (Agee 1994; Agee and Edmonds 1992; Hessburg et al. 2005; district fire records). Hot-dry, warm-dry, and cool-dry portions of the project area (Fire Regimes I and III) were dominated by mature stands of ponderosa pine and associated species (USDA 1997, USDA 1999, Hessburg et al. 2005). Low- and mixed-severity fires here favored low tree density and clumped tree distribution, light and patchy fuel beds, simple canopy layering, and fire-tolerant tree and associated species compositions. At the landscape

scale, Hessburg et al. (ibid.) describe how low and moderate-severity fires typical to the dry forest in Fire Regimes I and III created mosaics of structure and composition that helped isolate the conditions and areas that supported high-severity fires. New openings created by frequent fires influenced spatial patterns that further reduced the likelihood of severe fire behavior and effects by creating patches that helped limit fire growth. The predominantly dry forest landscape responded to wildfires with high resiliency (defined as low overstory mortality) and relatively low risk of losing key ecosystem components such as terrestrial and aquatic habitat and hydrologic function. Severe fires were uncharacteristic and rarely occurred in dry forests except during region-wide extreme climatic events (Agee 2003, Hessburg et al. 2005).

Growing conditions in cool-moist regions of the project area (Fire Regime IV) helped create denser, multi-layered more continuous stands of vegetation. Fire behavior in these areas typically transitioned from surface to crown fires readily, replacing stands.

Post-Settlement Influences on Fire Behavior

Fire behavior in dry forests such as those within the project area have noticeably changed to less frequent, more severe state partly because of land management practices such as fire suppression, grazing, and logging (Agee 1993; Lehmkuhl et al. 1994; Everett et al. 2000; district fire suppression records).

Fire Suppression

Since around the 1930s, fire suppression in the project area excluded the effects of frequent fire thereby increasing surface fuels, denser stocking of understory tree seedlings and saplings, and stocking of shade-tolerant tree species. District records indicate that about 400 fires started in the project area between 1910 and 2013; about 90% were contained at less than 3 acres, with none on record exceeding 5000 acres. Keeping these fires small meant more continuous vegetation, lower canopy-base-heights, and fewer fire-created openings that would help limit the growth of wildfires. In the hot-dry, warm-dry, and cool-dry forests within the project area, these conditions help provide more opportunities for surface fires to transition into crown fires, causing higher mortality, contributing to fire growth, and limiting suppression opportunities. In addition to fire exclusion, fire regimes have been altered by decades of grazing that both reduced the fine fuel loading created by herbaceous materials, and exposed soils to help promote tree regeneration.

Past Grazing Activities

In the early part of the 20th century, widespread grazing of cattle, sheep, and horses occurred over most of the project area. Reductions in fine fuel loading by grazing kept ignitions from spreading in many areas, even without active fire suppression. Consequently, the role of natural fires in reducing fuels and thinning understory brush and trees were minimized. In addition, bare soil created by grazing provided further opportunities for tree seedlings to grow in areas where ground cover and vegetation would have otherwise outcompeted and prevented them from establishing. The combined effect of reduced fine fuels and increased conifer development during this period contributed to creating denser forests. These overstocked stands were protected further by increasingly effective fire suppression in the latter half of the 20th century to present day.

The current effects from cattle grazing on wildfires have been minimized in recent decades. This is due to a considerable drop in the number of cattle grazed in the project area and improved range management practices, including pasture rotation and monitoring.

Past Vegetation Management Activities
Past activities in the project area are described in the project file. More than 70 years of timber harvest in the project area altered the response to wildfires by reducing the proportion of fire-tolerant forest cover types that have been replaced with more shade-tolerant species. This change also caused an increase in tree canopy cover and lowered canopy-base-heights, allowing surface fires to more readily carry into overstory crowns. Harvest removed many of the large fire-resistant trees, leaving younger trees that are less tolerant to fire because of thinner bark and lower canopy base heights. Past replanting practices in the project area created dense plantations that have not been thinned in decades, creating unusually thick stands of maturing trees. Where these conditions continue to exist in the project, resiliency to wildfire is uncharacteristically low because surface fires have more chances to climb into the overstory tree canopy over larger areas, increasing tree mortality and associated risk to key ecosystem components.

Associated fuels reduction treatments occurred in the project area to treat slash created by commercial harvest and timber stand improvement thinning. Although timber sale area maps indicate large areas of fuels treatments, only small portions of each sale area were treated with prescribed fire depending on post-sale fuels prescriptions. Fuels treatments in the 1970s and 1980s created fuel breaks by hand-thinning the understory vegetation with chainsaws. Beneficial effects from these treatments have largely disappeared as woody fuels have increased and understory trees have established and grown, providing fuel ladders for fire to move from the surface to crowns. Vegetation and fuels reduction treatments within the Frazer Creek drainage over the past 15 years focused on isolated portions of the transmission/highway corridor, leaving some areas at higher risk to wildfires.

Recent Insect and Disease Activity
As described in the Vegetation portion of Chapter 3, two types of insect and disease-related events continue to affect fire regimes in the project area. Mountain pine beetle outbreaks in the mid-1990s caused high levels of mortality in lodgepole stands within the project area, especially in Frazer Creek. Douglas-fir beetle is starting to cause mortality in large-diameter Douglas-fir in the project area. An ongoing western spruce budworm infestation continues to defoliate and weaken trees especially in the northern portions of the project area, targeting Douglas-fir in particular. As spruce budworm activity continues unabated, mortality is expected to increase as stressed trees are unable to recover from defoliation (J. Daily, personal communication). While outbreaks of western spruce budworm tend to have the greatest impact on understory trees (USDA 2012), many stands of multi-storied Douglas-fir in the project area have been stressed by the current outbreak long enough that some overstory is dying, most notably in the Highway 20 corridor within the project area. Mortality caused by western spruce budworm occurs in patches, and dying trees rapidly go through the red-needle phase that contributes to increased fire behavior, becoming snags with few needles that would act as a fire receptor and increase flame lengths. Defoliation and eventual mortality caused by the western spruce budworm eventually decreases crown fire behavior; mortality in the understory trees helps limit crown fire initiation, while mortality in the overstory increases canopy spacing. Mortality in all canopy levels will eventually increase fuel loads and subsequent flame lengths during wildfires, but this change will likely occur in patches across the landscape depending on rate of mortality and size of trees affected.

Associated Influences on Fire Behavior
In addition to changes in fire behavior created by past management activities and current vegetation conditions, other factors affect wildfire growth, behavior, and management in the

proposed treatment units. Limited access created by existing road closures delays response times and helps create hazardous conditions for suppression resources (such as insufficient escape routes to safety zones), thereby limiting suppression options. The length and severity of wildfire seasons across the Western U.S. is expected to increase (Liu et al. 2010; Climate Central 2012; Westerling et al. 2006), and existing combinations of fuel, topography, and weather that contribute to extreme fire behavior continue to challenge fewer available suppression resources in the WUI environment. As wildfires grow larger and more severe, they are more likely to create uncharacteristically large snag patches in forests that were historically characterized by low-severity fire.

The Carlton Complex Wildfire

In 2014, the Carlton Complex wildfires (hereafter known as the Carlton Complex) burned through about 70% of the project area with unusual severity and speed. Post-fire Burned Area Reflectance Classification (BARC) data was acquired after the Carlton Complex to evaluate soil burn severity (and, by inference, vegetation burn severity); see the Soil Burn Severity map in Appendix J. This data indicates that about 14% of the project area experienced high-severity fire, 18% had moderate-severity fire, 32% had low-severity fire, and 6% did not burn within the fire perimeter. Post-fire field observations showed that most vegetation was severely burned in moderate-severity fire. The remaining 30% of the project area is outside of the fire perimeter and split by a continuous four-mile-wide swath of moderate- to high-severity burned area extending from lower Frazer Creek through Finley Canyon and east to Thrapp Mountain. The uncharacteristically large openings created by this fire will affect future fire behavior in the project area; as fire-killed trees collapse over the next 10-40 years, they will contribute unusually high amounts of large woody debris to more readily ignitable grasses, shrubs, and trees, creating a fuel profile that supports further uncharacteristic fire behavior, increased reburn potential, more severe fire effects as fires have higher residency time on soils, and increased resistance to fire control (USDA 2012, Brown et al. 2003).

Wildland Urban Interface

The Okanogan County Community Wildfire Protection Plan (CWPP) (Schlosser et al. 2009) designates all National Forest lands within the South Summit II Forest and Fuels project area as Wildland Urban Interface (WUI) to reflect the concerns over human development within this fire-prone environment. For this reason, descriptions applicable to the project area in this analysis are synonymous with descriptions of fire behavior and hazards to the WUI. The Okanogan CWPP identifies two priority treatment areas that overlap the project boundary in the Highway 20 corridor and in Benson Creek. For more than 80 years, continued development within and adjoining the project area has contributed to an increasingly complex wildfire environment with far-reaching influences that extend into the project boundary. Private lands adjacent to the project area contain an increasing number of homes and outbuildings; private timber and grazing lands; and state lands managed for wildlife habitat and timber production. Within the project boundary, about half of the power transmission lines that currently provide the only source of electricity to most Methow Valley residents were destroyed by the Carlton Complex, cutting off electricity to valley residents for over a week. About four miles of Washington State Route 20 runs through the project area adjacent to this feature, providing the only direct year-round travel route between the Methow and Okanogan Valleys. All of these features experienced some level of damage and disruption during the Carlton Complex; while this fire was extreme in its speed and severity, it exemplifies how disturbances such as fire may move across ownerships and agencies. J. R. and Loup Loup Campgrounds and the Loup Loup Ski Area lie within the Frazer Creek drainage, each with varying levels of development and infrastructure.

The certainty of future wildfires and forecasted increases in fire season length, size, and severity increases fire risks to WUI values even under optimum suppression conditions. Despite the beneficial effects of fires on the dry forested landscapes described by Hessburg et al. (2005), the proximity of WUI values in the project area will likely always require a full-suppression response to wildfires as long as human safety is not compromised. Management actions like thinning and prescribed fire are viable fire surrogates that will help realize these benefits as restoration treatments occur (USDA 2012; Agee and Skinner 2005; Covington 2003; Prichard et al. 2010; Stephens et al. 2012).

Current Fire Behavior in Proposed Treatment Units

When the Carlton Complex created the four-mile-wide opening in the project area, it changed the scale of the South Summit II Forest and Fuels project from a comprehensive 50,000 acre landscape assessment with treatment proposals to an analysis of two isolated areas in the northeast and southeast portions of the project area. Treatments are proposed for most of these areas, with about 90% in Fire Regime I, 7% in Fire Regime III and 3% in Fire Regime IV.

Proposed units were initially evaluated for crown fire behavior with FlamMap 5.0 (Finney et al. 2012), using benign conditions (early-season high fuel moistures, no wind) to establish a baseline comparison of mild fire conditions. Results indicate that these conditions would support surface fire over about two-thirds of proposed treatment areas, and passive crown fire (where individual trees or small groups of trees torch) over the remaining one-third. Less than 1% of the project area demonstrated active crown fire (where fire moves through the forest canopy independent of surface fire). In the drier, windier conditions that typically occur in the project area in mid- to late-summer (90th percentile weather using Leecher Mountain Remote Automatic Weather Stations data), FlamMap modeling indicates that active crown fire potential increased slightly with associated increases in wind speeds until winds above the canopy (20-foot winds) reach 15 miles per hour (mph) or greater, at which time the active crown fire potential increased noticeably across the project area. Winds recorded at Leecher RAWS come from the south/southwest about 40% of the time, often exceeding 13 mph.

Fire potential was modeled using Fuels Characteristics Classification Systems (FCCS) software (Ottmar et al. 2007; Sandberg et al. 2007; Schaaf et al. 2007). Details on modeling variables and processes are available in the analysis file.

Under moderately dry and very dry fuel conditions representative of mid- to late-summer, and with low (2 mph) midflame wind speeds to provide baseline fire behavior, surface fire behavior potential has an average capacity to support a surface fire, with moderate flame lengths (between 2-3 feet). Current crown fire potential (a composite rating of passive torching and active crown fire potential) is generally average within the represented fuelbeds in Fire Regimes I and III, with a high capacity for initiation due to the horizontal and vertical continuity of ladder fuels. The capacity for sustained crown fire is low because of the discontinuous overstory in many areas. Surface fire behavior and crown fire initiation increases with higher windspeeds. These results indicate that the forests in Fire Regime I are currently moderately to highly departed from historical reference conditions because these areas would generally have had a low capacity to support crown fire initiation. Modeling results indicate that current conditions in Fire Regime III are compatible with creating mixed-severity conditions common to this regime. As modeled in FlamMap above, the crown fire potential in the project area favors passive crown fire spread rather than

active crown fire; while this fire behavior is common to Fire Regimes I and III, torching contributes to fire spread and hampers suppression efforts by lofting firebrands in the direction of wind spread and is undesirable when values such as developed areas, commercial forest lands, and infrastructure are nearby. Fire potentials modeled for units in cool-mesic environments (Fire Regime IV) indicate that surface and crown fire initiation potential is high because of the generally heavier fuel loading and denser stands. Current conditions in all regimes create increased risk to WUI values because proposed treatment units across all fire regimes are adjacent to or near developments such as the Loup Loup Ski Area and Highway 20/powerline corridor, and private and state lands where fire spread would be undesirable because of the risks it creates for these features.

Current Condition of Riparian Habitat Conservation Areas (RHCAs)

The project area contains about 2806 acres of RHCAs that bisect the landscape. Vegetation conditions within RHCAs are described further in the Aquatics and Vegetation sections of the E.A. Historically and currently, wildfires travel through riparian habitats within dry forested areas across the Eastern Cascades without discriminating between riparian and upland; riparian fire breaks both stopped fires and acted as crown-fire corridors to side-slopes that would not burn otherwise (Agee 1998). A study by Everett et al. (2001) indicates that riparian areas have longer fire return intervals than adjacent side slopes, and burn more severely. The study also demonstrate substantial continuity in fire disturbance between side-slope and adjacent riparian forests. Because most of the RHCAs in the project area are relatively small features within a larger landscape dominated by frequent-fire regimes, the frequency, behavior, and effects of fire in the RHCAs are heavily influenced by how fire moves and behaves through surrounding features. Treating around RHCAs to limit the spread of fire into these buffers is not always effected; treated areas with lengthy edges adjacent to untreated areas are likely to suffer substantial mortality during wildfires, even if fire behavior is reduced (Agee & Skinner 2005).

The Carlton Complex burned through almost half of the RHCAs in the project area, in many areas without the influence of strong winds or steep topography. Existing surface fuels in combination with this increased understory density provide a ready path for surface fires to climb into the overstory canopy, placing the shade-providing trees at risk with associated risk of increasing stream temperatures**.** Outside of the fire perimeter, many of the intermittent RHCAs still contain unusually thick patches of pole-sized conifers that have regenerated since the last fire disturbance; these conifers, in conjunction with accumulations of surface debris, create horizontal continuity of fuels that helps carry fire from adjacent areas into and through these RHCAs.

Current Fire Behavior in RHCAs

Fire modeling in FlamMap shows that about 70% of RHCAs that didn't burn in the Carlton Complex are most likely to experience surface fires, with the remaining 30% likely to experience passive crown fires where individual trees or small groups of trees burn. The continuity of surface fuels adjacent and through RCHAs make it likely that surface fires will readily travel through these features, likely consuming the duff and reducing understory vegetation that help buffer streams from sedimentation. Drier fuels and increased wind speeds will help increase consumption and reduce the ability of riparian vegetation RHCAs to act as a fire break.

Current Condition of Forest Plan Old Growth

Before the Carlton Complex, the South Summit II project area contained about 4300 acres of Forest Plan Old Growth (FPOG) in scattered stands; since the Carlton Complex, about

45% of this feature remains post-fire, mostly concentrated in the NE portion of the project area (refer to the Vegetation and Wildlife sections of the E.A.). About 75% of the remaining FPOG is within Fire Regime I, where low-severity fires would have helped maintain large tree structure common to this feature. The remaining FPOG is divided evenly between Fire Regimes III and IV, where moderate and high severity fires would have contributed to more fragmentation or complete consumption of multi-storied stands.

Current Fire Behavior in Forest Plan Old Growth
Modeling using mild conditions in FlamMap and FCCS shows that about 40% of the remaining FPOG would experience passive crown fire behavior, where individual trees or groups of trees would torch and be killed by fire. About 60% of FPOG would experience surface fire. These stands have an above-average potential for crown fire initiation, making it likely that surface fire would transition to crown fire. Crown fire initiation potential increases with drier summer conditions and greater windspeeds more common to the project area. Areas likely to be affected by passive crown fire increase under the same conditions. Gaps created by group torching may result in enough fragmentation of a stand it no longer meets the criteria for this FPOG designation. The recent loss of over half of the FPOG in the project area and the length of time it takes to replace similar stand structure provides a strong incentive to limit fire severity that damage FPOG resiliency to future wildfires.

3.3.3 Environmental Consequences

Proposed treatments would have a minimal effect on existing surface fuels because underburning is not proposed for the project and piling treatments would focus on activity-created fuels. For this analysis, changes in crown fire potential measure how proposed fuels and vegetation-related activities affect fire regimes, WUI, and specific features including RHCAs and FPOG, including how treatments move areas toward their historical range of variability (Purpose and Need #1, #2, and #4).

3.3.3.1 No Action
If no action is taken to improve fire resiliency in Fire Regimes I and III in proposed treatment units, vegetation conditions would continue to move towards more uniformly, uncharacteristically crowded and stressed conditions. Assuming that past treatments in the project area that reduced fuels and fire behavior are effective for about 20 years (Rhodes and Baker 2008; Stephens et al. 2012), the current value of these treatments is already nonexistent across much of proposed treatment areas given the age of most vegetation and fuels treatments. As stands continue to grow more dense and surface fuels accumulate in the absence of treatment, both surface fire and crown fire potentials would increase with associated increase in the severity of fire effects inconsistent with the historic range of variability for dry forests in Fire Regimes I and III. Fires within Fire Regime IV in the project area would be within historic range of variability if no actions were taken. The resilience of RHCAs and FPOG to wildfire would diminish because of increased potential for crown fire initiation and spread, especially from nearby areas given their susceptibility to adjacent disturbances. If no treatments occurred to help mitigate current fire behavior, the risk to WUI concerns previously listed would increase because surface fuels and vegetation conditions would contribute to more intense fire behavior that may spread to these features.

The project landscape is predisposed to burning in the dry summer climate (Agee and Skinner 2005) and, coupled with the normal pattern of lightning ignitions, makes wildfires a certainty, not a possibility. Fire frequency and behavior would be exacerbated by

anticipated climate changes such as reduced snowpack with earlier melt-off, drought, longer summer weather conditions, and lower stream flow levels. These changes would create conditions that allow fuels to dry out earlier and more completely, allowing for earlier fire spread with greater available fuels (Millar et al. 2007).

Given the current state of proposed treatment areas and the likely outcome of no management actions, taking no action would not meet the stated Purpose and Need for Issues #1, #2, and #4 of this project as described in Chapter 1 of the EA.

3.3.3.2 Proposed Action

Proposed fuels treatments are described in Chapter 2 and in Appendices B and D and displayed on the South Summit II Forest and Fuels Proposed Treatments map in Appendix J. LFR thinning would consider soils, aquatic resources, wildlife habitat, air quality, and other resource concerns as described in the design criteria in Appendix A. Completion of underburn activities proposed in this project would require about 0.5 miles of hand fireline and 1.8 miles of machine fireline that would follow design criteria in Appendix A of the EA. Some fuels units contain small inclusions of areas burned with moderate- to high-severity in the Carlton Complex, but these areas would not be thinned because the stand structure would not require tree removal.

Proposed Action Effects on Project Area & WUI

Reductions in vegetation and treatments of activity fuels described in the proposed action would help reduce crown fire potentials in treated areas, accomplishing principles of fire-resilient forests (Peterson et al. 2005) and also reducing hazards to adjacent landowners, visitors, and improvements within and near the project area including the campgrounds and the Loup Loup Ski Area. The proposed action therefore meets Purpose and Need statements #1 and #4 in the project area/WUI and specifically in FPOG. Activity fuels would be treated to minimize contributions to existing surface fuel loading and avoid increasing surface fire behavior. Crown fire initiation in Fire Regime I and III would be within historical ranges, and where overstory thinning occurred in concert with ladder fuel reduction thinning in the understory, crown fire spread in these regimes would also be consistent with historical ranges. Where crown fire initiation would be slightly reduced in Fire Regime IV in the project area, this effect is balanced by the need to reduce hazards to nearby WUI values. Treatments would be accomplished over a period of about 15 years. In particular, these treatments would reduce hazards to WUI and FPOG features by achieving one or more of the following effects:

- Increasing canopy base heights in commercial harvest and fuels reduction units to about 15 feet or more across portions of treatment units by implementing ladder fuel reduction thinning to remove small-diameter trees and prune lower branches that provide a path for fire to move from the surface to the overstory tree canopy, or through the overstory. This treatment would mimic understory tree mortality and lower branch removal caused by wildfires and reduce the potential for crown fire initiation to low levels, minimizing the risk of subsequent spotting and fire growth;
- Reducing tree overstory canopy bulk density and canopy continuity by removing trees averaging 10 inches DBH and 61 feet tall in commercial harvest units, breaking up the horizontal and vertical continuity of canopy fuels across portions of treatment units. Ladder fuel reduction treatments would reduce canopy bulk density primarily in the lower canopy layer and disrupt vertical fuel continuity between the surface and upper canopy layers. Harvest with ladder fuel reduction treatments would decrease canopy bulk density to less than 0.10 kilograms per cubic meter, disrupt physical

contact of tree crowns, and reduce the potential for crown fire spread through the upper canopy layer;

- Retaining the larger, more fire-resistant trees within treatment units;
- Reducing activity fuels in commercial harvest, ladder fuel reduction, and non-commercial thinning units through treatments including machine piling, hand-piling, pile burning, and underburning. Reducing surface fuel size through mastication to hasten decomposition. Reducing fuel accumulations caused by hazard tree removal along Highway 20 by removing debris from the site as needed to limit uncharacteristic accumulation of large debris.

In 2350 acres of proposed harvest treatments, the risk of both crown fire initiation and spread would be reduced because ladder fuels would be minimized and canopy fuels would be reduced. In 6600 acres of ladder fuel reduction units, the risk of crown fire initiation would be reduced because ladder fuels would be thinned. Treatments would do little to reduce pre-existing surface fuels except for within 70 acres in regeneration harvest units, where underburning is proposed in preparation for replanting. While landscape-scale underburning helps mimic historical fire effects common to many areas of the project area, it also temporarily reduces surface litter and can briefly contribute to increased runoff. Given that proposed treatments lie upstream of areas with widespread moderate- to high-severity fire and storm damage effects associated with the Carlton Complex, underburning will be deferred until future management entry into the project area to provide time for soil, vegetation, and hydrologic processes to stabilize.

Adaptive Management Strategies
In 1575 acres where ladder fuel reduction (LFR) thinning is proposed in harvest units that are slated for machine piling, the debris from LFR thinning would be added to existing machine piles of harvest debris. If the harvest unit does not have machine piles (i.e. because there was not enough harvest debris to machine-pile or the LFR thinning occurred after the machine piles were burned), the LFR debris would be hand-piled and pile burned.

Proposed Action Effects in RHCAs
Proposed fuels treatments would affect up to about 275 acres of the RHCAs in the project area, increasing the proportion of RHCA with high fire resilience over the next 15 years and meeting Purpose and Need #2. Thinning in these areas would target conifers only and help promote survival of the larger shade-providing trees by limiting the spread of fire from surface to overstory canopy. Stream buffer protection measures would be applied within intermittent and perennial reserves during thinning operations and ignition as described in the design considerations in Appendix A. Fuels thinning treatments would have little effect on stream shading and resulting temperatures because thinning would be restricted to small-diameter trees and would not occur in areas directly adjacent to streams, therefore having little effect on trees that provide shade to regulate stream temperature (see Appendix A for further design criteria). Burning hand-piles at the outer edges of RHCAs would result in minimal loss of ground cover (see Water Resources report in this EA). In three harvest units with 22 acres within RHCAs, machine piling would occur at the outer edges of the RHCAs, resulting in far less actual RHCA treated. Piled areas would be assessed after burning to determine needs for revegetation of bare ground. These measures would help attain Riparian Management Objectives by increasing the resilience of RHCAs to disturbance by wildfire while minimizing disturbance of riparian ground cover and vegetation.

Proposed Action Effects in FPOG
About 500 acres of FPOG would be treated to reduce stand density and activity fuels to minimize wildfire behavior and effects. Proposed treatments in FPOG allowed by the Forest Plan amendment for this project would increase fire resiliency by reducing crown fire initiation and spread over the next 15-20 years. Treatments in nearby units proposed by this project would reduce the risk of uncharacteristic wildfire behavior and effects moving into the FPOG from outside its boundaries. In addition, most FPOG in the project area lies close to developments within the project area, including Highway 20, the powerline corridor, JR and Loup Loup Campgrounds, and the Loup Loup Ski Area. Minimizing wildfire behavior in FPOG will help sustain this limited feature on the landscape while minimizing risks to WUI features.

3.3.3.3 Cumulative Effects of the Proposed Action

Present, Ongoing, and Reasonably Foreseeable Future Actions
Current activities ongoing or planned in the project area that affect fire behavior and fire resiliency include the Brimstone Salvage timber harvest and associated fuels treatments near Polepick Mountain; salvage harvest proposed on adjacent DNR lands, fire suppression, and cattle grazing.

Brimstone Salvage
Harvest operations in this project should be concluded by the end of February 2015. Landing piles would be burned in fall 2015. Salvage operations will reduce reburn potential in burned areas by removing snags that would otherwise contribute to heavy fuel loading as they collapse otherwise collapse, increasing fire severity and resistance to control.

Salvage Harvest on DNR Lands
Washington State Department of Natural Resources proposes to harvest fire-killed timber near Thrapp Mountain and in the Texas Creek vicinity in 2015. These treatments overlap the project area spatially because some of these DNR lands lie within the project boundary. Fuels treatments associated with these activities may coincide with harvest activities proposed by this project in the Frazer Creek drainage. This treatment would potentially help reduce reburn potential in burned areas by removing snags that would contribute to heavy fuel loading that would otherwise collapse, increasing fire severity and resistance to control.

Fire Suppression
As mentioned above, the proximity of the project area to state and private lands, and the inclusion of critical infrastructure such as Highway 20 and the powerline, will necessitate full suppression efforts on ignitions across the project area during and after project implementation. While these efforts help protect WUI, continuing to limit this natural disturbance in the project area helps perpetuate the increase of surface and canopy fuels and limits the patchiness of the landscape caused by fire.

Summary of Cumulative Effects
The combination of vegetation and fuels treatments in and adjacent to the South Summit II Forest and Fuels Project would increase resiliency to fire by reducing crown fire initiation and spread potential in treated areas. The effects from ladder-fuel reduction and piling treatments on crown fire initiation would be expected to last about 10 – 15 years; effects from the combination of ladder fuel reduction, overstory thinning, and piling treatments on crown fire initiation and spread would be expected to last about 25 years, depending on the intensity of the overstory thinning. Treatments will help reduce risks to adjacent WUI values.

The combined effect of the proposed action with planned thinning and fuels treatment projects on DNR lands on Polepick Mountain and in the Benson Creek area over the next five years would bring much of the Fire Regime I in this area to Condition Class 1 by mimicking the effects of past disturbances, improving fire resiliency and decreasing fire potential for wildfires that may enter the project area from adjacent state or other National Forest system lands.

Other proposed and reasonably foreseeable future projects would have little to no effect on fire resiliency and fire potential within the South Summit II Forest and Fuels project area.

3.3.3.4 Consistency Statement

Implementing the Proposed Action would be consistent with the goals, objectives, and standards and guidelines of the Forest Plan, as amended by the Eastside Screens. Cost-effective treatments would be used to leave the fuels at an acceptable level without increasing threat of wildfire. Management objectives would be met for vegetation, wildlife, aquatic, and other resources as described above. Appropriate management responses to wildfires would continue throughout the project area during project implementation and into the future. No potential opportunities to implement future fuels treatments or prescribed fire project would be eliminated. Fuels thinning and prescribed fire treatments would be consistent with PACFISH and Forest Plan Guidelines. Further details are available in the project file.

3.4 AIR QUALITY

The section below summarizes the existing condition information, along with the direct, indirect and cumulative effects from the South Summit II Forest and Fuels Project, as analyzed in the South Summit II Forest and Fuels Project Air Quality Report (Trebon 2015), available in the project record.

3.4.1 Issues for Analysis

Issue (applies to Purpose and Need # 1, #2, and #4): Prescribed fire treatments proposed in the South Summit II Forest and Fuels project would produce smoke that temporarily affects air quality, potentially affecting human health and welfare and visibility.

Indicator: Smoke from prescribed burning contains two criteria pollutants that have National Ambient Air Quality Standards (NAAQS) associated with them. This analysis measures the amount of these pollutants that would be created by proposed prescribed fire treatments.

Analysis Method: This analysis uses Consume 3.0 (Ottmar et al. 2005) to measure particulate matter measuring 2.5 and 10 microns (PM2.5 and PM10) produced by prescribed burning proposed by this project. Modeling details are available in the project records.

Analysis Area:
Smoke produced by prescribed burning proposed by this project may affect the areas shown in Figure 3.4-1. Human use of these areas ranges from infrequent (as in wilderness areas) to constant. This analysis is geographically bound by the airsheds over these areas.

Figure 3.4-1 Airsheds Potentially Affected by Proposed Prescribed Fire Treatments

Area of Concern	Type of Airshed	Direction from Analysis Area	Distance from Analysis Area
Chiliwist Valley	Populated Area	East	Adjacent
Methow Valley	Populated Area	West	Adjacent
Okanogan Valley	Populated Area	East	11 miles
Brewster	Town	Southeast	9 miles
Carlton	Town	Southwest	4 miles
Methow	Town	Southwest	7 miles
Okanogan	Town	East	15 miles
Omak	Town	East	17 miles
Pateros	Town	South	12 miles
Twisp	Town	West	4 miles
Winthrop	Town	Northwest	11 miles
State Route 20	Highway	Within	Within
North Cascades	Class I	West	25 miles

National Park			
Glacier Peak Wilderness	Class I	West	45 miles
Pasayten Wilderness	Class I	Northwest	26 miles

3.4.2 Affected Environment

Air quality in the airsheds listed above changes frequently as locally and regionally produced pollutants move through or stay in the area depending on weather. Even before European settlement in the Methow and Okanogan valleys in the 1800s, air quality in the Interior Columbia Basin was not pristine at times because natural and human sources of fire regularly created smoke that limited visibility and introduced pollutants into the air. Early panoramic photographs taken around the 1920s from various peaks in the Methow Valley, Pasayten Wilderness, and Okanogan Valley are obscured by far-reaching haze. Evidence from lookout tower records in the Methow Valley indicate that smoke from local and distant wildfires frequently settled into the airsheds surrounding the project area.

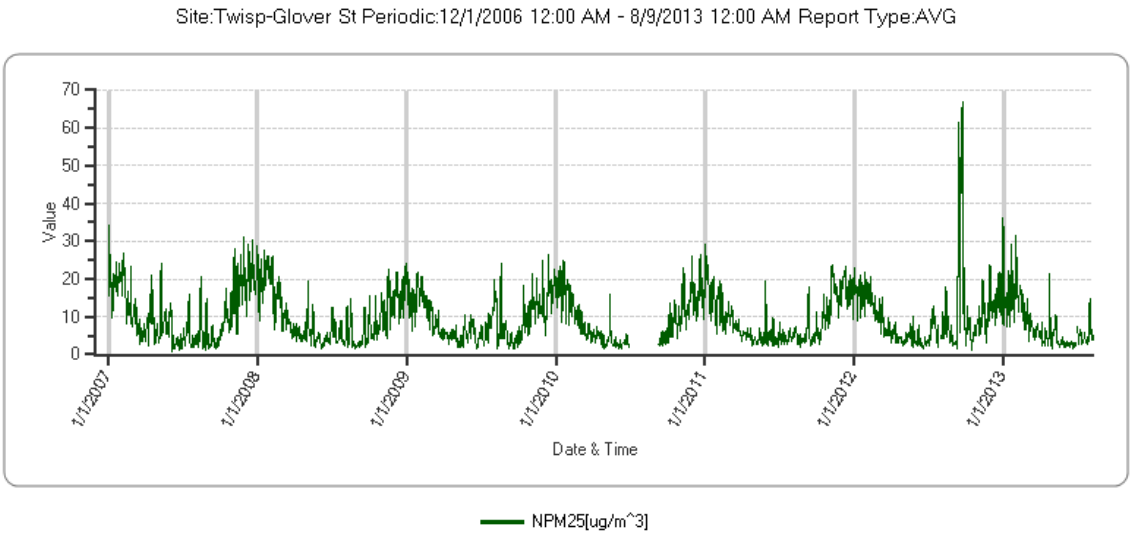
Levels of smoke declined as fire was excluded from forests, particularly after the start of organized fire suppression in the 1930s (USDA Forest Service 1997), but in the past 20 years has increased as wildfires burn more frequently over larger areas for longer periods across the Western United States and Canada. The 1994 wildfires near Wenatchee, Washington, for example, produced 24-hour concentrations of PM that were more than double the federal health standards, and these conditions persisted for days (USDA Forest Service 1997). Anecdotal evidence indicates that the 2003 Farewell Fire and 2006 Tripod Fire produced air quality problems for residents of the Okanogan and Methow valleys similar to those experienced in 1994. More recently, wildfires in Eastern Washington during September 2012 affected air quality around the interior Columbia River basin, producing hazardous conditions for more than eight days (WA DOE 2012). Routine summer inversions in Eastern Washington increase the impact of wildfires on ambient air quality during these fire events. Over the past few centuries the average annual area burned by wildfire in Washington was estimated at 326,172 acres (Agee 1993), an amount certain to emit high levels of PM. Research indicates that these impacts are likely to increase as wildfire season lengthens (Liu et al 2010; Climate Central 2012; Westerling et al. 2006).

Current Air Quality

Air quality is considered good in the vicinity of the project area during most of the year. Past air quality impacts from wildfires or prescribed fires have been relatively brief and leave no lingering residues. The Washington State Department of Ecology has monitored air quality and PM2.5 levels in Twisp since November 2006. Figure 3.4-2 displays data taken by Twisp monitor, located about four miles west of the project area, from 2006-2013. Short-term elevations of PM2.5 have occurred occasionally during the months when prescribed burning was conducted (roughly April to early June and October to early November). None of these occurrences exceeded National Ambient Air Quality Standards for PM2.5 or PM10. Peaks of longer duration were recorded between the late fall and winter months, most likely caused by smoke from local wood-burning stoves hanging low in the valley during periods of stagnant air. The only reading that exceeds the EPA's primary standard for 24-hour average levels of PM2.5 occurred in late summer/fall of 2012 and was caused by local wildfires in the Methow Valley area that emitted uncontrolled amounts of smoke, followed by periods of stagnant air. As wildfires were brought under control and air movement increased, levels of PM2.5 dropped off sharply. Other spikes in PM2.5 occurring during

summer months correspond with heavy wildfire activity in the Methow and Okanogan Valleys and the region beyond, including Canada. Episodes like these demonstrate how wildfires have more potential than any other air pollution source in the country for exposing the public to extremely high short-term PM2.5 fine particulate concentrations (Ottmar, personal communication, 2/10/2004). Wildfires from 2009 and previous years have impacted air resources by degrading ambient air quality and impairing visibility.

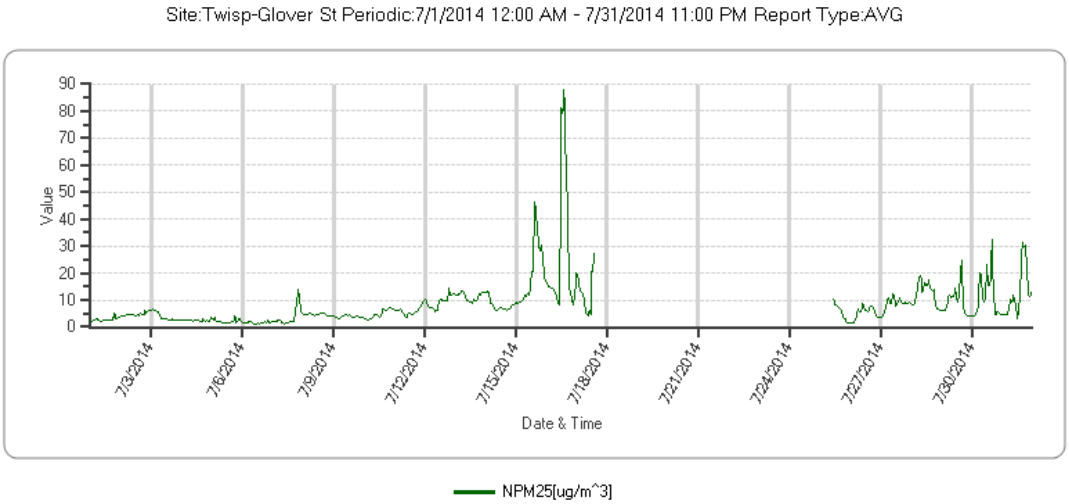
Figure 3.4-2 Monthly Average PM2.5 in Twisp from December 2006 through July 2013



Source: WA DOE 2013

Figure 3.4-3 below shows PM2.5 levels in Twisp during July 2014 immediately preceding the Carlton Complex wildfires and during the major burn periods during these wildfires from July 15-17. Recorded PM2.5 levels were over twice the 24-hour NAAQS for a brief period. The gap in data between July 18 and July 26 reflects the widespread power outages caused by the fires that prevented the monitoring equipment from operating.

Figure 3.4-3 Daily Average PM2.5 in Twisp from July 1 – July 31, 2014



Source: WA DOE 2015

3.4.3 Environmental Consequences

3.4.3.1 No Action

If proposed treatments did not occur in the South Summit project area, the airshed listed in Figure 3.4-1 would not be affected by prescribed fire treatments originating in the project area. Smoke from nearby prescribed fire treatments, natural fire events, and intrusions from outside influences would continue to affect these airsheds. If no treatment occurs, the increased fuel loading throughout the fuel strata in the project area combined with the certainty of future wildfires creates the high likelihood of longer-burning wildfires with increased levels of associated smoke production and air quality impacts. Unplanned smoke output during wildfires would not be reduced by prior reduction of debris by fuels treatments, and would continue to occur regardless of optimal dispersal conditions. As surface, ladder, and canopy fuel loads continue to increase, fires would likely burn more intensely, with more fuel consumption, longer smoldering, and higher levels of pollutants expelled into the air (Ottmar, personal communication, 02/10/2004).

3.4.3.2 Proposed Action

The following direct and indirect effects of proposed treatments would impact air quality.

Particulate Emissions

Prescribed fire treatments would directly affect air quality because they produce particulate matter (PM). Emissions that would be produced by the proposed action were modeled based on average expected fuel loading, weather, and fuel moisture parameters. Figure 3.4-4 displays the maximum quantities of PM2.5 and PM10 that would be created by each type of prescribed fire treatment in the proposed action. The number of landings is determined by using a typical average of one landing needed for about every 10 acres of harvest. The actual number of landings and acres treated by harvest and subsequent prescribed fire treatments like machine piling/burning or underburning would likely be less as acres with viable harvest tends to diminish during project layout. Natural fuels, harvest, or ladder fuel reduction treatments would receive one prescribed fire treatment except for some areas where dense understory stand structure would require thinning more debris than could be safely underburned in one entry. In these instances, the ladder fuel reduction debris would be hand-piled and piles would be burned after curing. The area would then be underburned as part of a larger surrounding landscape underburn treatment. Emissions created by this project would be dispersed during spring and fall burn periods over about 10 years with ample opportunity for dispersal as projects are initiated and completed.

Figure 3.4-4 Particulate Matter Emissions Produced by Prescribed Fire Treatments

Treatment	Amount Treated	Tons PM10 per Acre or Landing	Total Tons PM10	Tons PM2.5 per Acre or Landing	Total Tons PM2.5
Underburn harvest debris in preparation for planting	70 acres	0.15	10.5	0.13	9.1
Burn hand piles	6,975 acres	0.02	139.5	0.01	69.75

Burn machine piles	1,610 acres	0.3	483	0.3	483
Burn landing piles	225 landings	0.3	67.5	0.3	67.5
		Totals	**700.5 tons**	**-**	**629.35 tons**

Effect on Human Health and Welfare
Smoke from prescribed burning in the project area may be visible to personnel, forest visitors, and the general public, and could cause potential undesirable health effects to these people if they are exposed to smoke for extended periods of time. Smoke hazards include PM, gases, and chemicals; these substances may enter the lungs and cause some form of irritation to an individual's eyes, nose, throat, and lungs.

Prescribed Fire Personnel
Crews working on prescribed fire projects would be exposed to the combined hazards of fire and smoke. Some components of smoke (benzo-apyrene and aldehydes) are carcinogenic; these compounds would most likely affect forest workers who receive lengthy or high exposures at the burn site. Prescribed fire personnel exposed to high smoke concentrations would be vulnerable to eye and respiratory system irritation; under some circumstances, continued exposure to high concentrations of carbon monoxide would impair alertness and judgment. The probability of this occurring on a prescribed fire would be low because crews are trained and visually monitored to avoid intense smoke exposure. Personnel working in smoky locations would be rotated frequently to limit long-term exposure. Locations on burn units at risk for fire spotting outside of control lines would be pre-treated with water or foam to reduce the need for personnel to patrol in heavy smoke.

Forest Visitors
Warning signs would be posted on roads approaching prescribed burn units before ignition starts to warn travelers of prescribed fire activities. Campgrounds affected by prescribed fire smoke are posted and visited before ignitions to notify visitors of impending burn activities. Personnel staffing prescribed burns monitor visibility on nearby roads and would take action such as ceasing or limiting ignition or temporarily blocking roads as needed until visibility improved. When burning in units that may affect visibility on State Highway 20, appropriately-sized signs will notify motorists of impending ignition activities at least 12 hours before implementation.

General Public
Public notifications in the form of an email news release would inform businesses, schools, local media, county health workers, and other interested parties before each spring and fall burn season and daily while prescribed burning is underway. News releases would describe the location and size of planned ignitions, contact information to reach district personnel, and the status of prescribed fire units in patrol status. Personal contacts would be made with those working and living in close proximity to the area of greatest possible impact to help minimize their exposure to smoke and protect human health and welfare. Other contacts may occur as described in the Methow Valley Ranger District Prescribed Fire Public Information Action Plan (Fuels Report, Appendix 2), which also describes the process to track and respond to public complaints.

Smoke Approval Process

The impacts of smoke on public health and visibility are ultimately regulated by the smoke approval process for silvicultural burning administered by Washington State Department of Natural Resources (WA DNR). Smoke approval would depend on projected emissions at the time of implementation (based on actual fuel loading, treatment acres, and fuel moistures), atmospheric stability, wind direction and speed, distance from smoke-sensitive areas, and known impacts to air quality from other sources. Weather forecasts would be examined at the state and local levels to determine potential smoke column ventilation and drift prior to approval. Following WA DNR approval of burn requests, local fuels managers and burn bosses would visually evaluate local air quality and ventilation conditions before committing to full ignition.

When smoke approval is given, ignition on any single day would be limited by the amount of personnel can ignite during the amount of time covered by the smoke request (local experience shows that ground crews can generally ignite up to 150 acres per day by hand on slopes up to about 35%, while aerial ignition accomplishes about 200 to 650 acres per day depending on fuel loading and burn objectives). Burning would be conducted over spring and fall, spreading potential emissions out over about four to six months each year over a period of 10-15 years.

Smoke dispersal conditions would be monitored before, during, and after main ignition to ensure that smoke created by burning is dispersing favorably, and that the number of acres ignited would not produce enough smoke to violate National Ambient Air Quality Standards. Smoke drifting towards populated areas with no indications of atmospheric mixing would trigger measures such as terminating or reducing ignition in that area until atmospheric mixing improved. These measures have been used successfully on the Methow Valley Ranger District over the past fifteen or more years of prescribed burning and are highly effective in reducing potential impacts to air quality.

Reduction of Smoke from Wildfires

Increased levels of prescribed fire can have temporary negative impacts on air quality, but in the long-term acute impacts to air quality from wildfires can be reduced (Schaaf 1996). Wildfires generally produce two to four times more smoke per acre than prescribed fires because of drier weather and higher fuel consumption during the less-efficient smoldering stage, with no way to control where the smoke goes or when it will occur. Smoldering that occurs during wildfires produces about twice as much PM10 and PM2.5 when compared to a prescribed fire (NWCG 2001; Ottmar, personal communication, 02/10/2004). While neither prescribed fire nor wildfire smoke is good for humans, prescribed fires would provide opportunities to reduce smoke quantity and control the direction and timing of smoke flow. Prescribed fire would restore or maintain fire-adapted ecosystems in the project area and reduce wildfire potential and smoke emissions. PM10 production from wildfires would be reduced considerably where prescribed fire treatments are applied. Since prescribed fires are planned (unlike random wildfire ignitions), their effects on air quality would be further reduced because ignition would be scheduled for periods when smoke would disperse quickly and avoid sensitive airsheds. Prescribed fire prescriptions would require conditions when fuels would be consumed more efficiently and produce less smoke.

The potential release of emissions during any wildland fire in the project area would be substantially reduced following implementation of the prescribed fire treatments described in the proposed action. Mechanical and prescribed fire fuels treatments would reduce fuels

throughout all strata in treatment areas. With lower fuel levels present throughout the project area, wildfires would be more likely controlled at smaller sizes, minimizing long-term air quality impacts.

Impacts on Nonattainment Areas and Class I Airsheds
The only nonattainment area currently designated in Washington State surrounds the Tacoma, WA vicinity (US EPA 2013b). Prescribed fire treatments proposed in this project would not affect this nonattainment area because small amounts of burning would occur over several years, and the geography and distance between these locations would prevent smoke from travelling into the nonattainment area. Potential smoke impacts to visitors in the nearest Class I airsheds (the Pasayten or Glacier Peak Wildernesses or North Cascades National Park) would be minimal because of the distances between the project area and these Class I airsheds, and because prescribed burning would occur in several entries with ample time in between to allow smoke to completely dissipate.

3.4.3.3 Cumulative Effects of the Proposed Action

Present, Ongoing, and Reasonably Foreseeable Future Actions
No past prescribed fire activities currently affect air quality in the Methow Valley. No prescribed burning activities or wildfires are currently ongoing within the Methow Valley drainage. Current ongoing or planned prescribed fire activities that affect air quality in the airsheds listed in Figure 3.4-2 include prescribed burning planned for National Forest lands on the Methow Valley Ranger District and on nearby state and federal lands managed by other entities, along with burning conducted by private individuals and wildfires. Any smoke drifting or settling in the middle and lower Methow Valley area would dissipate completely within one to three days with no lingering evidence. Wildfires are likely to continue to occur in the Methow Valley drainage and surrounding areas, with full suppression efforts likely used outside of the Pasayten Wilderness. Smoke from future wildfires may linger for days or weeks, depending atmospheric stability and the size of the fire, but would dissipate completely after the fire is out. As mentioned above, the overlap of WUI in the project area will necessitate full suppression efforts on wildfire ignitions across the project area during and after project implementation.

Summary of Cumulative Effects
The cumulative effect of present and reasonable foreseeable future actions and the proposed action on air quality would include settling or drifting smoke that would soon completely dissipate after ignition as air currents flowed through the area, with limited effects on human health and welfare and visibility.

3.4.3.4 Consistency Statement
Implementing the proposed action would be consistent with the goals and objectives, and standards and guidelines of the Forest Plan applicable to air quality. Prescribed fire treatments would be designed and implemented to comply with the Clean Air Act and the Washington State Smoke Implementation Plan. See Specialist's Report (Trebon 2015) for more detail.

3.5 ECONOMICS

The section below summarizes the existing condition and the direct, indirect, and cumulative effects from the South Summit II Forest and Fuels Project as detailed in the South Summit II Forest and Fuels Project Economics report (Isaak 2015), available in the project record.

The decision to provide a sustainable and predictable supply of commercially valuable sawtimber was made and documented in the *Record of Decision for the Okanogan National Forest Land and Resource Management Plan Final EIS* (USDA Forest Service 1989b). The purpose is to help maintain the stability of local and regional economies that depend on a supply of forest products from National Forest system lands. Timber sale projects are expected to maximize net public benefits while achieving management goals for other resources in the most economically efficient manner (USDA Forest Service 1989a) and to contribute towards having total timber sale program benefits equal or exceed the total costs over time (USDA Forest Service 1989b).

3.5.1 Issues for Analysis

Issue (applies to Purpose and Need #5): Provide commercially valuable timber and other forest products that are economically viable and sustainable.

Indicator: The value of the standing sawtimber trees.

Analysis Method: Use data gathered from field reconnaissance, stand exams, and timber cruising to estimate value of timber within proposed commercial harvest units. Compare information to current estimates of timber market.

Analysis Area: Methow Valley Ranger District

3.5.2 Affected Environment

The current regional timber market is showing signs of decreasing slightly relative to last year because of a declining export market (Ekstrom 2015). Trees to be harvested from the South Summit II timber sale offering are expected to have a positive stumpage value. As evidence for this, a relatively stable demand for sawtimber occurs within the appraisal zone of the Methow Valley Ranger District. Over the past three years, timber sales offered from this area have sold at higher stumpage rates than expected, and local timber sale purchasers have indicated continued demand for sawtimber offerings from the Methow Valley Ranger District.

Biomass values are less certain due to a fluctuating market. Local demand is limited because the South Summit II project area is just beyond the optimal hauling distance to established processing facilities that utilize this material.

3.5.3 Environmental Consequences

An estimate of the harvestable volume was determined using field sampling of the stands within the proposed harvest areas and interpretations of aerial photographs. Sawtimber values, based on delivered log prices, were determined from the indices used in the USDA Forest Service Product Quality Adjustment (PQA) and Appraisal Update dated #01-15. The PQA and cost files also provide a basis for the cost estimates of harvesting and hauling sawlogs and other forest products and the associated costs of road maintenance, logging slash disposal, erosion control, soil restoration, and other work. The value of the logs at the

mill (delivered log price) minus the direct and indirect costs of felling the trees, getting them to a landing to be loaded onto a log truck, and hauling the logs to a sawmill is the stumpage value, expressed as the dollar value per thousand board feet (MBF) or hundred cubic feet (CCF) of sawtimber.

Additional forest product volume is found in the topwood of sawtimber trees, the slash from logging, and in the bolewood of small diameter trees that do not meet sawtimber standards. This material, commonly known as biomass is assessed for use as pulp chips, wood pellets and other bio-fuels. Quantities of this material are expressed as green tons of wood fiber.

3.5.3.1 No Action

No harvesting of trees from the South Summit II project area would occur and thus no sawtimber or other forest products would be provided to regional mills with no economic value derived from the sale. The supply of forest products that this project represents would have to come from other areas of the Okanogan- Wenatchee National Forest to meet the allowable sale quantity. Taking no action would not meet the Purpose and Need for Issue #5 of this project.

3.5.3.2 Direct and Indirect Effects of the Proposed Action

The South Summit II Forest and Fuels Project area includes a variety of commercially valuable tree species including Douglas-fir, ponderosa pine, western larch, Engelmann spruce, subalpine fir, and lodgepole pine. Douglas-fir and ponderosa pine are the two major components of the expected volume because the majority of harvest treatments are within the drier ecological zones of the project area. Douglas-fir makes up nearly three-quarters of the total because ponderosa pine and western larch are the favored species to retain on these sites. Engelmann spruce, subalpine fir and lodgepole pine (collectively known as “white wood” species) make up less than ten percent of the expected volume because these species usually occur on cooler and more moist sites and are found only as incidental inclusions within the proposed treatment areas.

The South Summit II Forest and Fuels Project would provide about 7,000 MBF or 14,000 CCF of sawtimber and an un-estimated amount of biomass from 2,350 acres of harvest treatment. This timber sale proposal would contribute to the District’s annual commercial forest products offering for fiscal year 2015 (October 2015 to October 2016).

The timber sale offering from this project would have an expected stumpage value of $296,500 ($21 per CCF or $42 per MBF) and a delivered mill value of $1,094,000. Stumpage values are somewhat below average for the district and reflect the added cost of using cut-to-length (CTL) equipment. Additional costs for reforestation planting and activities related winter operations (such as shortened season and snow-plowing) were included. In addition to the sawtimber value, an unestimated amount of potential biomass material would be available. The delivered mill value of this material is estimated at $25/ton. This information indicates that the proposed action would meet Purpose and Need #5.

3.5.3.3 Cumulative Effects of the Proposed Action

The geographic boundary for this economic analysis is the Methow Valley Ranger District. The time frame for this economic analysis is projected through fiscal year 2015. No past economic actions affect the present, on-going, or proposed future actions in the project area.

Present and On-going Actions
Brimstone Salvage Sale is currently conducting harvest operations on approximately 250 acres within the South Summit II project area. Legal locations of this activity include Township 33N Range 23E Sections 22-27.

Reasonably Foreseeable Future Actions
The Washington Department of Natural Resources plans to conduct salvage sales to harvest dead and/or dying trees on approximately 1,300 acres near Thrapp Mountain, the Chiliwist Valley, and in the Texas Creek drainage in spring 2015. Legal locations of this activity include Township 31N Range 22E, Township 32N Range 22E, and Township 33N Range 23E.

Summary of Cumulative Effects
Excluding the Brimstone Salvage Sale and the proposed timber sale, the Methow Valley Ranger District will have no additional forest product volume remaining within the South Summit II project area under contract by December 2015.

3.5.3.4 Consistency Statement
The South Summit II Forest and Fuels Project would provide sawtimber and other wood fiber to meet the demand for commercially valuable forest products and provide an economic benefit to the region. The timber sale volume would provide a portion of the allowable sale quantity offered by the Okanogan-Wenatchee National Forest.

3.6 WATER RESOURCES

Introduction
The section below summarizes the affected environment information, along with the direct, indirect and cumulative effects of implementing the South Summit Forest and Fuels Project, as analyzed in the Water Resources Specialist's Report (Hanson 2013, George 2015), available in the project record, and Water Resources Supplemental Analysis (Humling and George 2013). A new sediment analysis has been completed considering roads, existing post-fire conditions, and proposed actions of this project. The Watershed Assessment for the Carlton Fire Burned Area Emergency Response (BAER) (Wright, Pyzik and George 2014) was also consulted. A detailed discussion of the fire's impacts upon the soils, sediment delivery, etc. will be discussed as per baseline conditions.

3.6.1 Issues for Analysis

Methodology and Scope of Analysis
Water resource impacts of proposed treatments are stratified into erosion and sedimentation to streams and wetlands related to the watershed hillslope processes and to the existing and proposed transportation system. The effects to water resources are described in terms of proxy indicators for sediment potential and model results of sediment yield. The measurement indicators describe the increase or decrease in erosion and sedimentation potential to streams in terms of likely sources of sediment.

The following indicators and measures will be used to compare effects:

- Miles of road within 300 feet of streams or wetlands;
- Number of stream crossings;
- RHCA acres treated (streams or wetlands);
- Changes in ground cover (acres of bare soil created);
- Acres of increased sediment production;
- Sediment production from fuels treatments;
- Sediment production from road crossings;
- Water quality (aquatic habitat – fine sediment and water temperature);
- Percent of watershed treated

Analysis Area: The analysis area for water resources assessment is defined as the National Forest System lands within the project area boundary. Direct and indirect effects of the proposed action to the seven 6th field Hydrologic Unit Code (HUC) watersheds within the boundary are discussed. The Forest Plan directs that the assessment of cumulative watershed effects to water quality be discussed in terms of the 5th field HUC watershed boundary.

The temporal scale for assessing water resource environmental effects includes both short- and long-term impacts. For the purposes of this analysis, short-term effects are defined as those that occur within about 10 years following proposed vegetation treatments. Long-term effects are defined as those that occur within about 10-20 years or more following proposed vegetation treatments.

Analysis Assumptions
Riparian Habitat Conservation Area (RHCA) classifications along intermittent and perennial streams, ponds, lakes, reservoirs, and wetlands provide for effective riparian ground cover

that will trap and filter sediment that may move during project implementation from entering streams and water features (US EPA 2005).

Standard RHCA widths apply to project area streams and wetlands as described in Appendix A (Design Criteria).

Research has shown the amount of surface cover to be one of the most important variables in determining surface erosion rates (Seyedbagheri 1996). Increased ground cover reduces erosion, transport, and sedimentation into streams during rainfall by reducing concentrated overland flow. Water velocity is reduced through buffer strips and roots maintain soil structure, allowing water to infiltrate into the soil. As water slows or infiltrates it releases its sediment load, reducing transport to the stream. Vegetation covers the stream, regulating temperature, and utilizes nutrients transported in the water, improving water quality. This analysis assumes that where effective riparian groundcover is maintained at 90-100% in RHCAs, sediment produced by management activities will be trapped and filtered out before reaching streams and water bodies.

This analysis assesses whether groundcover will be reduced below 90-100% and whether the proposed buffer widths within the RHCAs are effective at trapping and filtering sediment from streams. It is assumed that sediment would be produced by ground disturbing activities, and this analysis isolates the subwatersheds where sediment would likely be produced.

Research Literature Review

Research on water temperature impacts from timber harvesting activities show that temperature in small streams may increase when the streamside vegetation canopy is removed during harvest operations; however these impacts are avoided when riparian buffers are provided. Leaving vegetation intact along the streams can eliminate the risk of temperature increases from reduced shade which have been measured up to 0.6 to 10.0 degrees C in western forests (Stednick USDA, 2010).

Research on mechanical treatments using rubber-tired timber harvester and rainfall simulator indicated light to moderate disturbance from mechanical operations did not considerably increase erosion over undisturbed control areas even on steeper slopes (Cram et al. 2007). Researchers have also reviewed the effects of mechanical treatments on water quality and several conclusions were reached. Mechanical treatments can impact water quality by an increase in erosional processes due to changes in the site's ground cover properties. This in turn will affect the existing erosional processes that are related to the local soil textures, soil moistures, slopes, and precipitation regimes (USDA 2010). Most studies agree that less site disturbance will result in less erosion potential. The primary erosional influences of mechanical understory treatments are likely to be associated with direct disruption to soils through yarding of cut vegetative materials and the area of disturbance associated with heavy equipment used in the treatment. These effects are particularly likely where these activities impinge on un-channeled swales or low order channels. Hydrologic changes associated with mechanical treatments are expected to result primarily from compaction, disruption and displacement of soil-surface structure due to yarding or other trafficking of equipment used in the mechanical treatment in the project area. Compaction may allow surface runoff to concentrate in swales, thereby increasing the potential for gullying. Changes in live vegetation density are not expected to be high enough to noticeably influence transpiration rates or interception of precipitation unless the extent of green-tree thinning is substantial within the area (Reid USDA 2010).

Watershed responses to fire include changes in runoff characteristics, sediment yield, and water chemistry. Under pre-fire conditions, vegetative groundcover (grasses, brush, and the forest canopy) intercepts precipitation and releases it as throughfall from canopy to soil, thus supporting infiltration. Infiltration reduces direct overland flow from precipitation. Runoff is generated through the variable source area concept where infiltration exceeds the saturation potential of soils. As the erosive potential of overland flow is minimized, nutrients and sediments are retained on site.

With reductions in vegetative cover, runoff and the erosion and sedimentation potential may increase. This increase in flow is related to how much of the watershed is burned (reduction in effective groundcover) and the duration and intensity of rainfall that hits the area post-fire. In the 0-5 year period post-fire, before groundcover becomes re-established runoff may become flashier as more streamflow is generated by overland flow, which may result in sharper, higher peak flows and often lower base flows. With less infiltration, vegetative uptake and retention of water, total water yields from burned watersheds may become higher. Once runoff begins, bare soils and ash are quickly removed from steeper slopes and potentially delivered to streams increasing impacts to water quality (USDA FS 2010).

Suspended sediment is the major nonpoint-source pollution problem in forests, most often associated with forest roads (MacDonald and Stednick 2003). Sediment and turbidity are the most notable water quality responses associated with fire (Beschta 1990). Erosion resulting from prescribed burning is generally less than that resulting from wildfire. Roads, skid trails, and site preparation techniques that cause soil disturbance are often a necessary component of prescribed burn projects (EPA 2005).

Fire not only removes groundcover exposing the soil, it also affects the soil's infiltration ability. Organic compounds in litter are volatilized during combustion and migrate into the soil profile, condense on soil particles, and form a water repellant layer (DeBano and others 1998). These soils are described as hydrophobic, and this phenomenon is more evident in dry, coarse textured (sandy) soils. It also appears that high temperatures, above 550 °F, destroy the compounds responsible for water repellency. These data suggest that fires that heat soils to an intermediate range of temperature (400 to 500 °F) are more likely to create a non-wettable layer than fires that heat only the soil surface or those that cause deep penetration of high temperatures. It is important to recognize that hydrophobicity occurs naturally (DeBano 1981) and may develop under prescribed fire conditions (Huffman and others 2001); however, the effect is not long-lived. Repeated measurements of hydrophobicity after fire suggested the phenomenon lasted ~1-2 years in forest soils of the Colorado Front Range, but is usually gone after less than 1 year (Huffman and others 2001).

3.6.2 Affected Environment

Watershed Characterization

The South Summit II Forest and Fuels Project boundary extent is ~50,000 acres and is located within four 5th field watersheds, or Hydrologic Unit Codes (HUCs): Swamp Creek-Columbia River, Loup Loup Creek-Okanogan River, Middle Methow River, and the Lower Methow River. These HUCS contain several 6th field HUCs within the proposed project (see Figure 3.6-1). The project boundary is limited to National Forest system lands and does not correspond to watershed boundaries that continue outside of the National Forest boundary. The project area includes 88% of the Benson Creek watershed, 38% of Lower Beaver Creek watershed, <20% of Swamp Creek and French Creek watersheds, and <10% of Alder

Creek, Texas Creek and Chiliwist Creek watersheds. Note: Summit Creek 6th field HUC has ~1 mile of roads within the project area. Less than 0.25 miles of road are proposed for decommissioning, which are the tail segments or roads beginning in Lower Beaver Creek. This watershed will not be analyzed further. South Fork Beaver Creek is outside of the project area and also has ~0.4 miles of road to be decommissioned and around ~12 miles of road will either be closed or remain closed. It will not be analyzed further.

Figure 3.6-1. Watershed and treatment areas by 5th and 6th field HUC

HUC NAME	ACRES	% of HUC5 Area	Project Planning Area ACRES	% of HUC 6 Area
Swamp Creek-Columbia River	**172,887**			**~4%**
Swamp Creek	36,773	~21%	6858	~19%
Loup Loup Creek-Okanogan River	**196,057**			**~1%**
Chiliwist Creek	26,593	~14%	1937	~7%
Middle Methow River	**248,723**			**~14%**
Lower Beaver Creek	30,747	~12%	11778	~38%
Benson Creek	24,266	~10%	21275	~88%
Alder Creek-Methow River	29,804	~12%	2770	~9%
Lower Methow River	**194,010**			**~3%**
Texas Creek-Methow River	20,446	~11%	1487	~7%
French Creek	19,391	~10%	3490	~18%

*Fifth field watersheds (HUC5) are in **bold**. Source: USGS GIS data.

Figure3.6-2 lists the Carlton Complex Wildfire acres burned within the subwatersheds in the project area. Figure 3.6-2 shows % of 6th field watershed burned and intensity by the Carlton Complex.

Figure 3.6-2. Percent and Intensity* of Watersheds Burned by 6th Field HUC

HUC NAME	Acres	Unburned	Low Intensity	Moderate Intensity	High Intensity
Swamp Creek	36,773	53%	29%	14%	4%
Chiliwist Creek	26,593	36%	38%	19%	6%
Lower Beaver Creek	30,747	19%	59%	15%	7%
Benson Creek	24,266	20%	36%	23%	21%
Alder Creek-Methow River	29,804	75%	20%	4%	1%
Texas Creek-Methow River	20,446	27%	50%	19%	4%
French Creek	19,391	16%	56%	23%	5%

*High = total loss of all vegetation & organics; bare, charred soil present.

Moderate = total/partial loss of ground vegetation but organic layer remains to some degree.
Low = minimal loss of ground vegetation and organic layer remains totally intact.
Source: USFS GIS data.

Average annual precipitation ranges from ~15 inches along the lower portions of the watersheds to ~30 inches towards the headwaters. Summer thunderstorms are typically localized and of short duration and high intensity. Fall and winter storms are typically Pacific maritime frontal storms dominated by rain from mid-October through mid-November. Fall rain storms are typically low intensity and long-duration. Snowfall accumulation begins in higher elevations from mid to late November with snowfall accumulations continuing through April. Rain-on-snow events are common, typically occurring from November through January, and range in their magnitude of hydrologic responses.

Initial watershed responses have started to occur in areas that burned within the project area with moderate to severe intensity. These responses will continue to occur until vegetation is established, including:

- an initial flush of ash
- rill and gully erosion in drainages and on steep slopes within the burned area
- flash floods with increased peak flows and sediment deposition
- debris flows.

The watershed responses depend on the occurrence of storm and melt events and should be greatest with initial storm events. The disturbances will become less evident as vegetation is reestablished, providing ground cover and increasing surface roughness. Increased potential for flooding exists within the entire fire-impacted area and downstream. Many channels that may have not seen flow in decades can now produce damaging floods and debris flows in small drainages. Storms within the burned area have already proven this reality with large debris flows, dams compromised, homes flooded, major highways washed out and people's lives and safety at risk. These storms were not defined by the National Weather Service as unusual or rare, making the potential for future such events very likely. The precipitation event that caused the debris flows, flash flooding and other impacts in August of 2014 was categorized ~5 year return interval.

Many of the streams have a flashy hydrologic response due to shallow depth to bedrock and steep headwater slopes. They have naturally high fine and coarse sediment load and channel responses alternate between floodplain aggradation and channel incision. There is a history of debris flows following fires in the watersheds.

Fire suppression entailed the creation of dozer fireline, hand fireline and the opening of closed roads as described in Figure 3.6-3. The majority of the fire line was rehabilitated with only a few small segments that were missed. Rehabilitation on these firelines included waterbars, decompaction, scattering slash and recontouring hillslopes. Monitoring of the rehabilitated areas showed positive results from rehab treatments, and for the majority of fireline, sediment transport to stream channels is not expected. The segments that were missed will be rehabbed in spring 2015.

Figure 3.6-3 Fire Suppression Activities (miles) by Sub-watershed

HUC12	Dozer Line	Hand Line	Closed Roads Used as Fireline
Alder Creek-Methow River	8.7	0.5	1.4
Benson Creek	13.0	1.4	7.9
Chiliwist Creek	14.2	4.8	15.5
French Creek	12.0	0.8	9.7
Lower Beaver Creek	1.9	1.1	3.1
Swamp Creek	31.8	1.3	3.4
Texas Creek-Methow River	14.6	0.1	0
Total	**96.3**	**10.0**	**41.0**

Sensitive Soils

Ash-capped soils in the project area are susceptible to displacement and erosion due to their low cohesion, high erodibility risk, and high potential for fire damage. These soils are sensitive to ground disturbance and displacement from harvest and fire. Since the majority of the project area is underlain with these erodible soils, erosion and sedimentation is a concern. See the Soils report for identification of project areas that meet or exceed allowable detrimental soil disturbance levels and for expected ranges of sediment yields from wildfire impacted hillslopes.

Groundcover

Groundcover is essential for reducing the displacement of soil particles from rain splash erosion, improving infiltration rates, and trapping and filtering sediment from entering streams. Field reviews identified evidence that vegetation within the RHCAs had been treated to the water's edge from evidence of stumps on the stream bank and charred debris. Levels of effective groundcover within the RHCAs were observed to be effective at trapping and filtering sediment under existing conditions where 300 foot vegetative buffers were intact and had 90-100% groundcover. Riparian areas that were burned had varying degrees of groundcover present ranging from basically intact in low severity burn areas to complete consumption in high severity areas. Cover consisted primarily of grass, forb vegetation and needle cast/litter, and had little rock and coarse woody debris content. Field review confirmed that stream crossings and areas where roads were within 300 feet of streams or wetlands were existing sources of sedimentation to streams. GIS data were used to define these areas and model sediment production on water resources. These analyses were used to create Design Criteria to avoid, minimize and mitigate the potential direct, indirect, and cumulative effects associated with the proposed actions.

Riparian and Stream Resources

The Forest Plan (1989), as amended in 1995 with PACFISH, describes streams by flow regime and classifies streams into RHCA categories for riparian and aquatic habitat protection. An ephemeral draw is a drainage that conveys surface water for short periods of time in direct response to snowmelt or rainfall runoff. An intermittent stream runs water in most months, but does not run water during the dry season during most years, and a perennial stream is a stream that flows year round. RHCAs are portions of watersheds where riparian-dependent resources receive primary emphasis and where special standards and guidelines apply. The RHCA Classes recommend standard buffer widths for vegetation management activities (see Appendix A and the Aquatics Resources section of this chapter for further information).

Perennial streams are within Class 1 (perennial, fish-bearing, listed species) or Class 2 (perennial fish-bearing, not listed) RHCAs, depending upon the aquatic habitat. Class 3 RHCAs are reserved for wetlands >1 acre; intermittent streams and wetlands <1 acres are designated as Class 4 RHCAs. Figure 3.6-4 lists the stream miles per watershed by RHCA class within the project area.

Figure 3.6-4 Watershed Stream Miles in Project Area by RHCA Class (USFS GIS data)

Watershed Name	Stream (miles)					% of Project Streams
	Class 1	Class 2	Class 4	Ephemeral	Total	
Alder Creek-Methow River	0	0	5	14	18	7%
Benson Creek	4	7	25	88	120	46%
Chiliwist Creek	0	0	0	3	4	1%
French Creek	0	0	6	12	18	7%
Lower Beaver Creek	2	3	16	43	62	23%
Swamp Creek	0	0	9	25	35	13%
Texas Creek-Methow River	0	0	3	7	10	3%
Totals	**6**	**11**	**65**	**192**	**267**	**100%**

Wetlands

There are approximately 184 acres of wetlands in the project area, of 169 acres are >1acre (Class 3) and 15 acres are <1 acre in size (Class 4). Figure 3.6-5 shows the US Fish and Wildlife Service's (USFWS) inventoried wetlands within the analysis area, listed by watershed.

Figure 3.6-5. Wetland Types and Area by 6th field HUC (USFS GIS data, and USFWS 2010)

Watershed Name	Wetlands >1 acre	Wetlands <1 acre	Total Wetlands (acres)	% of Project Wetlands
Alder Creek-Methow River	0	0	0	0%
Benson Creek	100	4	104	56%
Chiliwist Creek	12	0	12	7%
French Creek	1	0	1	<1%
Lower Beaver Creek	18	5	23	13%
Swamp Creek	38	6	44	24%
Texas Creek-Methow R	0	0	0	0%
Totals	**169**	**15**	**184**	**100%**

Created Openings

Streamflow response to change in forest cover is directly related to climate, species composition, and the percentage reduction in stem density. Research from 95 watershed experiments conducted in United States forests show that on average, annual runoff increased only ~0.1 inches for each 1% of watershed area harvested (Stednick 2006). This issue will not be analyzed in depth because there are no clear-cut harvest areas proposed

and the no regeneration harvest units (selective seed tree) proposed are equivalent to 1% of the watershed in this project. Project design criteria require that no more than 20% of any watershed area be treated annually (USDA USFS 2010, Beche et al. 2005). The effects of timber harvesting as a thinning, selective cut, or other partial canopy removal treatment, will have less of an effect than complete canopy removal. Less site disturbance will result in less erosion potential and less runoff; remaining vegetation will quickly utilize increased available nutrients and water from evapotranspiration savings.

Riparian Roads and Crossings

A major modification to watershed function is from the existing road networks in the project area that increase in road density with proximity to the headwaters. Roads change the way watersheds handle runoff and drain the hillslopes, and they also deliver more sediment into the system at crossings or when they are placed adjacent to a stream. There are 332 miles of road associated with the project area; there are 111 road crossings, and 69 miles of roads within 300 feet of streams. Figure 3.6-6 shows the road miles, crossings and riparian road miles for each 6th field watershed. Roads within 300 feet of streams including crossings are direct indicators of sediment sources and will be as a proxy to evaluate sediment delivery to streams. Sediment delivery from roads to streams within the project area will be discussed in combination with wildfire impacts later in this section of the document.

Figure 3.6-6 Project Road Miles, Stream Crossings, and Roads within 300 Feet of Streams by Watershed

Watershed Name	Road Miles Associated With Project Area	Road Crossings Within Project Area	Road Miles Within 300 Feet of Streams
Alder Creek-Methow River	12.5	7	2.5
Benson Creek	139.5	54	34.7
Chiliwist Creek	21.9	3	0.9
French Creek	25.3	9	7.1
Lower Beaver Creek	65.6	17	12.5
South Fork Beaver Creek	12.6	0	0
Summit Creek	1.5	0	0
Swamp Creek	44.0	16	8.7
Texas Creek-Methow River	9.2	5	2.2
Totals	332.2	111	68.6

Water Quality

The Forest Plan, as amended, directs that the assessment of cumulative watershed effects to water quality be discussed in terms of the 5th field HUC watershed boundary. The Washington Department of Ecology (DOE) has water quality sampling locations downstream from the proposed project area for four 5th code HUCs: Swamp Creek-Columbia River, Loup Loup Creek-Okanogan River, Middle Methow River, and Lower Methow River. Water quality parameters (with Washington State Water quality criteria) most likely impacted by timber harvest are sediment and water temperature. These standards allow short-term increases over background levels.

Water quality in nearby rivers and streams has been assessed at regular intervals since 1996, with the most recent assessment in 2012. When water quality does not meet criteria

specified in the Clean Water Act, these water bodies are included on the state DOE lists for impaired or threatened water bodies (also known as the 303(d) list). During the testing period from 1996 – 2012, the Columbia River and the Methow River have been consistently listed because of increased water temperatures, and Chiliwist Creek has been listed because of pH (Washington State DOE 2013). The affected reaches are all below the 6th field watersheds draining the proposed South Summit II Forest and Fuels Project: the Columbia River is ~25 miles below, the Chiliwist reach is ~9 miles below and Methow River is ~13 miles below. To meet the intent of the Clean Water Act, activities planned in tributaries to the Okanogan and Methow Rivers should not further increase water temperature or affect pH in the downstream reaches of listed rivers, and should help restore water quality in the river where possible. Design criteria for this project outline management practices to avoid, minimize, and mitigate water quality impacts as described in USFS National Water Quality Best Management Practices (USDA FS 2012).

The state water quality parameters specific to aquatic habitat that are most likely susceptible to change by vegetation and fuels treatments are turbidity, fine sediment, and temperature. These data are collected and managed by the MVRD Fisheries program. See below for a summary of fish habitat data for stream temperature and sediment core data for the South Summit project area. These data indicate that the fine sediment habitat parameter is in exceedance on Frazer Creek.

Water quality parameters of temperature and sediment have not been updated by the state DOE since the Carlton Complex fires. They are likely adversely affected.

Aquatic Habitat

Salmonid spawning habitat in Frazer Creek and Benson Creek (the primary fish-bearing streams in the project area) was found to exceed the Forest Plan standard for fine sediment in salmonid spawning habitat, based on quantitative, volumetric sediment sampling in representative habitat. Both Benson and Frazer Creeks were heavily impacted by the Carlton Complex Fire. Many other streams were also heavily impacted by the fire. Expected effects upon the stream channels that have occurred and will likely continue to occur are listed in the watershed characterization section above.

Water Yield and Sediment Delivery Increase from Wildfire

A Burned Area Emergency Response (BAER) team was assembled to analyze the effects that the Carlton Complex fire would have upon water yield and sediment delivery to determine where areas of high risk to property and safety could be expected. The BAER team summarized the Soil Burn Severity information to identify the percent of the catchments that burned at moderate and high severity. This combination of severities is used to indicate the hydrologic response for the catchments modeled because it is these severity ranges that produce the majority of the post-fire runoff. Eight catchments of various sizes were modeled within and close enough geographically to the project area to reveal expected changes in runoff regime. Modeling details are available in the specialist's report.

The design storm used for modeling represents a 25-year statistically historic convective thunderstorm producing a one-hour high-intensity rainfall event. This storm has a 4% chance of occurring in any given year and about an 11% chance of happening during the first 3 years following the fire. The amount of precipitation for this storm is 0.77 inches, whereas instantaneous short duration (15 min.) intensities during the design storm can range between 0.3 and 3.2 inches/hour.

Figure 3.6-7 shows the modeled estimates of the effect of modeled rainstorms, peak flows, and sediment delivery to the stream network. The acres within each catchment include all acres within and outside of National Forest lands. The pre-fire peak flow is the expected flow from the modeled storm prior to the fire. The post-fire peak flows are the expected flows from the one-hour storm modeled 2 years and 25 years after the fire. The 100-year event was calculated using a different model but is included as a comparison of the magnitude and/or significance of the post-fire changes. The modeling results for a 25-year storm event on burned ground exceeds the 100-year event on unburned ground in every catchment. In other words, the 100- year event is considered a significant hydrologic event; therefore, a post-fire event that produces equal or greater flows would be of concern. Results are modeled estimations only; actual watershed response may differ.

Figure 3.6-7 Estimated Pre-fire and Post-fire Peak Flows and Sediment Delivery

Catchment Name	Acres	Pre-Fire 2-Year Peak Flow (CFS*)	Post- Fire 2-Year Peak Flow (CFS)	Sediment Tons/Acre 2Yr. / 25Yr.	Post-fire 25 Yr. Event Peak Flow (CFS)	Pre-fire 100-Year Event Peak Flow (CFS)
Benson	7869	2	166	0.24 / 1.97	270	231
Bowen	607	2	73	3.79 / 20.63	130	23
Cougar	1236	~1	86	1.92 / 8.50	140	47
Finley	9814	1	66	0.09 / 3.99	1230	212
Frazer	8527	1	356	1.07 / 4.79	500	248
Piper	860	~1	176	5.14 / 17.61	500	31
Storer	1382	1	170	1.61 / 15.94	140	55
Volstead	6117	2	190	1.44/6.91	190	100

*CFS: Cubic feet/second

Figure 3.6-8 shows modeled estimations of post-fire hillslope erosion as modeled by ERMit. Hillslope erosion does not equal sediment delivery to the stream network. Sediment delivery rates of 3 tons/acre or less are considered to be normal sedimentation rates. The highest erosion risks are on the steepest slopes with the greatest soil burn severity, and the highest amount of sediment delivery is expected during the first year post-fire, with gradual reductions thereafter. Modeling parameters are available in the soil specialist's report.

Figure 3.6-8 Soil Erosion Risks within the Carlton Complex Fire Perimeter

Soil Burn Severity Class 30-50% Slopes	Sediment Delivery Year 1 (tons/ac)	Sediment Delivery Year 2 (tons/ac)	Sediment Delivery Year 3 (tons/ac)
High	15-21	10-15	2-10
Moderate	10-13	5-10	1-5
Low	3-7	1-3	>1
Soil Burn Severity Class 20-30% Slopes	**Sediment Delivery Year 1 (tons/ac)**	**Sediment Delivery Year 2 (tons/ac)**	**Sediment Delivery Year 3 (tons/ac)**
High	9-12	5-8	2-4

Moderate	5-8	3-5	1-3
Low	1-4	1-3	>1
Soil Burn Severity Class *5-20% Slopes	**Sediment Delivery Year 1 (tons/ac)**	**Sediment Delivery Year 2 (tons/ac)**	**Sediment Delivery Year 3 (tons/ac)**
High	5-8	2-5	>1
Moderate	3-5	1-3	>1
Low	1-3	1-2	>1

*0-5% slopes were modeled but not displayed in the table because model results were below baseline sedimentation rates.

Transportation Network Effects upon Sediment Regime

The Hillslope Erosion Model (HEM) was utilized to calculate surface erosion rates for the existing road crossings within the analysis area. The inputs for the HEM model include slope percent, slope length, soil texture, canopy cover, groundcover, and runoff. Actual rainfall event data from the nearby Leecher Peak RAWS station from 1999 through 2012 was utilized to define the wettest and driest rainfall periods of record (April through October). The driest year was 2008 with three storms over 0.25 inches of rain and the wettest year was 2011. The sedimentation rates produced from the two representative rainfall years were then averaged for the purposes of impacts analysis. Sediment production rates were calculated for the wettest and driest rainfall periods in the last 14 years to describe the best and worst case scenarios for sediment production at road stream crossings. A total of 11 storms were modeled for the Wet year total and 3 storms were modeled for the Dry year, for a total of 14 storms. This was done prior to the Carlton Complex Wildfire.

Figure 3.6-9 summarizes the annual sediment production (tons) per stream crossing by sub-watershed on all roads for the existing condition. To include the Carlton Complex impacts and be conservative it was assumed all sediment from roads within 300 feet of a stream channel would be transported to the stream channel due to the lack of vegetative cover. To represent the changed condition, wet year sediment data was only used to calculate the sediment budget for the project area for SSII, including in areas that were unburned. Dry year sediment values and avg. values are shown in Figure 3.6-9 to give an estimate of the fires impact upon the sediment delivery from the road network. These values are produced by the model to give a representation of impacts, they are not meant to be quantitative descriptions of actual sediment delivery values.

Figure 3.6-9 Annual Sediment Production (tons) per Existing Road Crossing

Watershed	Wet Year	Dry Year	Avg. of Wet and Dry Years
Alder-Methow	39.9	3.3	21.6
Benson Creek	254.3	15.1	134.7
Chiliwist Creek	21.3	1.7	11.5
French Creek	39.8	3	21.4
Lower Beaver Creek	74.2	7	40.6
Swamp Creek	46.7	3.7	25.2

Texas – Methow	31.9	2.1	17
Totals	508.1	35.9	272

3.6.3 Environmental Consequences

Watershed Impacts
A combination of factors including location, elevation, drainage size and shape, vegetation type, slope, soil properties, and effectiveness of groundcover (vegetative and woody debris) depict how a watershed will respond to precipitation. Predictably unmanaged forest watersheds handle precipitation, runoff and erosion differently than forests managed for multiple uses. Road building, timber harvest, fuels management, wildfire and grazing all modify forest canopy, effectiveness of groundcover, and soil productivity. These activities inherently impact natural infiltration rates that in turn impact runoff, erosion and sedimentation. Areas where increases in sediment potential are seen most dramatically are where bare soil areas are concentrated within the riparian or stream area. Indicators of watershed runoff modification and erosion and sediment potential directly are related to riparian road densities, stream crossings, and changes in effective groundcover.

3.6.3.1 No Action
Taking no management action would result in no increased project-related short-term risk to site productivity, surface erosion, and water quality because no additional area would be disturbed by harvest or fuels operations and road construction, decommissioning, or closures. In the long term, there would be no potential benefits from restoration of currently compacted areas or reduction in the risk of additional high-severity fire due to fuel reduction treatments. Potential effects from additional high-intensity wildfire would be loss of soil nutrients from vaporization, increased rates of soil erosion and stream sedimentation, and loss of riparian stream shading with resulting increases in water temperatures. Existing soil compaction from previous harvest activities would recover more slowly as natural vegetation and physical processes restore soil function. Long-term reduction in sediment yields due to road decommissioning and road closure would not occur.

Groundcover
Groundcover within the RHCAs and upper watersheds would remain at existing levels. Groundcover within the stream bottoms and riparian areas would remain high (90-100%) where unburned and provide effective filtration of watershed runoff and adequately trap and filter sediment before reaching the stream. Groundcover within the project area was found to be effective for trapping and filtering sediment from streams when roads were greater than 300 feet away. Outside of the fire, the majority of bare soil within the project area is related to road surface area. Areas impacted by the high and moderate intensity wildfire would slowly revegetate and within 3-5 years approach pre-fire conditions.

Riparian Roads
Roads in RHCA would continue to exist where they are in current locations, at current densities. No road decommissioning, closure, or culvert removal would occur in roads within RHCAs and consequently none of the associated benefits would occur. The associated benefit of long-term reduction of sediment yield, stated above is especially beneficial.

Sediment Yield at Crossings
There are 111 road crossings within the project area that would continue to produce ~508 tons of sediment per year. No road crossings would be removed.

Sediment Production from Wildfire
Heavy fuel loading in areas that are unburned would not be managed and therefore the threat of high severity wildfire would remain. Increased sediment production from hillslopes and road networks may resemble current conditions within the burn scar.

Water Quality
The risk of sedimentation post-wildfire would continue to episodically threaten water quality within the project boundary for 3-5 years or more post fire. It is likely that sediment-related exceedance of water quality standards (turbidity) would be detectable at the State sampling location downstream from the project area during spring run-off and storm events. Sediment inputs related to high-severity wildfire have produced detectable exceedances to fish habitat standards related to fine sediment. For further discussion, see the Aquatics Report. Sediment inputs from existing roads would remain.

Temperature
No change to existing shade levels or the general stream temperature regime would result under the No Action Alternative. No changes in riparian forest structure or composition would occur. Wildfire impacts would persist until vegetation recovers, with associated loss of canopy cover, increased stream solar warming, and shift in temperature regime (USDA 2011). Several riparian roads would not be decommissioned or closed and these areas would remain compacted and continue lacking forest cover that would otherwise provide shade to project area streams.

The No Action Alternative would not meet the Purpose and Need #3 regarding the existing transportation system effects upon watershed function.

3.6.3.2 Proposed Action
Proposed activities would have short-term direct, indirect, and cumulative effects on water resources in terms of erosion and sedimentation to streams and wetlands. However, by implementing prescribed hydrology, soil, and aquatics design criteria, the project would minimize the negative short-term impacts in order to meet vegetation management objectives and improve some watershed function as well. There are no treatments associated with moderate to high-severity burned areas in this project besides tree planting. There is some harvest taking place is areas of low burn intensity (~250 acres). There may be areas of small inclusions of moderate to high intensity burn, but when these are encountered they will be avoided. There is no salvage harvest planned.

The proposed actions of commercial timber harvesting, temporary road construction and fuel treatments have the potential to adversely affect soils, water quality, and associated overall watershed condition. The potential adverse effects of most concern include soil erosion and its associated potential adverse effects on water quality and downstream aquatic habitat. Proposed treatments in riparian areas and ephemeral drainages are avoided except in areas where RHCAs have roads for a logical buffer or the treatment is for the benefit of RMOs. Where present, the treatments are designed to reduce bare soil area, erosion and sedimentation to these watershed resources. Potential effects related to changes in hydrologic timing of water flows due to changes in canopy closure and increased interception by roads resulting in potential effects on groundwater have also been mitigated through project design. Groundwater can potentially be impacted by changes in timing and flows resulting from management activities. Changes in canopy closure from harvest or fuels activities and actions which change soil infiltration rates may influence groundwater

recharge rates. Roads cuts on steeper terrain can directly intercept groundwater flow and route water to stream channels at faster rates than would occur naturally (Ketcheson and Megahan 1996). At the micro-site level, RHCA buffers would be utilized to protect springs, seeps, and wetlands so that no impact to groundwater is expected. Since the Proposed Action is not expected to cause any measurable change in hydrologic timing or flow levels, there would not be any measurable change in groundwater resources. The potential to increase early spring water flows and and/or increase summer stream temperatures is mitigated through project design by limiting the treated watershed acres to below 20% per year. Road related impacts have been analyzed and reductions in road miles and crossings would have positive watershed impacts as discussed below in the Sediment related sections.

Created Openings

As described previously, this issue will not be analyzed in depth because no clear cut harvest is proposed and no regeneration harvest (selective seed tree) proposed is equivalent to 1% of the watershed in this project.

Proposed Treatments by Watershed

The water resource discussion is organized to show the proposed activity and related effects by watershed. Figure 3.6-10 lists proposed treatments by watershed and sub-watershed (6th HUC). The treatment acres are discussed in terms of activity proposed within sensitive riparian and soil areas (RHCAs). Machine-piling and harvest are ground disturbing activities and their impacts to erosion and sedimentation have been avoided and minimized by design criteria in Appendix A. Hand-piling causes minimal impacts to groundcover effectiveness.

Figure 3.6-10 Proposed Treatments by Subwatershed in Acres

			Fuels/NCT (acres)*		Harvest (acres)	
6th HUC NAME	**Project**	**Planting**	**All**	**RHCA**	**All**	**RHCA**
Swamp Creek	6858	949	2526	72	868	29
Chiliwist Creek	1937	471	413	1	647	1
Lower Beaver Creek	11,778	764	1442	25	275	2
Benson Creek	21,275	5778	1924	92	499	1
Alder Creek-Methow River	2770	101	4	0	0	0
Texas Creek-Methow River	1487	0	114	0	0	0
French Creek	3490	218	1127	51	59	0
	Totals	**8283**	**7550**	**241**	**2348**	**33**

Groundcover Alteration

Proposed treatments and season of harvest are described in Chapter 2: Alternatives. Each treatment activity is associated with a different level of groundcover alteration in perennial/intermittent and ephemeral drainages within the project area. Alteration or removal of groundcover in RHCAs and ephemeral drainages increases the potential for erosion and

sedimentation by reducing the effectiveness of groundcover to trap and filter sediment from upslope areas. There may be tiny short-term increases in fine sediment delivery to streams that already exceed the aquatic habitat standard. These short-term impacts would not be detectable at the watershed scale and therefore anti-degradation requirements would be met.

Proposed vegetation treatments would create changes to the amount of groundcover and its structure (although tree planting is not expected to impact sediment delivery). Temporary roads, skid trails, landings, machine piles, hand piles and areas of high-severity burning (including some areas under burn piles) are areas where groundcover would be temporarily removed exposing bare soil surface during harvest and prescribed burning activities. Most of these activities are proposed outside of RHCAs and at a distance away from streams and wetlands; however there are ~33 acres of thinning and harvest, and ~241 acres of fuels treatments in RHCAs. In these areas, design criteria are targeted to avoid, minimize and mitigate sedimentation impacts to riparian resources. There is no underburning or machine piling in any RHCA. There is not expected to be any measurable increase in sediment delivery from hand piling and thinning in RHCAs.

Up to 1,850 acres of harvest in the South Summit area would be specifically restricted to winter logging conditions in order to minimize compaction and displacement of ash cap soils. Summer logging with harvester-forwarder equipment in a cut-to-length (ctl) harvesting system or other harvesting systems to protect soils, is being used in some areas to avoid disrupting winter recreation in roughly 498 acres. In the remaining 2 acres of harvest units the harvest season is optional and equipment may include conventional feller-buncher/grapple skidder (whole tree logging) equipment or use a cut-to-length system depending on soil conditions.

Riparian Habitat Conservation Areas (RHCAs)

Approximately 33 acres of proposed harvest units lie within RHCAs. All harvest activities within RHCA management zones would be done with the objective of attaining riparian management objectives for water temperature, sediment regime, large woody debris, and bank stability. Design criteria listed in Appendix A includes use of buffers where no treatments would occur. Buffer widths of 50 to 300 feet or more (depending on stream flow or regime or wetland type (perennial or intermittent), fish-presence, adjacent hillslopes, road locations, and soil sensitivity) would ensure that Forest Plan and PACFISH standards and guidelines are met. As such, harvest within RHCAs would always take place in the outer portions of the RHCAs and heavy equipment use and harvest would not occur in areas that are perennially wet or where vegetation cover is dominated by riparian species. No harvest is proposed in RHCAs that burned in the Carlton Complex. RHCA boundaries would be implemented to maintain and restore historic vegetation characteristics by managing for large trees, historic hardwood/aspen components, and increasing resiliency to disturbance by fire, insects, and disease.

Proposed harvest treatments within RHCA boundaries include about 13 acres of commercial thinning, 4 acres of commercial thinning with dwarf mistletoe treatment, and about 16 acres of aspen maintenance treatment, typically consisting of commercial thinning to remove conifer competition. Project design criteria employed to mitigate adverse soil and habitat effects includes required winter logging of all harvest units within RHCAs, as well as a range of standard BMPs required to protect water quality and aquatic life that are listed in the Appendix A.

Groundcover Removal

Temporary removal of effective groundcover is expected to occur in areas of the watersheds where temporary roads, skid trails, landings, machine piles, hand piles and areas of high severity burning (small portions of underburn units) occur exposing bare soil surface during harvest and prescribed burning activities. These areas will persist throughout the implementation of post-winter harvest machine-piling and burning, summer harvest and machine-piling/hand piling and burning.

There would be an increase of ~135 acres of bare soil in the project area created by proposed activities (see Figure 3.6-11). Field review indicates that pile burning related bare soil creation recovers to effective groundcover levels within 2-10 years post treatment. In bare soil areas, there is a small possibility of erosion and potential sedimentation to streams and wetlands if there were runoff producing storm events during implementation and prior to vegetation becoming reestablished (2-10 years).

Figure 3.6-11 Bare Soil Creation Related to Proposed Fuels Treatments

Proposed Fuels Treatments	Acres treated	Activity Related to Increase in Sediment Potential	Estimated Bare Soil Created (acres)
Harvest Unit – LFR** Thinning, Machine Pile/Burn, Burn Landing Piles	1,575 acres*	Average 10 piles per acre, 10'x10' Landing Piles: average 1 pile per 10 acres of harvest (~0.1 acre)	~52
Harvest Unit - Burn Landing Piles LFR Thinning + Hand Pile / Burn	675 acres*	Landing Piles: average 1 pile per 10 acres of harvest (~0.1 acre) Average 25 piles per acre, 4x4	~13
Harvest Unit – Underburn for planting site preparation	70 acres*	Maximum 3% high severity burn	~2
Campground Unit: LFR Thinning, Machine Pile / Burn	35 acres*	Average 10 piles per acre, 10'x10'	~1
NCT Unit: Hand Pile / Burn	1,000 acres	Average 25 piles per acre, 4x4	~9
Fuels Unit: LFR + Hand Pile / Burn	6,300 acres	Average 25 piles per acre, 4x4	~58
Fuels Unit: LFR Thinning, Mastication	300 acres	No bare soil from burning	0
Total Fuels Treatments Proposed	**9,955 acres**		~135

**Maximum potential acreage, depending upon harvest method and utilization. Landing piles may be utilized for biomass if economically feasible.*
*** LFR: ladder fuel reduction thinning*

Proposed reductions in effective groundcover in RHCAs have been avoided, minimized and mitigated by project design to limit bare soil creation in floodplain areas mainly through avoidance. Project design criteria applied to proposed ground-disturbing scenarios would limit bare soil creation in RHCAs. Harvest and fuels activities are designed to maintain

effective groundcover and utilize existing roads, skid trails and landings to minimize the creation of additional disturbed. The effects of groundcover removal, soil disturbance or bare soil creation are discussed in terms of acres of bare soil created. The majority of the timber harvest would be completed during winter, thus mitigating much of the bare soil creation, erosion and sedimentation that could occur during summer harvest activities. Summer harvest activities would utilize existing road networks, thus avoiding new creation of bare ground in the long-term.

Some ground based activities are proposed within the RHCAs to meet vegetation management objectives, which could increase erosion and sedimentation potential in these areas. Project Design Criteria would strictly minimize treatments within the inner RHCA, thereby minimizing increases in sedimentation. Mitigation measures to reduce sedimentation below any additional sediment produced from the project include approximately 2.2 miles of road decommissioning in the Lower Beaver Creek and Benson Creek Watersheds prior to project initiation which would result in a net reduction of current sediment levels throughout the duration of the project. These roads were originally proposed for pre-project decommissioning to offset underburning increases in sediment delivery prior to the Carlton Complex Wildfire. Since the fire, there is no underburning in RHCAs and only ~70 acres of underburning proposed in the entire project area in four regeneration harvest units to reduce potential sediment delivery. Current levels of sediment transport would see a reduction (from project actions) and no Forest Plan Amendment would be required to address sediment concerns regarding salmonids.

Proposed treatments would possibly create a maximum total of ~135 acres of bare soil within the project area. A small fraction (less than 0.1%) of this may occur within an RHCA boundary and is primarily related to hand pile burning. This would not produce a measurable increase in sediment. Approximately 0.4 miles (~0.7 acres of bare soil) of temporary road construction would occur to provide access to harvest units. These roads would be decommissioned as soon as the harvest is completed and are not expected to contribute sediment to the stream network.

Riparian Roads and Crossings

The largest expected increases and decreases in overall sediment yield from proposed actions are related to increased traffic and changes to the transportation network. Figure 3.6-12 summarizes the changes to the riparian road mileage and the number of crossings throughout the project by 6th field HUC. There are 111 stream crossings within the project area. Proposed changes include the opening of 21.7 miles of closed/unauthorized roads, and increased traffic on the system during project implementation. The largest decrease in sediment would be tied to the decommissioning of ~85 miles of road and the removal of 45 stream crossings. The sediment produced from road stream crossings would be the main source of sediment. Immeasurable increases would also be produced from thinning and fuels treatments in the RHCAs in addition to the road related sediment production. The total amount of roads within 300 feet of streams would decrease by 25.3 miles, from ~68.6 to ~43.3 miles. In addition 26 stream crossings would be put into ML1 which is stable hydrologic storage and would decrease sediment delivery from those roads. This would reduce the bare soil area available for erosion and sedimentation to streams by ~90 acres.

Figure 3.6-12 Stream Crossings and Roads Adjacent to Streams**

6th Huc Name	Current Road Miles Project Area	Road Miles Project Area (Post)	ML 1 Miles Project Area (Post)	Stream Crossings (project area)	Roads within 300 feet of stream (mi)				Stream Crossings Post Project Decom.	Stream Crossings Post Project ML 1
					Existing*	During*	After	Post		
Alder Creek-Methow River	12.5	10.5	4.7	7	2.5	2.5	2.5	2.2	6	3
Benson Creek	139.5	99.5	52.6	54	34.7	32.2	30.3	21.3	30	10
Chiliwist Creek	21.9	19.4	7.6	3	0.9	0.9	0.8	0.8	3	2
French Creek	25.3	18.9	10.3	9	7.1	7.1	6.7	5.4	5	4
Lower Beaver Creek	65.6	49.3	18.1	17	12.5	10.4	10.2	7.4	9	0
South Fork Beaver	12.6	12.2	7.2	0	0	0	0	0	0	0
Summit Creek	1.5	1.3	0.1	0	0	0	0	0	0	0
Swamp Creek	44	29.6	12.8	16	8.7	8.7	6.5	4.2	9	3
Texas Creek-Methow River	9.2	7.8	4.5	5	2.2	2.2	2.2	2.0	4	4
Totals	332.2	248.5	117.9	111	68.6	64.0	59.2	43.3	66	26

*Existing condition lists some UA roads that have been decommissioned as part of fire suppression. "During Harvest" shows current condition of roads minus decommissioned UA roads.
**Miles are averaged so they are may slightly differ from proposed action

Sediment Production

The Hillslope Erosion Model (HEM) was utilized to calculate surface erosion rates for the existing road crossings within the South Summit Project analysis area. Inputs and specific modeling results are described more fully in the Water Resource Specialist Report in the project record. Harvest units were not modeled because most of the units (88 of 97) are winter harvest only and the amount of harvest in RHCAs was deemed too insignificant for measurable sediment transport. Past sediment modeling predicts that thinning would produce no measureable sediment. Design criteria also limit bare soil creation and sediment transport pathways. Fuels treatments were dropped from modeling because there are only ~70 acres of underburning proposed in the project area. Past modeling also predicts ladder fuel reduction and non-commercial thinning produce no measurable sediment. Machine piling would occur in limited portions of RHCAs according to design criteria, and hand piling would be minimal in RHCAs. Neither action was deemed a significant source of sediment.

Road Sediment Contributions

National Forest System roads and unauthorized roads within the project area represent the largest component of erosion prone area (bare soil) impacted by proposed actions that may potentially contribute sediment to streams. Sediment deposition into streams is known to impair aquatic habitat by filling in pools and affecting spawning habitat for anadromous species (PACFISH RMOs). The most likely sources for sediment to enter streams are at stream crossings and along native surface road segments that are within 300 feet of streams (Ketcheson and Meghan 1996). Open roads contribute more sediment than closed roads due to ground disturbance from wheeled vehicles across the road surface.

Sediment Yield at Crossings

The comparison of pre- and post-project annual sediment production due to stream crossings is shown in Figure 3.6-13. This comparison considers the existing sediment production for crossings and also shows the potential sediment savings that would occur once roads are decommissioned or hydrologically closed (placed into ML 1 status). Additional sediment delivery would be expected from road reconstruction and increased haul traffic. Typical wet and dry years are calculated and averaged to come up with an average sediment delivery, and the wet year's average was used as a baseline due to the altered conditions from the fire. Due to the lack of vegetation, it was assumed all sediment from roads within 300 feet of a stream channel would be transported to the stream channel. The dry and average totals are shown to show the fires impacts and to give an estimate of savings once the project area returns to a more stable vegetated condition.

Sediment production was evaluated for each crossing in the project area on National Forest System lands by road number and organized by watershed to calculate total sediment loading for each 6th field HUC. Further detail on sediment production rates for each crossing by Forest Service Road number is available in the specialist's report.

Figure 3.6-13 Existing Condition vs. Post-Project Annual Sediment Production (tons) per Stream Crossings

Watershed and Project Phase	Wet Year	Dry Year	Avg. of Wet and Dry Years
Alder-Methow			
Existing level	39.9	3.3	21.6
Post project	20.7	1.5	11.1
Benson Creek			
Existing	254.3	15.1	134.7
Post project	138.3	7.8	73.05
Chiliwist Creek			
Existing	21.3	1.7	11.5
Post project	18.8	1.3	10.05
French Creek			
Existing	39.8	3	21.4
Post	24.2	1.8	13
Lower Beaver Creek			
Existing	74.2	7	40.6
Post project	44.7	4.3	24.5
Swamp Creek			

Existing	46.7	3.7	25.2
Post project	32.3	3.2	17.75
Texas - Methow			
Existing	31.9	2.1	17
Post project	26.2	1.6	13.9
Totals	**WET**	**DRY**	**AVERAGE**
Existing	508.1	35.9	272
Post project	305.2	21.5	163.4

The crossings in the Benson Creek watershed produce the most sediment in the project with ~116 tons of sediment modeled per year. Post-project, after road decommissioning and crossing removal, the sediment rate for Benson Creek would be reduced by ~40%. Road crossings at the project scale contribute 508 tons of sediment per year and after the project is completed this rate would be reduced to 305 tons per year, a 40% reduction. This action would improve watershed conditions related to sediment. These totals would resemble the average totals as the burned area is revegetated and water yield is reduced.

There may be isolated streambank alteration at the potential site of culvert removals at stream crossings during road decommissioning. These effects would be short-lived and lead to a reduction in sediment levels once the removals are completed.

Water Quality
There would likely be no detectable impacts to water quality parameters including temperature or pH at the State Water Quality monitoring locations far downstream of the project area. There would be small localized increases in sediment along the haul route from increased traffic.

Aquatics Habitat
Road decommissioning and stream crossing decommissioning would create long-term net sediment reductions. The pre-implementation road decommissioning would reduce sediment from project related actions far below any additional sediment created during the project. Net project-related sediment yield in fish-connected watersheds would remain negative throughout the life of the project when assessing proposed actions. This would ultimately result in more substantial permanent reduction in chronic sediment yield to fish habitat downstream of the project area.

Water temperatures are not expected to increase from current levels since no new created openings would be created within RHCAs. As vegetation grows and the tree canopy in past created openings fills in, average water temperatures would be maintained or decrease as shaded areas increase.

Other Proposed Actions
The following proposed actions are categorized by being neutral or beneficial to watershed processes and their impact on the indicators of water quality and sediment delivery.

- Hazard tree removal along the Highway 20 corridor, vegetation management at JR and Loup Loup Campgrounds, and procuring easements on roads crossing DNR lands would be neutral to watershed processes and sediment delivery because they are making no change to existing conditions that could contribute sediment.

- Construction of 1.8 miles of dozer fireline and 0.5 miles of hand fireline, and construction of a horse campground in the North Summit area would create bare soil but are not within any RHCA boundaries. Fireline would be rehabbed as needed as soon as burn is over. The campground is on top of a hill with little slope. Little to no sediment would be delivered to any streams

- Culvert installation and upsizing (8 sites), pre-project road decommissioning (approximately 2.25 miles), designation of Administrative Use Access routes (approximately 30 miles), installation of gates in the Frazer Creek/powerline corridor area, and construction of a ford and 200 feet of road to provide Okanogan PUD administrative access would all be beneficial to watershed processes and sediment transport. Culvert removal and upsizing benefit hydrologic function of the altered stream channel. The decommissioned roads would remove ~50 tons of sediment that is currently being delivered to streams. The access trails would lower traffic and improve sediment delivery. The gates would lessen illegal traffic and lower sediment delivery. The hardened drivable ford would enable ~1 mile of RHCA road paralleling Frazer Creek to be decommissioned and improve sediment delivery and riparian vegetation. All of these actions have small temporary increases in sediment production but would be off-set by long term improvements in watershed condition.

Summary of Direct and Indirect Effects

There would be long-term reductions in erosion and sedimentation related to the reduction in transportation network mileage at the project scale. This project should produce positive watershed effects in the long- term by reducing riparian road density and road crossings, increasing the health of forest groundcover and reducing the risk of high severity wildfire in areas that have not burned.

There would be short-term increases in sediment in the project area from increased traffic, road decommissioning and culvert removal. Pre-implementation road decommissioning would offset sediment production and reduce sediment in the short- and long-term prior to project initiation.

Harvest activities are not expected to increase sediment production because design criteria have been incorporated to avoid sediment delivery to streams and wetlands via winter logging or excluding harvest in RHCAs. Modeling of non-ground disturbing thinning activities showed that these activities would not produce erosion and sedimentation. These activities are not expected to produce increases in fine sediment within the project area due to implementation of design criteria. Sediment delivery would remain constant because of winter operations where freezing soil temperatures and snow covered road surfaces would limit sediment delivery potential during winter harvest activities and negate the impacts of increased traffic on roads within 300 feet of streams and at road crossings.

The total reduction in sediment from road decommissioning/proposed crossing removal post project would be ~203 tons per year, a 40% reduction from 508 tons per year to 305 tons per year. This amount would only improve over time as the burned area recovers.

The amount of sediment delivered to streams and wetlands from roads and hillslopes would be immediately reduced from the pre-project road decommissioning. Hillslope sediment would return to pre-fire levels in 2-10 years or until vegetation re-establishes within the RHCAs and hillslopes. It may take longer for vegetation to grow on the closed roads. Under Alternative 2, ~85 miles of road is proposed for decommissioning. Although rehabilitation

through de-compaction and/or re-contouring cannot assume complete reversal to natural conditions, treatments would initiate a long-term recovery process. Anticipated results would also provide for improvements in hydrologic function that otherwise would be prolonged because of the persistence of soil compaction. The closing of ~118 miles of road to traffic would also improve watershed conditions.

3.6.3.3 Cumulative Effects of the Proposed Action

Past and on-going actions such as the Carlton Complex wildfire and its associated repair and restoration activities that affect resources may be described as part of the existing condition information for specific resources.

Present, Ongoing, and Reasonably Foreseeable Future Actions

Mechanical Treatments and Prescribed Fire Treatments
Prescribed fire activities would not overlap in time and space with ongoing or foreseeable projects. Brimstone Salvage sale has been completed. This consisted of ~250 acres of salvage harvest near Pole Pick Mountain within the project area. This sale was done over frozen soil and snow. It had limited impacts to soil resources and was conducted in an area of low slope and away from of riparian areas. No cumulative effects from thinning or prescribed fire will occur at the same time of within the spatial boundary.

Washington Department of Natural Resources Activities
The Washington Department of Natural Resources proposes to conduct salvage sales to harvest dead and/or dying trees on approximately 1300 acres near Thrapp Mountain, the Chiliwist Valley, and in the Texas Creek drainage in spring 2015. Legal locations of this activity include Township 31N Range 22E, Township 32N Range 22E, and Township 33N Range 23E. These sales have a high potential to impact soil resources detrimentally. The amount of disturbance is unknown and will depend upon antecedent soil moisture and season of harvest. This salvage will have cumulative impacts upon sediment delivery and water yield in the watersheds harvested.

In addition, the DNR plans to repair boundary fence along the FS/DNR boundary near Thrapp Mountain that was burned during the Carlton Complex. Burned trees that pose a hazard to the fence line would be felled on Forest Service lands within six feet of the existing fence line. This should not pose any additional cumulative impacts.

Wildfire and Fire Suppression

Active fire suppression continues in and near the near the project area because of its proximity to private and state lands and associated developments. Suppression activities have contributed to changing the natural fire cycle from frequent, low-intensity fires to much less frequent, higher-intensity fires.

Active fire suppression has protected much of the South Summit project area over the past decades, but has resulted in increased fuel loading and high intensity wildfire (Carlton Complex). The proposed thinning would reduce potential fire behavior (see fire/fuels report, Trebon 2015). The benefits of fires with lower intensity and severity would include a reduced potential of erosion and sediment deliver, flooding, and possible slope instability.

On small wildfires, disturbance from fire suppression activities is usually limited to hand tools; most hand fire-line construction has only minor impacts to the soil resource. Machine line using heavy equipment is also built during wildfire suppression. These machine lines

are rehabilitated following suppression activities to improve drainage and groundcover conditions where bare soil was created resulting in no increase in erosion and sedimentation. During fire suppression, closed roads may be reopened for access and incorporated as fire line. As part of the post-fire work, the areas of disturbance are rehabilitated and the roads returned to their previous condition in most cases.

Road System Use

Roads will continue to exist on the landscape and their connected environmental and ecological effects. The road surface and crossings are the most erosive surfaces in the project related watersheds and add fine sediment to the stream network during runoff generating precipitation events. Forest users will continue to drive on roads surfaces and a small level of unauthorized road building will likely occur associated with OHV use and firewood gathering. These activities, when occurring close to streams may increase the potential for erosion sedimentation rates, create bare soil areas, reduce shade and wood recruitment by removing snags within proximity to streams, and widen stream channel geometry by breaking down streambanks.

The Proposed Action would act to improve some of the possible cumulative effects associated with the road system. Closing or decommissioning roads within 300 feet of streams would reduce the ongoing fine sediment delivery to streams and reduction in road density within the RHCAs would serve to reduce the additional sediment delivery.

Two road segments (4100458-0.21L-1 and 4100535-0.63L-1) being used for the Brimstone Salvage sale in the Finley Mountain area are scheduled for decommissioning after the sale is complete. Maintenance of system roads continues and includes danger tree removal along roads when needed

Road Maintenance and Burned Area Emergency Repair

There is ~28 miles of road blading, ditch cleaning, culvert cleaning and waterbar construction/installation that will occur within the project area in spring 2015 that is associated with BAER. This will cause a short-term increase followed by a longer term reduction in sediment.

All developed roads built in the past have a lasting effect on soil productivity, infiltration, runoff, erosion and sedimentation due to compaction and displacement of soils. Their maintenance for ongoing residential access, recreation, and forest management would result in some continuation of impacts. However, road maintenance including culvert installation, blading, and brushing typically improves drainage and decreases erosion from water channeling down the road surface in the long run. Proper design, placement and maintenance of Forest roads help to reduce erosion and sedimentation to streams.

Grazing

There are four grazing allotments within the project area: Frazer, Finley, Benson and Texas. The Carlton Complex wildfire damaged or destroyed several range improvements and opened access to riparian areas formerly limited by dense vegetation growth or fences. Fire-related modifications and mitigation measures are not limited to but may include the following:

- Repair or replace burned fence and water developments
- Construct electric fence to reduce drift to riparian areas and other pastures within the burned area; selective directional felling of burned trees within riparian areas to limit access by livestock and help trap sediment; reduction in number of cattle

grazing; changing season of use; increase riding; establishing allowable use triggers as to when livestock must be moved; and increase compliance checks and monitoring.

When grazing resumes, the proposed treatment units are subject to cumulative grazing impacts including bare soil creation near streams, springs, wetlands, lakes, and ponds. Water resource impacts of grazing are limited to areas where the animals trail and access water and create areas of accelerated erosion and sedimentation from hoof action disturbing the soil surface through trampling, shearing of banks, and compaction of saturated soils. These areas of disturbance are mostly small in aerial extent and correlate to trails, stream crossings and water sources. Grazing will continue in the foreseeable future. The thinning units in which ground based equipment will be utilized are generally located in forested areas, so there should be little or no overlap with cattle in the grassland areas.

Recreation

Activities include: campground management, including hazard tree removal, road and other infrastructure maintenance; snowmobiling and snowmobile trail grooming; hunting; camping in campgrounds and dispersed sites; firewood gathering; Off-Highway Vehicle (OHV) use; pleasure driving; mountain and road biking; hiking; horseback riding; cross-country skiing and ski trail grooming; and downhill skiing.

Disturbance from general motorized use and recreational access has been occurring and would continue throughout the units indefinitely. We anticipate no changes in the existing recreation profile. Other recreational activities that occur off the developed roads, such as the gathering of miscellaneous forest products and hunting, are occurring in the project area. Closing skid trails in this area following treatment should prevent this occurrence and should not have additional effects on soils and sediment delivery in the project area. Cumulative effects to the watershed from recreational vehicle use are not expected. See the Recreation Specialist Report for further discussion on recreational vehicle use.

3.6.3.4 Consistency Statement

The South Summit Project would comply with the Okanogan Forest Plan and meet State Water Quality Standards. Alternative 1 would not meet Forest Plan standards for fine sediment in aquatic habitat in Frazer and Benson Creeks. The proposed silvicultural and fuel treatments in Alternative 2 would not be expected to increase fine sediment production to a measurable extent. Any increase will be more than offset by proposed activities that would result in a net reduction of sediment entering streams, starting with pre-disturbance road decommissioning prior to vegetation and fuels management. The South Summit II Forest & Fuels Project is compliant with Riparian Management Objectives because no measurable shade reduction would occur within the core zone of riparian harvest, thinning, or fuels units along perennial streams. State Water Quality standards would be maintained by employing proposed Design Criteria to avoid, minimize, and mitigate water quality impacts as described in USFS National Water Quality BMPs (USDA USFS 2012). See Specialist Report and Supplemental Analysis for more detail.

3.7 AQUATIC RESOURCES

The section below summarizes the existing condition information, along with the direct, indirect and cumulative effects from the South Summit II Forest and Fuels project, as analyzed in the South Summit II Forest and Fuels Aquatic Resource Report (Shull 2015), available in the project record.

3.7.1 Issues for Analysis

The standard habitat indicators utilized to analyze effects to endangered species are listed below. These indicators were also used to assess impacts to non-sensitive fish species and their habitat conditions within the project area, which only include non-sensitive native and non-native fish. These parameters provide essential habitat functions to target sensitive aquatic species. Therefore, if the set of habitat parameters are maintained and/or protected, the sensitive species relying on them downstream will also be protected. For each issue analyzed, indicators were selected that provide understandable, quantifiable and responsive measures of the degree of impact that would result from the implementation of the alternatives. Rationale for exclusion of other indicators is included in the Aquatics Specialist Report in the project record (Shull 2015).

<u>Temperature</u>
Stream temperature is of vital importance to the survival and development of native (often sensitive) salmonid species (Richter and Kolmes 2005). It can be affected via timber harvest, thinning, fuels reductions, and road-building within the RHCA. Forest vegetation treatments such as these can remove stream-shade producing trees. Direct solar warming radiation is often reported as the primary factor for summertime maximum temperatures (Brown and Krygier 1970; Sinokrot and Stefan 1993; Johnson 2004). Wildfires may increase water temperatures to lethal levels during burning and removing riparian and upland vegetation from a fire, directly affecting salmonids by elevating stream temperatures for several years following a fire.

Indicator: Projected amount of shade loss within 100 feet of perennial streams.

Analysis Methods: Quantitative information on water temperature monitoring data, where available, and qualitative discussion on changes in stream shading.

Analysis Area: The project area and each of the connected HUC 6 sub-watersheds (Frazer Creek, Beaver Creek, Benson Cree, Middle Methow River, and Lower Okanogan River).

<u>Suspended Sediment/Turbidity and Substrate/Embeddedness Changes</u>
Fine sediments, or fines, (sand, silt, and clay material) are naturally occurring in stream systems. Higher road density and other human activities can increase contribution from upland, non-channel sources. Excess fine sediment delivered constantly over time or in large volumes rapidly in single episodes can have negative ecological effects to aquatic habitat and species by increasing turbidity and reduced light penetration directly affecting fish. This indirectly affects fish by reducing primary productivity of algae and other organisms used for food, smothering and suffocating fish eggs, and changing river channel morphology.

Indicator: Modeled tons/acre of sediment pre-project and post-project.

Analysis Methods: Potential effects via fine sediment will be assessed by considering the mechanisms by which fine sediment could be introduced to water features in the project area. Results from pre-project and post-project sediment delivery modeling (see Water Resources section) will be used to compare expected changes in fine sediment delivery rates. A qualitative assessment of effects to aquatic habitat and associated effects to sensitive species and their habitats will follow.

Analysis Area: The project area and each of the connected HUC 6 sub-watersheds with particular emphasis on fish-bearing streams and key receiving waters downstream of the project area.

Large Woody Debris

The abundance and recruitment rate of large woody debris (debris at least 35 feet long and 12" in diameter) (LWD) into streams can be affected via timber harvest, thinning, fuels reductions, and road-building within the RHCA, simply by removing trees and downed wood that may make it into the channel eventually.

Indicator: Number of pieces of LWD per mile.

Analysis Methods: The analysis will consider treatment units in proximity to streams, stream class and fish presence, existing wood levels, and changes in wood from the Carlton Complex Fire. Road treatments will consider post-project designations of road segments within the wood recruitment zone and ongoing illegal firewood cutting (due to proximity to streams) in the project area.

Analysis Area: The project area and each of the connected HUC 6 sub-watersheds. Emphasis will be place on stream segments near treatment units or road system treatment sites.

Change in Road Drainage Network/Road Density and Location

The negative interactions between forest roads and aquatic/fish resources are well documented in literature (Cederholm et al 1980; Ketcheson and Megahan 1996; Trombulak and Frissel 2000; Megahan 2001). Drainage networks associated with roads (including ditch lines and road surfaces) can run water during rain events, which artificially increases the stream network. High road densities within watersheds can lead to degraded stream locations. Road location is important regarding impacts to streams. The most significant sources of road-derived fine sediment are stream crossings and along native surface roads and segments within 300 feet of stream (Ketcheson and Meghan, 1996). Roads constructed parallel to streams often remove ground that otherwise would grow trees for shade and instream LWD recruitment.

Indicators: Total road miles within 300 feet of streams (the sediment delivery zone) by HUC 6 sub-watersheds.

Total number of intermittent and perennial stream crossings will be compared pre-project, at different stages of the project, and post-project.

Analysis Methods: Forest corporate and project spatial (GIS) data on streams and the current and proposed transportation network will provide quantitative road density measurements and number of stream crossing information.

Analysis Area: The project area and each of the connected HUC 6 sub-watersheds, with emphasis on road density within RHCA designations within the project area.

3.7.2 Affected Environment

The analysis area for this project are the riparian features in the project area and downstream reaches of hydrologically-connected stream habitat potentially affected by these activities (Frazer Creek and lower Beaver Creek, Benson Creek, Texas Creek, French Creek, Methow River, Swamp Creek, Hooker Creek, Chiliwist Creek, and Summit/Loup Loup Creeks). Riparian features include wetlands, ephemeral drainages, intermittent creeks, and perennial streams that drain in all directions but northward.

The analysis considers proposed vegetation and fuels treatment units, road management activities, and horse camp construction in the sub-watersheds within the project area. There are no ESA listed fish or critical habitat within the project area. Aquatic species of concern are restricted to ESA salmonids. Proximity to ESA-listed species is generally greater than four stream miles from the project area. More details on stream class by mileage, fish distribution, and proximity to sensitive species are presented in Figure 3.7-1.

The project area spans the broad upper reaches of a portion of the Okanogan Range and drains via multiple sub-basins. About two-thirds of the project area drains westerly into the Methow River (Methow Sub-basin), while a very small area in the northeastern corner drains eastward into the Okanogan River (Okanogan Sub-basin). Another relatively small portion in the southeastern corner drains roughly south into the Columbia River (Chief Joseph Sub-basin).

Figure 3.7-1 Project Hydrologic Unit Disposition

Hydrologic Unit and Code	HUC size (acres)	Project Area		
		Acres	% of HUC in Project Area	% of Project Area
Methow River Sub-basin 17020008	**1,164,079**	**41,286**	**3.5%**	**82.3%**
Middle Methow River Watershed 1702000806	*248,595*	*36,309*	*14.6%*	*72.4%*
Lower Beaver Creek Sub-watershed 170200080608	30,735	12,272	39.9%	24.5%
Benson Creek Sub-watershed 170200080609	24,257	21,267	87.7%	42.4%
Alder Creek - Methow River Sub-watershed 170200080610	29,790	2,770	9.3%	5.5%
Lower Methow River Watershed 1702000807	*193,912*	*4,977*	*2.6%*	*9.9%*
Texas Cr - Methow River Sub-watershed 170200080702	20,436	1,487	7.3%	3.0%
French Creek Sub-watershed 170200080705	19,384	3,490	18.0%	7.0%
Okanogan River Sub-basin 17020006[1]	**1,029,886**	**2,009**	**0.2%**	**4.0%**
Loup Loup Creek - Okanogan River Watershed 1702000605	*196,028*	*2,009*	*1.0%*	*4.0%*
Summit Creek Sub-watershed 170200060502	11,239	87	0.8%	0.2%
Chiliwist Creek Sub-watershed 170200060505	26,587	1,922	7.2%	3.8%
Chief Joseph Sub-basin 17020005	**856,708**	**6,858**	**0.8%**	**13.7%**
Swamp Creek - Columbia River Watershed 1702000505	*172,834*	*6,858*	*4.0%*	*13.7%*
Swamp Creek Sub-watershed 170200050502	36,763	6,858	18.7%	13.7%
Total Project Area		**50,153**		**100%**

Carlton Complex Fire and Post-fire Storm Effects

The Carlton Complex Fire burned about 35,000 acres or ~70% of the project area, mostly in July 2014. Burned Area Reflective Cover (BARC) data indicated high-severity fire affected about 14% of the project area, resulting in total loss of all vegetation and organic matter and creating bare, charred soil. About 18% had moderate-severity fire with partial to total loss of vegetation and some retention of organic matter. About 32% had low-severity fire with minimal loss of vegetation and an intact organic layer. The remaining 36% of the project area did not burn.

Where the fire burned at high and moderate severity, most of the streamside trees and riparian vegetation were killed. A significant post-fire rain storm caused several debris flows across the project area, resulting in severe channel scour, vertical erosion in stream channels (downcutting), and bank erosion. Fine sediment levels in most impacted streams are well above desired conditions. Several streams in the project area and Beaver Creek are in an unstable state. Therefore, a goal in the design of this project is to not exacerbate the heavy impacts from the fire and debris flows.

Notable streams impacted or burned over by the fire include Beaver, S. Fk. Beaver, Lightning, Frazer, Benson, Beaver, and Finley Canyon Creeks. Many small headwater streams were burned over during the fire. Fire impacts ranged from minor ground cover burning up to complete mortality of riparian and conifer vegetation. Frazer Creek and Finley Canyon Creek experienced the most severe fire activity of these streams. The lower 1.7 miles of Frazer Creek experience mostly high-severity burn where most of the riparian conifers and standing riparian vegetation were killed including along the streambanks. Most of the vegetation and ground cover on the adjacent valley walls are in similar condition. Finley Canyon experienced the most severe fire activity of the project area. Most of the trees and understory in the whole drainage were killed, especially along the intermittent channel in the valley bottom. Creeks like Beaver, Lightning, S. Fk. Beaver, Benson, and other larger streams experienced mostly light burn severity and most of the overstory and riparian vegetation remains intact.

The loss of vegetation as described will contribute to increased stream temperatures until vegetation is re-established and, because of this, salmonid use in burned areas during the summer will be temporarily reduced or non-existent. Warmer stream temperatures will usually occur in the spring, summer and fall, negatively altering the timing of egg incubation, fry emergence, smolt outmigration, and upstream migrations of adults. Loss of riparian vegetation can also lead to lower winter temperatures, due to increases in evaporative cooling in the absence of vegetation. This can lead to the formation of anchor ice earlier in the year, and have impacts to fall spawning fish (i.e. bull trout). Elevated temperatures may occur in Frazer Creek, Beaver Creek, and Benson Creeks for over 6 years after the fire.

Wildfires are known to cause large sediment loads to streams in the few years post-fire. This is primarily due to loss of ground cover, which aides in preventing overland flow and protects against the transport of sediment particles over the ground (Gresswell 1999). Where the fire burned at moderate or high severity, most or all the ground cover was removed. In the low severity burn areas, a mosaic of ground cover with some areas of bare ground remains.

On August 21, 2014, a heavy rain storm hit the project area with close to an inch of rain hitting the burned area in a short period. The storm produced extensive run-off that led to severe hillslope erosion across much of the project area. Numerous small headwater

streams and ephemeral draws received runoff and hillslope erosion and activated as debris flows. These smaller debris flows hit larger streams, forming large debris flows that caused substantial channel scour, downcutting, bank erosion, and heavy sedimentation. Debris flows occurred in the Upper Beaver, Lower Beaver, Benson, Swamp, and Alter Creek-Methow River sub-watersheds. Field review done after the post-fire rainstorm observed several debris flows across the west side of the project area and nearby areas.

Overall, many stream reaches and riparian areas within the burned area were set back to early seral, unstable conditions because of fire and storm effects, especially those in moderate- to high-severity burn areas. Ground cover in these areas was removed and will have no vegetation protecting surface soils for a few years. Channels where debris flows occurred are in a highly unstable state with raw banks and high fine sediment levels, and often the channel bed was down cut or aggraded with fines.

Debris flows that followed the fire added wood to the stream system in Frazer Creek, Benson Creek, and other smaller tributaries. Substantially more wood will enter these streams once the fire-killed trees fall into adjacent channels. Wood levels are expected to increase in fish-bearing streams within the project area and this will help in the recovery of channels affected by debris flows.

The heavy rain storm caused an increase in naturally flowing streams in the project area. Several small, dry draws were activated during the rain storm that will now continue to function as intermittent streams for a few years. This is due to the loss of vegetation and duff that is typical in dry draws, which typically only flow during heavy rain events. Over time, these channels will revegetate and they will stop flowing surface water on a yearly basis.

The Carlton Complex Fire BAER team modeled sediment delivery to the stream network following heavy rainfall events. Modeled sediment yield ranged from about 0.25 tons up to about 1 tons per acre for a two-year event and about 2 tons up to 4.8 tons per acre for a twenty-five-year event. Based on the drainage area for these estimates, the amount of sediment delivered to streams during these frequency storms are shown in Figure 3.7-2.This figure shows acres of each drainage within National Forest lands. The modeled frequency storm event that occurred on August 21st was a 5-year re-occurrence magnitude. Therefore, the amount of sediment delivery would be higher than the 2-year frequency volumes. See the Water Resources Section for more details.

Figure 3.7-2. Estimated Volume of Sediment Delivered to Streams in Project Area in Post-fire Rainstorm

Drainage	Acres in Analysis Area	Tons/acre	Estimated Tons for 2-Yr Event	Estimated Tons for 25-Yr Event
Frazer	8512	0.24	2043	40,772.48
Finley	9088	0.09	818	36,261.12
Benson	7168	1.07	7670	14,120.96

The storm produced extensive run-off that led to severe hillslope erosion across much of the project area. Numerous small headwater streams and ephemeral draws received runoff and hillslope erosion and activated as debris flows. These smaller debris flows hit larger streams, forming even larger ones that caused substantial channel sedimentation. Where

roads intercepted debris flows, the crossings generally failed and in a few cases the road diverted the debris flow down the road.

Fish-bearing streams impacted by debris flows include Beaver Creek, Frazer Creek, and Benson Creek. The debris flow in Beaver Creek was due to a road failure along Volstead Creek (Forest Service road 4225200). This road is outside the project area, but is a problematic road that has failed twice now since 2006, resulting in heavy fine sediment delivery to Beaver Creek. Most of these debris flows entered the Methow River starting at the confluence with Beaver Creek. The Methow River received a substantial volume of fine sediment from the project area as well as from other debris flows in Gold Creek and other lower drainages that caused high turbidity all the way to the Columbia River. Extensive fish mortality likely occurred in the Methow River and in Beaver and Frazer Creeks.

Post-fire sediment measurements have not been done. However, field observation suggests fine sediment levels in Frazer Creek, Benson Creek, and Beaver Creek are substantially elevated. Fish habitat conditions are non-functioning as a result.

Management Direction in Riparian Areas

Current forest management guidelines provide considerably more protection for aquatic and riparian resources than was granted in the past. Riparian Habitat Conservation Areas (RHCAs) are discrete management areas where management activities must meet specific Forest Plan Standards and Guidelines and Riparian Management Objectives (RMOs). These management directions are applied to maintain and/or attain riparian function and provide the criteria against which attainment, or progress toward attainment of the riparian goals is measured. RHCAs are not explicitly exclusion buffers, but under the PACFISH direction, all management activities occurring within Riparian Habitat Conservation Areas (RHCAs) must maintain existing ecological conditions or lead to improved conditions to be consistent with the management guidance. Specifically, PACFISH Riparian Management Objectives (RMOs) and standards and guidelines for activities in RHCAs (or with the capacity to affect conditions in RHCAs) serve to “provide adequate environmental safeguards for proposed or new and ongoing project and activities that pose an unacceptable risk within RHCAs or that degrade RHCAs.” As described in Appendix A, RHCA descriptions and standard widths vary according to a range of criteria including flow/water-presence regime, fish presence, and other considerations. The amount of RHCA types in the project area are shown in Figure 3.7-3.

Figure 3.7-3. Distribution of Project Area Streams by Sub-watershed (HUC12)

Project Area, by Sub-watershed (HUC6)	Stream Class (Total Linear Distance in Miles)			
	Perennial Fish-bearing	Perennial Non-fish-bearing	Intermittent	Total
Alder Creek - Methow River	- -	- -	5.0	5
Benson Creek	4.0	7.0	25.0	36
Chiliwist Creek	- -	--	3.0	3
French Creek	- -	- -	6.0	6
Lower Beaver Creek	2.0	3.0	16.0	21
Swamp Creek	- -	--	9	9
Texas Creek - Methow River	- -	- -	3.0	3
Entire Project Area	**6.0**	**11.0**	**65**	**82**

The project area contains approximately 2,805 acres of RHCAs. Figure 3.7-4 displays the amount of high, moderate, and low burn severity in RHCAs as estimated from the BARC data. On NFS lands, the fire burned more of the Benson Creek drainage compared to the others with about 783 RHCA acres burned. The Lower Beaver Creek was next with about 470 acres burned. Notable moderate and high-severity burning occurred in Lower Beaver Creek and Benson Creek. The other sub-watersheds within the fire burned near the top of the drainage and the amount of acres burned on NFS lands was much smaller; however, more of these drainages burned on adjacent state and private lands so overall riparian impacts likely continue outside the project area.

Figure 3.7-4. RHCAs Acres and Estimated Burn Severity in the Project Area

			Percent of total RHCA acres burned			
Total RHCAs by Sub-watershed	**Total Acres in Project Area**	**Total Estimated Acres Burned**	**High**	**Moderate**	**Low**	**Total %**
Alder	122	106	2.5%	26.2%	58.2%	86.9%
Benson	1314.6	783	15.4%	16.8%	27.3%	59.6%
Chiliwist	72.5	13	13.9%	3.2%	0.8%	17.9%
French	148	47.3	2.7%	11.5%	17.8%	32.0%
Lower Beaver	713.2	469	13.5%	21.9%	30.3%	65.8%
Swamp	356	42.9	6.1%	4.8%	1.1%	12.1%
Texas	77.4	38.5	11.4%	17.6%	20.8%	49.7%
Total for All RHCAs	**2805**	**1500**	**12.3%**	**16.4%**	**24.7%**	**53.5%**

Road Crossings and Road Density near Streams

The project area contains an estimated 111 stream crossings and about 69 miles of roads within 300 feet of streams; see further details by sub-watershed in the preceding Water Resources section. Though roads typically provide a range of public benefits, their construction and presence can alter watershed-scale hydrologic and ecological processes. Hillslope processes are interrupted as groundwater is day-lighted, then sped to surface water via a changed and simplified drainage network (Luce 2002), increased erosion (Megahan and Kidd 1972), and increased risk of landslide events (Swanson and Dyrness 1975). Other impacts of roads include direct habitat loss, loss of tree production and eventual woody debris recruitment, habitat fragmentation, and increased human impacts (Wisdom et al. 2000). Ecological responses are direct and indirect, including mortality from road building and direct vehicle collisions, modification of animal behaviors and distribution, spread of exotic species, increase human presence, and alteration of physical, ecological, and chemical properties of riparian forests. Overall, the presence of roads is highly correlated with negative changes in species distribution, abundance, and critical hydrologic, geomorphic and ecological processes (Trombulak and Frissell 2000). Impacts of forest roads and the benefits of their removal are described well by Switalski and others (2004).

In the post-fire environment, road drainage features must accommodate flows under these changed and variable conditions to prevent failure. Road structures designed for the unburned forest condition are often unable to accommodate increased runoff, sediment, and

debris following fire. Post-fire flows often exceed design capacity, resulting in road drainage structures failing or roads diverting streams.

Post-fire debris flows and flood flows hit numerous roads during the August 2014 rain storm. In most cases, this caused culverts to plug and road crossings to fail. Field review observed 28 road failure points across the project area and associated sub-watersheds. Another 31 possible road failures are estimated based on their location on steep slopes in the high fire severity area. Roads diverted streams at five locations across the area as well. Road failures exacerbated the post-fire rain event, adding volumes of more sediment to streams in some areas.

Resource specialists completed a post-fire Burned Area Emergency Response (BAER) assessment with the objective of identifying imminent post-wildfire threats to human life and safety, property and critical natural or cultural resources; and take immediate actions to manage unacceptable risks. A wide array of response actions were considered to achieve the emergency response objectives. From this process, three actions were considered feasible which included seeding some moderate and high severity burned areas, road drainage reconstruction, heavy culvert cleaning and culvert removal. About 28 miles of BAER treatments planned for summer 2015 will re-establish drainage on damaged roads in the project area boundary. This work involves rebuilding road failures, re-establishing road surfaces and ditch lines, and repairing damage to cut and fill slopes. These efforts would stabilize a portion of the roads in the project area, including some roads proposed as haul routes by this project.

Species Considered

Fish species within the project area are limited to non-native brook trout. In the greater cumulative effects area (i.e. downstream of the project area in waters hydrologically connected to project area drainages) species listed under the Endangered Species Act (ESA) include Upper Columbia River (UCR) steelhead, UCR spring Chinook, and Columbia River (CR) bull trout. All three species have designated critical habitat downstream of the proposed project area. Magnuson-Stevens Fishery Conservation and Management Act (MSA) species include Chinook and coho salmon. In addition to those sensitive species, there are cutthroat and rainbow trout (likely westslope cutthroat and redband rainbow trout, but of unspecified genetic heritage) and multiple species of non-game species in streams below the project area such as Frazer, Beaver, Swamp, and Loup Loup Creeks, as well as the Methow, Okanogan, and Columbia rivers. See Figure 3.7-5 for cumulative effects watershed estimated fish distribution.

No listed, candidate, or Region 6 Sensitive aquatic invertebrates or amphibians are known to occur in any project area watershed. Masked duskysnails, a recent R6 sensitive mollusk, occur in lakes in neighboring counties. Specific surveys in project area ponds have not been conducted and the species is highly unlikely to be present in standing water wetlands/ponds due to their preference for cold, clear water (Monthey 1998).

Figure 3.7-5 Sensitive Aquatic Species and Occurrence in the South Summit Affected Area

Species	Conservation status[1]				Species Presence	
	ESA	USFS R6 Sensitive	EFH	MIS	In Project Area Streams	Nearest Proximity (mi)
Bull trout	Threatened	-	-	Yes	No	Beaver Cr. (5)
Steelhead	Threatened	Yes	-	Yes	No	Frazer bottom (5)
Spring Chinook	Endang.	Yes	Yes	Yes	No	Beaver Creek (7)
Rainbow/redband trout	-	-	-	Yes	No	Frazer Creek (3)
Westslope cutthroat	-	-	-	Yes	No	Beaver Cr. (5)
Brook trout	-	-	-	Yes	Yes	Benson/Frazer Cr
Summer/fall Chinook	-	-	Yes	Yes	No	Methow River (10)
Umatilla dace	-	Yes	-	-	No	Methow River (10)[2]
Pygmy whitefish	-	Yes	-	-	No	Outside basin
River lamprey	-	Yes	-	-	No	Columbia R. (50)
Masked duskysnail	-	Yes	-	-	Unlikely	Fish (40) and Curlew (60) lakes

[1]ESA – Endangered Species Act; EFH – Magnuson-Stevens Act Essential Fish Habitat; MIS – USFS Management Indicator Species
[2]Dace (*Rhinichthys* spp.) have been documented in the Methow Sub-basin but not regularly keyed to species

Fish and Aquatic Habitat Conditions by Selected Sub-watershed

Most Forest Service stream inventory efforts in the Methow and Okanogan drainages have concentrated on streams with ESA-listed salmonids or the formerly sensitive redband and westslope cutthroat trouts. Consequently, quantitative stream habitat inventories for project area streams have not been conducted, with the exception of Frazer Creek, which was surveyed in 2005 (USDA 2005). Most project area streams, in terms of mileage, are intermittent and non-fish bearing (see Figure 3.7-3); the only fish-bearing streams within the project area are Frazer and Benson creeks.

Qualitatively, decades of human impacts have degraded stream and riparian habitat in the project area, including timber harvest to stream edges, large woody debris removal as a standard procedure during timber sale contract administration, extensive road network construction, highly effective fire exclusion, power line construction, cattle grazing, illegal firewood cutting, and dispersed recreation impacts. The fire and post-fire debris flows have altered and degraded fish habitat further in Frazer Creek, Benson Creek, Beaver Creek, and the Methow River. Channel conditions inside the project area boundary now have extensive raw, unvegetated banks, high sediment loads, channel downcutting, and loss of stream side vegetation.

Habitat impacts were assessed by the indicators described above; detailed information is available in the Project Biological Assessment (BA; Shull et al., 2015, in project record). The following sections describe the status of these indicators in five key sub-watersheds within the project area or the larger watersheds affected by these streams. Those habitat parameters include: stream temperature, increased fine sediment delivery to the stream network, road-network effects, and large woody debris recruitment. These habitat indicators were significantly impacted from the fire and post-fire debris flows.

Frazer Creek Habitat Conditions

Stream Temperature: Limited data collection in 2005 (USDA 2005) indicates that this stream was within the range of properly functioning for sensitive salmonid species' rearing conditions according to NOAA and USFWS. However, stream temperatures are expected to increase in Frazer Creek because high-severity and moderate-severity fire burned a portion of the RHCAs in this drainage. Higher temperatures would likely occur for several years until vegetation in RHCAs recover and provide full shade.

Fine Sediment Delivery: The 2005 Stream Inventory survey of Frazer Creek (USDA 2005) noted excessive fine sediment values during routine pebble counts. More recent quantitative intra-gravel core sampling (USDA 2011) found that intra-gravel fine sedimentation values exceeded the Forest Plan standard of 20% fines (<1mm) in salmonid spawning habitat. Post-fire and debris flows, fine sediment levels are expected to be markedly higher. Several tons of sediment, which included fines, entered the Frazer, Beaver, and Benson Creeks post-fire and storm. These streams and others entered into the Methow River, which affected miles of habitat.

Large Woody Debris – Instream and Recruitment: The 2005 survey (USDA 2005) found that instream wood levels were low according to Forest Plan standards in fish-bearing reaches of Frazer Creek within the project area. It noted that trees on the streambank were small and that past timber harvest had removed the large trees in the riparian. A more recent project-specific investigation was conducted in 2012 (USDA 2012), looking at Forest Plan standard, and 'effective' woody debris. This effort investigated the upper perennial, non-fish-bearing extent of Frazer Creek (approximately 1 mile reach below the JR Campground). This effort found that standards were being met in the upper creek and that there were additional pieces of 'effective' woody debris in the reach (pieces greater than bankfull in length that were actively creating habitat and trapping fine sediment). In addition, there were many pieces per mile of large woody debris ready to recruit to the channel. Typically these were logs that meet Forest Plan standards but are suspended above the channel, above bankfull width, thus are not counted according to Forest Service Inventory protocols.

The fire and subsequent debris flows added wood to Frazer Creek and Benson Creek. Fire-killed trees will eventually fall and add more wood to the few fish bearing streams. Additionally, on all the small headwater streams, more wood expected to recruit in over the next few years. The increase in wood will help stabilize channels and aid in their recovery.

Road Network and Riparian Roads: Roads within RHCAs in most of the sub-watersheds in the project area average about 12% of all road mileage. In the Frazer Creek drainage, roads in the RHCA comprise about 40% of all roads in the sub-watershed. Many of these are very close to the stream, compromising RHCA functions in a variety of ways. Highway 20 and the single powerline supplying power to the upper Methow Valley run parallel and overlap with Frazer Creek over a substantial part of its course. There are also an estimated 15 stream crossings in the road system. The road system is likely the chief concern in terms of aquatic habitat for Frazer Creek.

Debris flows and heavy rain impacted several points on roads in this drainage. On the south side of the creek, debris flows impacted one road crossing and likely three others on State lands. Other impacts in the Frazer Creek bottom area and in Jack Creek were observed. Road failures contributed to the current high fine sediment loads.

All the fish barriers associated with private driveways crossing the creek outside of the project area were blown out during the post-fire debris flows. A local salmon recovery group worked with land owners to build bridges over the creek that now would provide full fish passage from below. However, a private irrigation diversion still remains near the mouth that blocks all upstream fish passage. The debris flows also blew out at least three in-channel beaver ponds that had been recently re-established by the Methow Valley Beaver Relocation Project. These ponds no longer function to trap sediment and prevent its delivery to Beaver Creek.

Beaver Creek Habitat Conditions

Due to the distance between project activities and the biology and demographics of salmonids in lower Beaver Creek, the only concerns of the project are temperature and fine sediment effects.

Stream Temperature: Lower Beaver Creek (outside of the project area but fed by Frazer Creek) exhibits relative warm water conditions during summer, which shapes salmonid behavior and distribution. Summertime temperatures exceed the level to function properly for sensitive salmonid rearing (such as bull trout); however, upper reaches support cold temperatures with summertime conditions supporting bull trout rearing. Anecdotally, Frazer Creek has a cooling effect on lower Beaver Creek.

Water temperature may slightly increase in Beaver Creek from the fire. Riparian vegetation remains mostly intact and will continue to provide shade because most of the portion of these RHCAs that burned experienced low-severity effects.

Fine Sediment Delivery: Prior to the fire, Beaver Creek had a high amount of surface fine sediment. Pebble count data (USDA 2012) show that over 20% of the surface sediment measured in the first six miles consist of sediments <6mm, an indication that fine sediment is likely exceeded desired conditions before 2014. Lower Beaver Creek functions largely as a transport reach. Methow Valley Ranger District data for streams surveyed in the Methow River Sub-basin show that very few similar channel type reaches similar levels of this type of sediment, suggesting that Beaver Creek has a very high sediment budget.

Post-fire debris flows occurred in the Frazer Creek, Wolf Canyon, Piper Creek, and out of Volstead Creek. The debris flow from Wolf Canyon appears to have settled out in an alfalfa field before connecting with Beaver Creek. Piper Creek deposited a mix of fines and course sediment to Beaver Creek. The main source for the debris flow in Beaver Creek was from Forest Service Road 4225200, which crosses Volstead Creek 11 times in a 1.25 mile reach. The culverts along this stretch of road were unable to accommodate the high flows, and stream flow was diverted down the road from a culvert that caused a large piece of the road to fail and deliver sediment to Beaver Creek. No measurements on fine sediment levels in Beaver Creek have been done, but they are likely high after the debris flows.

Benson Creek Habitat Conditions

Stream Temperature: No time-series stream temperature data are available for Benson Creek; however the robust standing crop of brook trout, a temperature-sensitive indicator, suggests that temperature regimes are suitable for salmonid survival year-round. A portion of the RHCAs were burned with moderate (16.8%) and high severity (15.4%), but most of that is within Finely Canyon, a fishless sub-drainage within the Benson Creek sub-watershed (other than some ponds that are stocked for fishing on Washington Department of Fish and Wildlife and private lands). Finely Canyon drains into Benson Creek below

Forest Service lands and does not affect fish habitat in Benson Creek in the project area. The amount of RHCAs that burned with moderate to high severity in the mainstem Benson Creek drainage is less than 13%, which is unlikely to measurable increase stream temperatures.

Fine Sediment Delivery: No prior habitat inventory had been conducted on Benson Creek. Recent quantitative intra-gravel core sampling (USDA 2011) found that intra-gravel fine sedimentation values exceeded the Forest Plan standards.

Post-fire debris flows occurred in the Finely Canyon and Benson Creek areas. In these areas, multiple small headwater draws formed debris flows that cumulated in Finley Canyon and Benson Creek. Heavy sediment loads were transported to Benson Creek, likely increasing fine sediment levels substantially. Fish habitat within Benson Creek is currently in a highly unstable state with very high fine sediment levels as a result of the debris flows.

Road Network and Riparian Roads: The Benson Creek sub-watershed contains about 42% of all roads in the project area; of these, about 12% are within RHCAs. Several major roads in obvious poor condition actively contribute road-related sediment to the stream network. There are an estimated 52 stream crossings in the road system in the project area. The road system is likely the chief concern in terms of aquatic habitat for Benson Creek.

The majority of road failures from the post-fire rain storm occurred across the Benson Creek sub-watershed. Most of it occurred within the Finley Canyon portion of the watershed because it received most extensive debris flow action. There were several debris flows that interacted with roads in the Finely Canyon drainage. Along the mainstem of Benson Creek, there were also multiple debris flows that plugged road culverts and blew out sections of roads. The main Benson Creek road diverted some debris flows down the road ditch line, which increase the sediment delivery effects. Existing roads in this sub-watershed are largely in poor shape. Much of the BAER treatment work is focused on repairing roads in the Benson Creek sub-watershed.

Large Woody Debris – Instream and Recruitment: No previous habitat data for Benson were available. To assess instream large woody debris, a representative reach of the fish-bearing extent of Benson Creek was investigated (USDA 2012). Large woody debris distribution was calculated at about 26 pieces of large wood per mile, with 162 pieces of effective woody debris, and nearly 100 pieces/mile of Forest Plan large woody debris ready to recruit to the channel (i.e. meet standard size but suspended above bankfull height). This wood level is below our Forest Plan Standard and Guide and even with the fire, the LWD levels are expected to be lower than the standard.

The burn severity along the mainstem of Benson creek and tributaries on NFS lands was low. Tree mortality was low and the debris flows incorporated less wood than areas like Frazer Creek and Finley Canyon. Wood recruitment from adjacent to channels in this area is similar to pre-fire conditions. Riparian roads limit natural wood recruitment.

<u>Middle Methow River Habitat Conditions</u>
Due to the distance between project activities and the biology and demographics of salmonids in the Methow River, the only concerns from the project proposal are temperature and fine sediment effects.

Stream Temperature: All monitored sites on the Methow River between Beaver Creek (RM 35) and the mouth at Pateros report temperatures above the level acceptable for the river to properly function as sensitive salmonid rearing during the summertime. This portion of the river is listed on the state Department of Ecology (DOE) list of threatened or impaired waterways because of this factor. The fire may increase water temperature in the Methow River, but since it is considerably larger than the burned area, temperatures are not expected to increase measurably due to fire-related effects.

Fine Sediment Delivery: No quantitative sampling has been conducted to measure fine sediment on the private lower reaches of the Methow River below the project area. The most recent habitat inventory of the mainstem Methow above Beaver Creek found that fine sediment values generally did not appear to be problematically high, though gravels were judged as excessively embedded in a short (1/2 mile) reach near the mouth of the Twisp River (USDA and USDI 2008). Because the channel form and gradient change below Beaver Creek, its transport capacity increases. Observations made during other habitat survey efforts include notes that mean substrate size increases, which is expected with increasing gradient. It stands to reason that the flushing capacity of the Methow below Beaver Creek is greater to the mouth. Consequently, we expect that fines would be less problematic in the lower reach than in the reach above the Twisp River.

The post-fire debris flows in Beaver Creek, Benson Creek, Canyon Creek, and Leecher Creek delivered high volumes of fine sediment to the Methow River. Additionally, multiple debris flows from the same August 12th storm entered the Methow River lower in the sub-basin. Visual observations of the Methow River suggest it had high turbidity and fine sediment loads for several days following the storm event. Several miles of fish habitat was impacted by high fine sediment levels. Specifically, summer chinook and steelhead were mostly likely impacted.

Lower Okanogan River Habitat Conditions

Due to proximity and hydrologic disconnection of project area activities and the mainstem and the biology and demographics of salmonid use in the Okanogan (no spawning in the reaches hydrologically below the project area), the only mechanism of concern would be temperature. Available temperature data for this area was not available but because it is on the state DOE list of threatened or impaired waterways because of temperatures, it is likely that it is non-suitable for rearing of sensitive salmonids during summertime. There are no reports of post-fire storm flows affecting the Okanogan Sub-basin from the burned area.

3.7.3 Environmental Consequences

3.7.3.1 No Action

Under the No Action alternative, none of the proposed actions would occur; including restorative road treatments or tree planting that would accelerate vegetation recovery in the moderate to severely-burned portions of the project area. The No Action alternative does not meet Purpose and Needs #2 and #3 as they relate to aquatic habitat because they do not promote development of species composition and structure diversity associated with historical disturbance regimes; retain and recruit large trees, snags, and down logs within RHCAs; and reduce impacts of the transportation network on aquatic habitat. Implications are discussed in terms of the four primary habitat parameters used in this analysis as well as generalized downstream effects to species of concern.

Temperature

No change to existing shade levels or the general stream temperature regime would result under the No Action alternative. No changes in riparian forest structure or composition would occur. Several riparian roads would not be decommissioned or closed, allowing continued access for illegal firewood removal. These roads would remain compacted, inhibiting growth of vegetation that would otherwise provide shade to project area streams.

Sediment
No short-term, localized fine sediment generation associated with road system alterations, timber haul, fuels treatments, or timber harvest activities would occur. Conversely, no improvements associated with decreased road density due to decommissioning, reductions in the number of stream crossing, increased road closures that reduce access for illegal firewood cutting, etc., would occur. As transportation/maintenance budgets continue to remain stagnant or decline, it is likely that the condition of Forest road systems would continue to deteriorate and continue to contribute additional road-sourced fines to the stream system without sale-associated.

Large Woody Debris
Riparian forest stands in the unburned area would continue in their current condition and trajectories, which are in many cases, trees stressed for nutrients, lack tree age diversity, and providing sub-optimal wood recruitment potential in terms of size of wood. Without forest health-oriented treatments proposed in some RHCA units (both harvest and fuels treatments), stands would continue to decline in health and senesce due to insect attack, wildfires, and other stresses discussed in Vegetation Section 3.2. While snags created through these processes would normally recruit to the stream channel and serve habitat function, in some parts of the project area (particularly Frazer and Benson Creeks) they are quickly removed illegally by firewood cutters, despite rules prohibiting cutting within 300-feet of fish-bearing streams. Large woody debris recruitment rates would continue to be retarded by declining stand health and excess roads inside RHCAs in the unburned areas.

Road Density and Proximity to Streams
Roads in RHCA would continue to exist at current dense levels and in close proximity to streams. Several roads damaged by the post-fire rain storm would remain in this state. No benefits associated with RHCA road decommissioning, closure, or culvert removal or up-sizing would result.

Species Conclusion
Brook trout within the project area, and other aquatic species occurring downstream of the project area were impacted from the increase in fine sediment levels and channel instability from the fire and debris flows. High fine sediment levels would continue both because of the fire but in the longer term because of no improvements to the road network. Existing artificial sediment delivery from all the riparian roads and stream crossings would continue to be high. Additionally, where these roads are located in the burned area, they present a higher risk of failure due to the burned conditions being at greater risk for faster erosion. Species would be subject to continued degraded conditions as measured in terms of intra-gravel fine sediment levels, stream temperature regime, and other watershed-scale hydrologic and geomorphic parameters related to road density, number of stream crossings, etc.

3.7.3.2 Proposed Action
Under the Proposed Action alternative, timber harvest, fuels reduction treatments, road management changes, tree planting, and horse camp construction would occur. Protective and avoidance measures described in the design criteria in Appendix A would ensure that

project activities would not exacerbate the currently disturbed drainages and streams. The Proposed Action alternative meets Purpose and Needs #2 and #3 as they relate to aquatic habitat because they promote development of species composition and structure diversity associated with historical disturbance regimes; retain and recruit large trees, snags, and down logs within RHCAs; and reduce impacts of the transportation network on aquatic habitat.

To meet the goal of not exacerbating the heavy impacts from the fire and post-fire debris flows, the project proposes to start the restoration process at the project initiation. Prior to other ground-disturbing actions, 1.45 miles of roads in the Frazer Creek drainage, and 0.74 miles of road in Benson Creek drainage would be decommissioned. These roads are primarily within RHCAs and were prioritized by the project Fish Biologists and Hydrologist because of their high risk to water resources and aquatic habitat. Decommissioning these roads would provide pre-project mitigation for short-term sediment effects and maintain a net-negative overall sediment budget through the approximate 10-year life of the project (and beyond).

Portions of the proposed action that have the greatest potential to affect aquatic biota and habitat (positively and negatively) include actions in proximity to streams. This analysis will focus primarily on activities occurring within RCHAs, especially roads within 300 feet of water features, and will discuss road system changes at watershed scales.

The project area presented very low risks to ESA-listed salmonids prior to the fire. Since post-fire debris flows took out the beaver ponds and the irrigation diversion ditch that prevented these fish from entering the project area, the risk has increased slightly but still remains low overall. Some drainages within the project area remain of little risk to ESA-listed species, including the Chiliwist, Swamp, and French Creek drainages.

Proposed harvest and fuels treatments include design criteria and mitigating measures and have very low potential to increase stream sediment levels or stream temperatures. There would be little harvest in RHCAs, and what would occur would occur in unburned areas, 80% of proposed harvest would occur during winter conditions, and most harvest would occur in the Swamp Creek drainage which has no fish for miles below the project boundary. Prescribed fire treatments in RHCAs would be pile-burning only, with no underburning proposed in these buffers. Road treatments would be mostly restorative, involving decommissioning or putting roads into hydrologic storage by closing them. The project proposes to build about 1/2 mile of permanent road with the horse camp and a short ford over Frazer Creek. The ford would add a sediment source, but it would be associated with decommissioning a 0.8 mile-long riparian road that currently is generating sediment into Frazer Creek at multiple locations. The project would decommission about one-third of the roads in the project area that lie within 300 feet of streams, and remove between 40 to 76 percent of all the stream crossings in the project area. These actions would substantially reduce sediment (see Water Quality report) and would contribute considerably to moving the project area towards recovery.

The horse camp would be located on flat ground, outside of any RHCAs. There would be no effects to aquatic habitat and it will not be discussed further.

Temperature:
By incorporating no-cut buffers in timber harvest units (>100 feet perennial and 50-90 feet along intermittent streams), riparian tree canopy cover providing shade to project area

streams would not be affected. Ladder fuel and non-commercial thinning would take place within the RHCA boundaries but would consist of thinning trees under 8" DBH that are understory trees, thus the canopy trees capable of providing shade would remain unaffected and would have risk of crown fire initiation reduced by this thinning. All fuels or harvest-related treatments RHCAs would retain existing trees of higher conservation value, typically large and old trees. Thinning around these trees would increase their vigor and crown, ultimately increasing their resiliency to disturbance as well as increase crown cover and shade for adjacent streams. Water temperatures would not increase over current conditions because no new created openings would be created in RHCAs. See the Water Resources Section for more details.

Sediment:
Localized, short-term fine sediment generation may occur in association with road system alterations, culvert treatments, timber haul, fuels treatments, and timber harvest. However, nearly all of the ground-based harvest activities proposed would occur outside of RHCAs and/or 300 feet from streams. Those that would take place within RHCAs would occur in winter so that snow cover and frozen ground would create very small or non-existent potential for sediment mobilization. Sediment analysis described in the Water Resources section of this EA notes that the vast majority of fines are being delivered annually by road system and commercial harvest activities generated no measurable increase in sediment yield due to buffers and mostly wintertime implementation. Similarly, the fuels thinning and prescribed fire treatments (ladder fuel thinning, hand piling burning, machine piling, and mastication) and non-commercial thinning (NCT) generated no measurable increase in fine sediment delivery to streams. The tree planting would be done by hand and would not generate sediment to streams. The horse camp project would build a permanent camping area and a gravel road, and its location well away from any riparian area means that it would not generate any sediment to streams.

Harvest-related road work such as road maintenance on haul routes and opening up closed roads for access to units would increase sediment delivery to streams. The pre-disturbance road decommissioning previously described in the Frazer and Benson Creek drainages ensures the sediment yield from the entire project starts with a net reduction in sediment delivery and it would remain on a net-negative trend for the entire project as more roads are closed, culverts removed, and roads decommissioned. The pre-project road decommissioning high sediment producing roads at the start of the project initiates the restorative process for the project area. Overall, sediment modeling predicts that the short-term (1-3 years) and long-term (3+ years) sediment yield would be negative, which will benefit project area streams and downstream aquatic habitat in Frazer, Benson, and Beaver creeks, as well as the Methow River. The relationship between reduced upland sediment input and instream habitat miles downstream is not understood so we make no predictions to the magnitude of habitat improvement, particularly in the Methow River.

Roads:
The Transportation System Section describes the proposed action in terms of road system changes. The Water Resources Section describes the watershed-scale changes in the roads system, which certainly has effects on aquatic habitat, particularly the collective sediment effects.

Overall, the pre-project road decommissioning, timber harvest associated road treatments, and the remaining road-related changes would result in improvements to riparian function, particularly in terms of local hydrology (reducing erosion and sedimentation), but also as

measured by length of stream currently encroached or otherwise impacted by roads in close proximity where wood recruitment, human presence, channelization, and other impacts may be occurring. The timber harvest phase would result in an approximate 9-mile reduction of roads within 300 feet of streams across the project area and a reduction of seven stream crossings plus one additional road crossing when closing a road. In phase 2 (non-timber sale road treatments), an additional 17 miles of roads within 300 feet of streams would be decommissioned along with an estimated 36 stream crossings removed, pending allocation of funding. Additionally, the road closure work outside of the timber harvest related road work would remove up to 40 more stream crossings. Removal of riparian roads and stream crossings would result in improved local hydrology (sediment reduction) and move the stream segments affected toward restoration in the long-term (see Figure 3.6-13 in the Water Resources Section).

Converting roads to winter Nordic trails would still allow for most or all stream crossings to be removed, so there would be sediment reductions associated with this treatment. Where roads are closed or decommissioned, but would maintain livestock permittee access, the crossings would be removed as well. Each of these treatments would be an improvement over existing road conditions, although not as effective as full decommissioning or putting roads into hydrologic storage.

In addition to this work, the project would install two culverts on stream channels where storm runoff destroyed former culverts. In addition, this project will upsize six other culverts damaged by storm runoff. These actions would improve road drainage, better stormproof against rain storms and would reduce sediment deliver to streams.

Large Woody Debris:
Researchers in similar forest types in British Columbia found that LWD in streams originated from up to about 210 feet from channels but the about 90% of instream wood was sourced from within 60 feet from the channel edge (Johnston, et al. 2011) at nearly all sites investigated. No part of the project would actively manage existing instream wood except at crossing removal, installation, or culvert upsizing locations, in which cases wood would be moved as necessary but not removed from streams.

The fire killed several trees within RHCAs in the project area. Wood levels have already increased since before the fire. Once more fire killed trees fall into streams, wood levels will increase even more. In the burned areas, wood levels are expected to meet or exceed desired conditions.

Harvest and fuels treatments across the project area would have very small effects to wood recruitment. Recruitment of small trees (<8” DBH) taken for fuels and thinning treatment would occur, followed by increases in larger (Forest Plan Standard size) trees in the long-term. No measurable changes to instream wood levels would occur in the short term. Streams in the project area lack sufficient hydraulic power to transport LWD from the project area to habitat that supports listed salmonids several miles downstream. There would be no effect to LWD levels or recruitment for these species’ habitats.

Summary of Effects to Aquatic Species
Redband rainbow trout, rainbow trout of unknown genetic heritage, and non-native brook trout are present year-round in Benson and Frazer Creeks, and are now subject to substantial increases in fine sediment from the fire and post-fire rain storm. A range of other sensitive and non-sensitive salmonids and non-game species occur in waters downstream

from the project area, including Beaver Creek and the Methow and Okanogan Rivers. Beaver Creek and the Methow River received large volumes of fine sediment that adversely affected critical habitat.

Modeling results indicate the project would initially have a reduction in fine sediment through decommissioning 2.2 miles of high aquatic risk roads. Following this work, the timber sale and associated road work would temporarily increase sediment, but at levels below the reductions from the pre-project decommissioning. Over time, more roads would be closed and decommissioned, further reducing sediment yield from the project area and creating a net reduction in fine sediment delivery to the stream network. Design criteria like minimizing harvest in RHCAs, limiting harvest in RHCAs to winter conditions, and no underburning in riparian areas result in no measurable increase in fine sediment levels. Decommissioning about 16 miles of roads within 300 feet of streams and removing between 45 and 85 stream crossing would have substantial reductions in sediment delivery to the stream network from roads. This would improve the sediment delivery within the project area and would help expedite the recovery process in the burned area. Due to the project area being over 4 miles above Beaver Creek and the Methow River, road improvements in the project area may not measurably reduce fine sediment in those water bodies. However, the number of artificial sediment sources would be substantially improved.

Temperature conditions in fish-bearing streams may be elevated as a result of the fire, but the project is not expected to influence this indicator. In the long-term, removing riparian roads and planting trees in some RHCAs would improve shade levels. Effects from these actions and processes are expected to increasingly protect cool water temperatures, although the process of re-establishing vegetation would take several decades before trees and vegetation along decommissioned roadways achieve sufficient height to provide a measurable increase in stream shading at a sub-watershed scale.

Management Indicator Species (MIS) and Their Habitats

Current MIS habitat in Frazer, Benson, and Beaver Creeks is non-functioning because of post-fire effects. This project would improve fine sediment levels by substantially reducing the amount of road-stream interactions.

Under the Proposed Action, the pre-project road decommissioning would initiate the restorative process at the beginning. As the project progresses, more restorative road treatments would further reduce impacts from roads. There would be some localized increases in sediment from the timber harvest-related road work, but a net reduction in sediment delivery would occur throughout project implementation. At the sub-watershed scale and beyond, this would be measured as a positive change.

Considering the combination of a substantially improved road system and light impacts from the project, effects are expected to improve habitat for interior redband/rainbow/ brook trout and other fish species, including mollusks. Therefore, the proposed action *may impact individuals or habitat, but would not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species of the above Management Indicator Species. Summary of effects determinations for all aquatic and semiaquatic species in project area sub-basins is presented in Figure 3.7-6.*

R6 Sensitive Species

Umatilla dace, if present in project streams, would be restricted to the lower gradient reaches of Beaver Creek and the Methow River. None are likely to occur within five miles of

the project area. No measurable increase in fine sediment or water temperature is anticipated at this scale. The effects determination for Umatilla dace is *no effect*.

Masked duskysnail, a recent R6 sensitive species, have not been documented in any project area lake, pond, or stream. Based on habitat preferences, it is possible though unlikely, that this species occurs in standing water wetlands in the project area. No project action would result in ground disturbance within at least 150 feet of these waters such that no change in the sedimentation/erosion of shorelines, leaf litter contibution or other substrates needed by the duskysnails would occur. The species and habitat effect determination for masked duskysnail would be *no effect*, whether present or not.

Figure 3.7-6. Sensitive Species List Species Determination Summary

Species	Status	Determination and Rationale
Fish Species of Concern:		
Bull trout	ESA Threatened	Determination: *May affect, not likely to adversely affect.* See project Biological Assessment
UCR steelhead	ESA Threatened	Determination: *May affect, not likely to adversely affect.* See project Biological Assessment
Interior redband rainbow trout	MIS	Determination: *May impact individuals/habitat, would not likely contribute to a trend towards federal listing, loss of viability.* Short-term impacts to project area streams would be localized, non-existent, or minor, giving way to long-term improvement of project area habitat and resiliency.
Brook trout	MIS	Determination: *May impact individuals/habitat, would not likely contribute to a trend towards federal listing, loss of viability.* Short-term impacts to project area streams would be of very low, giving way to long-term improvement of project area habitat and resiliency.
Umatilla dace	R6 Sensitive	Determination: *No effect*
Pygmy whitefish	R6 Sensitive	Determination: *No effect.* Pygmy whitefish are not present in the project area.
River lamprey	R6 Sensitive	Determination: *No effect.* River lamprey are not known to be present anywhere in Okanogan County.
Mollusk species on the Regional Forester's Sensitive Species List:		
Masked duskysnail	R6 Sensitive	Species is not known in project area. Preferred habitat not present area. If present in project wetlands, habitat requirement would be unaffected. *No effect*.

3.7.3.3 Cumulative Effects of the Proposed Action

As discussed at the beginning of Chapter 3, the aggregate impact of all prior human actions or natural events is reflected in the existing condition, which is discussed earlier in this section.

Present, Ongoing, and Reasonably Foreseeable Future Actions

Actions that overlap the proposed action in both space and time that would have cumulative impacts when considered with the proposed action from an aquatics resource perspective include: ongoing road use, firewood cutting, cattle grazing, ongoing fuels treatments, and habitat restoration actions in Beaver Creek.

Transportation/Road System Use

Roads will continue to exist on the landscape with the associated environmental and ecological effects. The road surface and crossings alone are estimated to be adding many extra tons of fine sediment to the stream network currently (see Water Resources Section).

Forest users will continue to apply wear and tear to roads surfaces and a small level of illegal road building will likely occur associated with ATV/ORV use and to access firewood sources illegally. These activities, when occurring close to streams can have negative impacts to sedimentation rates via erosion, reduce shade and wood recruitment by removing snags within proximity to streams, and widening stream channel geometry by breaking down streambanks and the vegetation that holds them together.

The Proposed Action would act to ameliorate some of the possible cumulative effects associated with the road system and would help expedite the recovery process from the fire impacts. Closing or decommissioning roads within 300 feet of streams would reduce the ongoing fine sediment delivery to streams and road reduction within the RHCA would serve to reduce the additional impacts such as wood recruitment, streambank deterioration, channelization, etc.

Firewood Cutting

Legal and illegal firewood cutting will likely increase within the project area due to the increased number of newly dead trees and the local demand for firewood. Firewood collection regulations currently stipulate that firewood must be collected within 200 feet of open roads and that no collection may take place within 300 feet of fish-bearing streams, or 150 feet of other streams. For the project area, this would include 300-foot avoidance areas for parts of Frazer and Benson Creeks, with 150-foot no-cut areas for other mapped streams. On-the-ground indicators suggest these regulations are often ignored, particularly along Frazer Creek where evidence of cut trees can easily be location both within about 50 feet of the channel as well as along user-built roads, beyond 200 feet from open roads. Road closures/decommissioning and gates proposed in the project would address these trends.

These activities are increasing the drainage network by damaging non-system roads that are not maintained, opening up new user roads, removing wood that would otherwise recruit to the channel of perennial streams, and likely reduces in a small amount of shade loss. These effects overlap with potential project-related effects in space in time.

Cattle Grazing

Within the burned areas, livestock grazing would not occur for at least 2-3 years. Outside of the burned areas, some grazing would continue to occur. Where grazing would continue, past monitoring has showed use levels are maintaining resource objectives.

Cattle grazing is causing some level of streambank erosion, fine sediment delivery to creeks, and riparian vegetation disturbance. These impacts overlap with the project area treatment areas in time and space.

The proposed action would open some forest cover, which would increase transitory range options for cows. Aspen treatments may increase cattle use of riparian area but the Range Specialist expects this to be dispersed. Monitoring and trigger actions in the current and next Allotment Management Plan/Annual Operating Instructions for the allotment will address these concerns.

Habitat Restoration Actions in Beaver Creek and Frazer Creek

Beaver Creek has been a conservation target for state and federal agencies and non-government organizations due to its importance as a spawning and rearing stream for steelhead, spring Chinook, coho, and bull trout. It is also an important water source for

irrigation. Recent work to reduce fish barriers includes upsizing culverts and removing and/or upgrading six irrigation diversions. Other ongoing riparian improvement projects outside of the project area in these drainages include riparian planting, large woody debris installation, irrigation efficiency projects, and implementation of conservation easements to improve grazing activities in the floodplain along the lower, private extent of the stream. Beaver have been relocated to the Beaver Creek drainage including Frazer Creek (on private land downstream of the project area). During the fall of 2014, several driveways that crossed Frazer Creek were blown out from the debris flows and replaced with bridges that will allow for more natural stream passage and fish passage. Fish improvement projects implemented over the last decade or so have improved fish passage to migratory species; where steelhead likely did not reach National Forest reaches of Beaver Creek, they have recently been documented in lower Beaver Creek around the National Forest boundary and Beaver Creek is now considered free-flowing to all life stages of all fish species. The effects of these activities in combination with those proposed in this project would likely result in improving the sediment and temperature habitat indicator functions. Additional large wood in the channel via active restoration, conservation easements, and beaver relocations, will increase sediment capture from upland sources, as well as have potential water storage/floodplain connectivity benefits.

Cumulative Effects Summary

Cumulative effects of these multiple activities are presented in terms of the habitat parameters discussed above.

Temperature: Ongoing actions and reasonably foreseeable future actions in the project area during the timeframe that project actions would occur are not expected to exceed current levels of shade maintenance, channel geometry, and hydrologic regime. Grazing, fire suppression, road use, or other actions would not act cumulatively with project actions to increase stream water temperatures, particularly at the sub-watershed scale and/or in fish habitat typically downstream of the project area.

Sediment: Ongoing actions and reasonably foreseeable future actions in the project area during the timeframe that project actions would occur are not expected to exceed current levels of sediment delivery, affect streambank integrity more than current rates, or have any other effects that could increase sedimentation. The net effect of the South Summit project is expected to be an improvement (decrease) to sedimentation and erosion rates. It is not expected that any other activity would act cumulatively with project actions to increase fine sediment delivery rates, generate turbidity, or increase levels of embeddedness in stream habitat, particularly as measured at the sub-watershed scale and/or in fish habitat typically downstream of the project area. Improvements from the restorative road treatments would surpass any minor increases from the timber harvest, fuels treatments, and their associated road work. These improvements would help expedite the recovery of the burned area because most of the road decommissioning and road closure lie within the Frazer and Benson Creek drainages.

Roads: Roads are the major ongoing activity that deteriorates aquatic habitat and watershed processes in the project area, especially after the fire and post-fire debris flows. No notable ongoing actions related to roads are expected to impart major changes in the number of road miles, road density, number of stream crossings, etc. It is not expected that any other activity would act cumulatively with project actions to negatively affect road system related metrics affecting local hydrology or aquatic habitat, particularly as measured at the sub-watershed scale and/or in fish habitat typically downstream of the project area. Removing

about one-third of the roads within 300 feet of streams and between 40 and 75 percent of the stream crossing in the project area would be greatest effect of the project and would be substantially beneficial.

Large Woody Debris: Wood levels have increased since the fire and wood will continue to recruit a high rates. Ongoing actions and reasonably foreseeable future actions in the project area during the timeframe that South Summit's actions would occur are not expected to negatively affect instream large woody debris in fish habitat. Illegal firewood activity is occurring in RHCAs of Frazer Creek and Benson Creek but wood levels and recruitment potential in both streams are good and improving. The net effect of the South Summit project is expected to reduce access to these firewood cutting locations such that the opportunity to cut snags along creeks will be reduced. It is not expected that any other activity would act cumulatively with project actions to reduce instream large wood, particularly as measured at the sub-watershed scale and/or in fish habitat typically downstream of the project area.

Considering the impacts of the fire on Frazer Creek, Benson Creek, Beaver Creek, and the Methow River along with past, present, and reasonably foreseeable future actions, aquatic habitat and fish in these streams likely have experienced reduced viability. Considering the current conditions along with the protective design criteria and extensive restorative road treatments proposed with this project, the South Summit II Forest & Fuels Project is not expected to degrade aquatic habitat. Overall, the primary beneficial effect of the project on habitat conditions would constitute both immediate and long-term improvements to fine sediment delivery rates by reducing a several riparian roads and stream crossings.

Salmonid habitat in Frazer, Benson, and Beaver Creeks are in poor condition and are now starting the process of recovery. Reducing a substantial amount of roads in RHCAs, in these sub-watersheds would help expedite the recovery process. Reduction of roads, particularly those in closer proximity to streams and those with stream crossings, would decouple the road and stream drainage patterns, increased area where tree/vegetation cover could reestablish (increase shade-producing vegetation and filtration capacity), and have other benefits to hydrologic/aquatic processes. However, the relationship between the fine sediment delivery rates and intra-gravel fine sediments is not fully understood. We expect reduction in the delivery rate of fines, and expect intra-gravel levels to decrease, but it is unknown if reductions would be enough to result in improvement to within Forest Plan standards.

The sediment delivery effects of the South Summit project, while modeled to be a net reduction, when combined with past, present, reasonably foreseeable future actions and the newly fire-caused changes, would be inconsequential when compared to background levels and those resulting from roads not included in the project and other ongoing impacts.

The cumulative effects are within the scope of anticipated effects to aquatic resources determined in the Okanagan National Forest Land and Resource Management Plan EIS (USDA Forest Service 1989:IV-93 and IV-94).

3.7.3.4 Consistency Statement

The design criteria and mitigation measures listed in Appendix A would be used to insure that all the alternatives are consistent with RMOs from the Forest Plan as amended by PACFISH. The South Summit II Forest and Fuels project is consistent with NFMA since critical aquatic and fish habitat parameters are being maintained, protected and enhanced. The project is also compliant with the ESA since it will not jeopardize the continued existence of any threatened or endangered species or result in the destruction or adverse habitat, consultation still in progress. See Specialist Report for more detail.

3.8 SOILS

The section below summarizes the existing condition information, along with the direct, indirect and cumulative effects from the South Summit II Forest and Fuels Project, as analyzed in the South Summit II Forest and Fuels Soils Report (Burgoyne 2013, Cerise 2014), available in the project record.

3.8.1 Issues for Analysis

Indicators for soil productivity are described below. Erosion, compaction, loss of organic matter, and soil displacement all play into detrimental soil disturbance. The following indicators will be used to compare effects:

- Acres of Detrimental Soil Disturbance (DSD); includes harvesting, prescribed fire, and post Carlton Complex Fire erosion. This indicator is a proxy for soil productivity.
- Miles of fire control line
- Miles of temporary road
- Number of new landings
- Miles of road decommissioned

Analysis Methods: Soil resources on the project area have been reviewed using soil survey data, data in GIS, and field reconnaissance. Many of the units have been field reviewed by the soil scientist to verify mapping, identify areas where soil productivity may be affected by proposed actions, and examine current disturbance on site (2012 & post fire 2014). Best Management Practices (BMPs) for soil protection in thinning units and along road segments are based on field data. Effects analyses were based on the proposed silvicultural prescriptions including road work and landings and fuel treatments including fire line construction.

In determining a significant change in productivity, a 15% reduction (20% in ash capped soils) in inherent soil productivity potential will be used as a basis for setting threshold values. This 15% reduction is generally considered a significant reduction of productivity over 20% of a treatment unit. Threshold values would apply to measurable or observable soil properties or conditions that are sensitive to significant change. The threshold values, along with aerial extent limits, would serve as an early warning signal of reduced soil productive capacity, where changes to management practices or rehabilitation measures may be warranted. Management activities have potential to cause various types and degrees of disturbance. Soil disturbance (a measure of soil productivity) is categorized generally into compaction, displacement, puddling, severe burning, and erosion.

Analysis Area: The harvest or fuels treatment units serve as the analysis area. Temporary roads, skid roads, and landings within unit boundaries are included in the disturbance analysis. System roads and long-term specified roads are considered for detrimental soil disturbance as well as new soil disturbance created from the Carlton Complex Fire.

3.8.2 Affected Environment

The temporal scale for assessing soil resource environmental effects includes both short- and long-term impacts. For the purposes of this analysis, short-term effects are defined as those that occur within about 10 years following proposed vegetation treatments. Long-term effects are defined as those that occur within about 10-20 years or more following proposed vegetation treatments. Post fire soil effects will be treated as a short-term effect for this analysis, but depending on vegetation response and future soil cover, some areas within the

fire scar may erode 10-20 years post fire and vegetation treatments. Soil productivity is a site-specific characteristic. Loss of soil productivity in a treatment unit alone will not lead to a loss in soil productivity in an adjacent stand or other areas across a watershed.

The analysis areas for consideration of cumulative effects are the same as those evaluated for the existing condition and direct/indirect effects. Assessment of cumulative effects on soil productivity at scales larger than the specific treatment unit boundary (such as the watershed scale) misrepresents the effects of management activities by diluting the site-specific effects across a larger area. In contrast to soil productivity, processes such as erosion regimes and hydrologic functions occur at a watershed scale and have been analyzed as such in the Hydrology Specialist Report.

Many units proposed for ground-based harvest with past harvest histories were surveyed in fall of 2012, and again in 2014, post-Carlton Complex. A range of soil types were visited across the project area and units were chosen for field review so that each soil map unit would be visited. Field soil quality assessments were performed by a professional journey-level soil scientist and trained soils crews. The National Soil Condition Assessment protocols were used (Page-Dumroese et al. 2009). Field surveys consisted of random transects with confidence intervals at or above 80% (+/- 5%) and included examination of the following indicators:

- Percent detrimental soil disturbance (DSD); defined as a decrease in soil porosity, or increase in soil bulk density, that impairs site productivity (Soil Disturbance Field Guide (Page-Dumroese et al. 2009).
- Percent cover by category; bare soil, rock, wood, vegetation, and litter.
- Down woody debris (tons per acre, greater than 3 inches size class).
- Litter and duff depths.
- Percent of rock in the uppermost soil horizon.
- Noted slope stability issues, erosion, and other soil concerns (Finley Canyon, and Benson & Frazer Creek drainages have significant slope stability and erosion concerns due to high burn severity, hydrophobic soil conditions, and total consumption of the vegetation and duff layer.)

In units that were not surveyed, detrimental disturbance calculations were projected based on past harvesting histories and soil type within the unit, and a soil burn severity map was used to assess the level of light, moderate, and severe burnt soil conditions. Appendix F lists current and post-project soil conditions.

The estimate of detrimental conditions found within the project area is likely higher than actual. The field soil survey methodology has been found to overestimate the amount of detrimental soil (Page-Dumroese et al. 2006a; Miller et al. 2010), providing a conservative assessment of existing soil condition. Informal comparisons on the reproducibility of the category calls found that both among a single observer and between observers, the category calls have a variability of 5 to 10% (Miller et al. 2010). Soil disturbance was estimated for un-surveyed units using harvest histories and disturbance found in units (surveyed) with similar harvest histories.

The existing and estimated values for detrimental soil disturbance are not absolute and are best used to compare differences between alternatives. The calculation of the percent of additional detrimental disturbance from a given activity is an estimate, because detrimental disturbance is caused by a combination of factors including existing groundcover, soil

texture, timing of operations, equipment used, skill of the equipment operator, the amount of wood to be removed, and sale administration. The estimation of detrimental soil disturbance from management operations assumes that BMPs (USDA 2012) would be implemented and that soil recovery would occur over time.

Site and soil productivity relies on complex chemical, physical, and climatic factors that interact within a biological framework. For any given site and soil, a change in any key soil variable (i.e., bulk density, soil loss, nutrient availability, etc.) could lead to changes in potential soil productivity. Defining the threshold at which productivity is detrimentally disturbed has been the subject of much discussion and controversy. Powers (1990) cites that the rationale for the 15% limit of change in soil bulk density was largely based on the collective judgment of soil researchers, academics, and field practitioners, as well as the ability to detect change in productivity through current monitoring methods. Thus the soil quality guidelines are set to detect a decline in potential productivity of at least 15%. This does not mean that the Forest Service tolerates productivity declines up to 15%; rather it recognizes the complexity of detecting detrimental soils. The 20% change in areal extent realizes that timber harvest and other uses of the land result in an unavoidable footprint. This limit is based largely on what is physically possible with the use of harvest and skidding machinery.

Currently, soil quality standards are being studied by a cooperative research project called the North American Long-Term Soil Productivity Study. The 5-year results were recently published (Page-Dumroese et al. 2006b; Flemming et al. 2006; Sanchez et al. 2006). The study is ongoing and provides the best available science to resource professionals. To date there has been no reduction in tree growth noted as a result of compaction or organic removal in plots with soils typical of the analysis area (Andisols). Additional controversy surrounds the use of the term ‘irreversible’ in NFMA. NFMA has guidelines that “insure that timber will be harvested from NFS lands only where soil, slope, or other watershed conditions will not be irreversibly damaged.” The detrimental soil disturbance described in this analysis would not result in substantial and permanent impairment. Detrimental soil damage is reversible if chemical, biological, and physical soil processes (for example organic matter, moisture, top soil retention, and soil biota) are in place and time is allowed for recovery.

Existing Condition

Soils are generally metamorphic in origin with a fine sandy volcanic ash cap that ranges in depth from seven to 30 inches. A small portion (approximately 8%) of the project area is colluvium and residuum from metamorphic and metavolcanic rocks. Much of the project area was glaciated and glacial till is common below ash capped soils (Andisols). Volcanic ash has a high water-holding capacity and provides an excellent germination substrate for many native plant species. Unfortunately, ash is extremely vulnerable to compaction, displacement and (when laid bare by disturbance) erosion. Post fire erosion is an existing condition and will remain that way for several years until adequate vegetation and ground cover are reestablished in the project area. All soils are more sensitive to compaction disturbance when moist, but ash-capped soils are especially sensitive when moist. Throughout the landscape, the soil has developed in a mosaic pattern as dictated by topographic relief, vegetation, and aspect.

Soil Resources

Under the objectives outlined in the National Forest Management Act, the USDA Forest Service has assembled the North American Long-Term Soil Productivity Research Program (LTSP). The LTSP has focused its attention on two soil properties that are most influenced by timber harvesting and fuel treatments and most related to forest integrity within the constraints of climate and topography: soil organic matter (soil productivity and nutrients), and soil porosity (Powers 1998). These soil properties are components to soil productivity as a whole and are used as a proxy to soil productivity because they can be measured effectively in the field. These two issues are also the primary soil concerns for the South Summit II project area. Soil organic matter is influenced by fire, silvicultural prescriptions, timber harvests, and decomposition and accumulation rates of vegetative material. Soil porosity is most influenced by mechanical compaction and a lack of bio-physical resiliency.

About one-third of the project area that is within the Carlton Complex fire scar has moderate to high burn severity, thus leading to total consumption of the soil organic matter layer and has left the soil surface bare. The resulting rain storms created debris flows in the high burn severity areas and transported soil material downslope in many drainages, generally at a rate of 20-26 tons of soil/acre (sediment delivery rates of 3 tons/acre or less are considered to be normal sedimentation rates). Figure 3.8-1 displays the results of erosion risk modeling for portions of the project area that burned in the Carlton Complex wildfire in 2014. See Soil Specialist report (Cerise 2015) for modeling details. “Soil Burn Severity Class” designations indicate the following:

- “High” = total loss of all vegetation and organic matter; bare, charred soil present.
- “Moderate” = total/partial loss of vegetation, but organic matter remains to some degree.
- “Low” = minimal loss of ground vegetation and organic layer remains intact.

Figure 3.8-1 Potential Soil Erosion Risk within Burned Portions of South Summit II

Soil Burn Severity Class 30-50% Slopes	Sediment Delivery Year 1 (tons/ac)	Sediment Delivery Year 2 (tons/ac)	Sediment Delivery Year 3 (tons/ac)
High	15-21	10-15	2-10
Moderate	10-13	5-10	1-5
Low	3-7	1-3	>1
Soil Burn Severity Class 20-30% Slopes	**Sediment Delivery Year 1 (tons/ac)**	**Sediment Delivery Year 2 (tons/ac)**	**Sediment Delivery Year 3 (tons/ac)**
High	9-12	5-8	2-4
Moderate	5-8	3-5	1-3
Low	1-4	1-3	>1

Soil Burn Severity Class *5-20% Slopes	Sediment Delivery Year 1 (tons/ac)	Sediment Delivery Year 2 (tons/ac)	Sediment Delivery Year 3 (tons/ac)
High	5-8	2-5	>1
Moderate	3-5	1-3	>1
Low	1-3	1-2	>1

*0-5% slopes were modeled but not displayed in the table because model results were below baseline sedimentation rates.

Soil Organic Matter

The importance of soil organic matter cannot be overstated (Jurgensen et al. 1997). This organic component contains a large reserve of nutrients and carbon, and it is dynamically alive with microbial activity. The character of forest soil organic matter influences many critical ecosystem processes, such as the formation of soil structure, which in turn influences soil gas exchange, soil water infiltration rates and soil water-holding capacity. Soil organic matter is also the primary location of nutrient recycling and humus formation, which enhances soil cation exchange capacity and overall fertility. Post-fire, most areas of high burn severity had total loss of the organic matter layer leaving bare, hydrophobic soil behind. These areas will not have a fuels treatment or harvest treatment associated with them and the organic material surface layer will develop over the next several years. The moderate to low burn severity areas still maintained some level of organic material and plant debris on the surface and have less hydrophobicity than the high burn severity areas.

These processes have direct and profound effect on site productivity and sustainability. Organic matter is the one component of the soil resource that, if managed correctly, can actually be improved by human activity. Manipulation of the organic constituents of the soil may be the only practical tool available for mitigating effects of harvesting systems that remove standing trees and dead and down trees, or cause extensive soil disturbance. Of the many organic materials incorporated in a forest soil, the woody component is in many ways the most important. To protect the sustainable productivity of the forest soil, a continuous supply of organic materials must be provided, particularly in harsh environments (Jurgensen et al. 1997).

Coarse Woody Debris & Soil Wood

Coarse woody debris (CWD) and organic matter (OM) are good indicators of site resiliency and overall forest health. Organic matter including the forest floor and large woody material is essential for maintaining ecosystem function by supporting moderate soil temperatures, improved water availability, and bio diversity (Page-Dumroese et al. 2010). Coarse woody debris amounts are generally low throughout the units surveyed in 2012. Rates averaged 3 tons/acre but ranged from 0-15 tons/acre. In cool mesic zones CWD should be around 12-25 tons/acre, in warm dry and cool zones material should be around 12-18 tons/acre and in hot dry zones material should be between 5 and 15 tons/acre (Graham et al. 1994). CWD, both standing (future recruitment) and down is important for site resiliency and recovery.

As of 2012, coarse woody debris (CWD) is lacking throughout the harvest units, averaging 3 tons/acre within the units surveyed in the fall of 2012. Large diameter trees and snags were present in the project area. Some trees would die from prescribed burning activities and contribute to woody debris recruitment. After the 2014 Carlton Complex, most of the high

burn severity areas have total loss of all CWD, and the moderate to low severity burn areas still retained much of the larger diameter CWD. The South Summit II project would leave as much CWD on site as is feasible through breakage during timber harvests and leaving the appropriate amount of CWD in fuel reduction units. Over time the remaining dead standing trees would fall and replace CWD that was lost due to fire in the project area. Coarse woody debris would be left on site according to forest type. Standing dead trees and trees killed from fire count towards meeting CWD standards because these trees are CWD recruitment.

Residue left after advanced brown-rot decay is a brown, crumbly mass composed largely of lignin. In healthy forest ecosystems, especially coniferous forests, the upper-most soil horizon contains a significant portion of brown-rotted wood residues. The sponge-like properties of advanced brown-rotted wood act as a moisture and nutrient sink. Because of the high lignin concentrations, and low carbohydrate rates, it persists on the forest floor for a long time (Blanchette 1995). This type of decay is no longer present in the high and moderate burn severity areas within the project area. However, the dead standing trees would fall to the soil surface and over the next several years the fungus populations would return and start the formation of brown-rot and return much needed organic material to the soil surface horizon.

The lignin product of brown rot is tremendously important in the forests of the West. Since brown rot typically affects only heart wood, large trees allowed to die and decompose naturally in the woods serve as an important lignin source. Early logging techniques in many areas including some areas of the South Summit II Project area that bulldozed forest debris into piles and then burned the organics significantly reduced the occurrence of soil wood. Soil wood possesses one key characteristic that makes it important: the ability to hold water. This high water-holding capacity provides:

- Plant-available water, especially during the dry summer months
- Excellent underground habitat for all types of soil biological organisms
- Appropriate conditions that cause a hub of mycorrhizae fungi activity

Wood decaying fungi in coniferous forest ecosystem have three major roles:

- breaking down plant residues and recycling carbon to the soil
- releasing mineral nutrients from plant residues and making the nutrients available to soil micro-organisms
- added tilth (structure) to the soil matrix

The outcomes of these processes promote soil water infiltration rates, soil water-holding capacity, cation exchange capacity, nutrient availability, nitrogen fixing activity, and habitat for mycorrhizae associations, and soil biological activity to name a few.

Ground Cover & Forest Floor

Soil cover from organic matter or vegetation averaged about 95% across all the units surveyed in 2012. Approximately 3% of the cover was woody material and the remaining 2% was bare soil or rock cover. Average observed depth of plant litter was 1.5 centimeters and duff was one centimeter (total organics 2.5 centimeters). The average optimum level of fine organic matter is 21 to 30% (Graham et al. 1994), which equates to 2-6 centimeters of surface plant litter and duff, depending on forest type. Optimum levels of fine organic matter relate to ectomycorrhizal fungus, which is a good indicator of healthy forest soil (Graham et al 1994). Following the fires of 2014, much of this ground cover has been altered within the burn scar. The high burn severity areas within the project area have no ground cover left, as

of fall 2014. These same areas encountered massive debris flows due to heavy rains and hydrophobic soils in the fall of 2014. Tree fall and vegetation recovery will help to restore the forest floor in these areas over time. The moderate to low severity burn areas within the project area did retain some amount of forest floor and vegetation cover. Management objectives, such as tree planting in the project area, would help to add more organic matter and cover to the soil surface, thus reducing the amount of time needed for full recovery.

In addition to cover directly on the soil surface, cover from vegetation can provide litter contributions in the future. Vegetative cover in the ground based thinning units was generally good, between 60 and 100%. Some of the units do have large open patches with no shade. Shade and vegetative cover are important factors in the recovery of these sites, both within the fire scar and outside of it within the project area.

Soil Porosity

Soil porosity refers to the amount and character of void space within the soil. In a “typical” soil approximately 50% of the soil volume is void space when not saturated. Pore space is lost primarily through mechanical compaction. Three fundamental processes are negatively impacted by compromised soil pore space:

- Gas exchange
- Soil water infiltration rates
- Water holding capacity

Within the South Summit project area, soil porosity has been reduced on the skid trails and landings within the proposed treatment units that have been harvested in the past. Soil porosity was also reduced after the fires of 2014 due to hydrophobic soils. Reduced soil porosity leads to reduced ability of soils to exchange oxygen and carbon dioxide thus affecting the ability of soil organisms to survive. Reduced soil porosity also impedes root growth.

Gas Exchange

Soil oxygen is fundamental to all soil biologic activity. Roots, soil fauna, and fungi all respire, using oxygen while releasing carbon dioxide. When gas exchange is compromised, biologic activity is also compromised. Some areas in the project area (high burn severity) will see a reduction in gas exchange for the next several years, but as vegetation starts to recolonize gas exchange will increase exponentially. Maintaining appropriate soil biologic activity is paramount when considering long-term forest resiliency.

Soil Water Infiltration Rates

Severely compacted soils do not allow appropriate water infiltration, leading to overland flow and associated erosion, sediment delivery, spring flooding, and low summer flows. Main skid trails and landings are the longest lasting detrimental disturbance, where many machines travel over the same route. Activities on moist soils are especially damaging. Work on dry or frozen soils maintains much more of a soils natural ability to quickly restore pore spaces.

Soil compaction leads to reduced soil porosity. Soil compaction is generally evaluated from 5 to 30 centimeters below the mineral soil surface. Specific depths for measurement are dependent upon soil type and management activities. Detrimental soil compaction is increased soil density (weight per unit volume) and strength that restricts root growth, reduces soil aeration and inhibits water movement. In the South Summit project area,

detrimental soil compaction was found on existing skid trails and old roads in most of the proposed ground based treatment units.

The percent of coarse fragments is a measure of rock content in the top 12 inches of mineral soil. Rock content is an indicator of the susceptibility of compaction on a specific soil type. Rock content over 35% will greatly reduce the effect of mechanical compaction (Welke and Fryles 2005). Generally coarse fragments in the South Summit II project area are less than 35%. Areas with coarse fragments less than 35% are more susceptible to compaction. Moisture is also an important factor in determining susceptibility to compaction, especially on finer textured soils. Dry soils are less likely to compact and have lower risk of compaction than moist soils (Welke and Fryles 2005). Even under moist conditions, coarse textured soils can compact. Soil water infiltration was severely altered after the Carlton Complex fire. Most, if not all of the soil high burn severity areas have some amount of hydrophobicity associated with them. Hydrophobic soils do not allow for water to infiltrate the soil matrix causing overland water flows that lead to slope failures. Slope failures and debris flows followed the fires in 2014, causing watershed damage in the project area. These areas will remain unstable for several years until vegetation and ground cover re-establish and hold the soil in place. No management activity is proposed on these heavily eroded soils as part of the South Summit II project.

Erosion Hazards

Surface erosion potential is a rating of the relative susceptibility of exposed soils to sheet and rill erosion. Surface erosion hazards are most important in prescribed burn units in the South Summit II project area. Within the proposed prescribed burn units, approximately 40% of the area has severe erosion hazard ratings and 60% of the soils are rated very severe. Soil cover following prescribed burning will be very important to the recovery of these sites and will decrease potential erosion following treatment. The potential for soil erosion concerns is not so much associated with mechanized treatments as with existing roads (Cacek 1998). The dominant processes in roaded areas are surface erosion from bare soil areas of roads, including the cutslope, fillslope, and travelway. Also erosion hazards are determined based on no soil cover. All prescribed fire and thinning units will have adequate soil cover following treatments.

Erosion hazards became more apparent following the fires of 2014. The Frazer and Benson Creek sub watersheds both had complete blowouts due to heavy rain on hydrophobic, easily erodible soils. Based on model outputs, the same event moved 20-26 tons/acre of sediment into the Finley Canyon area. These areas will continue to be at a very high risk for these types of erosional events for the next several years, until vegetation and ground cover re-establish in the project area.

Re-vegetation of cut slopes and fill slopes is often difficult due to lack of soil moisture, organic material, low productivity potential, and desiccation of seeds and seedlings, especially on south-facing slopes. On moist slopes, re-vegetation efforts are more successful since erosion of road cut slopes and fill slopes is generally lower. Within the project area, cut and fill slopes are generally vegetated. Road erosion and sediment yield usually decline after construction (Jones 2000; Switalski et al. 2004) but can provide a chronic, long-term source of sediment to streams. Periodic large pulses of erosion may occur during intense water yield and overland flow events in interaction with road drainage systems and high burn severity areas. Roads and their associated impacts are analyzed in detail in the Hydrology Specialists Report for this project.

General Soil Disturbance

Past harvesting activities including conifer removal and regeneration harvesting occurred in many of the units proposed for treatment since the early 1900's. Timber harvesting occurred on approximately 29,158 acres within the South Summit II project area and regeneration harvesting occurred on approximately 2,620 acres within the project area. Observed detrimental disturbance due to compaction was associated with old primary skid trails and landings. Other factors leading to DSD and non-detrimental soil disturbance in many of these units was soil displacement, rutting and soil erosion caused from steep skid trails, bare soil, and dozer piling of topsoil. Modern harvesting techniques do not have as great an impact as in the past and current SWCPs and BMPs mitigate many of the past concerns.

Fuels treatments were also completed on many timber harvest units within 2-5 years following harvesting. Landscape scale underburning occurred on approximately 11,464 acres between 1998 and 2010. Effects from fuels treatments and landscape underburning include reduced organic matter because of loss of litter and duff layers as well as some increased erosion. Effects from the 2014 fires have greatly increased the erosion rates in the project area, but proposed management in the project area will not increase the rates of erosion. The average aerial extent of detrimental soil disturbance in units with a past harvest history was about 14% (within a general range of 5-25% including disturbance from system roads). Grazing disturbance including compaction and erosion was also found. Compaction from cattle grazing is generally concentrated near water sources.

3.8.3 Environmental Consequences

3.8.3.1 No Action

No adverse impacts to soils would occur, other than that which will happen naturally in the Carlton Complex burn scar. Recovery of existing impacted soils would continue through natural means (freeze/thaw cycles, root penetration into compacted soils, etc.). Litter and duff accumulations would continue to increase, unless removed by wildfire. Overall, trends toward increased soil productivity on all units with detrimental soil disturbance would occur, gradually over the next several years. No cumulative effects are anticipated.

3.8.3.2 Proposed Action

Proposed activities would have long- and short-term direct negative effects on forest soils. However, by implementing the soil design features prescribed here the project would meet the Region 6 Soil Quality Standards as well as the Forest Plan standards, and would therefore not have a significant impact to soils regarding management activities in the project area.

Effects from past logging operations are detectable up to 80 or more years. Newer logging systems create less soil disturbance. Proposed activities use techniques that maintain or promote natural soil bio-physical resiliency. The effect of proposed activities should be relatively short compared to techniques used in the past. Generally, detrimental effects on soils are not permanent and depend primarily on soil texture, parent material, aspect, and level of disturbance (compaction, rutting, etc.). Vegetative recovery time is approximately 30 to 70 years as the second growth timber becomes established around the disturbed areas and develops enough crown foliage to intercept and evapotranspirate moisture (Dykstra and Curran 2002; Froehlich and McNabb 1983; Froehlich et al. 1983 and 1985). Freeze-thaw cycles, soil organisms, and root growth would help alleviate compaction and rutting. Soil displacement may last longer, but design features would minimize soil displacement. Recovery of soil organic matter in the surface soil horizon displaced during logging is a

relatively long process; 20 to 60 years to decompose raw soil organic matter into humus (Powers et al. 2004). The duration of disturbance from temporary roads would be greater than 60 years since mineral soil would be exposed. Soil rehabilitation would reduce this timeline by improving water and gas infiltration and percolation but soil biota would still need time to decompose vegetation litter into soil organic matter and humus.

Soil Organic Matter (Soil Productivity and Nutrients) and Soil Porosity

Most harvest and fuels treatments would maintain a functional forest floor on at least 80% of any activity unit meeting the R6 SQS and Okanogan-Wenatchee NF Forest Plan. In four regeneration harvest units, underburning may cause slightly more soil exposure for the purposes of meeting site-preparation objectives; soil exposure would recover quickly as these units would be replanted within six - twelve months of underburning. In burned units, design features and harvest techniques would be used to improve soil quality and trend these units towards meeting regional standards in the future. This project is designed to provide for a continuous supply of CWD (Graham et. al. 1994) and nutrient cycling would not be affected in thinning units because mitigations have been recommended for leaving excess fine material and woody debris in units lacking organic matter.

Thinning treatments would use whole tree yarding or machine slash piling, where needed, to reduce residual slash for fuel considerations. The proposed treatments would leave slash on the ground through at least one winter providing an opportunity for the needle nutrients to leach into the soil.

Nearly all forest plants have a strong dependence on mycorrhiza fungi for extracting nutrients and moisture from the soil. In all alternatives, microorganisms would continue to populate the soil, contributing towards site productivity through nutrient cycling and reforming soil aggregates. Any project effects would not be adverse to soil productivity because nutrient replenishment, forest floor, and humus stores would remain on the site (Busse et al. 2009).

In the commercial thinning units, localized areas with detrimental levels of soil compaction, displacement, and other physical disturbances would reduce the ability of soils to exchange oxygen and carbon dioxide thus affecting the ability of soil organisms to survive. Outside of landings and skid trails, large areas (greater than 100 square feet) with detrimental levels of soil disturbance are not expected because of project design features (for example, the ground would be dry or frozen and designated skid trails would be used), standard soil operating procedures, and Timber Sale Contract provisions. In addition, favorable habitat for soil organisms would be maintained outside of designated skid trails as limited soil disturbance is expected off these skid trails. Any reduction of productivity attributable to soil organisms would be short-term (less than 5-years).

Harvest operations remove biomass and site organic matter and thus affect nutrient cycling. Generally, nutrient losses are proportional to the volume of biomass removed from a site. Nutrients are lost during harvesting by removing the stored nutrients in trees, and additional nutrients are lost if the litter layer and woody debris are removed. Whole-tree harvesting, which extracts larger amounts of biomass, especially nutrient-rich foliage, compared to conventional sawlog or thinning operations, removes a larger amount of the nutrients from the site. The exact amount of nutrients lost from a particular site would vary with forest types and particular site conditions (Grier et al. 1989). The amount of nutrients present in the trees would also vary with stand age and development of the humus layer (Grier et al. 1989). Moreover, the greater the proportion of nutrients stored in trees, the greater the

potential for site degradation and declines in productivity after harvesting operations. The data suggest that nutrient losses from whole-tree harvesting are considerably greater when compared to conventional sawlog harvesting for all nutrients. Calcium losses were particularly large for whole-tree harvesting due to the high concentrations of calcium present in the wood fiber of twigs, branches, and boles (Adams 1998, Mann et al. 1988).

The impacts of burning depend on levels of fire severity. Landing piles would result in the highest severity from concentrated burning. Litter and duff consumption is likely to occur at high rates in pile burns. Small, dispersed piles would minimize litter loss. Prescribed under burning typically result in a positive benefit with a mosaic pattern of burned and unburned ground and predominately low severity burn. Effects are significantly reduced when soil moisture levels are above 25% (Neihoff 2002).

Prescribed fire can increase available nitrogen for one to two years (Choromanska and DeLuca 2002). Burning slash piles could create extremely high temperatures in concentrated areas and would lead to volatilization of nitrogen, loss of phosphorus and potassium (DeBano 1981). If litter layers and organic matter is kept intact throughout the rest of the stand, nutrient losses would be minimal from burning slash and would be localized. Nitrogen-fixing plants can colonize sites following fire and help restore N in the ecosystem (Newland and DeLuca 2000; Jurgensen et. al. 1997). Following fire, soil erosion can increase, which could also reduce the nutrient pool (Megahan 1990). Generally, if plants colonize sites following fire, nutrient levels can reach pre-fire levels quickly (Certini 2005). Charcoal deposited following fire also adds carbon to the soil (DeLuca and Aplet 2008). These interactions are expected within the burn scar of the project area, and will take several years to develop.

Indirect effects of soil nutrient loss include reduced growth and yield and increased susceptibility to pathogens, such as root disease (Garrison and Moore 1998, Garrison-Johnston 2003) and insect infestation (Garrison-Johnston et al. 2003 and 2004). Precipitation (Stark 1979) and weathering of rocks will continue to make additional nutrients available on site. Annual needle, leaf, and twig fall, forbs, and shrub mortality will continue to recycle nutrients within the project area.

Soils and overall site productivity can be adversely affected by weeds. Noxious weeds impact soils by shifting plant species composition with below ground implications to soil biota. Noxious weeds such as cheatgrass (Bromus tectorum) and spotted knapweed (Centaurea maculosa) influence below-ground soil function by changing soil nutrient status and water dynamics, creating legacy effects that favor opportunistic species (Gundale et al. 2008). Noxious weeds are not affecting soil productivity in the proposed activity units since their population is currently restricted to the road system or isolated patches. Weed populations effect soil productivity through retarding native plants, a shift in above and below ground biomass, reduced amounts of organic matter being added because of a lack fine feeder roots, and a loss of plant leaf material. These biological changes provide cascading effects on soil erosion (reduced soil cover) and higher soil temperatures. High soil temperatures in turn lead to increased oxidation of organic matter and a downward cycle that favors weeds; they are adapted and competitive in harsh sites. For an in-depth discussion on weeds, refer to the Invasive Species section.

By maintaining organic matter and native ground cover on at least 80% of the site by limiting disturbance to 20% or less of the unit area, nutrient cycling and availability should not be altered and soil productivity would be maintained. Site preparation within each of the 4

planting units may temporarily reduce the organic matter below 80%, but organic matter recruitment from the tree planting would return the units to acceptable levels. Leaving slash on site would be extremely important in meeting the standards. Although several units currently have greater than 20% of the area in a detrimental soil condition, proposed activities should not increase the current disturbance and would help the units trend towards meeting standards in the future. There would be not ground disturbing activities in the high burn severity areas, and the organic matter and soil cover would re-establish naturally over time. Where management takes place in moderate to low burn severity, project features would enhance the organic matter and soil cover overall. The project design features prescribed in Appendix A would meet the Region 6 Soil Quality Standards, the established standard for protecting soil resources, and would not have a significant impact to soils.

Erosion

All alternatives are designed and have BMPs (USDA 2012) to reduce bare surface soil, erosion, and off-site movement of soil material. No soil erosion is expected from harvest units as long as the duff layer and vegetative ground cover is maintained. Bare surface soil and the loss of groundcover and the root tight zone may occur in landings, along temporary roads, and within the main skid trails corridors. Harvest units would rely on groundcover re-establishment and hillslope topography to control erosion and off-site movement of eroded material. Effective groundcover would re-establish in about 5 years in summer harvest units. Winter harvest units do not warrant this concern due to operations being conducted over snow and frozen soil. The few summer harvest units proposed in the project area have light to moderate burn associated with them, but the extent is limited and would create an added erosion risk to soils in the project area (See Appendix F for details on these units). Creating snags and downed logs would enhance soil cover on proposed summer harvest units. Minimal soil erosion is expected following prescribed burning activities, much less than observed following the Carlton Complex fire. Road crossings are generally the main source of sediment and are addressed in detail in the Hydrologist Report. Proposed activities would not bring surface cover below 85% from harvesting or prescribed burning operations as long as soil mitigation measures are followed. Most secondary skid trails are expected to maintain adequate forest floor, groundcover, and root-tight zone.

Erosion within the Carlton Complex fire scar will continue to have wildfire related erosion for the next several years. Future erosion will likely be most intense in the Frazer and Benson Creek sub-watersheds, and in the Finley Canyon area. Once sufficient ground cover and vegetation has re-established the natural erosion rates should drop dramatically and soil productivity will return to pre-fire levels.

Generally, as slopes increase the potential for bare soil surface erosion increases. Hillslope topography, vegetation, groundcover, organic matter, woody material, and surface roughness are important controls on the development, transport, and capture of harvest related erosion (Litschert and MacDonald 2009). They found limited occurrence of rills or sediment plumes from harvest units actually entering streamside management zones. When found, the sediment appeared to be from heavily used skid trials. The study concluded that current forest harvest procedures, proper design, layout, and use of skid trails, Timber Sale Contract provisions, and soil BMPs were largely effective at reducing rill erosion and sediment delivery.

General Soil Disturbance

All ground based commercial tractor units with sensitive soils and/or high disturbance at or above 20% detrimental soil disturbance (DSD) would be winter logged or harvested utilizing

a slash mat to protect the soil surface from compaction and displacement and increase site resiliency. Detrimental impacts to soils would be minimized by winter logging or using harvesting systems that reduce soil disturbance. Temporary increases above standards are likely, but active restoration measures would be implemented to prevent exceeding Forest Plan standards at the conclusion of project activities. The remaining units would be thinned when the soil is dry, generally the latter half of June through September. Soil moisture operating conditions would be made by the Soil Scientist or the Timber Sale Administrator (after an initial site visit with the Soil Scientist) prior to harvesting activities.

Harvesting within proposed units is designed to avoid detrimental soil impacts on more than 20% of the activity area. In addition, there is close coordination with the Sale Administrator during implementation. This involvement and coordination ensures that soil resources are considered in ground-disturbing activities and that appropriate measures are taken to meet the R6 SQS and minimized equipment footprints on the ground.

Following treatment and proposed restoration activities, harvested units should not exceed their current detrimental soil disturbance level and should trend towards meeting or exceeding R6 SQS in the near future. All BMPs would be applied to minimize the new footprint and rehabilitation, above the timber sale contract, is proposed. The goal of maintaining soil function and processes in all harvest units would be achieved by implementing mitigations, standard Timber Sale Contract provisions, as well as BMPs. These design features and management practices would minimize the extent of compaction, rutting, puddling, and displacement.

Expected detrimental disturbance by treatment type is outlined in Figure 3.8-2. Appendix F contains unit-specific information about expected detrimental disturbance. The coefficient indicates the amount of expected disturbance per acre of each type of treatment. These estimates are based on culmination of monitoring reports and literature (Niehoff 1985, 2002; McIver and Starr 2000); the estimated disturbance coefficient is generally less than indicated. Detrimental disturbance percent refers to the activity area, in this case unit boundaries. Though much of the soils within the project area have sandy textures to buffer compaction, ash influenced soils lacking coarse rock are highly susceptible to compaction. Skid trails and landings would be reused whenever possible, to minimize new detrimental disturbance. Recovery depends on the effectiveness of roots to penetrate the soil and vegetation to establish, restoration of soil chemistry and the return of porosity and drainage. Recovery accelerates once the soil loosens and organics begin to accumulate.

Figure 3.8-2 Estimated Detrimental Soil Disturbance by Treatment Types

Proposed Action Combinations*	Detrimental Disturbance Coefficients
LFR and summer Mastication	10%
Winter harvest, LFR, Underburn	3%
Winter harvest, LFR, MP &B	3%
Summer Harvest, LFR, and MP & B	10%
Summer Harvest (slash mat), LFR, MP & B	8%

*LFR=ladder fuel reduction (non-commercial thin), MP&B = machine pile and burn

The susceptibility of soil to physical disturbance, compaction, displacement, rutting, or puddling is a function of soil rock content, soil texture, original bulk density, soil moisture, soil protections (frozen or snow covered ground), and soil organic matter (Page-Dumroese et al. 2006).

Research conducted during dry season operations have documented increases in ground disturbance of 5-40%, depending on equipment used and method of operation. Typically, soil disturbance is found on less than 15% of the activity unit (Page-Dumroese et al. 2009; McIver and Starr 2000; Clayton 1990; Klock 1975). Disturbance is generally limited to main skid trails and landings due to increased traffic. Recent research and monitoring suggests average disturbance across a unit from tractor logging on dry soils is about 10% (Neihoff 2002).

Soil compaction results from the first few passes with mechanized equipment (Han-Sup et al. 2006; Froelich 1980; Froelhlich et al 1983). Low pressure tracked or wheeled equipment may have stationary or static ground pressures as low as 7 psi. Once in operation, torque from pulling heavy loads, turning or forwarding motion increases ground pressures and thus compaction, so using slow speeds and an easy-does-it approach can minimize some of this disturbance. In comparing rubber tired with tracked skidders, Clayton (1990) reported tracked vehicles had 50% greater dynamic pressure even though both had equal static pressures. Soil disturbance related to harvest and log removal is highly dependent on both the equipment used and operator skill. Skidding downhill versus uphill would reduce torque and related churning of surface soil. Research by Han-Sup et al. (2005) further supports the use of designated and existing skid trails as a way to minimize soil disturbance. The use of slash mats with logging equipment decreases impacts and increases soil resiliency.

Temporary Roads and Machine Fireline

Temporary road construction causes soil compaction, displacement and reduced soil hydrologic and biologic function. Mileage of new temporary road is used as an effects indicator. Approximately 25 miles of new temporary road is proposed and approximately 84 miles of temp and unauthorized roads would be de-compacted and re-contoured under the proposed action, thus putting approximately 1400 acres of soil back to proper functioning condition. Temporary road construction would have a temporary effect on soil conditions, but soil recovery would be achieved in 2-5 years. The sedimentation effect to the watershed would be evaluated at a watershed scale under the Hydrologist Report.

Machine-built fireline would have similar effects to soils as temporary road construction and would be cross drained while in use and rehabilitated following treatments. Approximately 2 miles of machine fireline are proposed leading to approximately 1 acre of detrimental soil disturbance. Fireline would be constructed with equipment using a 3 to 4-foot wide blade.

Rehabilitation would occur on newly constructed temporary roads to recover these areas as soon as harvesting operations finish. Recovery would likely be slower than other harvesting-related disturbance given the high traffic. Current temporary road construction practices address the potential negative impacts with stringent rehabilitation efforts where temporary road prisms are de-compacted and contoured. Topsoil would be conserved and replaced where possible to further recovery. Road fill is covered in slash for biological and site amelioration.

Hydrological recovery is expected within the first 10 years with soil infiltration rates lower than natural forest rates (Luce 1997; Foltz and Maillard 2003). For the long term, infiltration rates improve over time as freeze/thaw and plant roots improve soil porosity though rates would remain lower than adjacent natural forest soil (Switalski et al. 2004). Soil biological function restores as forest floor and native plant communities returns.

Road Maintenance and Reconstruction

Proposed road maintenance activities such as blading, drainage improvements, and surfacing on existing dedicated roads and proposed road reconstruction activities such as realignment, curve widening, clearing and grubbing, and excavation work is proposed on roads in the project area. These activities may increase short-term sediment movement from road surface runoff initially, but should be minimal, especially at road locations higher on the slope that are at a relatively low gradient and provide for sufficient buffer zones from streams.

Landings

Effects from landing construction could include soil compaction, litter loss, loss of coarse woody debris, increased potential for erosion, nutrient losses, loss of soil hydrologic and biologic function and possible weed incursions.

Log landings are expected to be 0.25 to 0.5 acres in size. Up to 225 landings would occur across the sale, totaling about 56 to 112 acres. The burn pile on each landing would occupy about 0.1 acres, for a total of 22.5 acres. Landing pile locations would prioritize the use of existing landings whenever possible; these sites would sometimes receive minor blading or small tree removal in order to prepare them for use. Erosion control measures would be used if needed to avoid movement from landing sites during maintenance and construction therefore resulting sedimentation is expected to be minimal. All landings would be rehabilitated and returned to pre-implementation conditions. Rehabilitation measures include recontouring surfaces, de-compaction of the soil to a depth of 12”, seeding the surface where bare mineral soil is present (using a seed mix approved by the District Botanist) and placing slash and other large woody debris along the surface to reduce soil erosion. Subsoiling has been shown to be an effective tool in treating compaction in soil textures found within the project area (Kolka and Smidt 2004) and could be used in certain circumstances.

Hand Fireline Construction

Effects from hand fireline construction are generally minimal and include soil displacement and loss of organic matter from hand digging. Hand lines would be dug to bare mineral soil, which could also increase erosion potential in these areas while they are in use. Approximately 0.5 miles of hand line is proposed leading to approximately .5 acres of detrimental soil disturbance. These hand lines would be crossed drained while in use and rehabbed following treatment to avoid erosion and encourage vegetation growth. Although hand lines would disturb soil, less than one percent of a unit would be disturbed by constructing hand lines. Existing trails, roads, and ridgelines would be used as control lines where possible.

3.8.3.3 Cumulative Effects of the Proposed Action

Cumulative effects include a discussion of the combined, incremental effects of human activities. For activities to be considered cumulative their effects need to overlap in both time and space with those of the proposed actions. For the soil resource, the area for

consideration is the unit because effects on soils are site specific. Erosion in the high burn severity areas will continue to erode and

Region 6 soil quality standards would be met when combining the existing and predicted impacts of proposed activities so that long-term cumulative soil impacts may not affect more than 20% of the activity areas, unless the unit currently exceeds 20%. If this is the case, the unit would not exceed the current disturbance percentage following treatment and would trend towards meeting the standard in the future. All proposed units would meet these standards and result in potential soil impacts that would put disturbance on a recovery path to meet or exceed R6 SQS.

Present, Ongoing, and Reasonably Foreseeable Future Actions

Mechanical Treatments and Prescribed Fire Treatments
Harvesting and prescribed fire activities would not overlap in time and space with past, ongoing, or foreseeable projects except where past disturbance has occurred. Existing soil conditions are discussed above. After winter harvesting has commenced there is a need to re-enter harvest units determined to contain over 10 tons/acre of 9” diameter or less woody debris to machine pile and burn excess material. Equipment would use existing skid trails when feasible, and use a single pass system piling debris that is reachable from the skid trail. This would minimize soil disturbance and would reduce or eliminate the creation of new DSD.

Wildfire and Fire Suppression
Much of the project area has seen some sort of wildfire activity from the Carlton Complex in 2014. The high burn severity areas within the project boundary will continue to see erosion from hydrophobic and bare soil for the next 2-5 years until vegetation and ground cover can re-establish. The high to moderate burn severity areas within the project area have very little chance of re-burning in the next decade. The light burn severity areas should fully recover within 2 years, depending on the growth response of existing vegetation. The benefits of fires with lower intensity and severity would include a reduced potential of excessive soil heating and sterilization as well as hydrophobic conditions that tend to increase sediment movement, flooding, and possible slope instability (DeDios Benavides-Soloria and McDonald 2005; Neary et al. 2005).

On small wildfires, disturbance from fire suppression activities is usually limited to hand tools; most hand fire-line construction has only minor (insignificant) impacts to the soil resource. Machine line using heavy equipment is also built during wildfire suppression. These machine lines are rehabilitated following suppression activities; any hand or machine line that was done during the Carlton Complex has been rehabilitated to the extent feasible within the project area. During fire suppression, closed roads may be reopened for access and incorporated as fire line, as was the case with the fires of 2014. As part of the post-fire work, these areas of disturbance are rehabilitated and the roads returned to their previous condition in most cases, and identified in the BAER report for the Carlton Complex.

Road Maintenance and Decommissioning
All developed roads built in the past have a lasting effect on soil productivity due to compaction and displacement. Their maintenance for residence access, recreation, and forest management calls for ongoing use, which results in compaction and displacement through the project area.

Road maintenance includes culvert installation, blading, brushing, and typically improves drainage and decreases erosion from water channeling down the road surface in the long run. For a detailed analysis and information on roads and related issues, please see the Hydrology Specialist Report.

Decommissioning or storage of roads would improve previously impacted road beds through de-compaction, addition of organic material, re-vegetation of bare areas, and weed control. Although rehabilitation through de-compaction and/or re-contouring cannot assume complete reversal to natural conditions, efforts initiate a long-term recovery process. Anticipated results would also provide for improvements in hydrologic function that otherwise may be prolonged as soil compaction persists.

Recreation

Disturbance from general motorized use and recreational access has been occurring and will continue throughout the units indefinitely. We anticipate no changes in the existing recreation profile. Other recreational activities that occur off the developed roads, such as the gathering of miscellaneous forest products and hunting, are occurring in the project area. Closing skid trails in this area following treatment should prevent this occurrence and should not have additional effects on soils in the project area. Cumulative effects to soils from recreational vehicle use are not expected. See the Recreation Specialist Report for further discussion on recreational vehicle use.

Grazing

There are four grazing allotments within the project area: Frazier, Finley, Benson and Texas. The proposed treatment units are subject to cumulative grazing impacts, but on a very limited basis due to loss of fencing and grassland areas in the Carlton Complex. Impacts of grazing are limited to areas where the animals bed, lounge, trail, or access water. These areas are mostly small in aerial extent. Impacts include compaction, removal of groundcover, and displacement. Grazing will continue in the foreseeable future where it is feasible given the extensive amount of high burn severity found within the project area. Generally in this area compaction is limited to the grassland portions of the project area and some riparian areas. Grazing effects do overlap in space and time with many of the prescribed fire treatments and post Carlton Complex burned areas. Assessing units following implementation will be extremely important in determining when soils are resilient enough to handle cattle grazing. This design feature will ensure that effects from prescribed and wild fire will be negligible prior to cattle returning to the units; therefore cumulative impacts to soils from grazing would be minimal.

Noxious Weed Treatments

Areas of disturbed soil provide an optimal location for weed establishment and subsequent invasion (DiTomaso 2000). Weeds establish quickly and can increase erosion, deplete soil moisture, and alter nutrient levels (DiTomaso 2000). Because the roots of noxious weeds are often deeper than native grasses, they also contribute less organic matter near the soil surface (Sperber et al. 2003). Refer to the Weeds Report for additional details on how undesired plant species will be dealt with. No additional effects to soils beyond what was analyzed for and disclosed in the EA are expected to occur.

Ongoing and Reasonably Foreseeable Activities

The other known ongoing and foreseeable activities in the area would not overlap in space with the current proposed activities and therefore would not have cumulative soil impacts.

Summary of Cumulative Effects

Cumulative effects are expected to be below 20% detrimental soil disturbance following proposed activities in most of the proposed harvest and prescribed burn units. Overall, potential soil impacts from management activities could affect 117 acres of the total project areas, excluding temporary roads, as described in Figure 3.8-3. This is a conservative estimate of all potential DSD. The soil disturbance estimate is calculated by multiplying the number of acres to be treated with the risk of soil disturbance. For example, the risk of soil disturbance on 100 acres of summer ground-based harvest is 10%, which equates to approximately 10 acres of soil disturbance. Additionally, not all soil disturbance associated with management is detrimental in nature.

Figure 3.8-3 Summary of Effects on the Soil Resource

Alternative	South Summit II Proposed Yarding and Hauling		
	Summer Ground-based (Acre)	Winter Harvest	Machine Fireline
Potential Soil Disturbance	10%	1-3%	4ft. wide x length of line = disturbance ac.
Total Acres to be Treated			
Alt. 1	0	0	0
Alt. 2	500 ac	1,850 ac	2 miles
Potential Acres of Additional Soil Disturbance			
Alt. 1 – Total	0	0	0
Alt. 2 – Total	50 ac	19-55 ac	12 ac

The South Summit II project would comply with the R6 Soil Standard and the Okanogan Wenatchee Forest Plan for long-term soil productivity. The proposed silvicultural and fuel treatments in Alternative 2 (Action Alternative) are not expected to adversely affect soil resources because of design features that would be implemented as part of the management alternative. These design features would help to ensure that resource safeguards would be in place that would prevent adverse effects on the soil resource from occurring. Where effects cannot be avoided, reclamation is planned in order to minimize or negate detrimental levels of soil disturbance. None of the treatment units would exceed R6 soil quality standards following implementation. Units that have detrimental soil disturbance levels above 20% (Regional and Forest Plan Standard) would not have an increase in detrimental soil disturbance and would trend towards meeting standards in the future.

Alternative 2 would have the largest effect on soil resources as measured by acres of detrimental soil disturbance (117 acres). Soil productivity changes would be expected to be greater under Alternative 2 than under Alternative 1 (No Action) because of equipment disturbance to the forest floor. This disturbance is expected to be limited to skid trails, landings, fire line, and temporary roads. The activity areas would be expected to maintain forest floor and CWD requirements throughout 80% of each treatment unit (harvest or fuels). Although rehabilitation through de-compaction and/or re-contouring cannot assume complete reversal to natural conditions, these efforts initiate a long-term recovery process. Anticipated results would also provide for improvements in hydrologic function that otherwise may be prolonged as soil compaction persists.

3.8.3.4 Consistency Statement

The planned actions adhere to the R6 soil quality guidelines for maintaining soil productivity as long as all design features are implemented. To meet R6 soil quality standards a unit must have less than 20% of its area in detrimental soil conditions or the cumulative effects from project implementation and rehabilitation should not exceed the conditions prior to the planned activity and should move toward a net improvement in soil quality (R6 SUPPLEMENT 2500-98-1). If this threshold for change is reached, corrective actions are taken to restore or stabilize the impacted sites and move the unit towards a net improvement in soil quality. The South Summit II project actions would not create detrimental soil condition in excess of 20% in units that are currently below 20% detrimental soil disturbance and would move all units about 20% towards net improvement in soil quality. Therefore the project is consistent with Forest-wide standards for site productivity (USDA 1986). The project would also comply with R6 erosion standards following activities. Implementing appropriate design features would ensure these standards are met following project implementation.

3.9 WILDLIFE

The section below summarizes the existing condition information, along with the direct, indirect and cumulative effects from the South Summit II Forest and Fuels Project, as analyzed in the South Summit Wildlife Technical Report (Sprague 2015), available in the project record. The report also discusses habitat types, field surveys, and sources of project effects in more detail.

The South Summit project specialist report was completed in April 2014 and consultation with U.S. Fish and Wildlife Service was completed in June 2014. The Carlton Complex fire burned in July 2014, and changed the baseline environmental conditions and project proposals. This updated report incorporates by reference the earlier version of the specialist's report (Sprague 2013), the biological assessment completed for the earlier report, and the specialist report and biological assessment for the new proposed action.

3.9.1 Issues for Analysis

Threatened, Endangered and Candidate Species
Indicator: Depends on species.

Analysis Methods: GIS comparison of habitat types and amount of habitat changed by project activities, field and literature review, and review of district observation database, unless otherwise noted.

Analysis Area: Depends on species. If not otherwise stated, the 50,000 acre project area is a large enough area to assess effects for most species. For cumulative effects, adjacent state land sections are also considered.

Threatened and endangered species are managed under the Endangered Species Act, and are an issue in projects where habitat exists for the species, if habitat would be negatively affected. Figure 3.9-1 lists species considered on the Okanogan-Wenatchee National Forest and whether habitat exists in the project area.

Figure 3.9-1 Threatened and Endangered Species Considered in Analysis

Species	Scientific name	Designation	Habitat in Analysis Area
Gray wolf	*Canis lupus*	Endangered	Yes
Canada lynx	*Lynx canadensis*	Threatened	Mapped habitat present, actual habitat is not present. Mapped area is dry forest.
Grizzly bear	*Ursus arctos*	Threatened	Yes
Marbled murrelet	*Branchyramphus marmoratus*	Threatened	Not within the known range.
Northern spotted owl	*Strix occidentalis caurina*	Threatened	Not within the known range.
Critical habitat for the Northern spotted owl		Threatened	Not critical habitat.

Species	Scientific name	Designation	Habitat in Analysis Area
Critical Habitat for Canada lynx		Proposed	Yes
Mardon skipper	*Polites mardon mardon*	Candidate	Not within the known range.
Fisher	*Pekania pennanti*	Candidate	Considered extirpated in Washington State, except where reintroductions are occurring. Species not considered further.

Marbled murrelets, spotted owls and mardon skippers will not be considered in this analysis because the analysis area is outside of their range.

Sensitive Species
Indicator: Habitat changes, unless noted.

Analysis Methods: GIS comparison of habitat types and amount of habitat changed by project activities, field and literature review, and review of district observation database, unless otherwise noted.

Analysis Area: If not otherwise stated, the 50,000 acre project area is a large enough area to assess effects for most species. For cumulative effects, adjacent state land sections are also considered.

The Forest Service implements the National Forest Management Act (NFMA) through the use of sensitive species. The Regional Forester identifies sensitive species when population viability is a concern. An expected downward trend in population numbers and/or habitat could indicate the need to identify a species as "sensitive." If habitat for the species is present in a project area, the sensitive species is considered an issue for analysis. The following species in Figure 3.9-2 have been listed as sensitive by the Regional Forester's Special Status Species List (December 2011).

Figure 3.9-2 Regional Forester's Special Status Species List

Species	Scientific Name	Habitat Type/Availability in Analysis Area	Comment
Gray flycatcher	*Empidonax wrightii*	Dry Mesic forest/ habitat present	
Common loon	*Gavia immer*	Riparian and Wetlands/ no habitat present	Lakes large enough for nesting are not present, species will not be considered further.
Columbian sharp-tailed grouse	*Tympanuchus phasianellus columbianus*	Non-forest Habitat/ habitat present	Some grassland habitat present in project area on range formerly occupied by sharp-tails. This range has not been

Species	Scientific Name	Habitat Type/Availability in Analysis Area	Comment
			occupied for decades. Prescribed fire may improve habitat if woody vegetation is not destroyed. However, reoccupation by sharp-tails is unlikely due to small size of the population and its isolation. Species will not be considered further.
Sandhill crane	*Grus canadensis*	Non-forest Habitat/ no habitat present	Nesting areas not present in analysis area, species not considered further.
Bald eagle	*Haliaeetus leucocephalus*	Riparian and Wetlands/ no habitat present	Nesting habitat (along larger fish-bearing streams) not present in analysis area. Species forages for roadkill along highway 20, particularly in winter. The ability to forage along highway will remain unchanged.
White-headed woodpecker	*Dendrocopos albolarvatus*	Dry Mesic/ habitat present	
Harlequin duck	*Histrionicus histrionicus*	Riparian and Wetlands/ no habitat present	Nesting habitat is medium size streams and rivers, none suitable in analysis area. Species not considered further.
Great gray owl	*Strix nebulosa*	Cold Moist/ no habitat present	Cold, moist habitat not present. Species not considered further.
American peregrine falcon	*Falco peregrinus anatum*	Cliff/talus/ no habitat present	Cliffs suitable for nesting are not found in the project area. Transient use while foraging may occur.
Lewis' woodpecker	Melanerpes lewis	Riparian and Wetlands/ habitat present	Species uses large cottonwoods in riparian and also burned area habitat. Leecher Fire (2012) would provide foraging habitat, and 38% of the fire would

Species	Scientific Name	Habitat Type/Availability in Analysis Area	Comment
			have additional fuels treatments. However, treatments would not occur within the short post-fire window where elevated insect activity attracts woodpecker use, so no effect to Lewis' woodpeckers is expected.
Townsend's big-eared bat	*Plecotus townsendi*	Dry Mesic/ habitat present	Hibernaculum located in project area, but not near project activities. Foraging habitat may be near project activities.
Pallid bat	*Antrozous pallidus*	Non-forest Habitat- / no habitat present	Uses more arid habitats than found in project area.
North American wolverine	*Gulo gulo luscus*	Wolverine/ no habitat present	Analysis area too low in elevation. Species not considered further.
Fisher	*Martes pennanti*	Fisher/ habitat present	Considered extirpated in Washington State, except where reintroductions are occurring. Species not considered further.
Western gray squirrel	*Sciurus griseus*	Dry Mesic/ habitat present	
Mountain goat	*Oreamnos americanus*	Mountain Goat/ no habitat present	Analysis area is too low in elevation, species not considered further.
Moose	*Alces alces*	Riparian and Wetlands/ habitat present	Wetlands present, moose occasionally seen, likely transient in area. Wetland habitat would not be affected by project activities.
Gray wolf	*Canis lupus*	Gray Wolf/ habitat present	
Larch mountain salamander	*Plethodon larselli*	Cliff/talus/ no habitat present	Known sites on the Okanogan-Wenatchee are in areas with annual precipitation greater than 60".
Pacific pond turtle	*Actinemys marmorata*	Riparian and Wetlands/ habitat limited	Some wetlands may be suitable, but historic

Species	Scientific Name	Habitat Type/Availability in Analysis Area	Comment
			range is western Washington and Columbia River Gorge. Species will not be considered further.
Striped whipsnake	*Masticophis taeniatus*	Non-forest Habitat	Not in range. Northern extent of range is central Washington, species will not be considered further.
Puget Oregonian	*Cryptomastix devia*	Riparian and Wetlands	Not in range. Species will not be considered further.
Grand Coulee mountainsnail	*Oreohelix junii*	Cliff/talus/ no habitat present	Analysis area does not provide the low elevation rocky outcrops used by this species.
Shiny tightcoil	*Pristiloma wascoense*	Cliff/talus/ not in range	Range appears to be further south. Mollusk surveys on the Methow district failed to locate this species, which will not be considered further.
Bluegray taildropper	*Prophysaon coeruleum*	Dry Mesic/ no habitat	Habitat very limited on Okanogan-Wenatchee, species has not been found. Species will not be considered further.
Astarte fritillary	*Boloria Astarte*	Non-forest Habitat	High elevation species, will not be considered further.
Meadow fritillary	*Boloria bellona*	Non-forest Habitat/ some habitat present	Habitat is meadows, aspen stands, grasslands and wet roadsides, pine forest openings.
Freija fritillary	*Boloria freija*	Non-forest Habitat	High elevation species, will not be considered further.
Labrador sulphur	*Colias nastes*	Non-forest Habitat	High elevation species, will not be considered further
Lustrous copper	*Lycaena cupreus*	Non-forest Habitat	High elevation species, will not be considered further.
Melissa Arctic	*Oeneis Melissa*	Non-forest Habitat	High elevation species,

Species	Scientific Name	Habitat Type/Availability in Analysis Area	Comment
			will not be considered further.
Peck's skipper	*Polites peckius*	Non-forest Habitat/ some habitat present	Mountain meadows, riparian habitats, and roadsides are habitat.
Tawny-edged skipper	*Polites themistocles*	Non-forest Habitat/ some habitat present	Analysis area too low elevation. Uses grassy habitats. Not documented on Okanogan-Wenatchee Forest.
Great Basin fritillary	*Speyeria egleis*	Non-forest Habitat/ habitat not present	Montane meadows and ridges, forest openings and rocky ridges. Not documented on Okanogan-Wenatchee Forest.
Zigzag darner	*Aeshna sitchensis*	Riparian and Wetlands/ habitat not present	High elevation boreal fens/bogs. Analysis area too low elevation. Species not considered further.
Subarctic darner	*Aeshna subarctice*	Riparian and Wetlands/ habitat not present	Similar to zigzag darner.
Subarctic bluet	*Coenagrion interrogatum*	Riparian and Wetlands/ habitat not present	Similar to zigzag darner.

Management Indicator Species (MIS)
Indicator: Depends on species.

Analysis Methods: GIS comparison of habitat types and amount of habitat changed by project activities, field and literature review, and review of district observation database, unless otherwise noted.

Analysis Area: depends on species. If not otherwise stated, the 50,000 acre project area is a large enough area to assess effects for most species. For cumulative effects, adjacent state land sections are also considered.

Management Indicator Species shown in Figure 3.9-3 are an issue if habitat for the species is present and would be affected by project activities. NFMA requires the Forest Service to manage fish and wildlife habitat to maintain viable populations of all native and desirable non-native wildlife. Management Indicator Species (MIS) are identified to meet requirements of this act and are an issue for analysis if habitat is present to support the species.

Figure 3.9-3 Management Indicator Species for the Okanogan National Forest

MIS	Indicator For		Habitat Present in Analysis Area	Species Present
Northern spotted owl	Mature and old-growth conifer		Outside the range	No
Barred owl	Mature and old-growth conifer		Yes	Yes
Pileated woodpecker	Mature and old-growth conifer		Yes	Yes
Three-toed woodpecker	Mature and old-growth conifer		Limited	Yes
American marten	Mature and old-growth conifer		No	No
Mule deer	Winter range		Yes	Yes
Ruffed grouse	Riparian and deciduous		Yes	Yes
Canada lynx	Lodgepole pine		No	Likely transient through area.
Primary Cavity Excavators	Pileated woodpecker	Dead and defective trees	Yes	Yes
	Three-toed woodpecker	Dead and defective trees	Leecher Fire.	Suspected in Leecher Fire area.
	Black-backed woodpecker	Dead and defective trees	Leecher Fire.	Yes
	Downy woodpecker	Dead and defective trees	Yes	Suspected
	Hairy woodpecker	Dead and defective trees	Yes	Suspected
	Lewis' woodpecker	Dead and defective trees	Yes	Suspected
	White-headed woodpecker	Dead and defective trees	Yes	Yes
	Williamson's sapsucker	Dead and defective trees	Yes	Suspected
	Red-naped sapsucker*	Dead and defective trees	Yes	Suspected
	Northern Flicker	Dead and defective trees	Yes	Yes

*The yellow-bellied sapsucker listed in the Okanogan Forest Plan (USFS 1989:III-78), was taxonomically split into three species in 1983: red-naped, red-breasted, and yellow-bellied sapsuckers (AOU 1983, Walters et al. 2002); only the red-naped sapsucker occurs in Eastern Washington.

In the planning process for the Okanogan Forest Plan, Management Requirement Areas (MRs) were established as reserve areas to implement this requirement. MRs were located in appropriate habitats, across the forest in a grid pattern close enough to allow dispersal of the indicator species between the habitat patches. MRs retained a limited resource

(mature/old growth conifer, dead and defective trees, winter range, riparian or deciduous habitat) largely by excluding vegetation management activities.

The MRs established as habitat for indicator species for mature and old habitats (barred, pileated, marten and three-toed woodpeckers) were located in the areas where large trees were present. These were generally dense stands. Recent science has recognized that, historically, these stands would have been more open and patchy, with more large trees. The dense, more uniformly forested pattern found over much of the project area today was a result of fire suppression and logging of the largest trees. The MRs for mature and old growth forest, which were previously treated as “set-asides” now require treatment to reduce the potential for wildfire and insect outbreaks, and to restore the forest to a more sustainable and historical condition.

Fourteen Management Requirement Areas (MRAs) for marten, pileated woodpeckers, barred owls, and three-toed woodpeckers are located across the analysis area. The areas selected, while the best available in terms of large trees and dense canopies, are not moist habitats, and marten are not likely to use those areas. Cool moist habitats associated with marten use are not found in the project area, which is comprised of dry and mesic forest. Habitat is also limited for three-toed woodpeckers, which use spruce/lodgepole stands. However, they are also strongly associated with burned forest, and are likely using the burned areas. Barred owls are an invader species whose range is expanding across the country.

Because treatments would retain the large trees and would move the stands to more resilient, fire pre-suppression conditions, the MRs for late/old species are less relevant as an implementation strategy for species viability than when the Forest Plan was adopted. Overall, there is a higher proportion of densely canopied dry forest and more habitat for species using these dense stands than was the case historically. Dense habitat for pileated woodpeckers and barred owls has increased at the expense of species using more open habitats. This habitat is at risk for stand-replacing wildfire and insect outbreaks due to the high densities, and is not sustainable. The proposed action is aimed at restoring these habitats, but would reduce habitat suitability for species using dense habitats in the short-term. Silvicultural prescriptions would leave clumps and patches of dense forest, connectivity corridors and riparian buffers, which would help mitigate the opening of the canopy and provide denser habitat for species requiring that habitat type.

The assessment process for species viability uses the concept of Historic Range of Variability (HRV) to assess likelihood of maintaining viable populations of species. By managing habitat within HRV it is assumed that adequate habitat will be provided because species survived those levels of habitat in the past to be present today. Thus, if current habitats are managed within the range of historic variability, population viability for those species that remain will likely be adequately ensured (Landres et al. 1999). Species viability is expected to be retained for all MIS with habitat in the project area.

For detailed information on MIS, habitat use and ecology, refer to Status of Management Indicator Species On the Okanogan and Wenatchee National Forests, April 2011 (Youkey, 2011), which is incorporated by reference into this report.

Focal Species

Indicator: Depends on species.

Analysis Methods: GIS comparison of habitat types and amount of habitat changed by project activities, field and literature review, and review of district observation database, unless otherwise noted.

Analysis Area: If not otherwise stated, the 50,000 acre project area is a large enough area to assess effects for most species. For cumulative effects, adjacent state land sections are also considered.

Focal species are an issue if habitat for the species is present and would be affected by project activities. The Forest Restoration Strategy recommends using the northern spotted owl, northern goshawk, white-headed woodpecker, American marten, pileated woodpecker, Lewis's woodpecker, and black-backed woodpecker to evaluate wildlife habitats. For this project area, the northern spotted owl will not be considered, as it is outside the range. Marten habitat is extremely limited, at best, in the project area, and martens will not be considered further.

Black-backed woodpeckers and Lewis's woodpeckers are associated with recently burned forest and insect outbreaks. The Leecher Fire (2012) and the Carlton Complex Fire (2014) areas are providing good habitat for species utilizing burned forest now, and this can be expected to continue for several years. Habitat for goshawks, white-headed woodpeckers, and pileated woodpeckers will be further analyzed, below.

Landbirds

Indicator: Depends on species.

Analysis Methods: GIS comparison of habitat types and amount of habitat changed by project activities, field and literature review, and review of district observation database, unless otherwise noted.

Analysis Area: If not otherwise stated, the 50,000 acre project area is a large enough area to assess effects for most species. For cumulative effects, adjacent state land sections are also considered.

Landbirds are an issue if habitat for the focal landbirds is present and would be affected by Project activities. Direction for landbird conservation is provided by the Migratory Bird Treaty Act and Executive Order 13186 *Responsibilities of Federal Agencies to Protect Migratory Birds* and MOU 08-MU-1113-2400-264 *Memorandum of Understanding between the U.S. Department of Agriculture Forest Service and the U.S. Fish and Wildlife Service to Promote the Conservation of Migratory Birds*.

Guidance for landbird conservation is provided by the Landbird Strategic Plan and The Conservation Strategy for Landbirds in Oregon and Washington (Altman 2000a, b, and Altman and Holmes, 2000).

Focal landbirds for dry forest or riparian habitat in the project area are white-headed woodpecker, pygmy nuthatch, chipping sparrow, flammulated owl, varied thrush, northern goshawk, yellow warbler, willow flycatcher, and red-naped sapsucker. Species associated with cold, moist habitat have not been considered, because habitat is not found in the project area.

3.9.2 Affected Environment- General

The Carlton Complex fire burned over approximately 70% of the project area in July 2014, with the middle portion (Finley Canyon area) experiencing moderate to severe effects to vegetation over much of the area. Because of the large amount of tree loss, most of the original South Summit units in that area were dropped. Several areas that had potential for salvage were packaged into the Brimstone Salvage Sale (248 acres). Prescriptions for the Brimstone units left several large dead trees per acre and all remaining live trees. The new proposed action for the South Summit project area focuses on areas that were unburned or experienced low severity fire, where restoration treatment is still needed. These areas are in the northwest and south portions of the project area.

High levels of tree mortality in the central portion of the planning area may affect forested connections between the Frazer and Benson Creek drainages, likely truncating the connectivity corridors established to meet Eastside Screen requirements in the initial South Summit analysis. Cover provided by deciduous vegetation, particularly willow, will recover rapidly in places. However, at this time there is no potential for delineating alternate connections between the northern and southern parts of the analysis area due to the severity of the effects in the middle portion. This standard cannot be met at this time. Connectivity corridors within the northern (north of highway 20) and southern portions are fairly intact, although in many areas they are no longer connecting late/old structure stands, as approximately 40% of those stands were burned with moderate/high severity.

Snag loss was an issue in the initial analysis, but due to the extent and severity of the Carlton Complex fire, which produced abundant new snags, snags are no longer an issue. Snags are currently distributed across the landscape at high levels, a condition which will last for several years, then decline over time.

Other localized fire effects that changed the baseline condition for wildlife include loss of cover on both summer and winter ranges for deer. Again, the central portion of the analysis area experienced the most loss, while the Frazer and Benson Creek areas were less affected. Hiding cover, which is provided by shrubs and trees, was probably affected most, but has the potential for the quickest recovery due to the shrub component. Thermal cover was also affected on winter and non-winter ranges. Many harvest units that would have further reduced cover were dropped. However, some units were retained because the work was still needed to achieve the desired condition, and negative effects to cover were expected to be minor. Forest Plan standards for non-winter ranges would continue to be met. Less than 1/3 of these ranges burned with moderate or high severity, and the remaining cover is abundant and well-distributed, except in the central section where the fire burned with moderate and high severity. Treatments are focused outside the moderate and high severity areas, and can be expected to open the forested canopy and result in more forage resources.

Projects that would contribute to cumulative effects have changed since the original document. Projects now include DNR salvage sales adjacent to the project area in Texas Creek (467 acres) and Thrapp Mountain (491 acres) areas, instead of one DNR timber sale on Polepick Mountain (278 acres) which has been dropped. One Forest Service salvage sale, Brimstone (248 acres) is in progress in Upper Finley Canyon in the middle portion of the project area. These sales would remove dead and dying trees, and leave live trees.

Effects to wildlife species include temporary disturbance and minor snag loss. Brimstone Sale would decommission one road post-project, which would reduce access for hunting and create more undisturbed habitat, which would be beneficial to many wildlife species.

Carlton Complex Fire rehabilitation work includes fence repair/replacement, selective directional felling of burned trees within riparian areas to limit livestock access and trap sediment, and felling of small burned hazard trees along fence lines.

Other projects include stream improvement, culvert repairs, road maintenance, fencing, water development and planting of native species. Cumulatively, in conjunction with the proposed action, these projects will add disturbance and may temporarily displace some species for a short time from units being worked in. Vegetation effects would be minor from these projects. Hazard tree removal and firewood cutting are also foreseeable actions, and would result in a loss of snags. This would be inconsequential in relation to the snag levels currently found across the project area and landscape.

Wildlife habitats in the project area have changed over the last century due to timber harvest, fire exclusion, grazing and firewood cutting. Lack of frequent low intensity fire has allowed the development of dense thickets of small trees over large areas. Resultant shading has reduced understory shrubs, forbs and grasses that provide forage for herbivore and omnivore species.

Timber harvest has resulted in the removal of large overstory trees, and in some areas, has resulted in evenly spaced stands of smaller trees. Large trees and snags are important den/nest habitat for many species. In some areas, the remaining large trees are threatened by competition from smaller surrounding trees and from wildfire. The area has become more homogeneous and less patchy. Another important change affecting many wildlife species is the loss of large snags due to firewood cutting and danger tree removal.

Recent fires have resulted in a variety of vegetation effects ranging from low-intensity to high- intensity areas. These are described in more detail in the fuels and silviculture specialist reports. The project has been modified to drop areas where treatments are no longer needed or would be detrimental to other resources. In addition, fuels treatments would be deferred in deer winter range, in stands providing deer cover for at least 3 years post-fire (2017 at earliest) where fire has resulted in loss of cover.

3.9.3 Environmental Consequences – General

Fuels Treatments

Ladder fuel Reduction thinning (LFR): LFR treatments could occur on approximately 18% of the project area, and noncommercial thinning would occur on another 2%. These treatments are expected to:

- Reduce stand density and canopy closures. LFR treatments that are not associated with harvest units would have follow-up treatments of hand piling or mastication, and are expected to reduce canopy closure up to 20-30%.
- Remove smaller size class trees up to 8” DBH.
- Reduce competition on large trees from small trees.
- Reduce risk of wildfire and insect activity.
- Increase understory shrub, grass and forb components over time, due to increased light to ground from reduced overstory canopy.

For wildlife species, this would mean a reduction in habitat connectivity (canopy continuity reduced), more open stand conditions, which would favor species preferring that habitat type and be detrimental to those using closed canopy conditions, decreased escape and thermal cover, and short-term disturbance during implementation. Increased food resources are expected as a result of increased mast (from accelerated growth of larger trees) and increased shrub/forb/grass component from decreased canopy closure. The treatments would be beneficial to wildlife species because they would reduce the risk of wildfire to the remaining forested stands.

Negative effects would be partially mitigated by leaving 20% of the area in each fuels unit untreated, in patches from 0.1 acre to multiple acres. This would provide some thermal and hiding cover for mule deer and other species, help to reduce loss of snags and down wood, increase habitat diversity, and provide some connectivity between more open areas.

In addition, treatments near moderately and severely burned areas on deer winter range would be deferred for several years, then reassessed to assure that adequate cover is available in the area.

Prescribed Fire: This includes underburning (70 acres) within harvest units and pile burning in harvest and fuels units. Underburning would occur over approximately 0.1% of the project area. Pile burning would occur on approximately 19% of the project area.

Underburning is expected to:

- Increase small snags and decrease large and soft snags.
- Reduce large woody debris slightly.
- Decrease understory canopy closure, shrub and grass/forb cover for 1 to 10 years (Pilliod et al. 2006). Underburning without other treatments is expected to reduce canopy closures up to 7%.
- Provide patchy openings.
- Decrease risk of severe effects from wildfire.
- Increase understory shrub, grass and forb components over time, due to increased light to ground from reduced overstory canopy.

Results to habitat and wildlife are expected to be:

- Increased structural complexity and habitat heterogeneity (except multiple entries with prescribed fire may reduce structural diversity over time) (Pilliod et al. 2006).
- Increased small diameter snags that provide temporary foraging habitat for some species (woodpeckers on wood-borers and bark beetles). However, small snags are usually too small to provide nest cavities (Pilliod et al. 2006).
- Some direct mortality may occur, particularly to ground-nesters and low-nesting species in spring burning, but is expected to be minor.
- Wildlife and invertebrate species that depend on down wood, snags, mistletoe brooms, dense forest with abundant saplings and small poles, and closed canopy-forests for survival and reproduction are likely to be detrimentally affected by fuel treatments altering those elements (Pilliod et al. 2006).
- Species that are associated with fairly open canopies and open forest floor may benefit (Pilliod et al. 2006).
- Increased food sources of fruits, berries, mast crops and herbaceous plants, from accelerated growth on large trees and reductions in canopy closure (more light to ground).

As with thinning treatments, reduction in habitat connectivity, more open stand conditions, which would favor species preferring that habitat type and be detrimental to those using closed canopy conditions, decreased escape and thermal cover, and short-term disturbance during implementation are expected to occur.

Pile-burning can be expected to result in small patches of bare ground (4'x4' for hand piles, 10'x10' for machine piles) in the areas where piles are located.

Other components of the fuels treatments include mastication (271 acres, 0.5% of area), and creation of firelines by hand or machine. These activities would add additional short-term disturbance.

Harvest Units
This includes all commercial units. Harvest units cover 5% of the project area, with regeneration harvest in 0.1% of the project area. Commercial harvest would be followed with one or more type of fuel treatment.

Effects of thinning would be similar to those in the LFR thinnings, above, except that the size class of trees removed would be larger, up to 21" dbh maximum in most cases. Canopy closures are expected to be reduced 30-60%, depending on the prescription and the fuels treatments.

Harvest prescriptions would be consistent with the Forest Restoration Strategy, and would provide for leaving clumps and patches of trees. Ares et al. (2009) found that understory species richness increased, post-thinning, and that gaps and leave islands increased richness.

Road Opening, Closures and Decommissioning
These activities would occur to support sale activities and to implement recommendations for the road network made in during the Middle Methow Minimum Roads Analysis process. Roads are generally associated with negative effects on both terrestrial and aquatic ecosystems (Trombulak and Frissell, 2000). An overall reduction in roads would occur both post-harvest and later as other road closures and decommissionings are funded and implemented. This would have positive effects for wildlife species.

Horse Camp Construction
Construction of a several-acre horse camp would occur in the North Summit area off the North Summit SnoPark. This would result in reduction of vegetation over several forested acres and increased disturbance in the area during construction and use of the camp. The area has been previously thinned and is characterized by mid-successional stands. A loop road would be constructed for campground access. The road would slightly increase road densities in the management area but would not result in loss of core area (undisturbed habitat >500 meters from a road or motorized trail). Effects to wildlife species would be inconsequential due to the already open nature of the stands, high level of current disturbance in the area, and location in a heavily roaded area. Effects of this action will be lumped with other vegetation management actions rather than considered separately in the rest of this report.

Threatened, Endangered, and Candidate Species

Gray Wolf
Indicators: Security habitat changes and number of miles of road decommissioned.

Methods: A moving windows (GIS) road and motorized trail density analysis was used to compare the amount of security habitat for each alternative by Bear Management Unit (BMU) (Gaines et al. 2003).

Analysis Area: Because wolves utilize large home ranges, the 101,921 acre Middle Methow Bear Management Area was used to assess effects. Appropriate habitat and food sources for wolves are found across the district.

3.9.2 Affected Environment

Wolves use a variety of habitats, but in the western United States occur most frequently in forests (USFWS, 2008). Diet consists mainly of ungulates, with elk, deer and moose expected to be the main prey in Washington. Some food is obtained through scavenging. Packs establish territories and defend them from trespassing wolves. Territory sizes usually average about 200 to 400 square miles in the western United States (WDFW, 2008).

Wolves are fairly tolerant of moderate amounts of human disturbance, and often tolerate some limited human disturbance of dens, especially when pups are younger than six weeks of age, regularly re-using disturbed den sites in subsequent years (Thiel et al. 1998, Frame et al. 2007, Person and Russell 2009). However, wolves sometimes respond to human disturbance near active dens by abandoning the location and moving their pups to other sites (Mech et al. 1991, Frame et al. 2007).

Wolves generally den from late-April until early July, staying at the natal den until the pups are about 8 weeks old. They then use a series of rendezvous sites (resting and gathering areas occupied after the natal den has been abandoned) throughout the summer (WDFW 2009).

In the northwestern United States, most wolves die from human causes such as control efforts to stop livestock depredation, or hunting. However, in areas where wolves are fully protected, such as large national parks, most wolves die from territorial conflicts with wolves in neighboring packs, starvation, or disease (WDFW 2011).

Gray wolves are sensitive to road-associated factors (Mech et al. 1988). While roads are not a physical barrier, they usually increase human presence and the likelihood of negative contacts (Wisdom, et al 2000). A disproportionate number of human-caused mortalities and vehicle collisions (Bangs and Fritts 1996) occur near roads (Mech 1970). Both Mech et al. (1988) and Thiel (1985) found that when road densities exceed about 1.6 km/0.9 km radius circle (1 mile/square mile^2), wolves avoided or were displaced from areas. Mladenoff et al. (1995) found that road density was the major predictor of wolf pack location. Jensen et al. (1986) reported that road densities >0.6 km/km^2 were apparent barriers to wolf dispersal. Road access also increases the likelihood of habituation to humans. Individual wolves can become accustomed to human presence, leading to nuisance situations that can result in the death of the habituated animal (Meagher and Fowler 1989). Roads also influence the effectiveness of habitat for ungulates (Mladenoff et al. 1995), which are the primary prey base for wolves in Washington (WDFW 2011).

The presence of gray wolves has been documented on the district, and individual wolves have been reported in the project area. There are no known den or rendezvous sites within

or adjacent to the project area. The project area provides year-round habitat for a major prey item, mule deer. Moose and elk also use the project area and could provide an additional food resource for wolves.

Past road and motorized trail construction has reduced the amount of security habitat for wolves (and their prey), which is defined as areas with open road and motorized trail densities less than 1 mile/square mile of habitat (Gaines et al. 2003). Currently, approximately 14% of the Middle Methow BMU is security habitat.

3.9.3 Environmental Consequences

Direct and Indirect Effects

3.9.3.1 No Action Alternative

The proposed action would use the timber sale to decommission approximately 4 miles of roads that are no longer needed, an opportunity that may not occur if the no action alternative is selected. Motorized access to the project area would remain at the same high levels that currently exist, and security habitat for wolves would remain limited in the short term.

The potential for disturbance to sensitive sites during project activities would be eliminated if the no action alternative is selected.

Changes to vegetation would occur in the long-term, even with the selection of this alternative. Over time, stand densities would continue to increase, which would mean decreased forage for ungulate species that are important prey for wolves.

3.9.3.2 Proposed Action

Potential effects to wolves could occur from construction of new temporary roads, decommissioning of roads, disturbance during project activities, or vegetation changes resulting from project actions. Potential effects to wolves from these actions are:

- Change in the amount of motorized access which could lead to mortality from hunting, trapping, poaching and vehicle collisions;
- Change in potential for disturbance at den and rendezvous sites;
- Changes to the ungulate prey base.

Motorized Access- The changes to the road system would result in changes to security habitat for wolves. Approximately 0.4 miles of temporary road would be built for use during harvest operations. Temporary roads would not be open to the public at any time, and would be closed immediately after harvest is completed.

Post-harvest, decommissioning would occur on all temporary roads and some other roads used during harvest that are no longer needed, which would reduce access that could result in mortality to wolves. Road closures would also reduce access, but were not modeled as a reduction in motorized access, because they are still open to OHV use. This likely over-represents the level of disturbance and human access that would affect wolves, since some of these roads are probably not receiving any use by OHVs. Additional road decommissioning would occur post- project as funding becomes available.

Security habitat for wolves would remain relatively static at 14% of the BMU during project implementation, with a gain of 2% post-project. The post-project calculation assumes that all the roads covered for decommissioning in this NEPA analysis are decommissioned.

Currently no den or rendezvous sites are known in the project area. It is possible that project activities could affect wolves at a sensitive site that was not identified. If a den or rendezvous site is located, project activities would be timed to avoid disturbance to wolves. Pack activity is not suspected in the project area at this time. However, expansion of the currently small breeding population of wolves in Washington is expected as a result of increased dispersal of wolves from recovering populations in Idaho and Montana, and dispersers from British Columbia (WDFW, 2009).

Changes to the ungulate prey base: Changes in deer and other ungulate populations are not expected to occur as a result of this project. Increases in forage across the project area may improve distribution of deer across the project area. See mule deer section, below, for more information.

3.9.3.3 Cumulative Effects of the Proposed Action

Geographic boundary: The geographical boundary is the Middle Methow BMU, a 101,921 acre area chosen to represent the large home range of a wolf pack.

Temporal boundary: The effects temporal boundary for wolves is from the early 1900s, when the road and recreational trail network for the forest was initiated, to the present time. Starting in the early 1900's, the advent of a road and trail system facilitated access which allowed predator control. By the 1940s, predator control actions had almost eradicated the Washington wolf population (Laufer and Jenkins 1989, Gaines et al. 2000a).

Vegetation management and fire suppression have changed the condition of the environment in these subbasins for deer and other ungulate prey, for about 100 years. Vegetation effects from this project would last for 20 to 40 years into the future. Fire suppression is on-going in this area.

<u>Past Actions</u>

Past actions that have continuing effects on the wolf population in the area today include:

1. Hunting, trapping, and predator control has resulted in an endangered population of wolves. These activities are no longer legal (except for predator control, in regulated situations), since gray wolves are currently an endangered species. However, poaching continues to reduce the wolf population.
2. Construction and use of roads and trails has facilitated access for killing of wolves and reduced security habitat for wolves and ungulate prey. Most of the road-building occurred with timber harvest, from about the 1940s to 1970s.
3. Vegetation management projects (thinning, timber harvest, prescribed burning) have increased forage for prey species, potentially resulting in increases in prey populations. Effects of this type of project last until the forest canopy has closed, and the forage species have been shaded out.
4. Fire suppression has allowed the opposite effect to occur, allowing stand densities to increase over time, and reducing forage.
5. Grazing and allotment management may displace deer and elk, and result in livestock depredation by wolves and subsequent predator control actions.

Rehabilitation efforts for the Carlton Complex fire decommissioned about 3 miles of unauthorized roads that were used as dozer line during the fire. These have been removed from the baseline.

On-going and Reasonably Foreseeable Future Actions
Actions that are planned in and around the project area that would act cumulatively to affect wolves are summarized in Figure 3.9-4.

Figure 3.9-4 Actions with Cumulative Effects to Wolves

Project Type	***Negative or Beneficial Effect***	***Possible Effect on Wolves***
Vegetation Management- timber harvest, thinning, fuels reduction projects	Beneficial	Reduction of canopy would increase forage for ungulate prey species. Burning stimulates growth of understory vegetation (grass, shrubs) for prey species.
Road construction, reconstruction, relocation and use.	Negative	Increases or improves motorized access which can result in poaching and collisions, and may result in avoidance of travelway by prey species. New road construction is largely on private lands.
Grazing	Negative	Increases potential for predator control actions and may lead to avoidance of grazed areas by prey species. There are 4 allotments in the project area. Mitigations and standards for forage use are in place.
Weed treatments	Beneficial	Reduces non-native species which compete with native species used by deer and elk. Weed spraying occurs as needed in the project area.

Desired conditions for gray wolves are:

- that den and rendezvous sites are not disturbed by human uses during periods of active wolf use,
- that wolf-livestock conflicts are minimized to promote recovery of a gray wolf population, and
- that livestock allotments are managed to reduce the potential for wolf depredations when wolves are known to be present.
- Ungulate prey base is maintained or increased.

An additional guide is that human activities that could potentially disturb active gray wolf denning or rendezvous sites should be managed to occur outside of the critical periods of April 1 to July 15.

Cumulative Effects Summary
While past actions of hunting, trapping, predator control, road and trail construction, and ongoing actions (use of the roads and trails) have resulted in adverse effects to wolf populations, the proposed action would be beneficial to wolves by providing additional security habitat.

Determination: The proposed action may effect, not likely to adversely affect gray wolves due to: 1) decreased motorized access, 2) mitigation measures to protect any active den and rendezvous sites, and 3) potential increases in forage for ungulate prey. There would be a short-term increase in human disturbance which is not likely to be adverse, and a long-term reduction in roads and better habitat for ungulates.

Canada Lynx and Critical Habitat
Indicators: Habitat changes (acres).

Methods: Areas that were mapped as lynx habitat by considering elevation and plant associations were field-reviewed to verify stand composition. Because no lynx habitat was found, no further analysis was done.

Analysis Area: The Critical Habitat and the Upper Beaver Creek Lynx Analysis Area (LAU) are the units for analysis for lynx. An LAU approximates a home range size of a female lynx.

3.9.3.2 Affected Environment
Canada lynx were federally listed as threatened in March, 2000 (U.S. Fish and Wildlife Service 2000). Lynx are a Management Indicator Species (MIS) for lodgepole pine habitats.

Lynx inhabit moist, coniferous forests that have cold, snowy winters and provide habitat for snowshoe hares (Koehler 1990, Koehler and Aubry 1994, Mowat et al. 2000, McKelvey et al. 2000, Ruggiero et al. 2000). The extent of this habitat type is northern Canada and Alaska and extending into the western U.S., Great Lakes, and northern New England. In the contiguous United States, the boreal forest landscape is naturally patchy and transitional because it is the southern edge of the boreal forest range (USFWS, 2009). In Washington, lynx are primarily found in high-elevation forests of northcentral and northeast Washington, including areas in Okanogan, Chelan, Ferry, Stevens, and Pend Oreille counties (Stinson, 2001).

Approximately 6,300 acres in the northern portion of the project area are designated as Critical Habitat for lynx, and about 2,500 acres are within the Upper Beaver Creek Lynx Analysis Unit (LAU). Approximately 200 acres of the Critical Habitat and LAU within the project area are mapped as lynx habitat, i.e. boreal forest types capable of supporting snowshoe hares. However, field review found that, despite the elevation, the mapped habitat is composed of dry Douglas- fir, with western larch, ponderosa pine and some seral lodgepole pine, and was not lynx habitat.

The Critical Habitat polygon (unit 4) is the southernmost polygon east of the Methow River, and the westernmost as well. It is disconnected from Critical Habitat unit 3 to the east by several hundred miles. The Upper Beaver Creek LAU is the southernmost LAU in the area. Most habitat is further to the north, although some exists in the upper elevations of the Sawtooth Range. See maps 1 and 2.

3.9.3. Environmental Consequences

Direct and Indirect Effects
3.9.3.1 No-Action Alternative
Field review found that the mapped habitat is not lynx habitat. Selection of the no-action alternative would not change conditions for lynx, Critical Habitat or snowshoe hare.

3.9.3.2 Proposed Action
There is one noncommercial thin unit proposed in Critical Habitat and the LAU. The unit is a dry mixed conifer stand of Douglas-fir, with some larch, ponderosa pine and lodgepole pine.

It is not lynx habitat now, and would not develop into a boreal forest stand, due to the primarily western aspect. There would be no effects to lynx or to Critical Habitat as a result of thinning this stand.

3.9.3.3 Cumulative Effects of the Proposed Action

There are no direct or indirect effects, therefore no cumulative effects to lynx or Critical Habitat as a result of the proposed action.

Determination: The proposed action would have no effect on lynx. It would have no effect on Critical Habitat. The habitat is not lynx habitat and the proposed action would have no effect on forest-wide viability.

Grizzly Bear

Indicators: Core area change (%). Core area is defined as areas 500 meters or greater from a road, motorized trail or high-use non-motorized trail.

Methods: Effects to grizzly bears were assessed by buffering roads, motorized trails and high-use non-motorized trails, to calculate the amount of core area in the Middle Methow BMU, as described in Gaines et. al (2003). This measure is intended to assess how much undisturbed habitat is available to grizzly bears.

Analysis Area: The analysis area is the Middle Methow Bear Management Unit (BMU), which encompasses the project area. BMUs are areas large enough to provide a variety of seasonal habitats.

3.9.2 Affected Environment

Grizzly bears are wide-ranging omnivores that use a variety of plant and animal foods, including roots, bulbs, tubers, fungi and tree cambium, ungulates, squirrels, carrion, fish and berries. Habitat selection is affected by (1) abundance and quality of foods; (2) gender-specific orientation to different nutrients; (3) reproductive status of females and concerns about security of dependent young; (4) presence and identity of other bears, especially adult males; and (5) presence of humans and prior contact with humans (Wisdom et al. 2000, USFWS 2011). Grizzly home ranges encompass large areas and average 489 square kilometers (189 square miles) for males in the Northern Continental Divide Ecosystem (USFWS 2011). Important seasonal foraging areas for grizzlies include riparian areas, wetlands, berry fields, avalanche chutes and ungulate winter ranges.

Human-caused mortality from human-bear conflicts, vehicle collisions, and hunting/poaching are the major factors limiting the recovery of grizzly bears (Knight et al. 1988; U.S. Fish and Wildlife Service 1993). Human access facilitated by roads and trails increases the potential for poaching, collisions with vehicles, and chronic negative human interactions at campgrounds and campsites (Gaines et al. 2003). Roads reduce habitat quality for large carnivores as a result of noise, avoidance of humans and habitat fragmentation (McLellan and Shackleton, 1998) and convert areas to non-habitat (Forman 2000, Reed et al. 1996).

Road avoidance leads to underutilization of habitats that are otherwise high quality (Wisdom et al, 2000). Mace et al. (1996) found that grizzly bears in Montana avoided roads with traffic levels greater than 10 vehicles per day. In southeastern British Columbia, grizzly bears underutilized about 9 percent of available habitats by avoiding areas 100 meters (328 ft.) from roads, regardless of traffic volume (McLellan and Shackleton 1988).

Graves (2002) studied grizzly bear use of habitats in relation to motorized trails and found that grizzly bears used areas near ATV and motorcycle trails less than expected. Bears selected against areas within 250-900 meters (0.2-0.5 miles) of ATV trails and within 450-600 meters (0.3-0.4 miles) from single-track trails. Graves et al. (2004) concluded that bears were less likely to spend time near trails with high (~5 trips/day average) motorized use than trails with low motorized use.

Because of the potential affects that road and trails can have on grizzly bears, human access management remains one of the most powerful tools for protecting and recovering grizzly bear populations (McLellen et al. 1999, USFWS 2011).

Currently, Forest policy includes guidelines for reducing the potential for bears to become food conditioned to human foods and require “no net loss” of core areas, in order to provide effective habitat for bears.

The Middle Methow BMU has about 20% core area. In other words, there is a high level of human influence on the habitat. A variety of plant and animal foods, including deer on all seasonal ranges, are found in the BMU.

3.9.3 Environmental Consequences

Direct and Indirect Effects

3.9.3.1 No Action Alternative

The proposed action would use the timber sale to decommission approximately 4 miles of roads that are no longer needed, an opportunity that may not occur if the no action alternative is selected. Motorized access to the project area would remain at the same high levels that currently exist, and core area for grizzly bears would remain limited, at around 20%.

Outside of the burned areas, forested stands would become denser, and less vegetation would be available for bears and ungulate prey on the approximately 2300 acres of harvest units.

In the burned areas, as vegetation recovers, deciduous vegetation would provide good bear foods until forest stand densities increase and canopies close, 20 years or more into the future. This would reduce potential food sources for bears in the area and reduce habitat suitability.

3.9.3.2 Proposed Action

Effects to grizzly bears could occur as a result of changes to core area and vegetation changes as shown in Figure 3.9-5. The changes to core area in this BMU are minor for grizzly bears, but would provide increased areas of relatively undisturbed habitat for a variety of other wildlife species that utilize smaller home ranges. Vegetation changes would occur as a result of the timber harvest, thinning and burning, and would provide increased availability and quality forage for bears and ungulate prey. Some loss of cover (used for hiding and meeting energetic needs) would occur. Disturbance would occur during implementation and could temporarily displace bears and ungulate prey.

Figure 3.9-5 Potential Changes to Middle Methow BMU Core Area

Current Condition	*During Harvest*	*After Harvest*	*Post-Project*
20.0%	20.0%	20.1%	21.9%

3.9.3.3 Cumulative Effects of the Proposed Action

Geographic boundary: The geographical boundary is the Middle Methow Bear Management Unit (BMU).

Temporal boundary: The cumulative effects temporal boundary for grizzlies is from the early 1900s, when the road and recreational trail network for the forest was initiated, to the present time. Motorized travel is expected to continue in perpetuity on the Forest. However, future decisions such as minimum roads analysis, access and travel management and Forest Plan revision are likely to change management direction within about 10 years.

Vegetation management and fire suppression have changed the quality and quantity of bear foods, both vegetation and animal, in the BMU over the last 100 years. Vegetation effects from this project would last for 20 to 40 years into the future. Fire suppression is on-going in this area.

Past Actions

The development of the road and motorized trail system on and off-forest in the BMU over the last century may have contributed to human-caused mortality to bears through hunting and trapping, vehicle collisions, and human/bear conflicts. Grizzly bears have been a protected species in the lower 48 states since 1975, and there is no longer a legal hunting season for grizzly bears. Approximately 561 miles of roads, including known unauthorized roads and closed roads that are available for OHV use, are located within the BMU.

Vegetation management activities such as timber sales, thinning and prescribed burning have had both positive and negative effects by increasing forage for bears and ungulates, reducing cover (used for hiding and energetic needs), and resulting in disturbance during activities.

On-going and Reasonably Foreseeable Future Actions

Actions that are planned or on-going in the BMU that would act cumulatively to affect grizzly bears are summarized in Figure 3.9-6 below.

Figure 3.9-6 Actions with Cumulative Effects to Grizzly Bear

Project Type	Negative or Beneficial Effect	Possible Effect to Grizzly Bear
Vegetation Management-timber harvest, thinning, fuels reduction projects	Beneficial	Reduction of canopy would increase forage for bears and ungulate prey species. Burning stimulates growth and palatability of forage.
Road construction, reconstruction, relocation and use.	Negative	Increases or improves motorized access which can result in poaching and collisions, and may result in avoidance of travelway by prey species. New road construction is largely on private lands.

Project Type	Negative or Beneficial Effect	Possible Effect to Grizzly Bear
Grazing	Negative	Increases potential for predator control actions and may lead to avoidance of grazed areas by prey species. Mitigations and standards for forage use are in place.
Weed treatments	Beneficial	Reduces non-native species which compete with native species used by deer and elk. Weed spraying occurs as needed in the BMU.
Recreation	Negative	Potential for disturbance and food habituation which could lead to human/bear conflicts.

Cumulative Effects Summary
The threats to grizzly bears in the recovery zone from management actions stem primarily from access management, and bear recovery depends largely on limiting mortality by humans. The proposed action would reduce the effects of access by reducing the road network in the BMU. The proposed action also counteracts past effects of fire suppression, which has led to denser stands and less vegetation foods for bears and ungulate prey.

Determination: The proposed action may effect (due to short-term human disturbance), not likely to adversely affect grizzly bears due to increases in vegetation foods for bears and ungulate prey and increases in core area.

Sensitive Species

Gray Flycatcher
Indicators: Potential habitat change in hot dry and hot warm dry environmental zones.

Analysis Area: Hot/dry and warm dry environmental zones in the project area.

3.9.2 Affected Environment
Breeding habitats for the gray flycatcher are shrub-steppe and open woodland. On the Okanogan-Wenatchee National Forest, habitat is scattered open ponderosa pine with bitterbrush and bunchgrass understories (Kent Woodruff, personal communication). In the central Washington Cascades, ponderosa pine trees within gray flycatcher territories are mid-successional size (mean dbh 11-13”) (Altman and Woodruff, 2011). Nests are generally open-cups in trees or shrubs within a few meters of the ground, up to 20 meters, and nest-building and egg-laying occur in early to mid-June in Washington (Altman and Woodruff, 2011).

Habitat loss and alteration that reduces the amount or suitability of flycatcher habitat is the most likely threat to the gray flycatcher population (Altman and Woodruff, 2011) and recent changes in fire regimes threaten persistence of the primary habitat type for this species.

Gray flycatcher habitat, mid-successional ponderosa pine and shrub-steppe habitat, is abundant in the project area, and gray flycatchers have been documented in several locations, in the hot/dry and warm/dry environmental zones. These two habitats comprise approximately 72% of the project area. About 30% of the hot/dry and warm/dry habitat in the project area burned with moderate or high severity effects.

3.9.3 Environmental Consequences

Direct and Indirect Effects

3.9.3.1 No Action Alternative

Fire suppression has resulted in higher stand densities and reduced understory vegetation, resulting in a reduction in habitat suitability for gray flycatchers. The no action alternative would continue this trend. However, the Carlton Complex fire burned with moderate or severe effects to vegetation and soils over almost one-third of the habitat in the project area, resulting in a more open condition, which may eventually result in better habitat for this species, when tree and shrub species regenerate. Approximately 2/3 of the habitat in the project area burned with low severity effects, and these areas may be improved habitat for gray flycatchers sooner.

3.9.3.2 Proposed Action

Research suggests that thinning and burning in dry forest have few detrimental effects on native understory vegetation, and that the understory is largely unchanged several years after the treatment (Forest Restoration Strategy 2012).

The proposed treatments (harvest, thinning, ladder fuel reduction, prescribed fire) would result in more open habitats across the project area. Post-harvest stand level canopy cover is expected to be above 25%, with the exception of the regeneration harvests on 70 acres, (approximately 0.1% of the project area), which are predicted to be 10%. However, to provide for a diversity of habitat types and species, prescriptions would emphasize clumps and gaps, so areas <10% and >70% canopy closure would be present, post-project. Fuels treatment units would retain 20% of the area in an untreated condition, to provide hiding cover and thermal cover for deer, and to meet habitat needs of other species.

In the short-term, stand-level shrub cover would be changed by prescribed burning (70 acres), and effects from prescribed burning are expected to be patchy. Shrub cover would be reduced in small areas of heavy fuel loadings, but overall effects of the prescribed burning are expected to be low-severity. Some loss of shrub component would occur during underburning, but abundant shrub cover would remain to provide habitat for this species. In the longer term, burning would increase the amount and quality of shrub habitat.

Thinning of the densely canopied stands would improve habitat for gray flycatchers. These heavily-stocked stands are not currently habitat for gray flycatchers. Thinning would reduce stand density and open the canopy, possibly enough to produce an understory component of shrubs that may provide nest or forage habitat and would increase overall understory richness.

Because the treatments would result in patchy effects, it is difficult to predict how much habitat would be improved for gray flycatchers as a result of treatments. However, approximately 8,851 acres of hot dry or warm dry environmental types are proposed for treatments that would potentially result in conditions that are not too open or too densely canopied for gray flycatcher use. This is about 18% of the project area and about 22% of the total hot dry/warm dry environmental type in the project area.

Harvest, thinning, burning and treatment of ladder fuels could have a short-term disturbance effect, but would reduce fuel loadings to protect remaining habitat. Abundant structure for nests and foraging would remain across the lower elevations used by gray flycatchers.

3.9.3.3 Cumulative Effects of the Proposed Action

Geographic Boundary: The geographic boundary is the extent of the Hot/Dry ponderosa pine and shrub steppe and Hot/Warm Dry Douglas-fir/ponderosa pine biophysical zones within the project area, approximately 72% of the project area.
Temporal Boundary: Temporal boundary is approximately 100 years in the past, when vegetation management and fire suppression began on the forest, to 20-40 years into the future, when the effects to vegetation would no longer be in evidence.

Past Actions
Fire suppression has been the primary driver of habitat change for gray flycatchers, although grazing may also have affected the understory shrub component. Fire suppression over the past 100 years has altered fire regimes so that ponderosa pine forests are no longer maintained by frequent natural fire, but have become denser and more susceptible to stand-replacing fire (Altman and Woodruff, 2011).

On-going Actions
Grazing and fire suppression are on-going in the project area and could affect gray flycatcher habitat. Grazing has the potential to reduce the shrub understory, but Forest Plan standards and guidelines restrict the utilization of the shrub component by livestock. Upland monitoring has shown that these standards are being met.

Fire suppression is on-going, and resulting in increases in stand densities and reduction in understory components. Fuels reduction treatments are occurring in the Benson drainage and would result in more open canopies.

Reasonably Foreseeable Future Actions
The DNR is planning two salvage sales, which would remove snags and open the tree canopy, potentially creating more open habitat for gray flycatchers. This would occur on about 958 acres immediately adjacent to the South Summit project area.

Cumulative Effects Summary
The project, planned fuels reductions, and possibly the DNR timber sales would partially counteract the negative effects of fire suppression, and would improve habitat for gray flycatchers.

Determination: The proposed action may impact individuals, but is not likely to cause a trend toward Federal listing or a loss of population viability. The proposed action would have a beneficial impact on gray flycatchers because it would reduce stand densities and increase availability and quality of shrub habitat. Mechanical treatments could cause a short-term disturbance effect.

White-headed Woodpecker
Indicators: Potential habitat change in hot dry and hot warm dry environmental zones.

Analysis Area: Dry forest habitat within the project area.

3.9.2 Affected Environment

White-headed woodpeckers inhabit low-elevation dry forests, and are a focal species for dry forest management in the eastern Washington Cascade Range, as well as an R6 sensitive species. White-headed woodpeckers are most abundant in burned or cut stands with

residual large live and dead pine trees (Raphael and White, 1984; Raphael et al., 1987). Many low-elevation dry forest species have been considered at risk due to the closing of dry forest canopies with fire exclusion, loss of large old ponderosa pine trees to logging, decline of herb and shrub understories from stand-canopy closure, and exclusion of low-intensity burns (Lehmkuhl et al.,1997; Wisdom et al., 2000).

Fuel reduction treatments that maintain or develop an abundance of mature pines that produce large cones with abundant seed (food) production, a moderately open canopy (50–70% cover), and the availability of snags and stumps for nest cavities (Garrett et al., 1996) would maintain or improve habitat for the species.

The presence of white-headed woodpeckers is documented on the forest, and in the project area. Approximately 80% of the project area is classified as dry forest habitat in the hot/dry or warm/dry types. The Carlton Complex fire burned in 2014 and is providing burned habitat over approximately 70% of the project area.

3.9.3 Environmental Consequences

Direct and Indirect Effects

3.9.3.1 No-Action Alternative

Fire suppression has resulted in higher stand densities and increased canopy closures, resulting in a reduction in habitat suitability for white-headed woodpeckers. The no action alternative would continue this trend in the unburned portion of the project area.

3.9.3.2 Proposed Action

Thinning and burning in remaining unburned dry forest stands would improve habitat for the white-headed woodpeckers by reducing competition and ladder fuels around large pines, which would accelerate development of large trees and increase the availability of seeds. Trees larger than 21” dbh would not be cut and would remain on the landscape to provide foraging habitat and, in time, large snags for nesting.

Because the treatments would result in patchy effects, it is difficult to predict how much habitat would be improved for white-headed woodpeckers. However, approximately 8,851 acres (18% of the project area) of the hot dry or warm dry environmental types would have treatments that would potentially result in conditions that are not too densely canopied for their use.

3.9.3.3 Cumulative Effects of the Proposed Action

Geographic boundary: The geographic boundary is the dry forest in the project area and adjacent state sections.

Temporal boundary: The temporal boundary is approximately 100 years in the past, when vegetation management and fire suppression began on the forest, to 20-40 years into the future, when the effects to vegetation would no longer be in evidence.

<u>Past Actions</u>

Timber harvest and fire suppression in the project area and across the landscape have affected pine habitats used by white-headed woodpeckers, by removing large pines and allowing a denser forest understory to develop. The Carlton Complex fire burned much of the project area in 2014, providing large areas of burned habitat.

On-going Actions
Fire suppression and fuels treatments are on-going, and would have competing effects on habitat for this species- fire suppression would reduce habitat suitability by allowing denser forests to develop. Fuels reduction treatments would reduce stand densities and reduce competition on larger trees. The Brimstone Salvage sale is removing dead/dying trees on 248 acres.

Reasonably Foreseeable Future Actions
The DNR is planning two salvage sales, which would open the tree canopy and remove fire-damaged trees on approximately 958 acres. These plus Brimstone Salvage would affect less than 1% of the area burned in the complex. Many areas of high-density snags would continue to be available for use by woodpeckers, so this is not expected to have a negative effect on white-headed woodpeckers.

Cumulative Effects Summary
The proposed action would improve habitat for white-headed woodpeckers by reducing competition and fire risk on large pines used for food. Other vegetation management actions that are on-going or planned would reduce snag habitat used for foraging and nesting by an insignificant amount in comparison to the total snag habitat available.

Determination: The proposed action may impact individuals, but is not likely to cause a trend toward Federal listing or a loss of population viability for white-headed woodpeckers. The proposed action would have a beneficial impact on white-headed woodpeckers because tree growth would be accelerated by removal of competing smaller trees, and potential for large-scale habitat loss through catastrophic wildfire would be reduced. The proposed project would improve conditions for white-headed woodpeckers in the project area and would not contribute to a negative trend in Forest-wide viability.

Western Gray Squirrels
Analysis Methods: Winter tracking surveys, the Forest's observation database, and field visits were used to identify areas of squirrel use and habitat.

Indicators: Potential change in forested habitats.

Analysis Area: The forested portion of the project area is the analysis area.

3.9.2 Affected Environment
Western gray squirrels inhabit mast-producing conifer-hardwood forests throughout their range. In Okanogan County, gray squirrels use ponderosa pine and Douglas-fir stands, and adjacent riparian black cottonwoods (WDFW, 2007). Sites with more large (>15" dbh) trees may be better habitat because they provide more food, better cover, more cavities, and, often, interlocking crowns important for nest site security and arboreal travel.

Food supply is the most important variable regulating tree squirrel populations (Gurnell 1987). Gray squirrels feed on pine seeds, acorns and hypogeous fungi such as truffles, as well as other seeds and fruits. In Okanogan County, pine seeds may be the most reliable food source (WDFW 2007). Ideal foraging conditions may be a balance between open conditions that encourage pine seed production and clumping of trees allowing arboreal travel, secure nesting sites and patches of high canopy closure that produce abundant fungi (WDFW 2007).

Nest trees are frequently conifers >15.8" dbh with dominant or codominant crowns and a marginal or interior stand location (WDFW 2007). Cavities in cottonwoods or alder may be used for natal nests. Most nest trees have interconnected crowns (defined as <1 meter separation), although in Okanogan County, some trees had no connections and others one connection with adjacent trees. Variables that appeared to be the most important in selection of a nest tree in Okanogan County were mistletoe infection, large dbh, and connectivity. Most Okanogan nests were in ponderosa pine or Douglas-fir, although black cottonwood was also used.

Optimal habitat for gray squirrels would provide conditions suitable for foraging and nesting. Desirable characteristics include clumpy stands that would allow for arboreal travel with large ponderosa pines to provide seeds for food, with nest trees connected to other trees by interlocking crowns.

Western gray squirrels have been documented in the Texas Creek, Finley Canyon, Yockey and Benson Creek areas. Four potential nests have been identified, but two were destroyed during the Carlton Complex fire. Much of the area of concentrated squirrel activity was burned with moderate or high severity, and squirrel mortality likely occurred.

Generally, unburned forested stands in the project area have the potential to provide adequate nest sites and ample potential for arboreal travel. Larger pines, and a variety of shrubs, produce seeds and berries for a diversity of food resources for squirrels. Red squirrels are abundant in the area and can be expected to compete for these foods. Turkeys are also found in the project area and may compete with squirrels for food resources.

3.9.3 Environmental Consequences

Direct and Indirect Effects

3.9.3.1 No Action Alternative

Stand densities would continue to increase in the unburned areas, providing increased arboreal travel and fungi foods. Competition on large pines from smaller trees would slow their growth, and reduce production of seeds, which are an important winter food source.

3.9.3.2 Proposed Action

Effects from harvest and fuels treatments on gray squirrels are mixed. Harvest and fuels treatments may result in loss of nests and potential nest sites (generally trees >15.8" dbh), would fragment the tree canopy that squirrels use for travel and escape cover, and would reduce abundance of fungi foods. Nest site loss is expected to be minimal because trees > 21" would not be cut, and known natal nests would be protected. Some loss of cavity habitat that would provide potential nest sites could occur with harvest and burning.

Thinning prescriptions would provide for retention of clumps of trees, which would provide opportunity for arboreal travel.

Underburning would remove some surface fuel which may reduce escape cover for squirrels moving along the ground. However, burning is generally patchy and larger down wood is not generally consumed. Thinning would increase food resources by accelerating growth of large ponderosa pines (which produce more pine seeds than small trees (WDFW, 2007), and also by opening of the tree canopy, which would allow the development of a shrub understory and additional foods. All fuels treatments would help to protect occupied and

potential gray squirrel habitat from effects of uncharacteristic wildfire. Protecting remaining habitat from fire is important after the large scale loss of habitat in the severely burned portions of the project area.

To mitigate negative effects, units were dropped or reconfigured to avoid removal of potential nest sites during harvest activities. Because nests are usually in the larger size class trees, it is unlikely that noncommercial or ladder fuel reduction thinnings would affect nests.

3.9.3.3 Cumulative Effects of the Proposed Action

Geographic boundary: The geographic boundary is the project area and adjacent state land sections.

Temporal boundary: The temporal boundary is the last 100 years, since fire suppression began in the National Forests, to 20-40 years into the future, when the project's effects to vegetation would no longer be in evidence.

Past Actions

Past actions that have affected western gray squirrels are fire suppression that resulted in denser stands that provide more arboreal travel opportunities, logging which removed large trees and seed sources, and grazing which affected the shrub component.

Ongoing Actions

Grazing, fuels reduction activities, and fire suppression are on-going in the project area and could affect western gray squirrel habitat. Grazing has the potential to reduce the shrub understory, but Forest Plan standards and guidelines restrict the utilization of the shrub component. Upland monitoring has shown that these standards are being met.

Fire suppression is on-going, and resulting in increases in stand densities and reduction in understory components.

Reasonably Foreseeable Future Actions

The Department of Natural Resources has several salvage sales planned, which would remove dead/dying trees in burned stands. These activities are could temporarily displace squirrels using adjacent stands.

Cumulative Effects Summary

Effects of past, ongoing and future actions with the proposed action are mixed, with fire suppression producing higher canopy closures, and more forest habitat for western gray squirrels, and the proposed action producing more open canopy conditions, moving the area to a more historical condition that would be more sustainable. The recent Carlton fire burned the middle third of the project area with moderate and high severity effects, destroying habitat. The proposed action would reduce risk of wildfire to remaining stands that may be providing habitat. Mitigation measures would help to retain opportunities for arboreal travel and maintain large trees suitable for nesting and foraging.

Determination: The proposed action may adversely impact individuals, but is not likely to result in a loss of viability in the project area, nor cause a trend toward federal listing.

Meadow fritillaries, Peck's skippers, and tawny-edged skippers

3.9.2 Affected Environment

The meadow fritillary is a Region 6 sensitive species that is found in moist meadows, aspen stands, grasslands, or wet roadsides on rich soils. They occur in openings in aspen and pine forests between roughly 2000-5000 feet elevation (Fleckenstein 2006b). The meadow fritillary is dependent on the maintenance of open, wet meadow habitat. Overgrazing by livestock and vegetation succession to woody brush is harmful to the species (Miller and Hammond, 2007). The known range of the species includes northern Washington into British Columbia. This species has been documented on the forest (Kent Woodruff, personal communication). The meadow fritillary is listed as "imperiled" in the State of Washington (NatureServe 2013).

Peck's skipper is a sensitive species found across much of the northern United States and Canada, and has been documented on the Okanogan-Wenatchee National Forest. Its range in the Northwest is restricted to mountain meadows, riparian habitats and roadsides, at elevations of approximately 2,000 to 5,000 feet (Pyle 2002). Caterpillars of this species feed on rice cutgrass (*Leersia oryzoides*), Kentucky bluegrass (*Poa pratensis*), bromes (*Bromus species*), saltgrass (*Disticlas spicata*) and other grasses (Opler et al. 2010, Pyle 2002a, Scott 1992). Adults nectar on a wide variety of flowers including purple vetch, oxeye daisy, red clover, thistles, selfheal, New York ironweed, blue vervain, common milkweed, swamp milkweed, dogbane, and New Jersey tea. (Opler et al. 2010, Pyle 2002). Threats to the species include competition from introduced skippers and habitat degradation from livestock grazing (ISSSP fact sheet, 2012). This species has been found in several locations on the adjacent Tonasket district.

The tawny-edged skipper is a sensitive species occurring across much of the United States and Canada, although it is not widespread in the Northwest. Washington records are from the northeast portion of the state, and the skipper has been documented on the Tonasket district. The tawny-edged skipper inhabits a variety of grassy habitats, where eggs are laid on host plants. Larvae feed on grasses and sedges. Adults are nectar feeders. Similarly to the Peck's skipper, threats to the species are introduced skippers (competition) and grazing (habitat degradation) (ISSSSP fact sheet, 2012).

Non-forest habitats are found across the project area on about 4,300 acres, and probably were more abundant prior to fire exclusion, which allowed vegetation succession to occur, and reduced grass and herbaceous food sources.

These species have not been identified in the analysis area, however habitat does occur there. The Carlton Complex fire resulted in moderate to high severity effects over about 1/3 of the project area, and resulted in reduction in tree canopy which would result in more ground vegetation over the next decade or more.

3.9.3 Environmental Consequences

Direct and Indirect Effects

3.9.3.1 No Action Alternative

The no action alternative would allow vegetation succession to continue, reducing potential food resources.

3.9.3.2 Proposed Action

Little is known about the effects of restoration activities on these species. Opening the forested stands, and returning to a more open condition could increase food resources and be a positive effect to the skippers and meadow fritillary. Underburning in more open habitats would occur on about 70 acres, and could result in loss of eggs, or vegetation that could be used for egg-laying or nectaring. This would likely be a short-term negative effect, as grass and herbaceous vegetation recover within 1 to 2 growing seasons (Pilliod et al. 2006). Underburning tends to produce a patchy mosaic of effects, and would not be likely to burn habitats completely. The fritillaries use wetter habitats, which are unlikely to burn during a spring burn, thus would probably not experience egg loss.

3.9.3.3 Cumulative Effects of the Proposed Action

Geographic boundary: The geographic boundary is the project area.

Temporal boundary: The temporal boundary is the last 100 years, since fire suppression began in the National Forests, to 20-40 years into the future, when the project's effects to vegetation would no longer be in evidence.

Past and Ongoing Actions

Past actions that would have affected these species are livestock grazing and fire suppression. Both are on-going.

Reasonably Foreseeable Future Actions

No future actions are identified at this time.

Cumulative Effects Summary

Little is known about these species, and the effects of restoration activities on them. Fire suppression would have resulted in more forested habitat and less habitat for species like skippers and fritillaries that use non-forest habitat. The proposed action would counter this effect, but may have a short-term negative effect if vegetation that is used for egg-laying or foraging is burned. The Carlton Fire resulted in more open early successional habitat across the project area and landscape which may be better habitat until forest canopies close again several decades in the future.

Determination: The proposed action may impact individuals, but is not likely to cause a trend toward Federal listing or a loss of population viability. In the short-term, vegetation loss from burning could result in loss of eggs over a small portion of the planning area. This is not likely to result in a loss of viability in the Planning Area, nor cause a trend toward federal listing. In the long term, the proposed actions may have a beneficial impact on the species because more open habitats would be present.

Townsend's Big-eared Bat

3.9.2 Affected Environment

Townsend's big-eared bats are a Region 6 sensitive species associated with conifer forests and open shrub habitats in eastern Washington. Townsend's big-eared bats are insectivores that focus on moths and often glean them from the foliage of trees and shrubs. They forage in shrub-steppe and open ponderosa pine areas (Wisdom et al. 2000), and use most forest types, including aspen, except for early-successional stages. They would also use upland and riparian shrublands and herblands.

Townsend's big-eared bats roost in caves, mines, rock outcrops, and buildings and are sensitive to human disturbance, particularly around roosts. Townsend's big-eared bat roost sites have been found in Okanogan County in caves, mines and old buildings (Nagorsen and Brigham, 1993), although they may also use bridges and water diversion tunnels (Pierson et al. 1999).

Conservation status for Townsend's big-eared bat is apparently secure in the western U.S. and Mexico, but the species is considered vulnerable due to specific cave requirements and sensitivity to disturbance. Key strategies for conservation include providing a pesticide-free insect food source and preventing human disturbance in or near winter hibernation sites and nursery roosts. Large snags and stands of old growth should be retained for use as roost sites (Natureserve, 2013).

A hibernaculum for Townsend's big-eared bats has been located in the project area, at a mine site. This area was affected by the Carlton Complex fire, but effects to the site and bats are unknown.

Potential foraging habitat is present across the project area. About 32% of the project area was burned with moderate to severe effects, approximately 38% burned with no or low severity, and the remaining 30% was outside of the fire footprint.

3.9.3 Environmental Consequences

Direct and Indirect Effects

3.9.3.1 No Action Alternative

Habitat for big-eared bats would continue to be present. Foraging habitats would remain wide-spread. No activities would occur near important winter roosts or hibernaculum.

3.9.3.2 Proposed Action

The proposed activities would not occur near the hibernaculum. These bats use a variety of habitat types, including snags and shrub-steppe habitats. Snag habitat is currently abundant. Shrub-steppe habitats are wide-spread in the area near the hibernaculum, and in the lower elevations of the project area.

Nothing is known about the effects of management activities on this species (Kent Woodruff, personal communication). Snag loss could reduce potential roost sites, where snags are lost through thinning and burning. However, this effect would be minor in comparison with the overall amount of snag habitat across the landscape.

3.9.3.3 Cumulative Effects

Geographic boundary: The geographic boundary is the project area.

Temporal boundary: The temporal boundary is the last 100 years, since fire suppression and management actions began in the National Forests.

Nothing is known about the effects of management activities on this species, so the following is an assumption. Past actions that could have affected this species are actions that reduced habitat. Since Townsend's big-eared bats use a variety of habitat types, habitat conversions are unlikely to lead to habitat loss. Snag habitat is the only habitat type that may be negatively affected by management activities. The recent fire resulted in snags being widely-distributed, at high levels, across the project area.

Cumulative Effects Summary
Little is known about these species, and the effects of restoration activities on them.

Determination: There is a lack of information on management effects, which makes a determination difficult. No activities would occur within a mile of the hibernaculum. Snag habitat would be lost through harvest and burning, but created through burning. More large snag habitat would be available over time as a result of the proposed action, but this would be minor in comparison to snag habitat created by the recent fires. Road closures and decommissioning would reduce firewood cutting and allow snag levels to increase over time. Therefore, the best determination possible given present knowledge of the species is that the proposed actions may adversely impact individuals, but are not likely to result in a loss of viability in the Planning Area, nor cause a trend toward federal listing.

Late/Old Habitat and Management Indicator Species
Indicators: Amount of late/old forest treated.

Analysis methods: GIS analysis, field review and comparison with Historical Range of Variability.

3.9.2 Affected Environment
Dry forest habitats have changed in comparison to historical conditions. Historically, dry forests were comprised of fine scale, even-age patches of old trees, regeneration, gaps and intermediate structural stages, with more large trees of pioneer species (Franklin et al. 2008), in this area, ponderosa pine and western larch. Currently, forest stands across the landscape are more homogeneous, higher density, with fewer clumps, particularly of large trees (Forest Restoration Strategy, 2012) and have more late-seral species. In the project area, this translates to more Douglas-fir, and less ponderosa pine and western larch. Logging has reduced numbers of old trees that are an important habitat component for many wildlife species. Fire suppression has led to much denser, multi-storied stands that are at risk for more severe effects from wildfire. Late/old stands in dry forests now are less abundant, and less open.

Over the project area, late/old stands comprised approximately 9% of the analysis area before the fire. Most of these stands were multi-storied stands with large old trees, rather than the more open, single-storied stands that were present before fire suppression. Figure 3.9-7 displays this information by biophysical environment, and shows the change from historical conditions, pre-fire.

Figure 3.9-7 Comparison of Historical Range of Variability with Pre-fire Condition

Biophysical Environment	***Multi-stratum with large trees***			***Single Stratum with Old Trees***		
	HRV %	Current %	Departure %	HRV %	Current %	Departure %
Hot-Dry	0.0	3.8	+3.8	10-30	0.7	-9.3 to -29.3
Warm-Dry	0.0	8.7	+8.7	15-30	0.2	-14.8 to -34.8
Cool-Dry	0.0	19.0	+19.0	32.5-56.3	1.3	-31.2 to -55.0
Cool-Mesic	0.0	25.0	+25.0	10-16	0.0	-10.0 to -16.0

About 42% of the late/old stands were burned with moderate to high severity effects in the Carlton Complex fire, leaving approximately 5% of the project area in late/old forest.

Management Indicator Species: Pileated woodpeckers and barred owls are the Management Indicator Species (MIS) for late/old habitats in the dry forest type that characterizes most of the project area. Three-toed woodpeckers are MIS for lodgepole pine habitats. However, three-toed woodpeckers also use recently burned forest, and are using the fire area. Pileateds, barred owls and three-toed woodpeckers are strongly associated with snag habitat

The pileated woodpecker is associated with medium-large trees and the cool/moist forest group. This species prefers areas with high densities of large snags and logs for foraging, roosting and nesting. Pileated woodpeckers select late-successional stages of coniferous or deciduous forest greater than their availability, but also use younger forests that have scattered, large, dead trees (Bull and Jackson 1995, Bull et al. 2007). This latter habitat is found in the project area. In northeastern Oregon, pileated woodpeckers selected unlogged stands of old-growth grand fir (Abies grandis) with closed canopies (Bull and Holthausen 1993) and in some cases open stands with high densities of large snags and logs (Bull et al. 2007). These woodpeckers are rarely found in stands of pure ponderosa pine (Bull and Holthausen 1993). Important habitat variables are large-diameter snags or living trees with decay for nest and roost sites, large-diameter trees and logs for foraging on ants and other arthropods, and a dense canopy to provide cover from predators (Bull 2003). A study of habitat use by Bull and Holthausen (1993) showed that pileated use increased with presence of large snags and large down wood, mature and old growth trees, canopy closures greater than 60% and no logging. Pileateds have been documented across the project area.

Barred owls are an invader species first found in Washington in the 1970s. The distribution of barred owls has expanded from their historic range in eastern deciduous forests, into western coniferous forests during the recent past (Mazur and James 2000). Barred owls are associated with moist, structurally diverse, closed canopy forests on gentle slopes (Singleton et al. 2010). Barred owls have been documented in the project area. Habitat is widely distributed across the Forest for this species, and viability does not seem to be of concern, due to lack of risk factors and an expanding range.

The three-toed woodpecker was selected to be an indicator of old-growth and mature habitat in lodgepole pine types (including subalpine fir) on the Okanogan National Forest. This habitat type is very limited in the project area, however, they are also strongly associated with areas of moderately to severely burned trees (Kotliar et al. 2008) where they forage on insect prey for several years post-fire. Underburning and forest thinning to prevent severe fires can negatively affect three-toed woodpeckers by reducing the opportunities for creating large areas of snags that provide critical foraging and nesting sites through moderate and severe fires (Horton and Mannan 1988, Hutto and Gallo 2006).

3.9.3 Environmental Consequences

Direct and Indirect Effects

3.9.3.1 No Action Alternative

Stand densities would continue to increase in the remaining late/old stands, providing better habitat for pileateds. However, competition would reduce growth of large trees that are important for their nesting and foraging. Stands would be at a higher risk of uncharacteristic

wildfire. No road decommissioning would occur. Road decommissioning would allow snags to be retained rather than cut for firewood.

3.9.3.2 Proposed Action

Effects to Late/old stands: Thinning (through harvest and fuels reduction activities) and burning would open the canopy, reduce stand densities, and would drive the multi-strata stands to a more single-storied, open condition with denser clumps. Some reduction of snags would occur, from danger tree removal during project implementation and through burning. Burning can be expected to create snags, as well. Large woody debris would be slightly reduced through prescribed burning, however burn prescriptions target fine fuels that are a fire risk rather than large wood, and this effect is expected to be minor. Silvicultural prescriptions would be consistent with the Forest Restoration Strategy, and would result in clumps of large trees being retained, which would provide denser areas and a more historical condition. Ultimately, treatments would reduce risk of losing large trees through fire, competition with other trees, and insect activity, and would retain large trees, and eventually, large snags and large down wood on the landscape.

Approximately 19% of the late/old stands in the project area would be in a harvest or fuels reduction unit. Large trees (>21” dbh) would be retained during treatment. Canopy closures are expected to be reduced by 30-60%. Reducing stand densities would reduce habitat suitability for pileated woodpeckers. However, retaining riparian buffers, clumps and patches, would help to mitigate this effect. Underburning would have negative effects on pileateds. Bull et al. (2005) found that ants were significantly less abundant, and pileated foraging was significantly reduced in stands that were treated with prescribed fire in comparison to stands that had mechanical fuel treatments only, or were not treated. However, underburning is not proposed in late/old stands, and is proposed only across 70 acres that could be foraging habitat. A positive effect would be the retention of large trees for longer periods due to reduced fire and competition risk, which would provide more nesting and foraging habitat for pileateds. Retention of large trees, snags and down wood during all treatments would help mitigate negative effects of treatments on this species.

For barred owls, the canopy opening may also have a negative effect. However, snag and down wood retention during treatments would mitigate these effects. Viability of this species is not in question.

Three-toed woodpeckers could be affected through harvest and ladder fuel reduction treatments, if trees that are currently hosting wood-boring beetles are harvested or thinned. However, given that almost 16,000 acres burned with moderate to high severities, with abundant tree mortality, food resources in the project area are not currently limited for woodpeckers.

Approximately 53 acres would be harvested in the cool and cold habitat types in the project area, which would remove some trees up to 21” dbh and reduce competition on the larger trees. An additional 966 acres would have small trees removed (up to about 8”dbh), which would reduce competition and reduce risk of fire. In the longer term, these treatments would accelerate stand development into late/old structure. Treatments would occur on about half of the cool/cold habitat type in the project area.

3.9.3.3 Cumulative Effects of the Proposed Action

Geographic boundary: The geographic boundary is the project area and adjacent state land sections.

Temporal boundary: The temporal boundary is the last 100 years, since fire suppression began in the National Forests, to 20-40 years into the future, when the project's effects to vegetation would no longer be in evidence.

Past Actions
Fire-suppression and logging have changed the character of late/old forests from open, single-storied patches of large pioneer species, to dense multi-storied stands. Fewer large snags occur compared to historical conditions, due to loss of large trees (fewer to become snags and down wood), firewood cutting and danger tree cutting.

On-going Actions
Fire-suppression, danger tree cutting and firewood cutting are on-going in the project area, contributing to increases in stand densities and loss of snags. A Forest Service salvage sale is in progress in the central portion of the project area, and is removing dead trees on 248 acres.

Reasonably Foreseeable Future Actions
The DNR salvage sales on Thrapp Mountain and in Texas Creek would remove dead and dying trees, resulting in a loss of snags over approximately 958 acres. Live trees would be left. It is not known, but unlikely, that these stands have late/old structure. All live trees would be retained. Large snags, an important habitat component, would be removed in the units.

Cumulative Effects Summary
Past actions have resulted in reductions in late/old forest habitat across the project area, denser conditions, with fewer snags and large trees. The proposed actions would restore more open conditions in about 19% of the total late/old stands and reduce the risk of wildfire and insect outbreaks, thus partially counteracting past logging and fire suppression. Longer term road closures and decommissioning would reduce access for firewood cutting and allow snag levels to increase.

Snags would be removed in the salvage sales. However, the units comprise a small portion of the overall area where these large structures are available due to the recent Carlton Complex Fire. Moderate and high severity effects are estimated to have occurred on 62,469 acres of the fire. The DNR and Brimstone salvage sales would harvest snags on about 3,553 acres, approximately 2% of the total area that experienced moderate to high severity effects.

Determinations
Pileated Woodpeckers: The proposed action would have a short-term negative effect due to reductions in dense forest habitat and potential loss of large snags and insect prey. Retention of large snags, down wood, and large trees by use of leave clumps, buffers and patches is a key component for reduction of this effect. In the long-term, large trees, snags and down logs would increase across the project area, and the risk of loss to wildfire and insect activity would be reduced. Road closures and decommissioning would increase retention of large snags.

Pileated woodpeckers are well-distributed across the project area and forest, although probably not as well distributed as historically (Youkey, 2011). Treatment would occur in about 19% of the late/old habitat in the project area. Across the district and forest, much of

the denser habitat type would remain. Forest-wide viability would be maintained for this species.

Barred Owls: Similar to the pileated woodpecker, the proposed action would have a short-term negative effect, with long-term positive effect. Range for this species is increasing, and forest-wide viability would not be affected by the project.

Three-toed Woodpecker: The proposed actions are not likely to affect recent fire foraging areas. The proposed action would have no effect on forest-wide viability for the three-toed woodpecker.

Late/Old Habitat and Focal Species

Northern Goshawk
Indicator: Changes in post-fledgling area (PFA) habitat.

Analysis Methods: Pre-field review of district observation database, goshawk surveys, and GIS analysis of vegetation data to guide selection of PFA.

Analysis Area: The analysis area is the project area, and the 3 nest stands/PFAs that are considered active.

3.9.2 Affected Environment:
Goshawks are a focal species that use stands with large trees, dense canopies, and high canopy closures for nesting. Goshawk nesting habitat is generally composed of mature and older forests (McGrath et al. 2003). In eastern Washington, nest stands typically have a relatively high number of large trees, high canopy closures (>50%), multiple canopy layers, and a relatively high number of snags and downed wood (Finn 1994, McGrath et al. 2003). Although old-growth characteristics are important to breeding goshawks, McGrath et al. (2003) found that old-growth stands were used for nesting only in proportion to their availability, while closed canopy stem exclusion stands were used more than expected based on availability.

Post-fledgling areas (PFAs) surround the nest area and are used by juveniles until they no longer depend on adults for food. PFAs provide hiding cover and foraging habitat for juveniles. PFAs consist of a variety of forest types and conditions, but in eastern Washington, were composed largely of structurally complex late-successional forests (McGrath, 1997). Hargis et al. (1994) found that foraging occurs in various cover types and structural stages and that the juxtaposition of several habitat types may enhance foraging.

East-side screens (1995) require that a 30 acre nest stand and 400 acre PFA be identified for active territories. Harvest activities can occur within the PFA, but not the nest stand. East-side screen direction is to retain the late/old successional stands and enhance younger stands towards that condition, as possible.

Eight territories have been identified in the project area since the 1980's. Recent surveys identified one active nest territory but it is likely that there are more active territories that were not located. Two additional nest stands/PFAs in the most recently active territories have been identified and were considered in the original analysis (June 2014). The Carlton Complex fire burned with moderate and high severity effects over most of one territory and on about ½ of a second territory. It is unknown if goshawks were directly affected, as nest

sites had not been located in 2014. Across the area of high and moderate severities, canopy closures were drastically reduced, and trees of all size classes were burned. Snag levels are high in the project area compared to the pre-fire condition, and canopy closures and large tree numbers are lower. In areas of low severity effects, understory vegetation was reduced, which would improve nesting and post-fledgling habitat for goshawks, but likely would negatively affect some prey species such as ruffed grouse. Overall, because of the extent of the moderate and high severity effects and their proximity to previously occupied territories, the fire was detrimental to goshawk habitat.

3.9.3 Environmental Consequences

Direct and Indirect Effects

3.9.3.1 No Action Alternative

Denser stands would develop, and areas with high canopy closures and large trees would provide suitable habitat for goshawks. However, because goshawks use a more open understory, increased densities in the understory could be detrimental. Large trees, snags and down wood, important for nests and prey habitat would develop more slowly due to competition, and would be at higher risk than in the action alternative, due to wildfire and insect activity.

3.9.3.2 Proposed Action

Nest stands: No treatments are proposed in nest stands.

PFAs: Approximately 24% of the post-fledgling area in the 2 territories where habitat remains would be thinned with LFR or pre-commercial thinning, and 3% of the PFA (included in the 43%) would also be commercially thinned (see Figure 3.9-8).

Figure 3.9-8 Restoration Treatments in the PFAs

Territory	*Thinning, NCT, LFR and Commercial Acres (%) of PFA*
Leecher	56 acres (13%)
Benson	141 acres (35%)

LFR and noncommercial thinning would benefit goshawks by reducing understory density and reducing risk of fire and insect activity which could destroy the nest stand and PFA. Commercial thinning would remove a larger size class of trees than the LFR and noncommercial thinning, and would result in more opening of the canopy, potentially reducing cover in the PFA. Loss of snags used for nesting or prey habitat would also occur, but would be minor in comparison with snag numbers currently existing as a result of the Carlton Complex fire.

The proposed actions would move stand structures toward mature and old forest structure, provide a variety of canopy closures and stand conditions, and result in a less uniform horizontal structure across the landscape, which would potentially improve habitat conditions for goshawks in the long-term over the current condition.

Within the PFAs, design criteria and mitigation measures (appendix A) would reduce negative effects of proposed treatments on goshawks.

Riparian habitat with dense deciduous vegetation that would provide habitat for important prey items such as ruffed grouse and hares would be retained by use of riparian buffers and connectivity corridors. Some canopy opening through fuels treatments would stimulate deciduous vegetation that would improve habitat quality for grouse, an important prey item.

Reynolds et al. (1992) and Squires and Reynolds (1997) recommended prescribed fire and thinning from below to achieve non-uniform spacing of trees, with a maximum of 30-50% canopy opening, to sustain habitat for the northern goshawk and their prey. Hargis et al. (1994) recommended interspersing seral stages rather than creating a large homogeneous area of mid-seral structure. Treatments in the PFA would follow these guidelines to the extent possible. However, the recommended canopy closures are higher than historical conditions for the dry forest, and would preclude thinning and harvest options. Retention of clumps, patches, riparian buffers, and connectivity corridors would result in denser conditions that would help to mitigate the overall reduction of overstory canopy.

3.9.3.3 Cumulative Effects of the Proposed Action

Geographic boundary: The geographic boundary is the project area and adjacent state land sections.

Temporal boundary: The temporal boundary is the last 100 years, since fire suppression began in the National Forests, to 20-40 years into the future, when the project's effects to vegetation would no longer be in evidence.

Past Actions

Fire-suppression and logging have changed the character of late/old forests from open, single-storied patches of large pioneer species, to dense multi-storied stands which provide better habitat for goshawks. Fewer large snags occur compared to historical conditions, due to loss of large trees (fewer to become snags and down wood), firewood cutting and danger tree cutting. The Carlton Complex fire burned with moderate and high severity effects on a third of the project area in 2014, producing high snag levels and resulting in loss of forested cover and multistoried stands.

On-going Actions

Fire-suppression, hazard tree cutting and firewood cutting are on-going in the project area, contributing to increases in stand densities and loss of snags. One salvage sale is in progress and would remove dead and dying trees over 248 acres.

Reasonably Foreseeable Future Actions

Two DNR salvage sales adjacent to the project area would harvest dead and dying trees on 958 acres. Some road decommissioning would reduce loss of snags as firewood and for hazard tree removal, however this would be minor in comparison with the influx of recent snags due to the fire.

Cumulative Effects Summary

Past actions have resulted in reductions in late/old forest habitat across the project area, denser conditions, with fewer snags and large trees. Increased stand densities have improved habitat for goshawks, loss of snags and large trees have reduced habitat quality. Recent fires have had the opposite effect on about 1/3 of the project area - producing lots of snags and reducing stand densities. The proposed actions would restore more open conditions and reduce the risk of wildfire and insect outbreaks, thus partially counteracting

past logging and fire suppression. Longer term road closures and decommissioning would reduce access for firewood cutting and allow snag levels to increase.

The proposed action would have a short-term negative effect due to reductions in dense forest habitat used by goshawks for nesting, and by some of their prey items. Retention of large snags, down wood, and large trees by use of leave clumps, buffers and patches is a key component for mitigation of this effect. In the long-term, large trees, snags and down logs would increase across the project area, and the risk of loss to wildfire and insect activity would be reduced. Treatments around aspen stands would improve habitat conditions for grouse, another important prey species. Road closures and decommissioning would increase retention of large snags.

MIS for Dead and Defective Tree Habitat
All primary cavity excavators found on the forest are Management Indicator Species for dead and defective tree habitat. Woodpeckers and sapsuckers nest and roost in snags and defective trees. These species require snags of the appropriate size, species, condition and density, and in the appropriate habitat type. See *Status of Management Indicator Species on the Okanogan and Wenatchee National Forest* (Youkey, 2011), incorporated by reference, for a discussion of habitat use and ecology. Dry forest habitat types (ponderosa pine/Douglas fir and east-side mixed conifer forest) and recently burned habitats are present in the project area.

The Carlton Complex fire produced high snag levels across 1/3 of the project area that experienced moderate and high severity effects. Another 38% of the area had low severity effects and can be expected to have some increase in snag densities. Because of the large extent of the fire effects across the landscape, snag densities are not an issue for this analysis.
The loss of snags that would occur due to hazard tree removal during harvest operations is minor compared to the fire effects, and effects to MIS species from the proposed action are too small to measure.

Determination
The primary cavity excavators are wide-spread across the forest and district, with the exception of the white-headed woodpecker (see White-headed woodpecker section, above). The proposed project would have no effect on forest-wide viability for these Management Indicator Species or other cavity-using MIS because of the wide-spread nature of the habitat, landscape-level increases in snags due to the Carlton Complex fire, and limited loss of snags as danger trees during project implementation.

Mule Deer Winter Range
Indicators: Changes in winter thermal and snow intercept thermal cover amounts/percentages and road densities.

Methods: Current cover amounts were estimated using air photo analysis and subtracting moderate and high severity burned areas.

Analysis Area: Winter range in the project area.

3.9.2 Affected Environment
Mule deer are a Management Indicator Species for winter range, and the Okanogan National Forest Land and Resource Management Plan contains standards and guidelines

for winter range cover and access. Since the time that the Forest Plan was written, studies have found that thermal cover is not as critical as forage quality and quantity for winter survival of deer (Forest Restoration Strategy, 2012). Cook et al. (1998) concluded that their findings, combined with those of other thermal cover studies (e.g., Robinson 1960; Gilbert and Bateman 1983; Freddy 1984, 1985, 1986), offered strong evidence that influences of thermal cover on animal performance and, by extension, population dynamics was rarely of consequence. Cook et al. (2005) noted that there are tradeoffs between providing dense forest cover and providing forage resources, and concluded that cover is needed where security is low or where snow accumulations are factors limiting animal performance. Mysterud and Ostbye (1999) found that, although cover is important for habitat selection of temperate ungulates, there is no hard evidence that cover affects demography so much that it limits population growth in forested areas, and that there is no evidence that specific arrangements of food and cover areas confer any large advantage to deer. The Okanogan-Wenatchee Restoration Strategy suggests that emphasizing the reduction of road density and enhancement of forage, can allow reduction in thermal cover while meeting the intent of standards for deer winter ranges, to resolve the potential conflict between restoring forests and winter range thermal cover.

Mule deer populations in Washington Department of Wildlife's Region 2, where the project is located, have experienced a gradual long-term decline in numbers which is attributed to reduced shrub diversity, declining productivity of aging shrubs and lack of recruitment of new shrubs due to fire suppression (Fitkin and Heinlen, 2012). Herd growth has plateaued, and productivity and recruitment has fallen off as the herd reached 20-25,000 animals, which appears to be the landscape carrying capacity for deer (Fitkin and Heinlen, 2012). Fitkin and Heinlen conclude that unless steps to revitalize shrub growth on winter range and human development is managed, this declining trend can be expected to continue.

Pre-fire cover amounts were the result of fire suppression over the last century, which led to increased acreages in denser stands that provide more thermal cover, and less forage than less dense conditions. Dense stands are not a sustainable condition, and are at risk of mortality from insects, disease and wildfire.

The Carlton Complex fire (2014) burned approximately 40% of the winter range west of the Okanogan River, and 28% of the high density (lowest elevation) winter range (Scott Fitkin, personal communication, 2/5/2015).

In the project area, about 19% of the winter range was burned with moderate or high severity effects. This resulted in loss of forested cover and a much more open condition, which will result in more forage resources over time. The current condition of post-fire thermal cover on the winter range is displayed below.

Figure 3.9-9 Post-fire Thermal Cover on Winter Range

Management Area	Okanogan Forest Plan Standards and Guidelines		Current Condition		
	Winter Thermal	Snow-intercept Thermal Cover	Winter Thermal	Snow-intercept Thermal Cover	Total Cover
05	25%	15%	5%	0%	5%

14	25%	15%	7%	12%	19%
26	25%	15%	1%	1%	2%
		Total	**6%**	**9%**	**15%**

Forest Plan standards and guidelines are not currently being met, and there is no potential for meeting those, even if they were sustainable, for several decades due to the fire in MAs 5 and 26. In MA 14, around ½ of the winter range burned with moderate or high severity. This occurred primarily in the north portion of the MA, so cover is not well-distributed. In MA 14, some large blocks of cover remain in the unburned portion of the Benson Creek drainage.

Access: Road densities are displayed in the Transportation section. Open road density standards for deer winter range are 1 mile per square mile in MA-26 and 2 miles per square mile in MA-14. These standards are currently being met in all deer winter range discrete management areas except for MA26-04, which is currently at 1.5 miles per square mile.

3.9.3 Environmental Consequences

Direct and Indirect Effects

3.9.3.1 No-action Alternative

"No action" would allow stand densities to continue to increase in the unburned area, providing more thermal cover and less forage for mule deer. These cover stands are not sustainable due to their high densities and are at risk for insects, disease and fire. This is likely to result in an overall decline in the ability of the winter range to support mule deer over time.

The no-action alternative would result in road densities being maintained at current levels.

3.9.3.2 Proposed Action

There are approximately 324 acres in 22 harvest units and 2,420 acres of fuels treatments (thinning, piling and mastication) that would occur on deer winter ranges. Most of the harvest would occur during the winter.

The proposed action would reduce thermal cover and increase forage for mule deer over about 1% of the winter range within the project area in MAs 5 and 14. The table below displays the cover remaining post-treatments, and was modeled assuming that the harvest treatments would remove all thermal cover within the unit. The assumption for the fuels units (outside of the harvest areas) was that approximately ½ of the seedling/sapling and post/pole-size component within the unit would be removed in the ladder fuel reduction treatments.

Figure 3.9-10: Estimated Post-treatment Thermal Cover

Management Area	Okanogan Forest Plan Standards and Guidelines		Post-Treatment Condition		
	Winter Thermal	Snow-intercept Thermal Cover	**Winter Thermal Cover**	**Snow-intercept Thermal Cover**	**Total Cover**
05	25%	15%	4%	0%	4%
14	25%	15%	7%	11%	18%
26	25%	15%	1%	1%	2%
		Total	**6%**	**8%**	**14%**

Because the total cover would be low post-treatment, to mitigate this reduction, and to provide for adequate cover distribution across the unburned portion of the project area (and to increase diversity and provide connectivity and habitat elements for other wildlife species), each ladder fuel reduction unit and non-commercial thinning unit would leave 20% of the area untreated, in patches from 0.1 acre to multiple acres in size. Fuels treatments in proximity to the moderate to high severity burned areas would be deferred until 2017, then reviewed to assess cover needs.

The canopy reduction from harvest and fuel treatments would result in an increase in forage species. Underburning would also result in increases in availability and palatability of forage species, as the older woody vegetation is burned and new vegetation growth is stimulated. However, it is important that patches of dense cover of at least 0.1 acres (>40% of mid-story canopy) be retained to provide hiding cover for mule deer (Chambers and Germaine, 2003). Disturbance could occur as a result of the winter logging, and deer may be temporarily displaced from the area being logged. The Forest winter range is higher elevation than the more heavily used areas on private land that are lower elevation and have less snow. Winter logging standards call for frozen ground and a minimum snowpack of 8“ of compacted snow, to protect soils. By the time this amount of snow has accumulated, deer have often moved to lower elevations where food is more available. Anecdotal information suggests that deer may remain in units being logged in the winter to forage on lichens and fir needles from logged trees.

Access: The proposed action would add 1 temporary road in deer winter range, equaling approximately 0.2 miles in MA14-07. This would slightly increase road densities during the period that it is open, but would not cause Forest Plan standards to be exceeded in the management area.

Pre- and post-harvest, approximately 10 miles of road would be decommissioned on winter range. As funding allows, an additional 25 miles of road would be decommissioned on winter range. Several of the roads would maintain an OHV trail for permittee use only for management of cattle allotments.

Reduced access would result in less disturbance to deer, particularly during the critical winter months and reduced potential for hunting and poaching.

3.9.3 Cumulative Effects of the Proposed Action

Geographic boundary: The geographic boundary is the project area and adjacent state lands, including all seasonal ranges.

Temporal boundary: The temporal boundary is the time since fire suppression and the road network began on the National Forest, approximately 100 years, to 20-40 years into the future, when the project's effects to vegetation would no longer be in evidence.

Past Actions

Past actions having the most influence on mule deer are actions affecting food resources, and development of the forest road network, which allowed access for hunting and poaching. Fire suppression, which resulted in development of dense stands, more cover and less forage over time, timber sales, thinning, fuels reduction treatments (which had the opposite effect of creating more open stands, more forage and less cover) have occurred in the project area. Livestock grazing has also occurred and affected forage.

On-going Actions

Livestock grazing continues across the project area, with 4 active allotments. Use of the allotments will be modified for the next few years due to the Carlton Fire. Forest Plan standards and guidelines are in place to restrict cattle use of forage needed by wildlife species, and monitoring indicates that this is effective.

Fire suppression will also continue in the project area and will allow development of dense stands and reduce forage resources.

Weed control actions will continue as needed, particularly along roads and recreation sites, and will benefit deer by reducing invasive plants that out-compete native vegetation used by deer and other wildlife species.

Reasonably Foreseeable Future Actions

The DNR is preparing a 457 acre salvage sale on winter range that will remove dead and dying trees in Texas Creek. Short-term disturbance could occur during the project and may temporarily displace deer.

Cumulative Effects Summary: The result of the proposed action, with past, on-going and future actions would be an improvement in forage quantity and habitat quality. The proposed action would partially counteract the effects of fire suppression. Overall, the trend in the project area would be positive for deer, due to the decreased access and increased forage.

MIS Determination: The proposed project would improve conditions for deer by reducing open road densities, particularly on winter range and would not contribute to a negative trend in viability on the Okanogan Wenatchee National Forest.

Ruffed Grouse (Riparian/deciduous MIS) and Focal Landbirds for Riparian Habitat

Indicators: Riparian and deciduous habitat treated.

3.9.2 Affected Environment

Ruffed grouse are a widely distributed management indicator species for riparian and deciduous habitats on the Okanogan and Wenatchee National Forests. See *Status of Management Indicator Species on the Okanogan and Wenatchee National Forest* (Youkey,

2011), incorporated by reference, for a discussion of habitat use and ecology.

Adult ruffed grouse eat seeds, fruits, leaves, buds of trees and shrubs, and insects. Young birds eat mainly insects and spiders (NatureServe 2013).

Ruffed grouse habitat was modeled as Riparian Habitat Conservation Areas and Riparian Reserves on the Okanogan and Wenatchee National Forests. This model indicates there are currently 193,891 acres of habitat distributed across 25 of 25 watersheds in the Okanogan National Forest. Upland deciduous habitat cannot be mapped at the Forest-wide scale because of the small stand size and patchy distribution. Average home range size of a brood is estimated at about 40 acres (16 hectares).

Ruffed grouse are closely tied to early-successional deciduous habitats, and the degradation or loss of these habitats constitutes a threat to the viability of local populations (Wiggins, 2006). Fire suppression has resulted in loss of early successional habitat used by ruffed grouse. Logging increases early-successional habitat used by ruffed grouse. Pesticide use that reduces insect abundance could affect chick survival.

Conservation status for the ruffed grouse is secure in Washington state and most of North America. The viability outcome for the ruffed grouse is an “A” on the Okanogan and Wenatchee National Forests, which means that habitat is widely distributed and abundant, and risk factors are not influencing habitat occupancy or demographic performance.

Approximately 1,300 acres of the project area were modeled as deciduous vegetation types, pre-fire. Riparian habitat also exists across the analysis area and provides good habitat for ruffed grouse, yellow warblers and willow flycatchers. A portion of the riparian and deciduous vegetation was burned during the Carlton Fire. Rapid resprouting of these vegetation types is expected.

3.9.3 Environmental Consequences

Direct and Indirect Effects

3.9.3.1 No-action Alternative

No effects to riparian or deciduous would occur with the no-action alternative. No road closures or decommissioning would occur. Aspen habitats would be reduced by conifer encroachment unless wildfire or other disturbance occurs.

3.9.3.2 Proposed Action

The proposed action would treat 34 acres of the Riparian Habitat Conservation Areas in the unburned area, generally the outer edges, with harvest and fuels treatments. Riparian buffers, and in some cases, connectivity corridors (meant to retain movement and dispersal habitat for upland species, as well as habitat for riparian species) and other design criteria and mitigation, would reduce negative effects to riparian habitat. No cutting of deciduous habitat would occur, although in some places small conifers providing ladder fuels to the upland canopy would be cut. This, with limited riparian treatment, would open the canopy and stimulate deciduous vegetation, which would improve habitat quality for ruffed grouse, yellow warblers and willow flycatchers.

Aspen habitat would be improved by harvest and fuels treatments. Harvest around the edges of aspen stands would remove conifers that shade the aspen, and would allow increased area of aspen to develop. Sixty acres of thinning of conifers to improve aspen

habitat is planned. Ladder fuel reduction treatment would do the same, with the smaller size class conifers. Some burning would also result in stimulation of aspen. This would improve habitat for ruffed grouse.

Road closures and decommissioning would reduce access for hunting of ruffed grouse.

3.9.3.3 Cumulative Effects of the Proposed Action

Geographic boundary: The geographic boundary is the project area and adjacent forest.

Temporal boundary: The temporal boundary is the last 100 years, since fire suppression and management activities began in the National Forests, to 20-40 years into the future, when the project's effects to vegetation would no longer be in evidence.

Past and Ongoing Actions

Fire suppression has allowed encroachment of conifers on aspen stands, reducing overall size and availability of this habitat type, and this is expected to continue. Grazing and road construction have affected the riparian habitat.

The proposed actions would stimulate understory development and increase presence of aspen habitat across the project area. Little change would occur to riparian habitat.

The Carlton Complex fire burned through aspen stands, which will stimulate growth of aspen in the project area.

Reasonably Foreseeable Future Actions

None are identified that would affect aspen and riparian habitats.

Cumulative Effects Summary: The result of the proposed action, with past, on-going and future actions would be an improvement in habitat quality for ruffed grouse, yellow warblers and willow flycatchers. The proposed action would partially counteract the effects of fire suppression.

Determination: The proposed action would improve habitat for ruffed grouse in the unburned portion of the project area. Some of the aspen/deciduous project area would have silvicultural treatments that would result in less shading of the aspen and allow the aspen clones to increase in size. Limited effects would occur in the riparian habitat, but would result in increased deciduous growth that would improve habitat for ruffed grouse and the focal landbirds for this habitat.

The proposed action would have no effect on forest-wide viability of ruffed grouse due to the small scale of the treatments (which would improve habitat) and wide-spread nature of the habitat. The viability outcome for ruffed grouse would continue as an "A" on the Okanogan-Wenatchee National Forest, meaning that suitable environments are broadly distributed and of high abundance.

Landbirds

3.9.2 Affected Environment

The effects of forest restoration treatments on landbirds have been studied in several research projects. Gaines et al. (2007) found that dry forest restoration treatments implemented using the range of variation to guide forest thinning and burning, increased overall avian density and the overall density of neotropical migrants. There were positive

density responses from several species that have been identified as species important to managers, including white-headed woodpeckers (which were only found in the treated stands) and chipping sparrows. Their results suggested that two aspects of the restoration treatments were important contributors to positive species responses: retention of the large tree component and creation of a more open overstory canopy.

Bagne and Purcell (2010) found that low-severity prescribed fires applied in spring served to drive the bird community towards pre-suppression conditions. Positive effects were found for riparian associate species, aerial foragers, and bark foragers.

Prescribed fire reduces populations of ground and shrub nesting birds (Wilson et al. 1995, Artman et al. 2001, Blake 2005), while benefiting populations of woodpeckers (Granholm 1982, Blake 2005, Russell et al. 2009) and species that forage in the air and on the ground (Saab et al. 2007, Russell et al. 2009).

Focal species for dry forest or riparian habitat in the project area are white-headed woodpecker, pygmy nuthatch, chipping sparrow, flammulated owl, varied thrush, northern goshawk, yellow warbler, willow flycatcher, and red-naped sapsucker. Species associated with cold, moist habitat have not been considered, because habitat is not found in the project area.

White-headed woodpeckers, goshawks and red-naped sapsuckers (primary cavity excavator) have been previously assessed, above. The effects of treatments on pygmy nuthatches, a focal species for large pines, would be similar to white-headed woodpeckers, and will not be considered further. Yellow warblers and willow flycatchers were discussed in the riparian MIS section, above. Figure 3.9-11 displays landbirds and applicable conservation strategies.

Figure 3.9-11 Focal Landbirds and Conservation Strategies

Species	Conservation strategies
Chipping sparrow (focal species for open understory)	Create open stand conditions and open understory with burning and thinning.
Flammulated owl (focal species for large snags)	Retain large snags. Open stands, but leave some thickets. Limit snag loss to firewood cutting.
Varied thrush (focal species for structural diversity)	Retain structurally diverse, multi-story conifer forest.

Project area habitat has changed over the last century in the unburned portions of the project area, and current stands are denser, more uniform, and have fewer large trees in comparison with historical forests (Franklin et al. 2008). In addition, fewer large snags are available due to firewood cutting and logging. This has resulted in a decrease in habitat quality in the project area for chipping sparrows and flammulated owls. The increase in density and multistoried habitat may have improved conditions for varied thrushes.

3.9.3 Environmental Consequences

Direct and Indirect Effects

3.9.3.1 No Action Alternative

Denser stand conditions would be maintained, reducing habitat quality for species using open stands, large trees or large snags. Firewood cutting would continue at the present levels and would reduce snag densities across the project area. However, due to the high numbers of snags created by the Carlton Complex fires, snag densities are not presently an issue.

3.9.3.2 Proposed Action

Fuel reduction treatments that change stand structure or composition would cause some species to gain habitat and others to lose (Lehmkuhl et al. 2007). The table below displays the expected effects for these focal species.

Figure 3.9-12 Summary of Focal Landbirds Habitat Conditions and Effects

Species	Direct and Indirect Effects	Conclusion
Chipping sparrow (focal species for open understory)	Stands would become more open with more ground foraging opportunities on approximately 25% of the project area.	Beneficial effect for chipping sparrow.
Flammulated owl (focal species for large snags)	Bigger trees over time and reduced potential for fire loss would create habitat improvement about 57% of the project area.	Beneficial effect for Flammulated owls. Combination of leave areas and thinning create improved habitat in dry forest.
Varied thrush (focal species for structural diversity)	Stand structure would become more open and have fewer canopy layers as a result of treatments, over much of the area. Mitigations of retaining 20% of fuels units in clumps and patches would retain habitat for the species.	Treatments would reduce habitat suitability for varied thrushes, but retained clumps and patches, riparian buffers and connectivity corridors would leave a minimum of 20% of the area untreated.

3.9.3.3 Cumulative Effects of the Proposed Action

Geographic boundary: The geographic boundary is the project area and adjacent state land sections.

Temporal boundary: The temporal boundary is the last 100 years, since fire suppression began in the National Forests, to 20-40 years into the future, when the project's effects to vegetation would no longer be in evidence.

<u>Past Actions</u>

Fire-suppression and logging have changed the character of forested stands from open, single-storied patches of large pioneer species, to dense multi-storied stands. Fewer large snags occur compared to historical conditions, due to loss of large trees (fewer to become snags and down wood), firewood cutting and danger tree cutting.

<u>On-going Actions</u>

Fire-suppression, danger tree cutting and firewood cutting are on-going in the project area, contributing to increases in stand densities and loss of snags.

Reasonably Foreseeable Future Actions

The DNR salvage sales would remove dead and dying trees in the Thrapp Mountain and Texas Creek areas on about 1,300 acres. Given the high levels of snags remaining across a considerable portion of the landscape, this is not likely to have a measureable effect on landbird species that use snags.

Cumulative Effects Summary

Past actions have resulted in reductions in forest habitat across the project area, denser conditions, with fewer snags and large trees. Increased densities may have improved habitat for varied thrushes. Loss of snags and large trees and denser, more uniform forest structure has reduced habitat quality for flammulated owls and chipping sparrows. The proposed actions would restore more open conditions and reduce the risk of wildfire and insect outbreaks, thus partially counteracting past logging and fire suppression. Longer term road closures and decommissioning would reduce access for firewood cutting and allow snag levels to increase.

3.9.4 Consistency Statement

The project is consistent with the Endangered Species Act, and determinations for threatened and endangered species. The project is consistent with the National Forest Management Act, the Migratory Bird Treaty Act, and Executive Order 13186, and would not result in adverse impacts to sensitive species or loss of forest-wide viability for MIS in the project area.

The project is consistent with Okanogan Forest Plan standards and guidelines for wildlife, but requests amendments for several wildlife standards. Amendments would not cause loss of viability for any species, and would allow protection of old growth habitats.

3.10 TRANSPORTATION

The following summarizes existing condition information along with the direct, indirect, and cumulative effects of the South Summit II Forest and Fuels Project, as analyzed in the South Summit II Forest and Fuels Project Fuels and Travel Analysis Reports (Orton 2014; Carroll 2015), available in the project record.

3.10.0 Issues for Analysis

The following issue was chosen for analysis because it represents cause-effect relationships between the implementation of the alternatives and the transportation system in the project area, and serves to highlight impacts and trade-offs for the decision maker. Indicators have been selected that provide understandable, quantifiable, and responsive measures of the degree of impact that would result from implementing the alternatives.

Issue (Purpose & Need #3): The current transportation system includes roads constructed over the past 90 years for administration of National Forest lands, user-built roads, and roads built to facilitate operation and maintenance of developments such as campgrounds and the PUD powerline. Some roads within the project area do not meet current safety and design standards or are now in excess to management needs because of changes in land management practices. Some roads are negatively impacting hydrologic function and aquatic habitat. Damage caused by Carlton Complex fire and subsequent storm events have impacted the transportation network in several areas; future storm events are likely to cause additional impacts to the transportation network in the project area. The desired future condition includes providing adequate access for sustainable resource management and recreation use while minimizing impacts from the transportation network to aquatic habitat and hydrologic function. Miles of open roads and maintenance costs would be reduced.

Indicator: This issue will be measured by changes in miles of open, closed, and decommissioned roads in the project area.

Analysis Methods: Analyzing the transportation network involved inventorying roads using historical maps, current GIS data, field data, and field review. Transportation Analysis was completed in which interdisciplinary team members evaluated the need for each road with respect to their resource to help determine the appropriate management direction for each road. Considerations included Maintenance Levels (MLs), closure or decommissioning recommendations, motorized access restrictions, new access needs, etc.

Analysis Area: Travel analysis considered all known roads within the project area.

3.10.1 Affected Environment

Refer to Appendix E for existing and proposed post-project designations for roads within the project area, as well as definitions of Maintenance Levels and road types. Project roads are displayed on the Proposed Transportation System map in Appendix J.

Existing roads consist of both National Forest System (NFS) roads (open and closed roads which are managed as part of the official Forest Service road system) and unauthorized roads. Unauthorized roads include user-built roads and roads were constructed for past resource management projects, then closed or decommissioned to past standards but not currently considered part of the official Forest Service road system. These roads are addressed in this project for the purposes of documenting their existence and taking appropriate management actions to decommission, close, or keep open.

Primary access into this area is provided by State Highway 20, as well as NFS Roads 4200000, 4100000 and 4150000. Road 4200000, the North Summit road, begins at the junction of State Highway 20 and ends at County Road 2017 to Conconully. It provides access to the Loup Loup Ski Bowl. Road 4100000, the South Summit road, provides the primary access south of State Highway 20 extending all the way through to private land on the south end of the project area. Road 4150000, Benson Creek Road, begins on private land on the western edge of the planning area extending southeast to a junction with the 4100000 road at the south edge of the planning area.

As shown in Figure 3.10-1, there are currently approximately 329.9 miles of road in the analysis area including 151.7 miles of open roads and 178.3 miles of closed roads (these include 89.5 miles of existing unauthorized roads). An NFS road may be closed (Maintenance Level 1) when it is decided it will not be needed for access to meet management objectives for one year or longer; placing roads in ML 1 reduces the potential environmental impacts and maintenance costs of the road.

Figure 3.10-1 Current Road System in Miles

Road Type	Open Roads	Closed Roads	All Roads
NFS Roads	151.7	88.4	240.1
Unauthorized Roads	0	89.9	89.9
Total	**151.7**	**178.3**	**329.9**

A Travel Analysis was completed for all roads within the project area. This analysis provided an approach to evaluate current conditions and recommend road management objectives. It also provided an opportunity to assess the needs, assets and liabilities of each road, and to identify road closure and decommissioning opportunities as well as which unauthorized roads, if any, should become part of the NFS system. The Travel Analysis is available in the project record. The recommendations identified in the Travel Analysis provided the basis for road management proposals made as part of the project proposed action.

The South Summit II Forest and Fuels project area includes all or part of twelve discrete management areas (MA) described in the Okanogan National Forest Land and Resource Management Plan (ONFLRMP) (USDA 1989), seven of which have standards for open road density. Current open road densities by discrete MA are shown in Figure 3.10-2. In MA26-04, open road density currently exceeds Forest Plan Standards.

Figure 3.10-2 Current Open Road Density

Discrete Mgt. Area	Discrete MA Area (square miles)	Open Road Miles	Open Road Density (mi./sq. mi.)	Forest Plan Standard
MA 5-08	8.50	24.90	2.9	3.0
MA 14-06	31.50	50.32	1.6	2.0
MA 14-07	33.44	46.11	1.4	2.0
MA 25-08	92.77	113.05	1.2	3.0
MA 25-10	20.64	45.49	2.2	3.0
MA 26-04	21.20	31.36	1.5	1.0
MA 26-11	4.38	3.41	0.8	1.0

*Arterials and Collectors are not included in the calculations for MA 5-08 as per the *ONFLRMP (USDA 1989)*

3.10.2 Environmental Consequences

3.10.2.1 No Action

The effects of taking no action on the transportation system include continued high sediment delivery from roads with associated detrimental impacts to hydrologic processes and aquatic habitat. No roads would be closed, decommissioned, or otherwise change Maintenance Levels. No stream crossings would be removed. Public access to currently open system roads and unauthorized roads would remain the same. Selecting the No Action alternative would not meet Purpose and Need #3 because it would not provide for long-term sustainable resource management, reduced maintenance costs, and reduced impacts on habitat and hydrologic function.

3.10.2.2 Proposed Action

During the project, the following activities would occur to roads within the project area some as described below and in Appendix E, and shown on the Proposed Transportation Map in Appendix J. The proposed action would reduce the overall miles of NFS and unauthorized existing roads, thereby reducing sediment delivery into aquatic habitat and reducing maintenance costs and achieving Purpose and Need #3 of this project. In addition, without this project, the process of restoring aquatic function in an area severely impacted by recent fire and storm activity would be considerably delayed by lack of funded road work that proceeds from timber sale activities associated with this project otherwise provides.

Changes in Open Road Density

During harvest activities, open road density values may temporarily exceed Forest Plan Standards in MA 5-08 and MA 25-10 in the unlikely event that all closed roads needed for harvest were opened at the same time. A Forest Plan amendment described in Chapter 2 would allow this short-term increase to facilitate harvest activities. This would result in fewer miles of open road and lower open-road densities at any given time.

Open road density by discrete MA is shown in Figure 3.10-3 (road densities exceeding Forest Plan Standards are shaded in grey). Open road density in MA 26-04 exceeds Forest Plan standards at the onset of this project. Roads in the South Summit analysis area are approximately 6% of the total miles of all roads in MA 26-04. The main roads in this discrete MA (the first 1.1 miles of 4207103 and all of 4207110) are necessary for resource management and fire protection access to a large area. The only two other roads in this discrete MA within the South Summit analysis area (the last 0.9 miles of 4207103 and WA-20-72.46L-1) are both proposed for decommissioning post-project. There are no further feasible opportunities for reducing road density in this management area with this project because so little of it lies within the project boundary.

Figure 3.10-3 Open Road Density by Project Phase and Discrete Management Area

Discrete Management Area (MA)	MA Area (sq. miles)	Forest Plan Standard Density (mi./sq. mi.)	During Harvest		After Harvest		Post-Project	
			Open Road Miles	Open Road Density (mi./sq. mi.)	Open Road Miles	Open Road Density (mi./sq. mi.)	Open Road Miles	Open Road Density (mi./sq. mi.)
5-08	8.50	3.0*	35.82	4.2	32.79	3.9	26.30	3.1
14-06	31.50	2.0	57.09	1.8	57.09	1.8	56.70	1.8
14-07	33.44	2.0	54.98	1.6	44.72	0.8	35.81	1.1

25-08	92.77	3.0	125.25	1.4	125.25	1.4	120.65	1.3
25-10	20.64	3.0	72.96	3.5	48.48	2.3	45.41	2.2
26-04	21.20	1.0	32.72	1.5	32.72	1.5	32.72	1.5

*Arterials and Collectors are not included in the calculation for MA 5-08 as per the *ONFLRMP (USDA 1989)*

Figure 3.10-4 displays open road density by 6th level HUC within the project area. Data below only considers the portions of each HUC that lie within the project area and are therefore subject to change by this proposed action. The proposed action keeps open road densities the same or decreases them in all 6th level HUCs.

Figure 3.10-4 Open Road Density During and Post-Project by 6th Level HUC

HUC Name	HUC Area (square miles)	During Harvest		After Harvest		Post-Project		Watershed Assessment Rating Post-Project
		Open Road Miles	Open Road Density (mi./sq. mi.)	Open Road Miles	Open Road Density (mi./sq. mi.)	Open Road Miles	Open Road Density (mi./sq. mi.)	
Alder Creek-Methow River	46.6	63.65	1.4	63.65	1.4	60.33	1.3	Fair
Benson Creek	37.9	70.28	1.9	58.21	1.5	52.44	1.4	Fair
Chiliwist Creek	41.6	39.23	0.9	33.84	0.8	33.51	0.8	Good
French Creek	30.3	23.39	0.8	20.36	0.7	20.36	0.8	Good
Lower Beaver Creek	48.0	72.08	1.5	70.00	1.5	60.73	1.3	Fair
South Fork Beaver Creek	27.4	50.63	1.8	50.63	1.8	46.94	1.7	Fair
Summit Creek	17.6	9.03	0.5	9.03	0.5	9.50	0.5	Good
Swamp Creek	57.5	54.71	1.0	39.44	0.7	37.15	0.6	Good
Texas Creek-Methow River	31.9	20.89	0.7	20.89	0.7	20.66	0.6	Good

Unauthorized Roads

The project area contains approximately 89.9 miles of unauthorized roads (roads are those that are not on the National Forest Service (NFS) road system and are not maintained by the Forest Service). Four miles of these unauthorized roads are used by Okanogan PUD to access the powerline in the project area and would be added to the NFS system. During harvest, about 21.3 miles of unauthorized roads would be opened to facilitate timber harvest; at the completion of harvest activities, 16.6 miles would be decommissioned, 0.5 miles would be converted to a Nordic ski trail, 1.8 miles would be added to the NFS system as closed (ML 1) road, and 2.8 miles would be added to the NFS system as an open (ML 2) road. Of the remaining unauthorized roads not used for project implementation, 47.2 miles would be decommissioned, 5.2 miles would become an open NFS system road, 14.7 miles would become a closed NFS system road, and 1.1 miles would be converted to Nordic ski trails as funding became available.

As described above, approximately 24.5 miles of unauthorized roads would be added to the NFS system in this project. About one-quarter of these roads have legal easements to access DNR or Okanogan PUD lands, or are used in maintenance and operations under a special-use permit. The remaining unauthorized roads proposed for addition to the NFS system provide stable, hardened access for future land management activities. Refer to Figure 3.10-5 for the summary of proposed changes to unauthorized roads.

Figure 3.10-5 Proposed Changes to Unauthorized Roads in Project Area

Current Miles	Add to NFS Road System	Decommission	Convert to Trail	Post-Project Miles
89.9	24.5	63.8	1.6	0

Roads Used for Commercial Harvest or Tree Planting Operations

An estimated 74 miles of roads would be used for hauling timber from proposed harvest units. Proposed post-project status is described in Appendix E. Winter harvest in the portion of the project south of Finley Canyon would primarily use NFS Road 4100000, hauling timber to the south/southeast through the Paradise Hill vicinity towards Brewster. A Forest Plan amendment would allow some of the designated groomed snowmobile routes to be plowed to allow winter logging in harvest units to alleviate soil resource concerns. Some roads designated as Nordic trails would be plowed for timber haul operations as described in the Recreation report in this EA. The effects on winter recreation are described in the Recreation section of this EA. Summer harvest proposed in the north portion of the project area would use NFS Roads 4100000 and 4200000 to haul timber to Highway 20.

Timber harvest operations would require construction of two segments of temporary roads totaling 0.4 miles. These roads would be decommissioned after harvest operations are completed. Unauthorized roads would be used for harvest operations as described above. Approximately 10.4 miles of closed NFS roads would be opened for harvest operations. Post-harvest, 8.6 miles of these roads would be closed (ML 1), 1.2 miles would be decommissioned, and 0.6 miles would remain open because they are needed for ongoing land management activities. Approximately 41.7 miles of open NFS roads would be used for harvest operations and would remain open post-project because they are needed for ongoing land management activities. Aside from the NFS roads being used for timber harvest operations, 24.8 miles of NFS roads would be closed, 0.1 miles would be opened, and 3.2 miles would be decommissioned as funding became available.

Approximately 8.5 miles of closed NFS roads would be briefly reopened during tree-planting operations to facilitate access to planting units. All of these roads would be closed post-planting.

Decommissioning Roads

Road decommissioning is defined as “activities that result in the stabilization and restoration of unneeded roads to a more natural state” (36 CFR 212.1). Decommissioning activities in the project area would strive to re-establish vegetation and, as necessary, initiate restoration of ecological processes interrupted or adversely impacted by the unneeded road. These activities would occur in such a way as to minimize environmental impacts associated with road decommissioning. Although short-term impacts may occur (such as temporary increases in sediment), long-term effects include a decrease in overall sediment delivery from the road and increased hydrologic function (see Aquatic Resources report for further

details). Treatments associated with decommissioning would include one or more of the following:

- Reestablishing former drainage patterns, stabilizing slopes, and restoring vegetation;
- Blocking the entrance to a road or installing water bars;
- Removing culverts, reestablishing drainages, removing unstable fills, pulling back road shoulders, and scattering slash on the roadbed;
- Completely eliminating the roadbed by restoring natural contours and slopes; and
- Other methods designed to meet the specific conditions associated with the unneeded road.

Approximately 2.25 miles of roads would be decommissioned before ground-disturbing activities began in connection with this project. These roads were selected by the project hydrologist and aquatics biologist because they impede attainment of Riparian Management Objectives. Figure 3.10-6 describes these road locations and lengths. As described above, 17.8 miles of roads that would be used in connection with harvest activities would be decommissioned after treatments were completed, and decommissioning on remaining roads as proposed would occur as funding became available.

Figure 3.10-6 Proposed Pre-Disturbance Road Decommissioning

Road	Drainage	Length (miles)
4100810-0.27L-1	Frazer Cr	0.4
4100810-0.15L-1	Frazer Cr	0.5
4100810-1.10L-1	Frazer Cr	0.54
4150259	Benson Cr	0.7
4150000-8.50L-1	Benson Cr	0.1
	Total	**2.25**

Closing Roads

"Road Closure" is a common term for placing roads in Maintenance Level 1 (ML 1) status, indicating that the road has been placed in storage between intermittent uses for periods exceeding one year. While road-motor vehicular traffic is prohibited, these roads may be managed and designated as a motorized trail and may be available and suited for non-motorized uses such as horseback riding, mountain biking, or hiking. Treatments associated with closing roads as proposed in this project are designed to restore hydrologic function and would include one or more of the following:

- The road entrance is physically blocked or disguised;
- Emphasis is given to maintaining drainage facilities and runoff patterns;
- Culverts may be removed;
- Planned road deterioration may occur;
- Basic custodial maintenance is performed to prevent damage to adjacent resources and to perpetuate the road for future resource management needs;
- No road maintenance other than a condition survey may be required if no potential exists for resource damage;

The project area currently contains about 88 miles of ML 1 roads. Past management practices in the project area usually closed these roads by physically blocking the entrance, performing little if any further hydrologic stabilization in anticipation of future access needs. As roads are closed as proposed with this project, hydrologic stabilization measures such as those described above would occur to place these roads in storage. Some of this work would occur as roads used for timber harvest activities are closed. Other currently closed

roads or roads proposed for closing would receive treatments as necessary as funding became available. *National Best Management Practices for Water Quality Management on National Forest System Lands* (*USFS National BMPs*) (USDA Forest Service 2012) addressing "Road Storage" would apply as well. The roads currently within or proposed for ML 1 status are listed in Appendix E.

Changing Maintenance Levels of Roads

Figure 3.10-7 displays proposed changes in maintenance levels that include the road decommissioning and closing as described above. Many NFS roads would remain open but at a reduced maintenance level to reduce maintenance costs. The proposed disposition of 89.9 miles of unauthorized roads is also shown; most of these roads would be decommissioned while some would be added to the NFS system or trail system because they are needed for land management.

Figure 3.10-7 Proposed Changes in Maintenance Level by Category

Road Category	***Pre-Project Miles***	***Roads Staying or Becoming This Category***	***Miles***	***Roads Changing From This Category***	***Miles***	***Post-project Miles***
Decommissioned (D)	0	UA to D	63.8	-	-	81.5
		ML 1 to D	14.5			
		ML 2 to D	3.2			
Unauthorized (UA) or PUD Road	89.9	-	-	UA to D	63.8	0
				UA to ML 1	16.5	
				UA to ML 2	8.0	
				UA to Trail	1.6	
Maintenance Level 1 *(closed NFS road)*	88.4	UA to ML 1	16.5	ML1 to D	14.5	114.5
		ML 1 to ML 1	73.2	ML 1 to ML 2	0.7	
		ML 2 to ML 1	24.8	-	-	
Maintenance Level 2 *(open NFS road)*	115.4	UA to ML 2	8.0	ML 2 to D	3.2	103.4
		ML 1 to ML 2	0.7			
		ML 2 to ML 2	87.2	ML 2 to ML 1	24.8	
		ML 3 to ML 2	7.5	ML 2 to Trail	0.2	
Maintenance Level 3 *(open NFS road)*	15.3	ML 3 to ML 3	7.8	ML 3 to ML 2	7.5	26.2
		ML 4 to ML 3	18.2			
		ML 5 to ML 3	0.2			

Road Category	Pre-Project Miles	Roads Staying or Becoming This Category	Miles	Roads Changing From This Category	Miles	Post-project Miles
Maintenance Level 4 *(open NFS road)*	18.6	ML 4 to ML 4	0.4	ML 4 to ML 3	18.2	0.4
Maintenance Level 5 *(open NFS road)*	2.3	ML 5 to ML 5	2.1	ML 5 to ML 3	0.2	2.1

Changes to the transportation network would generally occur in four phases. In the first phase, 2.25 miles of pre-disturbance decommissioning would occur before ground-disturbing activities began, as described above. In the second phase (during harvest), some closed NFS roads and unauthorized roads would be opened as described above to facilitate harvest operations. In the third phase (after harvest), the roads used for harvest operations would be managed as described above. In the last phase (post-project), the remaining proposed decommissioning, closing, or conversions to Nordic trails would occur as funding became available.

New Road Construction and Gate Installation

Approximately 0.5 miles of new road would be constructed in a loop at the proposed horse camp at the west end of the North Summit Snopark, providing access to visitors using the campground. See Appendix E for the proposed site plan for this facility showing road locations. In the Frazer Creek drainage, approximately 200 feet of new road would be constructed with a drivable dip across Frazer Creek to provide administrative access to PUD staff for occasional inspection and maintenance of the powerline. Construction of this road and dip would allow decommissioning of approximately 1 mile of road currently used by the PUD that lies directly adjacent to Frazer Creek and is degrading water quality by contributing sediment into the creek. To reduce potential sediment production due to vehicle traffic and to control illegal firewood cutting in riparian areas in the Frazer Creek / Okanogan PUD corridor, gates would be installed in suitable locations on the 4108650, 4100810, and 4100810, and 4108650-0.31R-1 roads.

Culvert Replacement/Upsizing

The Carlton Complex wildfire and post-fire storm events resulted in overland debris flows that impacted the transportation system, damaging or destroying culverts in key locations. The Burned Area Emergency Response evaluation completed after the fire recommended installing or increasing the size of culverts in six locations within the project area. BAER funding was not approved to cover these activities, and this analysis covers the environmental assessment required for these activities. The proposed action would install two culverts and upsize four additional culverts as described in in Figure 3.10-8. This work would occur as soon as funding is available and would be installed to engineering specifications adequate for anticipated debris and stream flows. Design and construction of these stream crossings would be accomplished by engineering with input from local Forest Service hydrologist, aquatics, and wildlife biologists and will follow applicable BMPs.

Figure 3.10-8 Proposed Culvert Work

Drainage	Road	Number of Culverts	Type of Work

Finley Canyon	4100300	2	Install
Finley Canyon	4100500	1	Upsize
Benson Creek	4150000	4	Upsize
Benson Creek	4150200	1	Upsize

Requested Easements
Approximately 5 miles of roads within the project area cross lands managed by the Washington Department of Natural Resources (DNR) and provide necessary access to Forest Service lands for this and future projects. As part of a cooperative road use agreement, the Forest Service has requested easements from DNR for these roads. These road segments are already NFS roads. Roads with easements requested are listed in Appendix E.

Administrative Use Access Trails
Approximately 24 miles of closed roads (ML 1) in the project area provide vital access to range improvements such as fences and water developments, or provide the only means of moving cattle up steep terrain from one pasture to another. The proposed action would provide for Administrative Use Access Routes to be established on these roads for authorized individuals only. Of these roads, approximately 22 miles of roads are either currently in Maintenance Level 1 or proposed for this designation post-project; 1.6 miles are in ML 1 and proposed for decommissioning post-project. Designating Administrative Access Routes on these roads allows for closing them to public use, providing a mechanism to stabilize hydrologic function while accommodating allotment administration, livestock management, and maintenance of range improvements. Administrative Use Motorized Access Routes would be established on approximately 23 miles of these roads to allow for limited use by ATV/UTVs or motorcycles. Approximately 1 mile of the roads proposed for decommissioning would be designed to accommodate horse use only to maintain the wildlife designation for that area as core grizzly bear habitat. Refer to Appendix E for a list of road segments that would be designated as Administrative Use Routes to facilitate range administration.

Converting Roads to Nordic Ski Trails
Approximately 1.8 miles of roads initially proposed for decommissioning are part of the South Summit Nordic skiing trail network (see Figure 3.10-9). Because decommissioning these roads would not allow future access by ski trail grooming equipment, the proposed action would convert these roads to Nordic ski trails to allow for continued use by trail grooming equipment and use by cross-country skiers. These trails would be approximately 12 feet wide to allow room for grooming equipment. If any culverts are removed, or other water crossings restored to improve drainage, the resulting water crossing would be passible by the groomer. These trails would generally be used by mechanized grooming equipment in the winter. Public motorized use of these trails would not be allowed.

Figure 3.10-9 Proposed Road-to-Nordic Trail Conversions

Underlying Road Number	Length (miles)
4100000-16.52R-1	0.56
4100715-1	0.50

4200100-1.6R-1	0.16
4200125-0.28L-1	0.16
4200215-0.70L-1	0.17
4200215-0.87R-1	0.04
4200218	0.24
Total	**1.8**

3.10.2.3 Cumulative Effects of the Proposed Action

This cumulative effects analysis considers effects of past, present, and reasonably foreseeable future actions within the project area. Any past actions not addressed below are no longer affecting the transportation system. The geographic boundary for this cumulative effects analysis is the South Summit planning area. The temporal boundary is from the 1920s when road construction first began in the area to 10 years into the future when most activities associated with this project have been completed.

Past Actions

As explained in the beginning of this chapter, this analysis relies on current environmental conditions as a proxy for the impacts of past action. This is because existing conditions reflect the aggregate impact of all prior human actions on natural events that have affected the environment and might contribute to cumulative effects. The following past actions provide context for understanding the current status of the transportation system. Construction of the major access roads in the area occurred from the 1920's to the 1940's. Records for Benson Creek Road (4150000), constructed in the 1920's, indicates "this was the first road to the Methow area and at one time was the mail route, the Filer Station being a stopping place on the route". ("Historical Record for Transportation Facilities", Okanogan National Forest files). Road construction for timber sale access intensified in the 1960's, continuing into the 1980's with most of the existing roads developed over that time frame. Some roads have been closed or obliterated over the past decades. This has been somewhat offset by new road construction, but there has been a steady decline in the miles of open road in the project area from its peak in the 1970s and 1980s.

Present and On-going Actions

NFS roads in the project area are primarily managed for resource management, recreation and fire control access. Other current uses of roads in the area include snowmobiling, groomed cross-country ski trails, hunting, firewood gathering, accessing several developed campgrounds and dispersed campsites, driving for pleasure, and access to powerline structures for maintenance. Access to private and state inholdings and property adjacent to Forest Service land is also provided by roads in the project area.

Limited road maintenance takes place, focused on keeping designated roads open and drivable and repairing damage from storms..

The Brimstone Salvage timber sale (located entirely within the project area) will decommission 1.5 miles of roads in the project area in 2015. Road reconstruction and

maintenance associated with this project included culvert cleaning and blading roads; this work will occur in 2015.

Reasonably Foreseeable Future Actions
Motor vehicle use of open roads in the project area will continue and limited maintenance of these roads will take place as well.

Road blading and ditch cleanout in connection with the Carlton Complex Burned Area Emergency Response proposal is planned for summer 2015. Approximately 28 miles of roads in the project area would receive culvert cleaning, ditch cleaning, and blading treatments.

Washington DNR proposes fire salvage harvesting on DNR lands adjacent to the project area near Thrapp Mountain, Leecher Canyon, and Texas Creek. Through an existing cost-share agreement, timber hauling would use NFS roads to reach Highway 20 and Highway 153. This use would not change the proposed road designations described in this project.

The transportation system, which was largely built and funded to support timber harvest, is now larger than current land management needs, and too costly to maintain. The Forest Service is currently in the process of reducing the number of roads to meet current and expected road maintenance budgets, as well as to reduce adverse impacts, such as sediment delivery into aquatic habitats. A road system that accomplishes these objectives, while providing needed management and recreation access, is the transportation system's goal.

Cumulative Effects Summary
The cumulative effect of the proposed action and all past, present, and reasonably foreseeable future actions would be a long-term decrease in the number of open roads and overall existing roads, reduction of overall maintenance costs, the elimination of unauthorized roads, and continued stabilization of existing roads through road maintenance activities, thereby minimizing sedimentation levels.

3.10.2.4 Consistency Statement
Road densities in MA 26-04 will continue to exceed Forest Plan standard of 1.0 miles per square miles, but will not increase after the project is completed.

Road densities in MA 5-08, MA 14-06, MA 14-07, MA 25-08, MA 25-10, and MA 26-11 will continue to meet Forest Plan standards after the project is completed.

3.11 RANGE

The following section provides a description of existing conditions along with the direct, indirect, and cumulative effects of the South Summit II Forest and Fuels Project, as analyzed in the South Summit II Forest and Fuels Range Management Analysis (McFetridge 2015), which is available in the project record.

3.11.1 Affected Environment

Introduction and Allotments and Associated Pastures Affected by Project

The Frazer, Finley, and Benson grazing allotments are located within the project planning area (see Figure 3.11-1). Only these allotments have pasture use areas containing planned treatment units. Environmental Assessments and decisions for the revision of Allotment Management Plans (AMP) have been completed for the three allotments in 2004 and 2005 with the AMPs completed in 2007. Livestock movement and grazing management is facilitated by utilizing fences, water developments, corrals, and stock driveways. Range management practices such as riding; adjusting intensity, timing and duration of use; proper salting, and maintaining water developments and fences would continue to be implemented through annual coordination between the District Rangeland Management Specialists and the permittee (rancher holding the grazing permit) to meet riparian objectives and to obtain a more uniform distribution of use on the allotment. The Carlton Complex wildfire burned 62% of the acres within the grazing allotment pasture use areas affected by the project activities. Just under half of the burned acres received high-severity stand-replacement fire that killed all or most of the trees (Chapter 1). The impacts of the wildfire will be analyzed. Existing locations of allotments and associated range improvements (fences, and water developments) within the analysis are shown on the South Summit II Forest and Fuels Range Map, available in the project record.

The purpose of this project, as described in the purpose and need statements, does not include analysis related to livestock grazing. As described above, grazing decisions have recently been made for the project area. This analysis addresses how livestock use patterns would be affected by the South Summit II Forest and Fuels proposed action.

Figure 3.11-1 Pasture Acres and Acres Burned in Carlton Complex within Project Area

Allotment/ Pasture	Outside Project Area	Within Project Area	Carlton Complex Burned Acres by Burn Severity			Total Burned Acres	Total Pasture Acres
			High	Low	Mod.		
Frazer							
Loup Loup	71	3057	49	527	128	704	3128
Jack Creek	14	2949	202	1778	577	2557	2963
Wolf	26	2046	410	1032	555	1997	2072
Total	**111**	**8052**	**661**	**3337**	**1260**	**5258**	**8163**
Finley							
Lower Red Shirt	0	3221	482	1734	962	3178	3221
Polepick	0	7560	1965	1443	1858	5266	7560
Finley Mountain	0	4052	2346	116	1581	4043	4052
Total	**0**	**14833**	**4793**	**3293**	**4401**	**12487**	**14833**
Benson							
Canyon	4	2056	91	1262	467	1820	2060
Post Canyon	0	1974	108	1289	460	1857	1974
North Half	49	6964	432	1849	970	3251	7013
Russian Springs	17	2866	126	822	199	1147	2883

Allotment/ Pasture	Outside Project Area	Within Project Area	Carlton Complex Burned Acres by Burn Severity			Total Burned Acres	Total Pasture Acres
			High	Low	Mod.		
Section 35	15	3052	0	0	0	0	3067
Yockey	1	4788	273	1498	538	2309	4790
Total	**86**	**21,700**	**757**	**5222**	**2634**	**10,384**	**21,787**
Texas							
Carlton 4	0	1102	99	503	213	815	1102
Minnie Mine	0	1146	33	905	155	1093	1146
Total	**0**	**2248**	**132**	**1408**	**368**	**1908**	**2248**
Grand Total	**197**	**46,833**	**6343**	**13,260**	**8663**	**30,037**	**47,031**

Current and Planned Management

Carlton Complex Fire

In response to changes in resource conditions caused by the Carlton Complex Fire, livestock grazing systems will be modified or grazing will be delayed where needed on all 4 effected allotments (Frazer, Finley, Benson, and Texas). The District will assess the need and availability to shift livestock to allotments with unused forage capacity. When standards are met that indicate sufficient vegetation recovery has occurred (see attached burned area recovery assessment from Tripod salvage) and fire damaged range structural improvements are sufficiently repaired; grazing can continue with modifications and mitigation measures in place. Specific modifications and mitigation measures are not limited to but may include the following: construct electric fence to reduce drift to burned area; directional felling of burned trees across streams to create livestock access barriers; Head Month (HM) reduction; changes in season of use; increase riding; establishing allowable use triggers as to when livestock must be moved; and increase compliance checks and monitoring.

There is one pasture in the unburned portion of the Benson allotment that will continue to be grazed in 2015 and beyond. Most likely the Loup Loup pasture of the Frazer allotment will continue to be grazed in 2015 and beyond with modifications and mitigation measures in place.

An estimated minimum of 3 years of rest will be needed for the pastures with the highest fire impacts. Pastures with light fire impacts may only need one year's rest (e.g., Russian Springs pasture). Generally 2-5 years of rest will be needed. Once the vegetation has fully recovered and fire damaged range structural improvements are repaired, the management of the allotments will return to that of pre-fire grazing systems under the current Allotment Management Plans.

A total of 29 miles of fence and 27 water developments were damaged in the allotments within the project area. Fences within the high severity burned areas may need complete reconstruction while the fences within the moderate to low burn severity will need much less repair. All water developments received some level of damage from extreme to very light. Grazing will not resume until these structural improvements receive an adequate level of repair. The following figures show the relative damage to fences and water developments within the affected grazing allotments that would be affected by the South Summit II Forest and Fuels project.

Figure 3.11-2 Miles of Fence Damaged in Carlton Complex

Grazing Allotment	Burn Severity			Total
	High	Moderate	Low	
Benson	1.0	2.3	7.3	10.6
Finley	2.6	4.2	4.8	11.6
Frazer	0.3	0.7	3.2	4.2
Texas	0.1	0.4	2.4	2.9
Total	**4**	**7.6**	**17.7**	**29.3**

Figure 3.11-3.Water Developments Damaged by Carlton Fire and Secondary Erosion

Grazing Allotments	Number of Water Developments
Benson	9
Finley	14
Frazer	2
Texas	2
Total	**27**

Allotment Descriptions

The Frazer Allotment includes Frazer, Wolf, and Jack Creek drainages north of Highway 20. Currently there are two permits that utilize three pastures (Wolf, Jack Creek, and Loup Loup). These pastures are grazed in conjunction with the Finley and Beaver allotments as needed to allow flexibility in grazing strategies and/or providing opportunities for pastures in both allotments. The Jack Creek pasture and the Loup Loup pasture are grazed using a grazing strategy that insures the maximum permitted HMs are not exceeded. The allotment is grazed under a deferred rotation system where grazing is deferred until after the growing season (with the exception of the Wolf pasture which is rested every other year). The pastures are mainly divided by fences with some natural barriers. The Carlton Complex wildfire burned 64% of the allotment acres (see Figure 3.11-1).

The Finley Allotment includes most of the National Forest between Highway 20 and the crest of Finley Mountain. The 3 pastures are Lower Red Shirt, Polepick, and Finley Mountain. The allotment is grazed under a deferred rotation system where the two early season pastures (Lower Red Shirt and Finley Mountain) are not grazed until well after the growing season every other year and the Polepick pasture is always grazed mid-season. The pastures are mainly divided by fences with some natural barriers. The Carlton Complex wildfire burned 84% of the allotment acres (see Figure 3.11-1).

The Benson Allotment includes most of the National Forest south of the crest of Finley Mountain. The six pastures are Post Canyon, North ½, Yockey, Canyon, Russian Springs, and Section 35. The allotment is grazed under a deferred/rest rotation system where early season pastures (all can be grazed early) are not grazed until well after the growing season every other year or the pastures are rested (typically Post Canyon and Canyon pastures). The pastures are mainly divided by fences with some natural barriers. The Carlton Complex wildfire burned 48% of the allotment acres (see Figure 3.11-1).

The Texas Allotment includes most of the National Forest on the south and southwest side of Mount Leecher. The two pastures are Minnie Mine, and Carlton 4, which contain some DNR and private lands and are grazed under a coordinated resource planning process (see below). A May 1 turn-on date is allowed for years when pastures are ready at that date.

The allotment is grazed under a deferred/rest rotation system where early season pastures (all can be grazed early) are not grazed until well after the growing season every other year or the pastures are rested. The pastures are mainly divided by fences with some natural barriers. The Carlton Complex wildfire burned 85% of the allotment acres (see Figure 3.11-1).

Coordinated Resource Management

All four allotments are grazed within Coordinated Resource Management (CRM) plans including private and State lands. CRM is a voluntary planning process through the local conservation District that strives to coordinate private, state, and federal lands into one management plan to balance environmental concerns with human needs. Rotations can be developed to alleviate resource concerns that may develop within the grazing allotments. This process will continue to be instrumental in coordinating grazing rotations to provide for burned area recovery.

Forage Type and Transitory Range

The primary forage type within these allotments is transitory range (a temporary increase in available forage). Much of the rangeland within the allotments is dominated by pinegrass under a conifer overstory. Fescue is often mixed in with the more open forest pinegrass habitat and it is often found in the transition zone between forest and shrub steppe habitat. Bluebunch wheatgrass is found primarily on the drier south and west facing slopes. Upland dry sedge species and needlegrass are also scattered or in small patches throughout the range. Nonnative seeded grass species are common in revegetated roadsides and in past timber harvest areas. Transitory range has been created through intensive logging activity since the 1950s and provides important temporary forage. Fuels treatments and especially the Carlton Complex wildfire have contributed to an open canopy on a large scale. Within the unburned areas, wildfire suppression has been successful in limiting the size of forest openings. Transitory range continues to fluctuate as the forest canopy opens and closes depending on the level of timber harvest, fuels treatments, and wildfire. Cattle access to transitory range within the project area has been improved by secondary roads that were constructed in conjunction with the timber sales.

Transportation System and Grazing Allotment Management

Virtually all the roads within the project area fall within grazing allotments. Roads are extremely important to the movement of cattle through the relatively steep rangeland within the project area. Roads were constructed in conjunction with intensive logging activity that started in the 1950s and were completed in the 1960s through the 1990s in conjunction with commercial timber harvest. Road construction increased livestock access throughout the allotment. Often the primary foraging areas are associated with road systems that were developed for timber harvest.

Roads are a very important physical component of the grazing allotments within the analysis area. Roads are needed both for FS administration and for the permittees to manage the livestock. The FS needs motorized vehicle access to efficiently administer the grazing allotments, specifically to inspect compliance with grazing plans, monitor grazing use, and inspect structural improvements. The permittee needs motorized vehicle assess to maintain structural improvements, for proper salt placement, to move cattle on and off the allotment via truck or stock trailer, to check on cattle distribution, and to look for cattle – commonly permittees will look for cattle using motorized vehicles, then ride to gather cattle once found. Of the 328 miles of road within the project area there are 114 miles of roads where there is a high need for range management activities.

Allotment Inspection and Monitoring – Livestock Use levels

To ensure management direction as outlined in the AMPs and Annual Operating Instructions (AOI, annual management instructions to the permittee) is followed, range management staff conduct allotment inspections throughout the grazing season. The Frazer, Finley, Benson, and Texas allotments have 38 designated monitoring areas (DMAs) across the allotments for monitoring streambank alteration (11 DMAs) and Riparian shrub use (11 DMAs) and use on riparian grasses/sedges (16 DMAs). The DMAs are chosen to be representative of a larger stream or meadow area or the most representative upland areas. The allowable use standard for livestock caused streambank alteration is not to exceed 20% current year alteration by livestock and limit allowable use on riparian shrubs to 40% utilization and riparian grasses to 45% utilization. All DMAs within the project area have been meeting allowable use standards over the past 10 years with few exceptions. If end of season monitoring identified a failure to meet the allowable use standards, management actions were taken in the next grazing season to prevent excessive use from reoccurring. Generally the actions have been the application of an allowable use move "trigger" and there have been no DMAs that have repeatedly exceeded allowable use levels.

Forage (grass) utilization standards are 45% in upland forested environments (pinegrass) and 55% in upland grasslands (bluebunch wheatgrass). Upland forage within the project area is meeting Forest Plan utilization standards with the exception of a few localized high use areas that may exceed 60% utilization.

Structural Improvements within Project Area

Fences within Commercial Harvest Units

There are 11 proposed harvest units that have Forest Service maintained fence within them for a total of 2.1 miles. Fences include FS allotment boundary fence, pasture division fence, private allotment boundary fence, riparian exclosure fence, and campground fence. The following table displays the length of fence within each commercial harvest unit by fence type and harvest type.

Figure 3.11-4 Fence Type & Length (in feet) within Proposed Commercial Harvest Unit

Unit	Fence Type	Campground Thin	Commercial Thin	Commercial Thin with patch openings	Aspen Maintenance	Total
034	FS Boundary		144			**144**
042	FS Boundary		2061			**2061**
061	Division				228	**228**
065	Division			1784		**1784**
068	Division		227			**227**
068	Private Bdy		2118			**2118**
079	FS Boundary		1044			**1044**
080	FS Boundary		722			**722**
091	FS Boundary		1007			**1007**
093	Campground	9				**9**
618	Pond Exclosure			794		**794**
680	Private Bdy		1177			**1177**
	Total	**9 ft.**	**8500 ft.**	**2578 ft.**	**228 ft.**	**11,315 ft. (2.1 mi.)**

Water Developments within Commercial Harvest Units

There are two proposed commercial harvest units that have established livestock water developments within. Figure 3.11-5 lists the harvest unit number and the associated allotment. There is only one water development in each unit.

Figure 3.11-5 Water Developments within Proposed Commercial Harvest Units

Harvest Unit	Allotment
68	Finley
673	Benson

3.11.2 Environmental Consequences

The Environmental Consequences are the impacts to the human environment that would result from implementing the proposed action or an alternative.

All Alternatives

The Carlton Complex Fire burned 53% of the grazing allotment pastures within the project area. The level of fire disturbance on the forage vegetation is relative to the level of burn severity. There are 6,343 acres of high severity and 13,260 acres of moderated severity burned area within the affected allotments. The effects of the fire on the four allotments will require modifying grazing systems or resting pastures until the forage vegetation has recovered. The effect of the South Summit II project in addition to the effects of Carlton Complex Fire on the forage response and the management of the allotments would be relatively very small.

Regardless of the alternative chosen, an increase in transitory range is expected in the Carlton Complex fire burned area as a result of a decrease in canopy cover and early seral conditions in forested plant communities. This availability would be from a combination of existing graminoid plants becoming more palatable post-fire and new plants becoming established. Also, more forage availability will come from the fire suppression restoration seeding and the Burned Area Emergency Response (BAER) seeding (see cumulative effects). The total amount of transitory range resulting from any of the alternatives would be limited in its availability to livestock depending on other factors such as slope and distance to water.

3.11.2.1 No Action Alternative

Forage Response to the Carlton Complex Wildfire

The landscape of South Summit II Forest and Fuels project areas would be left in its current condition as altered by the Carlton Complex wildfire and associated erosion. Some portions of the project area burned with moderate to high severity, damaging or consuming the existing forest stands structure. This has opened many forest stands that had developed a dense or closed canopy structure, providing for an expected transitory forage response. This opening of the canopy is expected to increase grass, forb and shrub production with a subsequent increase in available forage in areas directly affected by the fire. The effects of the fire on forest understory and intermingled shrub and grassland communities would vary based on prior species composition and adaptive strategies of individual species (Crane 1983, Agee 1994). Typically, understory species associated with dry forest plant communities are either tolerant of, or enhanced by, low and moderate intensity fire (Agee 1993). Also, Arno (1999) observed increases in species such as Scouler's willow, pinegrass, elk sedge and Ross' sedge following thinning and burning in dry forest vegetation types. Both rose and snowberry retained their pre-treatment abundance, while species such as bitterbrush and kinniknick showed a slight overall decline in post-treatment abundance.

Owens (1982) indicates that the degree of shrub regeneration is directly associated with the amount of overstory mortality resulting from a fire. The intensity of the burn would largely affect the degree to which individual species respond. It is anticipated that the Carlton Complex fire would function to enhance the understory vegetation relative to plant vigor, productivity, and diversity and consequently result in an increase in forage and browse available for grazing by permitted livestock within the allotments. Also there would be a slight increase in production in non-forested plant communities post fire. This increase would be due to an opening in canopy cover where tree mortality has occurred in areas where conifers were encroaching into non-forested plant communities or where shrub cover and decadent plant material has been removed.

In other locations within the project area, however, the fire either underburned through stands with low intensity or did not burn at all, leaving the vegetation structure relatively unchanged. Within these forested stands, the canopy closure would continue and the availability of understory forage would decrease slowly. As snags fall and debris accumulates, taking no action could result in limiting livestock use patterns and distribution within these areas. However, with the expected large scale increase in transitory forage production created by the Carlton Fire, this would more than offset the projected loss of forage in the low intensity or unburned areas. The expected outcome of this alternative would still result in the least amount of transitory range available for livestock grazing.

Expected Future Condition without Proposed Action
The landscape of South Summit II Forest and Fuels project areas would be left in its current condition

3.11.2.2 Proposed Action – Direct and Indirect Effects of the Proposed Action

<u>Commercial Harvest and Pre-commercial Thinning</u>
Acres of Commercial Harvest and Noncommercial Thinning relative to the Grazing Area
The Finley allotment has the greatest percentage of acres of Commercial Harvest (6.1%) with the Texas allotment having none. Only 4.8% of the grazing area within the four affected allotments would be harvested. The Carlton Complex fire burned 84% of the Finley allotment area and 63% across the four affected allotments (Figure 3.11-6). The overall impacts of commercial harvest relative to the impacts of the Carlton Complex fire is very small

Figure 3.11-6 Acres of Commercial Harvest relative to the Grazing Area and Carlton Fire

Allotment (% wildfire in grazing area)	Total Grazing Area	Camp-ground Thin	Commer-cial Thin	Commer-cial Thin with patch openings	Aspen Maint-enance	Seed Tree Regen	Total Harvest	Percent harvest within grazing area
Benson (48%)	21,787		793	249	37	70	1149	5.2 %
Finley (84%)	14,833	2	583	311	9		905	6.1 %
Frazer (64%)	8163	33	98				131	1.6 %
Total		**35**	**1474**	**560**	**46**	**70**	**2185**	**4.8** %

Up to 2185 acres of harvest in the South Summit area would be specifically restricted to winter logging conditions in order to minimize compaction and displacement of ash cap soils. Summer logging with harvester-forwarder equipment or other harvesting systems to protect soils would be used in some areas to avoid disrupting winter recreation. The remainder of the harvest units, where soils are favorable, would be logged using conventional feller-buncher/grapple skidder (whole tree logging) equipment.
Direct conflict with livestock grazing would be minor because a large percent of the commercial harvest units would most likely be logged while the pastures are being rested to provide for post fire vegetation and soil recovery. With the affected rangeland having 63% percent of the acres within the burned area, the direct effect on the current available forage would only be a slight reduction relative to the overall direct reduction in forage caused by the fire. Also the following measures would be implemented through design features or mitigation. Seventy-seven percent of the total proposed acres of commercial harvest within the grazing allotments would occur in the winter well outside of the grazing season. Design features for summer harvesting operations would limit disturbance to soils and to current year's available forage. Fence right-of-ways and trails would be cleared of slash produced by logging or post-sale activities. It would be a contract requirement that all gates remain closed while cattle are grazing in the area. The greatest potential for direct effects would be the potential for damage to fences. There are 2.1 miles of allotment boundary, pasture division, and campground fence within the proposed commercial harvest units (see Figure 3.11-4). All existing structural range improvements in the proposed timber sale area would be contractually protected and reconstructed if damaged. No trees would be cut that are incorporated into the fencelines and extra care would be taken to locate improvements during treatment activities occurring in the winter due to limited visibility because of the accumulation of snow. Within the summer logged harvest units, temporary breaks in fences to facilitate logging would increase the likelihood that livestock would exit from the affected pasture. Coordination between the District Range Manager, Timber Sale Officer and the grazing permittees would occur to help prevent these conflicts.

The area of the commercial harvest units within the affected pastures is small relative to the grazing area. Depending on how long it takes for the vegetation to recover within the Carlton Complex burned areas (2-5 years), there would be a strong likelihood that the soil impacts from the proposed harvest activity would recover within the timeframe of the wildfire soil and vegetation recovery.

The area of the commercial harvest units within the affected pastures is small relative to the grazing area. The proposed commercial harvest would open the canopy and create a flush of transitory range. It is well-documented that thinning and/or removal of the forest component in dry forest ecosystems results in the stimulation of the associated understory component (Riegel et al.1995, Naumburg and DeWald 1999, McConnell and Smith 1970). In general, the research indicates that productivity of understory vegetation is inversely related to tree density and directly proportional to the amount of solar radiation that reaches the understory vegetation. The same research indicates that increased productivity is positively correlated with larger trees and wider spacing. The indirect effect of increased plant productivity is an increase in forage and browse that is available for grazing by permitted livestock. However, with 63% of the rangelands within the affected grazing allotments within the Carlton Complex fire, there has been a relatively high removal of previously closed canopy throughout the project area. With the affected rangeland having only 4.8% percent of the area within the Commercial Harvest units, the indirect effect of an increase in transitory forage production would be slight relative to the increase in transitory forage expected in the burned area.

Quaking Aspen Maintenance Thinning
There would be 60 acres of quaking aspen thinning to maintain and restore species composition to more closely reflect historical conditions. Informal monitoring of post-fire aspen regeneration within grazing allotments across the Methow Valley Ranger District has found that burned aspen stands regenerate quickly and with few cattle impacts. There is expected to be an abundance aspen regeneration within the Carlton Complex burned area outside of the proposed aspen thinning units as well as other shrubs such as Scouler's willow (*Salix scouleriana*). After a 2-5 year delay of grazing to provide for vegetation recovery, including shrub recruitment, there would be a very low potential for cattle to impact treatment objectives.

Riparian Habitat Conservation Areas (RHCAs)
Riparian areas that were impacted by the Carlton Complex wildfire will not be grazed until sufficient vegetation recovery has occurred. These RHCAs may be rested for several years depending on how long a period of recovery is needed. There has been a need in the past and there will continue to be a need to reduce the level of livestock use in some riparian areas within the project area. Approximately 34 acres of proposed harvest units lie within RHCAs. All harvest activities within RHCA management zones would be done with the objective of attaining riparian management objectives and no-cut buffers would be employed to ensure that Forest Plan and PACFISH standards and guidelines are met. By attaining these objectives and meeting these standards and guidelines, cattle access is not expected to increase. During summer, livestock tend to be attracted to riparian zones due to water availability; higher concentrations of nutritious, palatable forage; and, if trees or shrubs are part of the system, preferable thermal conditions (Leonard et al 1997). Cattle generally prefer grasses and forbs to woody vegetation, at least when the herbaceous vegetation is green. Some degree of moderate use of palatable herbs (primarily grasses and sedges) can occur within the riparian area without undesirable browsing of riparian shrubs and without streambank damage (Hall and Bryant 1995). In riparian areas, livestock generally do not browse woody plants if they have a sufficient supply of palatable grass (Leonard et al 1997). As long as a sufficient level of palatable grass is available outside of the riparian area, as discussed further below, undesirable streambank damage and browsing of riparian shrubs is unlikely.

Some of the harvest units are within pastures that are grazed in the early season (May-June). The forage type within these early season pastures is predominantly bluebunch wheatgrass on the open south facing slopes and pinegrass in conifer-dominated sites. In the early season the forage preference by cattle is for bluebunch wheatgrass over pinegrass. The cattle utilize the bunchgrass habitat while cool temperatures and moist soils keep the bunch grass green and palatable. The cattle will mostly be distributed in the upland bunchgrass habitat during the early season as the upland plants have similar or higher nutritional content then the riparian forage, there is better water distribution, and preferable thermal conditions for the cattle (Wyman et al 2006). Cattle would utilize the pinegrass transitory forage within the harvest units to a much lesser extent and the existing riparian shrub densities would be maintained, because the early season timing of livestock use would favor upland forage within most of the harvest units.

Some of the riparian areas within the project area are intermittent headwater streams. Livestock would not be attracted to these areas for water, because these streams typically do not have surface water during the summer grazing season. Most of the perennial streams have dense populations of riparian shrubs that stabilize the banks and limit

livestock access. Project design details and mitigation measures would help prevent additional livestock impacts to riparian areas. There is a series of wet meadows in the headwaters area of the streams that flow into Finley Canyon and Hooker Creek where there is currently the greatest need to reduce the level of livestock use. On wet years, these wet meadow areas fill with water were the standing water greatly precludes livestock grazing. This can be a stark contrast to dry years when the water in the meadows can completely dry up. When the meadows are dry and firm, the level of use can approach or exceed allowable use standards. These observations within these meadows are well documented with over 10 years of monitoring data. Many studies have documented the effects of timber harvest on streamflow in the Rocky Mountains of North America. Most studies were associated with small research watersheds less than 300 hectares in size and all of the studies observed water yield increases after timber harvest. Most investigators attribute streamflow increases after timber harvest to decreases in evapotranspirative (evaporation and transpiration) losses. (Burton, 1997) The proposed commercial harvest and pre-commercial thinning within the watershed is expected to increase in water yield with more water retention within the wet meadow areas resulting in reduced livestock use levels. Similarly, there will be an increase in water yield expected from the tree mortality caused by the Carlton Complex wildfire. The combined outcome is expected to be a much greater increase in water yields in the wet meadow areas.

The soil disturbed by project activities in harvest units adjacent to the perennial streams would be seeded with grasses that would help draw cattle away from perennial riparian areas. All perennial streams would have a no-cut buffer zone from 50 to 300 feet or more. The accumulation of down, dead material in the buffer zone would impede cattle access. Large accumulations of down dead material have led to decreased access to riparian areas in other streams on Methow Valley Ranger District and continue to be a benefit in protecting the riparian habitat.

Opening forest stands with proposed forest treatments would increase available forage outside of riparian areas. The number of cattle that access riparian areas may decrease, because grazing distribution patterns would improve in the uplands. Even though the more open stands could allow easier access to riparian areas, no additional use of riparian areas is expected because cattle distribution would be improved and direct access to streams would be restricted by riparian vegetation along streams.

Water developments in the upland areas that lack water are often a key factor in reducing livestock concentrations in riparian areas (Wyman et al 2006). The permittee would continue to maintain the upland water developments. Range management practices such as riding; proper salting, and maintaining allotment fences would also reduce the potential for additional livestock impacts to riparian areas.

Fuels Treatments

Ladder fuel reduction (LFR) thinning would not increase livestock access to riparian areas. Aquatic resources design details would not permit LFR thinning anywhere inside the perennial RHCAs where mesic riparian vegetation dominates. This would prevent LFR treatments from getting close enough to stream channels to create new openings to the riparian areas for cattle access. Treatment of forest stands adjacent to riparian vegetation would reduce the severity of effects from wildfire. Proposed vegetation treatments that provide for the greatest potential to reduce the severity of wildfires and consequently sustain the dense riparian shrub community would best maintain the current limited cattle access.

The only underburning proposed in this project would occur in 70 acres within four regeneration harvest units to prepare these sites for replanting. The small scale of these treatments indicates that these treatments would have little effect on livestock distribution patterns within the project area.

The proposed action would reduce the stand structure adjacent to and at the outer edges of riparian areas. Approximately 274 acres of proposed fuels treatments lie within RHCAs. All treatments within PACFISH designated RHCA management zones must maintain or help achieve Riparian Management Objectives.

Timing of prescribed fire activities relating to scheduled grazing rotations could cause adjustments to be made in intensity, timing and duration of livestock use within the affected pastures. These adjustments to meet resource protection standards would be incorporated into annual operating instructions.

There are fencelines within Fuels units with LFR treatments. This includes fencelines within the project area and private and state land boundary fences that are on the fuels unit boundaries. Existing fences have been identified on the project maps and would be protected during these activities. Hand-pile burning is not anticipated to cause risks to fencelines. All fence damaged would be repaired to original design standards, or if damaged by the Carlton Complex wildfire, back to the fire damaged condition.

Effects of Transportation System Changes

The transportation system changes would have the potential to reduce livestock access to foraging areas and general livestock distribution throughout the grazing unit. A study on Cattle behavior responses to roads in forested range in the Oregon Blue Mountains matches our observations here in North Central Washington. The study unit had been previously logged, leaving a network of logging roads and skid trails. The study found that cattle used logging roads extensively as primary routes of travel and roads apparently played a key role in distribution of livestock, enabling them to travel easily through steep and broken country. Some use was made of vegetation near the roads in this terrain, but the distance at which utilization occurred decreased dramatically with increases in slope above or below the road. Cattle using these steep areas returned to the road to bed to rest. Conversely, the study found that roads in gentle terrain did not seem to be an important factor in distribution. Cattle trails in this terrain frequently did not follow a road, even when one was nearby. The study also concluded that preferred vegetation types such as pine uplands were not grazed when isolated by rough terrain with no road access. (Roath and Krueger, 1982)

As part of a well-functioning grazing allotment, roads play a very important role in providing cattle access to foraging areas. The management level of a road has little bearing on cattle access and closed roads may provide more cattle travel utility than open roads. One of the most important functions of roads in the analysis area is the cattle access they provide to foraging areas that would otherwise be isolated and not available due to rough, steep, or densely forested terrain. Also, some roads serve as stock travel routs providing easy cattle movement between pastures.

The transportation system changes would have the potential to restrict access for grazing allotment management. Some roads provide the only reasonably efficient access to rangelands within a grazing allotment for administration, livestock management, and for maintenance of improvements. Roads with a maintenance level (ML) of 2 or greater meet the minimum range management access needs within the project area. Typically ML 3 road

would be needed for large semi-trucks with trailers; however, all livestock are driven on foot on and off of the four allotments and there is currently no need for large trucks to haul livestock. Currently OHV access is permissible on ML 1 roads which can meet the minimum access needs for most range management activities but is limited to OHV, horse, or foot travel. Often, access is so limited due to impassible barricades, washouts, and debris, that the low feasibility of access becomes prohibitive to use the road without costly maintenance and modifications – even ATV access. Access on decommissioned roads can be more restrictive to livestock, horse, or foot travel that it is easier to travel off road. The proposed action would provide for Administrative Use Motorized Access Routes to be established on approximately 31 miles of roads with a post-project status of ML 1 or decommissioned. This access would be for authorized individuals only. The routes would be designed to provide for hydrologic function and, on approximately 29.9 miles, accommodate limited ATV/UTV access for maintenance of stock tanks, fences, administration, or other legitimate reasons. On 1.1 miles of these roads, the route would be designed to accommodate horse traffic only to maintain the wildlife designation as core grizzly bear habitat. The design of these administrative routes would accommodate travel by cattle and horses. Refer to Appendix E for a list of road segments that would be designated as Administrative Use Routes.

Road system changes in the Proposed Action that would eliminate steam crossings and remove portions of road from Riparian Reserves would be beneficial in reducing livestock access to the affected stream segments. Transportation systems facilitate livestock access to riparian areas, especially at stream crossings, so the elimination of roads associated with Riparian Reserves would reduce the potential for impact by livestock.

Effects of Horse Camp Establishment

The horse camp would be established within the Loup Loup pasture of the Frazer Cattle allotment. Typically, this pasture is grazed by 60 cow/calf pairs in August and September. The area of the proposed camp typically receives light cattle use, however any water or feed in the camp would be an attractant to cattle and use would increase. The camp area would be fenced and effective in excluding cattle. The loss of forage would be minimal to the overall forage production in the pasture.

3.11.2.3 Cumulative Effects of the Proposed Action

This cumulative effects analysis considers effects of past, present and reasonably foreseeable future actions within the South Summit II Forest and Fuels project area. The geographic boundary for this cumulative effects analysis is the entire project area boundary and the temporal boundary is from about 50 years in the past when improved range strategies and structures have been in place to 20 years in the future, the period of time in which proposed project activities would influence transitory range levels.

Past Actions

The effect of past actions on Range is described as part of the existing condition information above under section 3.11.1.2. These included timber sales, fuels treatments, and wildfires.

Present and On-going Actions

Carlton Complex wildfire suppression rehabilitation and BAER implementation activities being completed will help revegetate and stabilize disturbed soils and reduce vegetation recovery time and providing for improved livestock distribution and a reduction in site specific impacts from grazing within the South Summit 2 harvest units.

Weed control would occur along roads and in some off road areas under the existing

Integrated Weed Management decisions. See the Invasive Plant Specialist Report for details. Removing weeds would allow desirable plants to become established and reduce the potential of spread from livestock grazing.

The 2007 Allotment Management Plans include actions such as more management flexibility built into the grazing strategies. It is expected that livestock impacts to stream channels will be reduced through these actions.

Active fire suppression will continue in the project area because of its proximity to private lands and associated developments. Suppression activities have contributed to changing the natural fire cycle from frequent, low-intensity fires that kept the forest structure with low tree density to much less frequent fires that allowed trees to become denser, reducing levels of transitory range. The Carlton Complex wildfire has changed the forest back to a very open forest stand structure in many locations. The suppression of fires will continue to reduce the fire frequency contributing to a slowly limit the availability of transitory range.

Reasonably Foreseeable Future Actions

The Okanogan-Wenatchee National Forest is conducting an environmental analysis for travel management planning that will designate motorized public access routes in this area. Currently OHV access is permissible on ML 1 roads but after implementation of the travel management plan, there would not be ATV access for administrative or permittee use. The proposed action would provide for the establishment of Administrative Use Motorized Access Routes on specific closed and decommissioned roads and this needed access would be retained after implementation of the Forest wide travel management plan.

Livestock grazing would continue. Range management techniques such as riding; adjusting intensity, timing and duration of use; proper salting, and maintaining water developments and fences would continue to be used to meet riparian objectives and to obtain a more uniform distribution of use on the allotments.

The implementation of the *Okanogan-Wenatchee National Forest Forestwide Site-Specific Invasive Species Treatment EIS* would increase the number of weed treatment options available and increase the area of infested lands that may be treated within the Project area. Early detection, rapid response to newly discovered infestations would increase treatment effectiveness and reduce the potential for spread of new populations. The outcome of the implementation of this future action would help to maintain a sustained yield of desirable forage plants and to reduce the potential of spread from livestock grazing.

The Carlton Complex BAER plan provides for the treatment of invasive plants using an Early Detection & Rapid Response (EDRR) strategy. Monitoring and treatment of noxious weed infestations will be conducted on FS lands associated with suppression activities and BAER treatments. Disturbed areas within and along the fire perimeter, such as dozer lines, hand lines, staging areas, safety zones and drop points will also be prioritized for monitoring and treatment. Treating invasive plants will help prevent the serious threat to native plant diversity, structure, and composition and ensure a sustained yield of forage for livestock. Riparian tree felling as described above would directionally fell burned trees across streams to add large woody debris to 12 miles of burned and severely eroded streams. In addition, approximately two miles riparian temporary electric fence would be constructed within the Carlton Complex to restrict cattle access and increase the potential to trap sediments. In addition to the design criteria to that would reduce impacts to riparian areas; this action

would provide additional protections for riparian vegetation recovery after the range is ready for post fire cattle grazing.

Repair or reconstruction would occur on approximately 29 miles of fire damaged fence and 27 water developments within the Carlton Complex burned area. Project design criteria provides for unrepaired wildfire fence damage at the time of project implementation to be repaired only back to the fire damaged condition. In addition, the DNR plans to repair boundary fence along the FS/DNR boundary near Thrapp Mtn that was burned during the Carlton Complex. If fence repair works overlaps in time and space with project activities, the work would be coordinated. The combined effect would be the best outcome for repair of the damaged fences.

The Washington Department of Natural Resources (DNR) plans to conduct salvage sales to harvest dead and/or dying trees on approximately 1300 acres near Thrapp Mountain and in the Texas Creek drainage in spring 2015. These salvage areas in Thrapp and Texas Creek fall within the Finley and Texas allotment grazing areas. The combined effect of the salvage and the Carlton Complex burned area on the DNR land would enhance the understory vegetation by opening the canopy resulting in an increase in forage and browse available for grazing by permitted livestock within the allotments. This would be an added benefit to the transitory range created by the project activities.

Cumulative Effects Summary

The cumulative effects of the South Summit Project when combined with the effects of the past, present (on-going) actions and reasonably foreseeable future actions is expected to be a short-term decrease in available forage disturbed by ground-based harvest systems 2-3 years). In the long term (approximately 20 years), with implementation of design criteria for the proposed action and on-going fuels treatments and weed management, transitory forage production would increase, improving livestock distribution and reducing riparian impacts. Transitory range will continue to fluctuate. As time passes, the increase in transitory forage availability created by the implementation of the proposed action would be reduced as the tree canopy closes. Shrubs, herbs and grasses would become less abundant due to the corresponding increase in canopy cover and associated increased shading (Naumburg and DeWald 1999, Host 1988, McConnell and Smith 1970). The average transitory range duration for an average conifer stand in the Northwest area is approximately 20 years (Baumgartner 1987).

3.11.2.4 Consistency Statement

The proposed action would be consistent with The Okanogan National Forest Regional Forest Plan standards and guidelines for achieving range management objectives. Compliance with the pertinent Prevention Standards listed in the Final Environment Impact Statement (FEIS) for the Pacific Northwest Region Invasive Plant Program Preventing and Managing Invasive Plants (USDA 2005 is included in Design Details for Range, listed in Chapter 2. Management objectives would be met to protect rangeland resources and continue the management of the affected grazing Allotments while providing for forest health.

3.12 SENSITIVE PLANTS AND UNIQUE HABITATS

The section below summarizes the existing condition information, along with the direct, indirect and cumulative effects from the South Summit II Forest and Fuels Project, as analyzed in the South Summit II Forest and Fuels Project Botanical Evaluation (Baraibar and Bowden 2015), available in the project record. For a specific report about the proposed North Summit Horse Camp, see the field notes taken at the site in the project file (Ohlson 2015).

Specific management for Sensitive species follows Forest Service Region 6 Sensitive Species policy as identified in Section 2670 of the Forest Service Manual (FSM). Sensitive Species are defined as those plants and animal species identified by a Regional Forester for which population viability is a concern, as evidenced by substantial current or predicted downward trends in population numbers or density and habitat capability that would reduce a species' existing distribution (FSM 2670.5). Management of sensitive species "must not result in a loss of species viability or create significant trends toward federal listing" (FSM 2670.32). This analysis assesses the effects of the proposed action on Sensitive and Federally listed plant resources and unique habitats within the South Summit II Forest and Fuels project area as required by the Forest Service Policy outlined in Section 2670 of the Forest Service Manual.

The plant analysis for this project covers species on the 2011 Regional Forester's Special Status Species Lists, which includes the Federally Threatened, Endangered, and Proposed Species (TE&P) and Sensitive Species List, provided under the Interagency Special Status & Sensitive Species Program (ISSSP). Surveys for all threatened, endangered and sensitive species were performed in 2002, 2003, 2010, 2011, 2012, and 2013. The complete list for R6 Special Status species can be found in the Botany project file. Since the project area is not within the Northwest Forest Plan, Survey and Manage species are not being considered.

3.12.1 Issues for Analysis

The following issues were chosen for analysis because they represent cause- effect relationships between the implementation of the alternatives and Sensitive plants and special habitats and serve to highlight impacts and trade-offs for the decision maker. For each issue analyzed indicators have been selected that provide understandable, quantifiable and responsive measures of the degree of impact that would result from the implementation of the alternatives.

<u>Treatments near Sensitive Plant Sites</u>

Sensitive plant sites will be excluded from both forest and fuels treatments. Established boundaries around plant locations have been delineated, and 50-foot buffer applied. All Sensitive plant populations within the project boundaries will be monitored over the course of the project and the results of this monitoring may result in modifications of design criteria.

Indicator: Population count and vigor of Sensitive plant species near treatment areas. Accidental or unforeseen treatment effects to Sensitive plant populations.

Analysis Methods: Monitoring will occur at all Sensitive plant populations within the project area, prior to treatment, over the life of the project and afterward.

Analysis Area: Sensitive plant sites within the project area and their immediate surrounding habitats will be analyzed.

Treatments near Sensitive Habitats
The direct and indirect effects of forest and fuels treatments on Sensitive plant habitats, namely wetlands and aspen stands could improve ecosystem functioning by increasing the availability of water, sunlight and nutrients. Improvements could increase biodiversity in these habitats where many R6 Sensitive plant species occur.

Indicator: Aspen stand and wetland vegetation vigor. Increase of vegetation and biodiversity of plant species.

Analysis Methods: Monitoring will occur in select aspen stands and wetlands within the project area, prior to treatment, over the life of the project and afterward.

Analysis Area: Sensitive plant habitats within the project area were analyzed

3.12.2 Affected Environment

Federally Listed Plant Species
There are no known occurrences of the Federally-listed plant species *Howellia aquatilis, Hackelia venusta*, *Sidalcea oregano var. calva,* or *Spiranthes diluvialis* within the analysis area. None of these species were found during botanical surveys conducted for this project. Marginal habitat for the Federally listed aquatic species *Howellia aquatilis* and facultative wetland species *Spiranthes diluvialis* is restricted to a few specific areas within the project boundary.

Region 6 Special Status Plant Species
One R6 Special Status Species involving 2 populations are known to occur in the project area: two populations of *Mimulus pulsiferae* (R6 Sensitive) and one population of *Mimulus patulus* (R6 Strategic). Mitigation measures will be followed for populations that are involved in forest or fuels treatment units to make sure they are not disturbed by project activities. *Mimulus* sites were not involved in fires during the Carlton Fire.

Mimulus patulus
One population of *Mimulus patulus* occurs near Russian Spring, southeast of Leecher Mountain. In the project area, *Mimulus patulus* is known to occur in seasonally moist habitats. This site is on the margins of a seasonal streambed, under a mostly open canopy dominated by ponderosa pine.

Mimulus pulsiferae
Two populations of *Mimulus pulsiferae* occur within the project area. *Mimulus pulsiferae* is listed as Sensitive by Washington State and U.S. Forest Service Region 6. This species prefers seasonally moist, open areas, often in exposed mineral soil and occurs in grass/forb dominated openings in ponderosa pine and Douglas fir forests.

Transportation System Conditions Associated with R6 Sensitive Plant Species and Sensitive Habitats
As mentioned in the Design Criteria in Chapter 2, “Areas of heavily disturbed soils (including landings, main skid trails, decommissioned temporary roads, and constructed road cut and

fill slopes) will be reseeded. Native seed will be the first choice in revegetation in areas where the objective is to restore the site to the landscape setting, such as decommissioned roads". The following roads lie within or near sensitive plant populations:

- Road 4150135 goes through the middle of a R6 Strategic plant population of *Mimulus patulus*. The road currently does not appear to be interfering with the main population. There is a culvert that runs under the current road that drains spring runoff from the population. Decommissioning the road and all the side roads that access this area may improve habitat conditions allowing the population to expand. Ensuring vehicle use stays on the existing road and maintaining adequate drainage would also improve habitat conditions because the terrain is flat, inviting off road use. The portion of road 4150135 along the stream and the stream crossing itself, along with connected spurs 4150130, 4150135-0.60R-1&2, 4150135-0.80R-1&2 and 4150100-0.97L-1 are proposed to be decommissioned. The remainder of road 4150135 and spur roads off of it are proposed to be closed or decommissioned.
- Road 4150145 connects with and forms a loop with road 4150135. Road 4150145 is proposed to be closed to protect an R6 Strategic plant species.
- Roads 4150575 and 4150575-1 access the upper portion of a sensitive plant habitat. The upper segments of road 4150575 are proposed to be decommissioned and the lower segment will be closed. Road 4150575-1 is proposed to be decommissioned.
- Unauthorized roads in harvest unit #638 will be decommissioned. The west branch of the upper road is directly adjacent to a *Mimulus* population. The Plant Specialist will flag the site prior to road decommissioning to ensure activities do not involve the population and will coordinate with Engineers to ensure disturbance is avoided.
- Road 4100000-10.16L-1 and 4100195-0.82L-1 are proposed for decommissioning and are directly adjacent to sensitive plant habitats. The Plant Specialist will coordinate will with Engineers prior to road decommissioning to ensure activities do not involve sensitive populations and to ensure disturbances are avoided.

Sensitive Habitats

Sensitive plant habitats in the project area primarily occur in or near aspen stands or wetlands; however, not all aspen stands or wetlands contain sensitive species. Due to the difficulty of locating and identifying some Sensitive plant species (particularly moonworts such as *B. crenulatum* and *M. patulus*), botanists can use indicators to gauge the likelihood of a Sensitive plant occurring in a given habitat. No populations of *Botrychium crenulatum* exist within the project area; however, potential habitat does. It is worth mentioning the species, its distribution and its life cycle in order to give a better understanding of management recommendations of potentially suitable habitat. Until sufficient monitoring has been performed at these potentially suitable sites, they are considered sensitive habitat.

<u>Potentially Occupied Areas of *Botrychium crenulatum* (moonworts)</u>

Botrychium crenulatum is listed as Sensitive by Washington State and U.S. Forest Service Region 6. It is a Federal Species of Concern. It has a Global Ranking of G3, indicating the species is vulnerable to local extirpation. It has a State Rank of S3 and is considered vulnerable. There are 33 known populations of *B. crenulatum* across the Northern portion of the Forest, 15 of which are in the Methow Valley Ranger District.

In the project area, several *Botrychium* species prefer the same or similar habitat to *B. crenulatum*. The presence and vigor of these less rare species is another tool used to assess the habitat suitability for, and likelihood of the presence of *B. crenulatum*. Before the 2014 Carlton Complex wildfire, *B. crenulatum* and similar less rare species of *Botrychium* were known to occur adjacent to the project area, exclusively in perennially moist riparian habitats, springs, or wetlands. Canopy closure in habitats containing *Botrychium* was typically near 70%, composed of red-osier dogwood (*Cornus sericea*), mountain alder (*Alnus incana*), quaking aspen (*Populus tremuloides*), and/or black cottonwood (*Populus trichocarpa*).

The fire burned through two known *Botrychium crenulatum* sites at a high severity. The vegetative cover was composed of red-osier dogwood (*Cornus sericea*), snowberry (*Symphoricarpos albus*), quaking aspen (*Populus tremuloides*), and/or black cottonwood (*Populus trichocarpa*). Other known sites, with similar species composition, of *B. crenulatum*, and less rare species of *Botrychium* burned at a mix severity, some at moderate-high and others low-moderate. These sites are not within the project area. An assessment of habitat and population disturbance by fire will not be made until monitored in the 2015 field season.

Immediate effects of fire on moonworts were undocumented as of 2014. For all members of the genus *Botrychium*, the main body of the plant is entirely underground, receiving many of its nutrients and most of its energy from mycorrhizae (Johnson-Groh, 2002). Mycorrhizae are fungi that survive underground by parasitizing the roots of photosynthetic plants. Since moonwort gametophytes are below ground, surface or crown fires may not damage them. Gametophytes residing in litter and duff are likely vulnerable to fire, especially ground fire. Fire during the growing season likely top-kills emergent moonwort sporophytes. Since their caudices and rhizomes are below ground, fire is probably not lethal to sporophytes growing in mineral soil. Fire may not damage dormant moonwort sporophytes. Most moonwort sporophytes are usually dormant during drought, so they are likely dormant in extreme fire years (Fryer, Janet L. 2014). Due to the drier than normal conditions in the project area, most *Botrychium* were likely dormant, and most above ground structures were likely not present when the Carlton Fire burned over the project area.

It is thought that members of *Botrychium* require disturbance such as fire in order to colonize and thrive in their habitats. Fire in and of itself is not detrimental to moonworts (Johnson-Groh and Farrar 1996a). Fires that are hot and stationary are likely to cause damage by killing the plant outright or indirectly by killing the mycorrhizae (Ahlenslager and Potash 2007). Johnson-Groh and Farrar (1996a) note that leaf loss due to fire does little harm to the plant.

According to Muller, “moonwort populations decline following droughts” (as cited in Ahlenslager and Potash 2007) and it is probable that increased exposure and drying from fire result in declines. Decline due to fire desiccation is probably negligible unless compounded by drought, high amounts of herbivory, or other limiting factors (Ahlenslager and Potash 2007).

Management of this species and its habitats requires an understanding of the complexities of its lifecycle and habitat requirements. Most rare plant species can be effectively managed and monitored based on factors such as microsite condition, population count, known threats, and overall vigor. *Botrychium*, however, presents a difficult conundrum in that most of its lifecycle is carried out underground. The only portion of the plant that can be

documented, without killing the organism, is the above-ground sporophyte (analogous to a fern frond – which produces spores). Because of this, many *Botrychium* populations likely go un-documented and accurate population numbers are impossible to achieve with any degree of certainty. Rather, rare *Botrychium* species must be managed based on habitat condition and whatever information can be gleaned by monitoring the vigor and abundance of sporophytes produced.

B. crenulatum requires specific ecological conditions in order to carry out its lifecycle. In order to be considered a sensitive *Botrychium* habitat, a site must match all characteristics known to be preferred by *B. crenulatum* (such as canopy closure, associated species, and soil saturation), as well as contain similar species of the same genus. Designation of sensitive *Botrychium* habitats is necessary because of the complex lifecycle of the species as well as the problematic nature of locating and identifying individuals. Once identified, these habitats should be monitored and managed in the same manner as Sensitive plant sites whenever feasible.

General threats to *B. crenulatum* include actions that alter existing site characteristics such as canopy cover, microclimate, hydrology, or mycorrhizal associations. *B. crenulatum* is susceptible to specific environmental disturbances such as high-intensity fire, drought, soil compaction, or physical disturbance of the soil that breaks connections between root and mycorrhizae or otherwise uproots the plants (Ahlenslager and Potash 2007). In most habitats, mycorrhizae can withstand and recover from physical stress to their hyphae or roots; however, deep saturated soils, the preferred habitat of *B. crenulatum* on the District, are easily penetrated by foot or hoof and may increase both organisms' vulnerabilities to mechanical damage (Wallace, 1987). Conifer encroachment into deciduous habitats of *B. crenulatum* can diminish groundwater abundance, reducing or eventually eliminating suitable habitat for *B. crenulatum*.

All known *B. crenulatum* sites on the District have been monitored every few years, since 2004. Despite the irregular fruiting of this species, a downward trend in population vigor appears to be occurring across nearly all known *B. crenulatum* populations on the District. The two populations known to occur adjacent to the project area were located in 1996 and 1997. At that time, 12 and 67 sporophytes were counted at each site respectively. These sites were most recently revisited in 2006, 2010, 2011, and 2012; no sporophytes were located during revisits.

<u>Aspen and Biological Diversity</u>

Aspen provides important wildlife habitat, landscape diversity, and frequently provides habitat for R6 Sensitive plants, such as *Botrychium ascendens, Botrychium crenulatum, Botrychium lineare*, and *Botrychium pendunculosum*. On the Forest, it is estimated aspen makes up less than 1 percent of the landscape (Hadfield and Magelssen 2004). Throughout the west, aspen is declining due to fire exclusion, long-term ungulate browsing and conifer or shrub encroachment (Brown et al. 2006, Bartos and Campbell 1998). On the Forest, the majority of the aspen stands are experiencing a moderate degree of conifer competition; they are retreating in size and there is about 20 percent mortality within the stands. Stands examined by Hadfield and Magelssen (2004) on the Okanogan National Forest showed some degree of browse damage on young suckers, however, the degree of browse in most areas does not appear to be substantial enough to prevent eventual establishment of the clone. The greatest risk for aspen is the small size of many of the aspen stands, which puts them at higher risk of being lost, especially from conifer competition. Stands less than one

acre are at the greatest risk (Hadfield and Magelssen 2004). Further information about aspen is contained in the Forest Vegetation section (3.2) of the E.A.

With conifer encroachment within the aspen stands, soil properties begin to change. A decrease in aspen leaf litter leads to a decrease in the organic matter accumulation, a decrease in soil water holding capacity, and a decrease in soil pH. The loss of soil water holding capacity and lowered soil pH favors a shift to conifers, which are more tolerant of the changed soil chemistry and drier soil conditions (Bartos and Amacher 1998). These habitat changes result in less favorable conditions for supporting Sensitive species dependent on the microsite conditions maintained by healthy aspen groves. Because conifers use more soil moisture than aspen, there is a loss of understory species dependent on the moister microsite conditions associated with healthy aspen. The result is a loss of biologically diversity at both the landscape and species level (Bartos and Campbell 1998).

Approximately 137 acres of deciduous stands (some with a conifer component), exists within the project area. Of these stands, 0.05 acres were in high-severity burned areas, 2 acres were moderately burned and 9.95 were in the low severity burn. Outside the boundaries of the project area and within the South Summit area, field observations have noted a flush of aspen suckers. Fire within the project area and South Summit has opened forested and riparian stands, creating habitats with more biodiversity. For several years, the increase of riparian and aspen stands will provided more habitats for Sensitive species. According to Bartos and Mueggler, “Aspen tend to regenerate profusely following fire” (as cited in Hessl 2002). Brown and DeByle report that, “the first reports of aspen decline coincided with the onset of fire suppression in many regions” (as cited in Hessl 2002). In fact, some researchers have suggested that fire suppression in the 20th century may be responsible for the loss of aspen cover in some areas of the intermountain West (Loope and Gruell Hessl 1973).

The fire will improve biodiversity in many habitats by opening stands and decreasing competition for sunlight, soil nutrients and water. This release of competition can also provide suitable habitat for invasive plants that require high light levels and disturbed mineral soil. DiTomaso et al. notes that, “fire has been recommended as a way of managing invasive species, and there are examples of successes” (as cited in Spies et al., 2001). According to Klinger et al.and Driscoll, “fire often increases their abundance and cover” (as cited in Spies et al., 2001). In high-severity burned areas in the Carlton fire of 2014, a native seed mix was used in an effort to decrease the spread and establishment of invasive plants into the native plant community.

Wetlands

Based on current wetland analysis, 10.22 acres of mapped wetlands are located in the project area (Figure 3.12-1). Approximately 9 acres are classified as forested or shrub dominated communities that are temporarily or seasonally wet. These areas are typically associated with cottonwood, aspen and red osier dogwood communities in the project area. Many of these areas are in association with aspen and may be ephemerally moist sites but were not considered wetlands when field verified.

Figure 3.12-1: Area (acres) of Wetland Types in the Project Area.

Shrub/Saturated	Forest/Temporary-seasonal	Shrub/Temporary-seasonal	Open Water	Emergent/Semi-permanent	Emergent/Temporary-seasonal	Emergent Saturated	Aquatic/Semi-permanent	Emergent-Shrub/Semi-permanent	Unconsolidated/Temp-seasonal	Total Wetlands
0.31	3.05	5.95	0.46	0	0.45	0	0	0	0	10.22

3.12.3 Environmental Consequences

3.12.3.1 No Action Alternative

Sensitive and Strategic plant species as well as their habitats would remain unchanged. There would be no risk of disturbance to microsite habitats through adjacent overstory removal, road treatments or fuels treatments. In response to changes in resource conditions caused by the Carlton Complex Fire, livestock grazing systems will be modified or grazing will be delayed where needed on all allotments in the project area. It is estimated that a minimum of 3 years of rest will be needed for the pastures with the highest fire impacts. Pastures with light fire impacts may only need one year's rest (e.g., Russian Springs pasture). Generally 2-5 years of rest will be needed. Once the vegetation has fully recovered and fire damaged range structural improvements are repaired, the management of the allotments will return to that of pre-fire grazing systems under the current Allotment Management Plans. One pasture in the unburned portion of the Benson allotment will continue to be grazed in 2015 and beyond. Most likely the Loup Loup pasture of the Frazer allotment will continue to be grazed in 2015 and beyond with modifications and mitigation measures in place (See Range Specialist Report).

In unburned portions of the area, the risk of wildfires becoming more severe would increase as stand densities continue to increase over time. The increased conifer competition for limited water and soil nutrients potentially decreases the availability of these resources for maintaining Sensitive and Strategic plant populations, aspen and overall biological diversity.

Federally Listed Plant Species

No effect would be expected on the Federally listed plant species *Howellia aquatilis, Hackelia venusta*, *Sidalcea oregano var. calva,* or *Spiranthes diluvialis* within the analysis area.

Region 6 Special Status Plant Species

Mimulus patulus

Mimulus patulus would not be affected by a no-action alternative. Current population trends would continue. A no action alternative would have no effect on *Mimulus patulus* populations in the project area. Continued disturbance by cattle and vehicle traffic would occur.

Sensitive Habitats

Potentially Occupied Areas of Botrychium crenulatum (moonworts)

Potentially occupied sites would continue to recover from fire disturbance. Current population trends in *Botrychium crenulatum* populations would be expected to continue under a no-action alternative. A no action alternative would have no effect on *Botrychium crenulatum* populations in the project area.

Aspen and Biological Diversity
Without treatment, some aspen stands would continue to be encroached by conifers. Vigor of encroached populations would diminish, increasing rates of disease and progressing toward a state of apical dominance with little to no regeneration. Conifer encroachment would continue to diminish the amount of available ground-water, placing water-stress on deciduous species such as aspen, dogwood, cottonwood, and willows.

Wetlands
Forested wetlands in or near proposed treatment areas would continue to experience some diminishment of available groundwater under a no-action alternative, due to conifer encroachment. Other wetlands would not be affected by a no-action alternative.

3.12.3.2 Proposed Action
There would be little disturbance or change to Sensitive and Strategic plant species and their habitats. There would be minimal risk of disturbance to microsite habitats through adjacent overstory removal, road treatments or fuels treatments. The resting cycle for resources, as a response to the Carlton Fire of 2014 on grazing allotments, is the same as mentioned in the No Action Alternative above.

Proposed forest and fuel treatments would help mitigate the risk and ecological effects of severe wildfire on Sensitive plant habitats.

Federally Listed Plant Species
No effect would be expected on the Federally listed plant species *Howellia aquatilis, Hackelia venusta*, *Sidalcea oregano var. calva,* or *Spiranthes diluvialis* because they were not observed within the analysis area.

Region 6 Special Status Plant Species
Mimulus patulus
No effect is expected on the one known population of *Mimulus patulus* within the project area. The proposed action may impact individuals or habitat, but will not likely contribute to a trend toward Federal listing or cause a loss of viability to the population or species because the fifty foot buffer, design criteria and the coordinated effort between resource specialists during implementation will ensure impacts are avoided near the plant.

Sensitive Habitats
Potentially Occupied Areas of *Botrychium crenulatum* (moonworts)
Under the proposed action, potentially occupied areas of *Botrychium crenulatum* sites will be excluded from timber harvest and burning. These areas are perennially moist riparian habitats, springs, or wetlands. Associated riparian species in these habitats are red-osier dogwood (*Cornus sericea*), mountain alder (*Alnus incana*), quaking aspen (*Populus tremuloides*), and/or black cottonwood (*Populus trichocarpa*).

While some disturbance might be beneficial to these populations; if treated, the combined effect of conifer harvest, burning, and subsequent livestock access (a side-effect of

tree/brush removal) would likely have a harmful effect on *Botrychium* populations. The proposed action may impact individuals or habitat, but will not likely contribute to a trend toward Federal listing or cause a loss of viability to the population or species. The proposed action may impact individuals or habitat, but will not likely contribute to a trend toward Federal listing or cause a loss of viability to the population or species.

Aspen and Biological Diversity
In proposed aspen regeneration stands, removal of conifers will improve vigor by increasing the available amount of ground water, sunlight and nutrients. These improvements will encourage biological diversity and may help create a habitat that is more conducive for *Botrychium*. The availability of more water will improve conditions for aspen and R6 Sensitive species which require moist soils. The disturbance created by treatments may mimic natural disturbance regimes which aspen and many Sensitive species require.

Wetlands
Any ground disturbing activity near wetlands will occur during winter, in accordance with design criteria described in Appendix A. Conifer removal in these areas would provide the same benefits for wetlands vegetation as it would for the aspen stands mentioned above.

3.12.3.3 *Cumulative Effects of the Proposed Action*

Present, Ongoing, and Reasonably Foreseeable Future Actions
Alternative 2 will not affect any Threatened or Endangered plant species, and no effects are expected for R6 Sensitive species so will not result in any cumulative effects. Protection measure specific to Sensitive plant sites have been compiled in the design criteria for this project. The coordinated effort between resource specialists during implementation will ensure impacts are avoided near Sensitive plant sites. Therefore, the cumulative effects analysis will focus on the effects of past, present, and reasonably foreseeable actions on potential habitat for R6 Sensitive plant species. The geographic extent of the cumulative effects analysis is limited to areas that contain habitat for R6 Sensitive plant species. Predictions of future effects are limited by understanding of reasonably foreseeable actions, and only extend ten years after implementation.

Past Actions
In order to understand the contribution of past actions to the cumulative effects of the proposed action, this analysis relies on current environmental conditions as a proxy for the impacts of past action. This is because existing conditions reflect the aggregate impact of all prior human actions on natural events that have affected the environment and might contribute to cumulative effects.

Present (On-Going) Actions
Actions likely to combine with timber stand management and fuels treatments to potentially affect habitat for R6 Sensitive plant species would include cattle grazing, road maintenance, recreation, and invasive plant treatments. While most of these actions would have little or no direct effect on suitable habitat, some of them may contribute to the effects of forest and fuels treatments. Fuels treatments, timber stand management, and recreation may open up or maintain routes for cattle to access special habitats potentially containing Sensitive plant species.

Weed Treatments: Invasive species treatments in the project area will greatly reduce competition with native species and keep establishment of populations out of potential R6 Sensitive plant habitats.

Fire Suppression:
Active fire suppression continues in the project area because of its proximity to private and state lands and associated developments. Suppression activities have contributed to changing the natural fire cycle from frequent, low-intensity fires to much less frequent, higher-intensity fires. High intensity fires can affect Sensitive plant populations and habitats by damaging or killing plants and altering the natural ecosystem functions of sensitive habitats.

Livestock Grazing & Post-fire Range Repair and Protection:
Portions of the Frazer, Finley, Benson, and Texas grazing allotments are located within the project area. The Carlton Complex wildfire damaged or destroyed several range improvements and opened access to riparian areas formerly limited by dense vegetation growth or fences. Fire-related modifications and mitigation measures are not limited to but may include the following actions that will help mitigate effects of cattle on Sensitive plant populations and habitats:

- Repair or replace burned fence and water developments
- Construct electric fence to reduce drift to riparian areas and other pastures within the burned area; selective directional felling of burned trees within riparian areas to limit access by livestock and help trap sediment; reduction in number of cattle grazing; changing season of use; increase riding; establishing allowable use triggers as to when livestock must be moved; and increase compliance checks and monitoring.

Recreational Activities: Recreational activities are on-going in the area and include: camping in dispersed recreation sites, hiking (developed trailhead for the Wolf Creek trail), mountain biking (developed trailhead at Chickadee), snowmobiling, cross-country skiing, and hunting. In addition, livestock often use dispersed campsites for loafing. These activities may make some areas more accessible to cattle, and facilitate the spread and establishment of invasive species.

Road Maintenance: Road maintenance may continue to provide cattle access to Sensitive plant habitats and could also facilitate the spread and establishment of invasive plants.

Firewood Cutting and Gathering: Firewood cutting and gathering in sensitive habitats (i.e. within RHCA's) could potentially make cattle access. Conifer removal in and adjacent to aspen is beneficial for the overall health of aspen stands.

Reasonably Foreseeable Future Actions

Cattle Grazing:
Grazing will continue on the Frazer, Finley, Benson, and Texas allotments. More active permittee cattle management would continue to be implemented through annual coordination between the District Rangeland Management Specialists and the permittee. In response to changes in resource conditions caused by the Carlton Complex Fire, livestock grazing systems will be modified or grazing will be delayed where needed on all 4 effected allotments. The District will assess the need and availability to shift livestock to allotments

with unused forage capacity. Pastures burned in the fire will likely need between 2-5 years of rest. When standards are met that indicate sufficient vegetation recovery has occurred and fire damaged range structural improvements are sufficiently repaired; grazing can continue under the current Allotment Management Plans with modifications and mitigation measures in place as needed. Unburned pastures within the Benson and Frazer allotments would be grazed in 2015 and later with modifications and mitigation measures in place as needed.

Areas opened up by timber stand management and fuels treatments may provide easier access by cattle to Sensitive plant habitats, such as riparian areas.

Invasive Plant Treatments:
The Okanogan-Wenatchee National Forest Forestwide Site-Specific Invasive Species Treatment EIS expected to be completed in 2015 would authorize the treatment of currently existing invasive species across the Okanogan-Wenatchee National Forest and would allow for treatment of infestations that are not currently inventoried. Implementation would greatly benefit native species and potential habitats for R6 Sensitive plant species. Post-Carlton Fire seeding occurred in fall 2014 along several roads within the project area to help limit establishment of invasive species; monitoring will occur during 2015 to assess effectiveness of this treatment. BAER EDRR (Early detection Rapid Response) weed treatments will help decrease the chance of invasive spread and establishment into native plant communities and sensitive plant habitats.

Various weed populations continue to be treated annually by spot-spraying with herbicide, hand-pulling, or bio-control agents. The 1997, 1999, and 2000 Noxious Weed Integrated Weed Management EAs cover portions of the project area.

BAER Road Work: Some roads will be closed through BAER roadwork, which will decrease the chance of spread and establishment of weeds. Other BAER road work will maintain roads which may continue to provide cattle access to Sensitive plant habitats and could also facilitate the spread and establishment of invasive plants.

Travel Management Plan: The Forest is conducting an environmental analysis for travel management planning that will designate motorized public access routes on the Okanogan-Wenatchee National Forest. It will change the current policy of motorized access being open unless designated closed, to closed unless designated open. The closure of roads would decrease easy access for cattle and decrease the spread and establishment of invasive plants. Cattle may still access closed roads, however, reclaimed or overgrown roads would make access more difficult. Invasive populations that occur along open roads could be spread by cattle into potential sensitive plant habitats.

Summary of Cumulative Effects
Present and proposed projects and activities within the South Summit II Forest and Fuels analysis area may contribute to the spread of invasive plants into potential habitats for R6 Sensitive plant species as well as native plant communities. In some areas where the canopy was opened due to the 2014 fire and the mineral soil was disturbed, spread and establishment of invasive plants will occur. As part of BAER (Burned Area Emergency Response), some of these sites in high burned severity areas will be treated through EDRR. Treatments through EDRR include surveying for invasive populations and treating them accordingly. In addition, impacts would be mitigated by the Okanogan-Wenatchee National Forest Forestwide Site-Specific Invasive Species Treatment EIS that would authorize the

treatment of currently existing invasive species across the Okanogan-Wenatchee National Forest and would allow for treatment of infestations that are not currently inventoried through an early detection/rapid response (EDRR) strategy. Fire effects on wetlands within the project area involved a small percentage (0.01 acres) in low burn severity. Design criteria will mitigate any potential effects when activities are adjacent to wetlands. Some impacts of motorized recreation that affects Sensitive plants and habitats would be mitigated by the Travel Management Plan. Timber and fuels treatments of upland communities would increase the amount of available forage for livestock and could decrease the impacts to riparian areas and associated aspen stands. Timber and fuel treatments may provide easier access to cattle into riparian and aspen stands. Due to the 2014 fire, grazing within the project area will be deferred for 3-5 years to help aid in the recovery of the area. If aspen stands and riparian areas are used by cattle before stands are able to recover from fire disturbance, there could be a decrease of active and healthy plants within these communities.

3.12.3.4 *Consistency Statement*

The South Summit II Forest and Fuels project would not adversely affect Sensitive or Strategic species or special habitat and is consistent with Forest Service Policy outlined in FSM 2670 and Forest Plan Forestwide Standard and Guideline 6-19 regarding protection of Sensitive plants. This project would also enhance or maintain biological diversity of species and landscape patterns and is consistent with Forest Service Policy outlined in FSM 2620. The risk of high severity wildfires would be reduced and hardwoods, such as aspen, would be perpetuated as a stand component. Planned re-vegetation with native species on decommissioned roads in is consistent with Standard 13 in the Final Environment Impact Statement (FEIS) and Record of Decision for the Pacific Northwest Region Invasive Plant Program Preventing and Managing Invasive Plants (USDA 2005).

3.13 INVASIVE PLANTS

The section below summarizes the existing condition information, along with the direct, indirect and cumulative effects from the South Summit II Forest and Fuels Project, as analyzed in the South Summit II Forest and Fuels Invasive Plants Report (McFetridge 2015), available in the project record.

This analysis conforms to the requirements of *Pacific Northwest Invasive Plant Program Final Environmental Impact Statement and Record of Decision* (USDA Forest Service 2005), hereafter referred to as the Record of Decision for the Pacific Northwest Region Invasive Plant Program Preventing and Managing Invasive Plants (USDA 2005). This project is intended to comply with the *Okanogan and Wenatchee National Forests Weed Management and Prevention Strategy and Best Management Practices* (USDA Forest Service 2001), the *Guide to Noxious Weed Prevention Practices* (USDA Forest Service 2001) supporting the February 3, 1999 Executive Order on Invasive Species, and the *National Strategy and Implementation Plan for Invasive Species Management* (USDA Forest Service 2004a).

Both FS National and PNW Region Noxious Weed Strategies use the term “noxious weeds” to broadly encompass all invasive, aggressive, or harmful non-indigenous species. The more recent term used by the Forest Service is “Invasive Plants”, which are defined as nonnative plants likely to cause economic harm, environmental harm or harm to human health (Executive Order 13112, 1999). The terms “invasive plant species”, “noxious weeds” and “weeds” are used interchangeably in this document.

3.13.1 Affected Environment

Current Invasive Plant Infestations

Many of the South Summit II Forest and Fuels treatment units have populations of invasive plants, but most of the populations are directly associated with roads and historical harvest activity disturbance. Few populations are present in undisturbed off-road areas where the highly competitive native plant communities preclude the establishment of invasive plants. Current locations of all invasive plant populations within the project area are shown on the South Summit II Invasive Plant Map, located in project file.

Invasive plant populations in the project area fall into three primary categories. These categories are used to prioritize invasive species for inventory and treatment:

1. *Established Invaders* are those species whose population levels and distribution are such that seed production cannot be prevented.
2. *New Invaders* are invasive plant species that occur sporadically on the Forest and that may be controlled by preventing seed production and early treatment.
3. *Potential Invaders* are invasive plants that occur on lands adjacent to the project area but have not been documented on lands administrated by the Forest; however, the potential for infestation is imminent.

Figure 3.13-1 lists new and potential invaders found within or adjacent to the South Summit II Forest and Fuels project area. Characteristics of these species are described in Appendix H.

Figure 3.13-1 Established, New and Potential Invaders within or adjacent to the project area

Established Invaders (most common):	**New Invaders**		**Potential Invaders** (on private land)**:**
	New Invaders within project area:	**New Invaders on Private and Forest land adjacent to project area:**	
Bull thistle	Hoary alyssum	Russian Knapweed	Bohemian knotweed
Canada thistle	Whitetop	Spotted knapweed	Scotch thistle
Common mullein	St. Johnswort	Hawkweed species	Yellow starthistle
Diffuse knapweed	Oxeye daisy	Common tansy	
Bulbous bluegrass	Dalmatian toadflax		
Dandelion	Sulfur cinquefoil		
Cheatgrass	Houndstongue		

Noxious weed information and analysis for the project area has been conducted through recent Okanogan and Wenatchee National Forests Noxious Weed Environmental Assessments (1997, 1999, and 2000) and through recent inventories.

Established Invaders

Seven Established Invaders occur throughout the project area: *Cirsium vulgare* (bull thistle), *Cirsium arvense* (Canada thistle), *Verbascum thapsus* (common mullein), *Centaurea diffusa* (diffuse knapweed), *Poa bulbosa* (bulbous bluegrass), *Taraxacum officinale* (dandelion), and *Bromus tectorum (cheatgrass)*. The lower priority established invaders are fairly widespread within disturbed areas in the project area and are so extensive Forest wide that they are not generally inventoried. Diffuse knapweed is the only Established Invader that has been inventoried and analyzed in this project. Although well established locally, it is a state listed Class B noxious weed. Diffuse knapweed is not continuous; it occurs as scattered individuals and in dense patches. Common mullein and bull thistle are less invasive and persistent than New Invaders. They generally do not out-compete most desirable vegetation and they diminish over time. Dandelion is well-established on some of the roadsides and skid trails. Cheatgrass is present in patches throughout the project area and there are a few small Canada thistle sites.

New Invaders

Seven New Invader species occur within the project area. New Invader weed populations are relatively low. Sulfur cinquefoil is well established on two roads within the project area at similar densities as diffuse knapweed. Oxeye daisy is much less common than Sulfur cinquefoil but is well established in several of the project treatment units. Common tansy, St. Johnswort, and whitetop populations are much more localized and are confined to just a few roads and off road sites. One Russian Knapweed site occurs within a single harvest unit and one Scotch broom site occurs within the project area, but outside of any treatment unit. There are four New Invader species that are well established on the Methow Valley Ranger District that are not within the project area, but have imminent potential to infest the area. Dalmation toadflax and spotted knapweed have the highest potential, because there are well established populations in relatively close proximity to the project area.

Potential Invaders
Of the potential Invaders not yet on National Forest System land, Bohemian knotweed has the greatest potential to infest the project area, because there are several well established patches in the upper Methow Valley.

Gross Acres/Infested Acres
Most of the acreages used in this analysis are gross acres where areas are delineated by the outer perimeter of the weed infestation and may contain large areas that are not currently occupied by weeds. Multiple species can occur on a site; therefore some overlap in total gross acres may occur. Infested Area acres are defined differently, by the canopy cover of the plants, excluding areas not infested. (North American Weed Management Association 2002) Field data collected on the Methow Valley Ranger District has shown that the District infestation area is 6%) of the gross area and is typical for the weed populations within the project area.

Competitive Vegetation
Pinegrass is the dominant competitive vegetation throughout the project area and provides good competition in deterring the establishment of new weed invasions and the spread of existing weed populations (Williams and Lillybridge 1983).

Carlton Complex Fire (Burned Area Emergency Response) BAER
The BAER team reported that fire is a disturbance that provides a receptive avenue for the spread of noxious weeds and/or invasive species. Weed invasion is a potentially threatening process leading to competition and habitat modification. The slow natural regeneration following moderate to high burn severity consuming seed bank threatens the native or naturalized communities of grass/shrub steppe habitat and where the natural regeneration is delayed due to the loss of the canopy, seed bank, and organic soil layer due to tree mortality. The BAER team reports that known noxious and invasive weed populations that include Dalmation toadflax, diffused knapweed, and other species cover approximately 1,263 acres within the fire perimeter, and are expected to aggressively compete with native species for space and nutrients in burned areas. Native communities are at high risk of type conversion to Knapweed and/or Toadflax and other non-native weeds by the spread of weed seed into high soil burn severity areas.

Invasive Plant Populations within Proposed Units
Commercial Harvest Units
A total of 52 gross acres of invasive plants are mapped within timber harvest units, which is 2.2% of the total harvest unit acres. This includes all of the New Invaders listed in Figure 3.13-1 including the diffuse knapweed populations. Diffuse knapweed and oxeye daisy populations make up most of total acres. Many of the infestations are very small with populations less than 1 acre and most are associated with roads and old timber harvest disturbance. Figure 3.13-2 summarizes the weed presence within the proposed commercial harvest units. Figure 3.13-3 includes all the units with known invasive plant populations by species and the gross acres. Figure 3.13-4 shows invasive plant acres by season of harvest.

Figure 3.13-2 Weed Species and Gross Acres within Proposed Harvest Units

Invasive Plant Species	Species Code	Acres
Hoary alyssum	BEIN2	2.3
Whitetop	CADR	0.1
Diffuse knapweed	CEDI3	35.1
St. Johnswort	HYPE	1.9
Oxeye daisy	LEVU	11.9
Sulfur cinquefoil	PORE5	1
	Total	**52**

Figure 3.13-3 Weed Species and Gross Acres within each Harvest Unit

Unit Number	Weed Species	*Gross Acres		Unit Number	Weed Species	*Gross Acres
052	CEDI3	2.2		639	CEDI3	2.1
060	CEDI3	3.8		641	CEDI3, PORE5	0.5
061	CEDI3	1.5		644	CEDI3	0.0
070	CEDI3	1.3		650	CEDI3	2.9
079	CADR, CEDI3, LEVU	0.3		661	CEDI3	2.0
080	CEDI3	0.1		664	CEDI3, PORE5	3.0
082	PORE5	0.2		669	CEDI3	0.6
088	BEIN2, LEVU	8.0		674	PORE5	0.3
091	CEDI3	0.4		676	CEDI3	0.2
092	CEDI3	3.0		693	CEDI3	6.9
093	CEDI3	0.3		697	CEDI3, HYPE	2.7
095	BEIN2, LEVU	3.8		698	CEDI3	0.8
560	CEDI3	0.3		809	CEDI3	0.5
580	LEVU	1.9		861	CEDI3	0.5
618	CEDI3	0.8		865	CEDI3	0.3
635	CEDI3	0.6			**Total**	**52**

*Where weed populations of different species overlap, the acres are counted for each species that overlap.

Figure 3.13-4 Gross *acres Invasive Plants in Commercial Harvest Units by Season

Total Acres within Commercial Harvest Units	Season of Harvest		
	Optional	Summer	Winter
52	**0.3**	**14.3**	**37.5**

*There is some species overlap, the acres are counted for each species that overlap

Noncommercial Thin Units

A total of 10 gross acres of invasive plants occur within the noncommercial thin (NCT) units, which is 1% of the total acres. Of the 50 NCT units, 19 have invasive plant populations. Diffuse knapweed and St. Johnswort make up all the weed populations (see Figure 3.13-5).

Figure 3.13-5 Invasive Plant Occurrence in NCT Units

Diffuse knapweed	St. Johnswort	Total
8.8	1.2	10.0

*Where weed populations of different species overlap, the acres are counted for each species that overlap.

Fuels Units

A total of 220 gross acres of invasive plants occurs within the fuels units outside of harvest or non-commercial thinning units, which is 2.2% of the total fuels treatment acres. Diffuse knapweed, sulfur cinquefoil, and oxeye daisy populations make up most of the acres (see Figure 3.13-6).

Figure 3.13-6 Gross *Acres of Invasive Plants within Fuels Treatments

Invasive Plant Species	Hand Pile/ Burn Piles	Landing	Machine Pile/Burn Piles	Masticate	Underburn	Grand Total
Hoary alyssum	0.4		2.3			2.6
Whitetop	1.4		0.0			1.4
Diffuse knapweed	83.0	20.0	14.1	13.3	1.0	131.4
Houndstongue	2.2					2.2
Common St. Johnswort	1.2	1.9				3.0
Oxeye daisy	57.3		11.9			69.2
Dalmatian toadflax				2.7		2.7
Sulfur cinquefoil	6.5		1.0			7.5
Total Weed Gross Acres	**151.9**	**21.9**	**29.3**	**16.0**	**1.0**	**220**

*Where weed populations of different species overlap, the acres are counted for each species that overlap.

Invasive Plant populations within Transportation System

Of the total 328 miles of road within the project area, approximately 79 miles are infested with invasive plants. These weed populations are mostly confined to the roadsides, occurring as fairly long stretches of road with just a few scattered plants, with occasional dense patches. Figures 3.13-7, 3.13-8, and 3.13-9 show the existing invasive plant presence on the current road system and the weed presence on all roads as affected by the proposed action.

Figure 3.13-7 Miles of Road Infested with Invasive Plants Before, During, and Post- Project

Maintenance Level	Current	During	After	Post
1 - BASIC CUSTODIAL CARE (CLOSED)	11.8	10.6	10.8	16.9
2 - HIGH CLEARANCE VEHICLES	42.6	48.1	47.6	38.5
3 - SUITABLE FOR PASSENGER CARS	12.7	13.5	13.5	13.5
4 - MODERATE USER COMFORT	6.1	0.0	0.0	0.0
5 - HIGH USER COMFORT	0.5	0.5	0.5	0.5
D - DECOMMISSION	0.2	1.2	1.5	4.6
STATE HIGHWAY	4.7	4.7	4.7	4.7
Total	**78.6**	**78.6**	**78.6**	**78.6**

Figure 3.13-8 Post-Project Miles of Road Infested with Invasive Plants (by Species)

Species Code	ML 1 (CLOSE)	ML 2-5 (OPEN)	Decom.	Hiway 20	Total
BEIN2		0.02		0.04	0.06
CADR		0.85	0.05	0.07	0.96
CEDI3	14.71	47.08	3.93	4.51	70.24
CERE6		0.82			0.82
CIAR4			0.01		0.01
CYOF	0.02	0.04	0.06		0.12
HYPE		0.19	0.11		0.29
LEVU	0.25	1.59	0.21	0.05	2.11
PORE5	1.89	1.92	0.07		3.89
TAVU			0.14		0.14
Total	**16.88**	**52.5**	**4.57**	**4.67**	**78.6**

Figure 3.13-9 Miles of Decommissioned Roads Post-Project by Road Number

Road	Weed Species Code	Decommission
4100000-3.29R-1	CEDI3	0.03
4100000-3.50L-1	CEDI3	0.02
4100000-3.97R-1	CEDI3, HYPE	0.05
4100300-3.19R-1	CEDI3	0.02
4100302-0.34R-1	CADR	0.05
4100370	CEDI3	0.30
4100456	CEDI3	0.05
4100458-0.21L-1	CEDI3	0.56
4100535-0.13L-1	CEDI3	0.02
4100535-0.63L-1	CEDI3	0.02
4100535-0.93R-1	CEDI3	0.03
4100600-0.11L-1	CIAR4, CYOF	0.07
4100810-1.10L-1	CEDI3, LEVU	0.04
4150000-4.50L-1	CEDI3, PORE5	0.02
4150000-5.81R-1	CEDI3, LEVU	0.04
4150200-0.51L-1	CEDI3, LEVU, PORE5	0.13
4150265	CEDI3	0.72
4150300-0.07R-1	CEDI3	0.02
4150400-0.75L-1	CEDI3	0.02
4150575	CEDI3, HYPE	0.76
4200100-0.70R-1	LEVU	0.03
4200100-1.26R-1	LEVU	0.08
4207103	CEDI3, TAVU	1.01
Total		**4.09**

3.13.2 Environmental Consequences

3.13.2.1 No Action Alternative

Expected Future Condition without Proposed Action

Invasive plant introduction by project vehicles and equipment would not occur. The only increase in soil disturbance within the project area would be due to natural mechanisms (wind, water, wildlife, wildfire), on-going projects (cattle grazing), and public and administrative activity (recreation, fire suppression). With these mechanisms, introduction

and spread rates would be highly dependent on natural conditions. Prior to the Carlton Complex fire, high fuel levels were expected to have a higher potential for severe wildfire in the project area. In light of the Carlton Complex wildfire that burned throughout much of the project area, the risk of additional severe wildfire is now greatly reduced as well as a reduced risk of introduction and spread from future fire suppression actions. However, if the unburned stands proposed for forest treatments are left in their current condition, there is still a risk of high-severity wildfire. In this event, the disturbance level of subsequent suppression actions and vehicle/equipment traffic, with minimal mitigation, may exceed the effect of the action alternatives under this project with a net increase in the likelihood of noxious weeds introduction and spread.

No new temporary road construction, decommissioning, or road closures would occur. The current level of vehicle access would continue with the introduction and spread of weeds by road users occurring relative to the level of traffic.

3.13.2.2 Proposed Action

Direct and Indirect Effects of the Proposed Action

The risk of noxious weed introduction and spread is estimated by assuming that the Prevention Management Strategy is implemented in this project through the project mitigation measures. Based on past observations, spread of noxious weeds is generally proportional to the amount of area disturbed. For the purposes of this analysis, “disturbance” includes: 1.) exposed mineral soil, 2.) reduction of competing vegetation, and 3.) increase of light levels through the opening of the canopy. For this project, vegetation treatment of forest stands, underburning, and transportation system changes would cause at least some level of disturbance. There is also the potential for new weed introductions and spread of weed seeds from project vehicles and equipment.

For the purpose of this weed analysis, the effects of commercial harvest treatments, non-commercial thinning, and fuels treatments are discussed. For forest vegetation treatments, the effects of opening the canopy and soil disturbance caused by equipment and tree removal will be discussed. Specifically for fuels treatments, the effects of the following will be discussed: ladder fuel reduction treatments (felling understory trees); machine piling; burning of hand piles, machine piles, and large slash piles; and underburning.

Weeds exploit disturbed sites. These are areas that have reduced vegetation competition, exposed mineral soils, and high light levels. If weeds are present before disturbance, or weed seeds arrive after disturbance, weeds will commonly increase on disturbed areas. Most activities that disturb soil and increase light levels create favorable conditions for weed invasions. (USDA Forest Service 2004b).

The existing natural control for noxious weeds is the presence of native herbaceous plants species that compete with weeds. The conifer understory within the project area is a mix of bluebunch wheatgrass, domestic grass species, and pinegrass. The most effective is pinegrass, though it can also be strong competition for tree seedlings, which also can reduce weed establishment in the Douglas fir/pinegrass plant association (Williams and Lillybridge 1983). Where pinegrass is the dominant grass species, it would provide adequate competition to deter the establishment of weeds outside the disturbed areas.

Commercial Harvest, Noncommercial Thinning, Ladder Fuels Reduction, and Aspen Management Treatments

These treatments would create a more open forest canopy. More light would provide more favorable conditions for noxious weeds; however, desirable plants that have been suppressed by a dense canopy would also benefit from a more open canopy. A study on understory response after thinning in a dense pine stand in the Upper Methow Valley found that pinegrass was 47% more abundant in thinned forests compared to uncut or unburned forests three years post-treatment (McConnell and Smith 1965). A study on the effects of thinning (and burning) on understory plant composition in ponderosa pine forests in Eastern Washington found that these treatments had surprisingly small effects on the composition, cover, and diversity of native forest understory plants 3-19 years post treatment. In contrast, the study found that nonnative plants showed small but positive responses to the combination of these treatments, with values much greater relative to no treatment, however nonnative plants remained a minor component of the vegetation in all treatments, averaging only 2% of the cover. (Nelson et al, 2008) It is expected that there would be a relatively low level of expansion, except in areas where light levels and soil disturbance have increased. These areas would have the highest potential for expansion of existing weeds and would have the potential for establishment of new weed introductions from seed spread. The overall weed cover would remain relatively low.

About 79% of the acres of harvest in the South Summit area would be specifically restricted to winter logging conditions (up to 1,850 acres) in order to minimize compaction and displacement of ash cap soils. The potential for new weed establishment and spread is greatly reduced with winter logging as there is virtually no soil disturbance that would create suitable germination sites and spread of existing weeds would be very low as the seeds would be under the snow. Conventional feller-buncher/grapple skidder (whole tree logging) equipment would only be used on up to 2 acres with minimal potential for establishment and spread of invasive plants.

Landing sites pose a greater risk of establishment and spread of invasive plants because the soil disturbance is concentrated within these sites. Potential landing sites that are infested with invasive plants classified as New Invaders would be prioritized for pretreatment by the Invasive Plants Specialist. Landing sites that have not been pretreated will be constructed away from areas infested with New Invader weeds. This mitigation will reduce the potential for spread.

The proposed noncommercial thinning would have a low risk of introduction and spread. Nelson et al. (2008) looked at the abundance of nonnative plants on roads relative to adjacent forest 3 to 19 years after thinning and burning treatments. Despite the abundance and proximity of weed seed sources on adjacent road corridors, cover and richness of non-natives were low within the treated stands; even in the most highly invaded sites (Nelson et al. 2008).

The weed distribution is scattered and patchy within the general weed population and the actual infested area is much less than 10% (see Gross Acres/Infested Acres Definition in Existing Condition section). This is a very small area relative to the total acres of harvest treatment. The spread of existing populations would be greatest in areas where the harvest activities intersect roads and historical harvest disturbance, but weed spread from seed sources on roads is expected to be relatively low.

The proposed action would also increase the potential for new introduction and establishment of New Invaders adjacent to the project area and from Potential Invaders from private land or Forest land adjacent to the project area. A contract provision would be included for all contract work to require equipment operators to clean all ground-disturbing equipment prior to entering the project site. This would reduce risk of weed seed introduction to the site. The Potential Invaders listed in the Existing Condition section are a priority for early detection and rapid response to control new infestations.

The combination of design features to minimize ground disturbance during summer operations and requirements for winter logging over snow would greatly reduce soil disturbance and better maintain the cover and density of desirable competitive vegetation to prevent spread or establishment of new weed populations.

Areas of heavily disturbed soils would be seeded, including landings and main skid trails. This would reduce soil erosion potential and area for weeds to become established. Seeding would establish competitive species to help prevent the spread of existing populations, and introduction and establishment of new noxious weed species. Certified weed-free seed would be used to help prevent new populations and species of weeds from entering the project area.

It is expected that there would be little to no detrimental soil effects from proposed noncommercial thinning activities based on past monitoring of noncommercial thinning activities. Noncommercial and ladder fuel thinning operations are conducted by hand crews working across the landscape on foot, which causes little detrimental soil disturbance. No increase in weed abundance is expected from noncommercial thinning.

Reforestation

Approximately 8320 acres of trees would be hand-planted. Typically a 12 – 18 inch scalp down to mineral soil would be made for each hand planted seedling at a density of 100 seedlings per acre. For each acre planted, only .008 acres of soil disturbance would occur. The native vegetation quickly reclaims the scalped area (conversation with District Reforestation specialist). The level of soil disturbance and activities with potential for weed introduction and spread is not expected to be greater than no action. No increase in weed abundance is expected.

Fuels treatments

It is not expected that underburning would increase the abundance of existing weeds with the exception of small high-severity burned spots. Prescribed fire can stimulate native vegetation growth and colonization by increasing the availability of nutrients, space, light and water. These same attributes can also encourage establishment of invasive plants that may be better suited to occupy niches in fire areas that have burned too severely for natives to resprout or recolonize. Post-fire recovery of native species is determined by colonizers that seed into disturbed areas and survivors that resprout following fires (Brooks and Pike 2001). The responses of plant communities to fire depend on a host of factors, including the frequency and severity of fire, season and spatial extent of burns, pre-burn vegetation occurrence (including non-natives) and phenology, site conditions (particularly moisture, available nutrients, light, and disturbance history); and post-fire conditions, including weather and availability of seed from invasive plants (Zouhar, Kristin et al. 2008). In a recent study in western Montana, prescribed burning was applied to weed infested bunchgrass communities. The primary target weeds were spotted knapweed, dalmatian toadflax, St. Johnswort, and leafy spurge. The low severity early spring burns implemented

in this study did not affect weed abundances during the period of response measurement. Target weed abundance on burn plots did not differ from target weed abundance on the check plots (Zouhar, Kristin et al. 2008). Prescribed underburn fires are designed to be low intensity with short residence times. These types of burns normally do not generate enough heat to consume organic duff layers. If duff is consumed, it is normally restricted to small discontinuous spots (See section 3.8 Soils). The spots that have burned too severely for natives to resprout or recolonize will likely be the only areas where there would be an increase in abundance of established invaders and to a lesser extent, New Invader weeds from prescribed fire.

Harvest could create up to 235 slash piles at landings which would be removed through commercial biomass utilization or burning, depending upon economic feasibility. Burning the piles would create the highest level of soil disturbance. This machine piling the slash would result in soil disturbance; however, large piles are typically placed in the pre-existing disturbed soil areas within landings, minimizing the level of additional disturbance. Large slash pile burning concentrates the heat of the fire in a single location, causing greater disturbance to the soil and plants in the area of the pile. Pile locations would be seeded post-burning. A study of slash pile burning in ponderosa pine forests found that burning of larger slash piles nearly eliminated populations of viable seeds and generated scars with increased susceptibility to invasion of exotic plant species (Korb et al. 2004). Native seed was used in the study which found that at a minimum, the slash pile areas need to have seed amendments and that amending the slash pile scars with native seeds increased the cover of native forbs and grasses and reduced the cover of exotic weed species relative to untreated scars. In addition to seeding, potential landing sites that are infested with New Invader weeds would be a high priority for pretreatment under the 2000 Noxious Weed Environmental Assessment. Landings that have not been pretreated will be constructed away from areas infested with New Invader weeds. Machine piling equipment would be cleaned prior to entering the project site. The risk of new introduction and the spread of existing new invader populations is low with the implementation of these mitigation measures.

Burning of hand piles and machine piles would create suitable sites for weed introduction and spread but to a much lesser extent than the large slash piles as the pile size would be much smaller. Smaller piles burn at a lower intensity and are more quickly revegetated by existing desirable vegetation than large piles and are usually preferred (USDA Forest Service 2008). However, similar to lower intensity prescribed underburn fires, the soil within the burned interior of the relatively small piles would be less likely to lose the organic duff layer and natives would be more likely to re-sprout. Where pinegrass is associateed with the burn piles, it is expected that natural regeneration would occur. Pinegrass sprouts from rhizomes and establishes from seed following fire. It may bloom profusely for the first two or three post-fire years, allowing rapid colonization of burned areas. It can also invade burned areas from off-site sources. Pinegrass generally increases in response to fire, often exceeding pre-burn levels (Brown et al. 2000). Because pinegrass is a major component of the native understory plant community within the project area, it is expected that small pile burn scars would re-vegetate through natural regeneration, limiting weed introduction and spread.

Construction of the proposed .5 miles of hand line and 1.8 miles of dozer line would increase the risk of weed spread and introduction. To reduce the risk of spread, no dozer or hand line construction would occur within existing weed patches and existing roads and natural barriers will be utilized as firelines wherever possible to minimize soil disturbance.

Hand lines would not be seeded as the line is usually not wide enough (up to 18 inches) to limit relatively rapid revegetation from existing native propagules. The dozer lines (3-5 feet wide) would predominately scrape off the above ground biomass with much of the perennial roots remaining in the soil for regeneration. The Fuels specialist and Botanist will determine whether spot seeding is necessary to restore the line to its pre-disturbance natural vegetation. New Invader populations near proposed containment lines will be identified on Burn Plan maps so that the populations can be avoided.

Transportation System Changes

Road closures would reduce the likelihood of vehicles using roads and spreading existing weed populations or introducing weeds (e.g. knapweed and sulfur cinquefoil) along roads. Closing all roads would be impractical because access is needed within the analysis area to provide for multiple use of the National Forest and to manage other resources. In addition, unless weeds are first eradicated along roads planned for closure, poor access would limit the treatment of existing weeds.

Approximately 74 of the total 328 miles (24%) of road system are currently infested with New Invader weeds. Disturbance to these roads that has the potential to spread existing weeds would include pulling of ditches, road widening, and grading of road surfaces.

The Proposed Action would disturb closed and open roads through actions taken to open, close, or decommission. Of the roads that are proposed to be reopened, closed, or decommissioned, as identified in the transportation section, approximately 21 miles are currently infested with New Invader weeds.

Figure 3.13-10 Miles of Road Infested with Invasive Plants Affected by Proposed Road Changes (not including Highway 20)

Transportation System Action	Existing Condition	During Project	Post Project
Opening Roads	61.9	62.1	52.5
Closed System Roads	11.8	10.6	16.9
Decommissioned Roads	.2	1.2	4.6
Total			**74**

There is a risk of spread of existing populations and new introduction of weeds by reopening and decommissioning. Where weeds are established on the roadbeds, there is a risk that reopening activities would disturb dormant noxious weed seedbeds and increase weed densities.

Decommissioning has the greatest potential for new introduction of weeds and spread of existing weeds. Decommissioning includes applying various treatments, including completely eliminating the roadbed (Travel Analysis Report). Ripping or decompacting the road surface loosens soil and increases infiltration capacity, improving the germination and growth of seeded plants. While road ripping has been shown to increase the rate of re-vegetation, it may create conditions conducive to weed invasion. Monitoring and preliminary research, however, suggest that ripping may actually reduce the risk of invasions, because native vegetation is able to out-compete weeds and because ripping eliminates a primary vector (human access) for further invasions. Moreover, locations with higher precipitation recover faster and are less susceptible to weed invasion. (Switalski et.al, 2004)

A study was conducted on the Kootenai NF on the effects of road decommissioning on intact vegetation on roadbeds and the effects of seeding on vegetation establishment after decommissioning. The study found that disturbance associated with road decommissioning significantly reduced the cover of vegetation on former roadbeds 1 year after treatment. Although both native and non-native plants declined after treatment, nonnative vegetation showed the greatest magnitude of response (circa 90% decline). They had expected that the short-term disturbance associated with road removal would result in high rates of invasion by non-native plants. In contrast, non-native plants were present at less than 1% cover 1 year after decommissioning. Given the low levels of nonnatives immediately after road decommissioning, this time period may be crucial for establishing native vegetation on highly disturbed former roadbeds, before non-natives have the opportunity to colonize. (Grant et.al, 2011)

The study results suggested that seeding may not be critical for increasing vegetative cover after road decommissioning but it did find, however, that native seeded species performed much better than non-native seed mixes and native seed mixes can result in faster vegetative establishment, and potentially stabilize soils and reduce erosion more than non-native mixes,1 year after road decommissioning—the period of time when vegetation establishment is most critical for erosion hazard reduction. (Grant et.al, 2011) Native seed would be the first choice in revegetation of decommissioned roads. Seeding in the same operational season that the roads are decommissioned would best meet erosion control and invasive plant competition objectives establishing desirable vegetation before non-natives have the opportunity to colonize.

Rapidly establishing and maintaining native plant communities on decommissioned forest roads is vital because until adequate plant cover is established, ripping alone provides only temporary and marginal improvements in soil structure. Vegetative cover on roads can improve soil structure by increasing soil organic matter, reducing erosion, and restoring the habitat lost from road construction. A study on the effectiveness of revegetation of ripped Forest Service roads in the Coconino National Forest in northern Arizona found that total plant cover and plant density of native perennial grasses and forbs was significantly greater on all seeded plots compared with unseeded plots14 months after seeding. The study contends that successful native plant establishment from seed is possible, countering lingering concerns among some forest managers that the use of native species in seed mixtures may be inadequate for revegetation projects. The study concluded that if ripping is used as a management tool, ripping and seeding is far more effective in increasing plant cover and density than ripping alone. (Elseroad et.al., 2003)

Off-road equipment would be brought in from areas outside the Forest that may have noxious weed infestations. The equipment may have mud or soil with noxious weed seed or plant parts attached. The Forest Service does not have control over off-Forest sites where the equipment may have been operating. All off road equipment will be cleaned prior to entering National Forest. Equipment cleaning would reduce the risk of introduction from this equipment.

Horse Camp Construction

The proposed horse camp in the North Summit area would increase the potential for invasive plant introduction via weeds seeds carried on vehicles and trailers, and from horse manure at the camp and subsequently dropped on trails and off-road travel routes. The camp would draw more visitors than the no action alternative and it is expected that the potential for new introduction would be relative to the level of use. All horse feed brought

into the camp is required to be certified weed-free. A high level of compliance is expected which would reduce potential for weed introduction. The highest risk of introduction would be seeds that pass through the digestive system that would have originated off Forest land.

Summary of Proposed Action Effects

The proposed action would result in more soil disturbance than no action and a higher risk of spread of noxious weed seed. The proposed action would also increase the risk of introduction of new noxious weeds into the project area by vehicles and equipment and would create more soil disturbance. However, implementation of the design features and mitigation measures in conjunction with the Prevention and Management Strategy would reduce the risk of introduction and spread of noxious weeds. In addition, the proposed action would reduce fuel levels more than no action, thereby reducing the risk of uncharacteristic high severity fire and the soil disturbance associated with fire effects and fire control.

Some of the proposed forest vegetation treatment units contain populations of invasive plants, but most of the populations are directly associated with roads and historical harvest activities. Few populations occur in undisturbed off-road areas. The spread of existing populations would be greatest in areas where harvest activities intersect roads and historical harvest disturbance. The total acres of potential weed spread for all project activities is very small area relative to the total acres of forest vegetation treatment.

3.13.3 Cumulative Effects of the Proposed Action

This cumulative effects analysis considers effects of past, present and reasonably foreseeable future actions within the South Summit II Forest and Fuels project area. The geographic boundary for this cumulative effects analysis is the entire project area boundary including adjacent private land and the temporal boundary is the period of time from the past 50 years, since improved range management strategies and structures have been in place, to 15 years in the future, the interval in which the proposed action has the potential to affect invasive plant spread and establishment.

Past, Present, Ongoing, and Reasonably Foreseeable Future Actions

<u>Past</u>

Past actions that have affected invasive plant spread are discussed as part of the existing condition of this section. Road building, grazing, timber harvest, and other soil disturbance activities over the past 50 years have provided: environments for noxious weed species establishment, vectors for noxious weed dispersal, and infestations to provide propagule source material. Invasive plants have become established, primarily along roadways, generally brought in by vehicles travelling along roads,

<u>Present and On-going Actions</u>

In order to address the threat and impacts of invasive plants spread following the Carlton Complex fire, the BAER team designed seeding treatments to protect the R6 sensitive plants and supplement the remaining native seed bank in order to promote a more robust recovery of the native plant community and avoid the potential for the conversion of the selected high soil burn severity areas to noxious weeds. As one seed mix was applied over a range of seed zones, four different species were in the seed mix to help guarantee success. The seeding was done in high severity burned areas occurring adjacent to forest roads and in polygons where noxious weed pressure on the native plant community is expected to be high. The seeding included 108 acres along roads and 719 acres within

upland polygons and was accomplished in November 2014. Weed invasion is a potentially threatening process leading to competition and habitat modification. This treatment will reduce the potential of weed establishment and will help control the spread of noxious weeds and non-native invasive species into certain high soil burn severity areas of the Carlton Fire. The seeding will also create a vegetative buffer between the existing weed populations and native plant habitat.

Integrated weed management (IWM) would continue to reduce or eliminate New Invader weed infestations on roads used during vegetation management activities, off roads in areas where treatment activities may spread weeds, and in high risk areas for prescribed burning. IWM would be accomplished through implementing the design criteria and mitigation measures in this assessment and a combination of all the control methods available with emphasis on early detection of new infestations, rapid treatment response, and prompt revegetation. The combination of herbicide, manual, and cultural treatment together would provide effective control of small populations. Treatments would be conducted by the District Weed program with herbicide treatments authorized under the 2000 Okanogan National Forest Integrated Weed Management EA Decision Notices.

Mushroom gathering has the potential of spreading noxious weeds due to increased vehicle travel along roads within the Carlton Complex wildfire area. Roads have been identified as the primary vectors for weed invasion and spread.

The New Invader weed sites within the project area would be prioritized for treatment with herbicide pre-project, as authorized by the existing 2000 Weed EA. Consequently, weed densities would be greatly reduced within some of the units before project implementation. The successful treatment would prevent all seed production but the risk of spread of existing seeds within the soil seed bank would remain. The proposed horse camp would be a high priority to survey for new invasive plant introductions and any new establishments would be detected early with a rapid treatment response.

Potential Invaders from outside the project area could spread through vehicle traffic to newly-disturbed soil within treatment units. These weeds are listed in the Existing Condition section of this report. The sites that are on National Forest are high-priority for chemical treatment authorized by separate decisions, which would greatly reduce the potential for spread into newly-disturbed areas. The sites that are on private land may not be controlled and will continue to add to the potential for introduction and spread in the project area. Not all off-road areas have been surveyed for noxious weeds so there is a potential for spread from undiscovered populations; however, the highest risk of spread occurs along the travel routes.

Active fire suppression will continue in the project area because of its proximity to private lands and associated developments. Wildfire activity in the next three to five years is expected to be low in the project area due to the relatively large area burned in the Carlton Complex fire. This combined with all the vegetation treatments would reduce the potential for Fire suppression activities to add to the soil disturbance and transport of New Invader weed propagules into the project area.

All types of recreation will continue to be vectors for disturbance, new weed introduction and weed spread within the project area, including, but not limited to, camping in campgrounds, dispersed camping, pleasure driving, firewood gathering, OHV riding, mountain biking, and snowmobiling.

Cattle grazing could also contribute to the spread of invasive plant species. Domestic and wild grazing animals contribute to invasive plant establishment and spread through selective eating, redistribution of invasive plant seeds in manure, skin, hair, and hooves, and soil disturbance, which creates conditions favorable for seed germination. Cumulative effects within the project area from cattle grazing will be reduced while the pastures burned in the Carlton Complex fire are being rested to provide for vegetation soil recovery. Limited livestock grazing will continue in the project area with modifications and mitigations in place to protect vegetation recovery. Healthy and vigorous vegetation capable of resisting weed invasion is possible through proper grazing methods (Sheley, et al., 1996). This will facilitate competition from native species and subsequent native vegetation recovery. Livestock may transport weed seeds across the landscape with dispersal into disturbed areas. It is likely that some of the New Invader populations were introduced by cattle within the project area; however, despite the relatively large number of cattle that are brought in from areas outside the project area, extensive weed surveys in recent years have not detected any of the weed species listed as Potential Invaders. The likelihood for introduction of these potential invader weeds is expected to be low.

Road maintenance activities including burned area emergency road repair activities have the potential to spread weeds. Activities will include improvement of drainage structures, road surface shaping and grading, and drain ditch cleaning. Road blading and ditch cleaning in areas with high concentrations of invasive plants would be done in consultation with District invasive plant specialists and would incorporate invasive plant prevention practices described in the Prevention and Management Strategy leading to the effect of reduced potential for weed spread.

Reasonably Foreseeable Future Actions

The Okanogan-Wenatchee National Forest Forest-wide Site-Specific Invasive Species Treatment EIS, expected to be completed in 2015, would authorize the treatment of currently existing invasive species across the Okanogan-Wenatchee National Forest and would allow for treatment of infestations that are not currently inventoried, through an Early Detection/Rapid Response (EDRR) strategy. The proposed invasive species treatments may begin within the next year and continue for 15 years. Invasive plants would be treated using one or a combination of manual, mechanical, cultural, biological, and chemical methods. Priorities for treatment and selection of treatment methods would be consistent with those described in the R6 2005 FEIS (USDA Forest Service 2005). This would increase the number of weed treatment options available and increase the area of infested lands that may be treated within the South Summit Project area. Using the EDRR strategy on newly discovered infestations would increase treatment effectiveness and reduce the potential for spread of new populations.

The Carlton Complex BAER plan provides for the treatment of invasive plants using an Early Detection & Rapid Response (EDRR) strategy. Known noxious and invasive weed populations that include Dalmation toadflax, diffused knapweed, and other species cover approximately 1,263 acres within the fire perimeter, and are expected to aggressively compete with native species for space and nutrients in burned areas. Monitoring and treatment of noxious weed infestations will be conducted on FS lands associated with suppression activities and BAER treatments. This treatment may be coordinated with private land treatments under the local County Weed Management Agreement. Invasive plant assessments will be made in areas that have a high potential for weed/invasive species establishment. Critical areas include roads, dozer lines, drop point, fire camps, and

ephemeral drainages and burned areas where suppression vehicles and equipment traveled through known noxious weed/non-native invasive plant species populations. Disturbed areas within and along the fire perimeter, such as dozer lines, hand lines, staging areas, safety zones and drop points will also be prioritized for monitoring. Treating noxious and invasive weeds prevents the serious threat to native plant diversity, structure, and composition. The BAER Team considered this treatment to be the minimum necessary to achieve a reduction in risk of invasive plant introduction into the native and naturalized vegetative communities.

Summary of Cumulative Effects

The incremental effect of the proposed action when combined with the effects of past, present (on-going) actions, and reasonably foreseeable future actions would continue to provide vectors for weed spread and some level of disturbance would continue to provide sites suitable for weed establishment. The expected outcome would be a short-term increase in the abundance of Established Invaders and slight increases in the abundance of New Invaders. In the long term, weed populations would be reduced with the following actions:

- continued integrated weed management
- the successful establishment of grasses from the BEAR seeding treatments
- less fire suppression and modified cattle grazing to provide for post fire vegetation recovery
- more weed treatment options available under the Forest-wide Invasive plant EIS
- completion of BEAR weed treatments
- implementation of project design features

The combination of these actions would lessen the risk of invasive plant introduction and spread into native plant communities in the project area.

3.13.3.4 *Consistency Statement*

The proposed action is consistent with the Okanogan National Forest Land and Resource Management Plan and consistent with the requirements of the R6 2005 FEIS. Compliance with the pertinent Prevention Standards listed in the R6 2005 FEIS, includes the prevention measures listed as Design Details, and the prevention standards listed in the Prevention and Management Strategy. Management objectives would be met to protect ecosystems from the impacts of invasive plants and to minimize the creation of conditions that favor invasive plant introduction, establishment and spread.

3.14 RECREATION

3.14.1 Issues for Analysis

The section below summarizes the existing condition information, along with the direct, indirect, and cumulative effects from the South Summit II Forest and Fuels Project as analyzed in the South Summit II Forest and Fuels Project Recreation and Special Uses report (Zbyszewski 2015), available in the project record. The following issues were chosen for analysis because they represent cause-effect relationships between the implementation of the alternatives and recreation/special-use-related resources, and serve to highlight impacts and trade-offs for the decision maker. For each issue analyzed indicators have been selected that provide understandable, quantifiable and responsive measures of the degree of impact that would result from the implementation of the alternatives.

Loup Loup Ski Bowl (Purpose and Need #4)

The Loup Loup Ski Bowl is located at the end of NFS Road 4200100. The forested stands between the ski runs have an increased surface and understory fuels that increase the risk of surface fires climbing into the canopy. These conditions increase the risk of high-intensity fire, and make rescue of injured skiers difficult. The proposed action would thin trees up to 8 inches in diameter and treat the resulting slash by hand-piling, then burning the piles, thereby reducing the risk of fire climbing into the tree canopy and opening the stands to make skier rescue easier and safer.

Indicator: The indicator is the post treatment stand condition in terms of fuel loading and openness of the stands.

Analysis Method: There will be a qualitative discussion of the pre- and post-stand conditions in terms of safety for skiers and ski bowl employees, and wildfire risk.

Analysis Area: The Loup Loup Ski area boundary.

Nordic Skiing

The groomed Nordic ski routes in the analysis area are very popular. The proposed action includes plowing the 4100000 NFS road starting at the 4100000/4100500 intersection south, in addition to the entire 4100600 network to allow winter logging of units with highly compactable soil. This would made the lower loop of Trail 9, all of Trail 10, K9 between Trail 9 and Trail 10, Lower K9, and the Lower Powerline closed to skiing for up to three years (the life of the sale). This would reduce the amount of trails open for skiing by approximately 15 kilometers. The Nordic ski trails adjacent to the Loup Loup Ski Bowl would not be plowed.

Indicator: The indicator is the change in the kilometers of groomed Nordic ski trails while the timber sale is operating.

Analysis Method: The kilometers of groomed trails that would be plowed will be determined, and this will be displayed as a percent reduction in trail kilometers.

Analysis Area: The area of Nordic ski trails adjacent to the Loup Loup Ski Bowl, and south of State Highway 20.

Snowmobiling
NFS roads 4200000 and 4100000 are groomed snowmobile routes. The winter logging included in the proposed action would require NFS road 4100000 from the intersection with NFS road 4100500, south to the NFS boundary near Gambler's Mill, to be plowed for up to three winters. Plowing on other roads in the portion of the analysis area south of State Highway 20 would essentially preclude all snowmobiling opportunities in this area for up to three winters. The groomed route following the 4200000 to the town of Conconully would still be open and groomed during the winter.

Indicator: The indicators are the change in snowmobile opportunities during the timber sale when road are plowed for winter logging.

Analysis Method: There will be a qualitative discussion about the temporary loss of the snowmobile routes.

Analysis Area: The analysis area is the North and South Summit Areas, extending east to the town of Conconully.

Loup Loup and JR Campgrounds (Purpose and Need #4)
The vegetation in the Loup Loup and JR Campgrounds is large Douglas-fir and western hemlock, with patches of thick understory Douglas-fir. The understory is competing with the larger trees, and the mortality rate in the large trees is accelerating. The proposed action would thin the understory to reduce competition with the large trees, and remove the large trees that have become hazardous.

Indicator: The indicator would be the rate of hazard tree development and the perpetuation of the big tree character.

Analysis Method: There will be a qualitative discussion about the condition of the campground forest stands after treatment, including perpetuating the big tree character and slowing the development of hazard trees.

Analysis Area: Loup Loup and JR Campground boundaries.

Horse Camp (Purpose and Need #7)
There is a need for a campground specifically designed for people camping with horses in the analysis area. Camping with horses is a very popular activity, but there are few developed horse camps in the state. There is an existing horse camp on the Methow Valley Ranger District, located in the Twisp River drainage. It is very popular, filled to capacity most nights during the summer. Another horse camp in the North Summit area would provide additional camping sites, and draw people to the area. Based on the popularity of horse camps around the state, this is expected to be popular and increase the recreation tourism in the county. The North Summit area is an ideal place for a new horse camp. It is located between the Okanogan and Methow Valleys, so would draw riders from the main population areas in the county.

Indicator: The indicator would be whether or not the horse camp is constructed.

Analysis Method: There will be a qualitative discussion of the benefits of the horse camp.

Analysis Area: The analysis area will be the Loup Loup Summit vicinity.

Dispersed Camping
People access dispersed camping sites from open roads. Closing or decommission roads could reduce opportunities for dispersed camping by blocking access to established sites.

Indicator: The indicator is the percentage reduction in open road miles in the analysis area.

Analysis Methods: There will be a qualitative discussion about the effects of the proposed action on access to existing dispersed sites, and the likelihood that new sites would be developed.

Analysis Area: The analysis will be bounded by the road system within the South Summit Analysis Area.

Hunting
Hunting is a popular activity, and most hunters drive the roads looking for game, and to retrieve game. Closing or decommissioning roads would reduce these opportunities.

Indicator: The indicator is the percentage reduction in open road miles.

Analysis Method: There will be a qualitative discussion about the effects of the proposed action on hunting opportunities, based on open roads, harvest activities, and access to dispersed campsites.

Analysis Area: The analysis area is the South Summit Analysis Area.

All-Terrain Vehicle (ATV)/Off Highway Vehicle (OHV) Use
ATV/OHVs are not allowed on roads open to highway legal vehicles. The Okanogan National Forest Travel Plan Map specifies that unlicensed ATVs/OHVs cannot be driven on open roads, but can be driven on any road closed with a berm. Road closure standards have changed since the map was issued in 1989, but typically roads closed with berms are either maintenance Level 1 or decommissioned. Closing and decommissioning roads will increase unlicensed ATV/OHV opportunities.

Indicator: The indicator is the percentage of change and total miles of maintenance level 1 or decommissioned road that provide for ATV/OHV riding opportunities.

Analysis Method: Current number of miles of road in maintenance level 2-5, and maintenance level 1 or decommissioned will be compared to the miles in each category with each alternative. The change in ATV/OHV opportunities will be expressed as a percentage increase or decrease compared to the current condition.

Analysis Area: The analysis area is the South Summit Analysis Area.

Firewood Gathering
Firewood gathering is currently authorized within 200 feet in either side of open roads outside riparian areas. Closing or decommissioning roads will decrease the area available for firewood gathering.

Indicator: Percent reduction in the number of acres available for firewood gathering.

Analysis Method: The number of acres currently available for firewood gathering will be generated using a GIS analysis buffering each open road by 200 feet, and buffering the streams by 300 feet. The area open to firewood gathering was calculated by subtracting the area within the stream buffers from the area within the road buffers. The same method will be used to determine the number of acres that will be available with each alternative. The results will be displayed by the percentage decrease compared to current conditions.

Analysis Area: The analysis area is the South Summit Analysis Area.

State Highway 20 (Purpose and Need #4)

The Washington State Department of Transportation does not have an easement for the portion of Highway 20 that runs through the analysis area. There are many hazard trees standing along the highway, particularly between its intersections with the Pole Pick Road (4100600) and the Loup Loup Summit. Trees killed in the Carlton Complex Fire along other sections of the highway are also posing a hazard to motorists. The Proposed Action would fall and remove these hazard trees.

Indicator: The indicator will be the ability to remove hazard trees along the highway.

Analysis Method: There will be a qualitative discussion about the frequency of hazard trees with implementation of the proposed action.

Analysis Area: The analysis area is approximately 300 feet on either side of the length of Highway 20 on National Forest System Land.

Power Line Corridor

The 115,000-volt, 3-wire electrical power transmission line bringing electricity to the Methow Valley passes through the analysis area. The Okanogan Country Public Utilities District maintains and operates the 4.7 miles of the line on National Forest System Land under a special use permit, originally issued in 1948. The existing road system is used by the PUD in the operation and maintenance of the power line. The PUD also maintains a 100-foot wide corridor (for a total of approximately 57 acres) for the lines. The PUD keeps the corridor free of trees, and falls hazard trees that develop along the edges of the corridor, in accordance with their special use permit. About half of the corridor within the project area was burned in the Carlton Complex Fire, which created numerous hazard trees along the burned portion of the corridor. Where the powerline corridor did not burn, adjacent stands in some areas have high stand densities and surface fuels that would contribute to increased fire intensity, with the potential to damage powerline developments.

The Proposed Action would thin some stands adjacent to the powerline corridor.

Indicator: The indicator will be the acres of treatments adjacent to the powerline corridor.

Analysis Method: The number of miles of road accessing the corridor currently and with implementation of the proposed action will be compared, and the effects of the road closures and decommissioning on the operation and management of the power line.

Analysis Area: The analysis area will be the power line corridor, approximately 200 feet on either side of the corridor, and all roads (system and non-system) accessing the corridor.

3.14.2 Affected Environment

Current Conditions

Loup Loup Ski Bowl

The Loup Loup Ski Bowl began operating in its current location in the 1960s. The total area includes approximately 300 acres, and offers 1,240 vertical feet of alpine skiing terrain. It has a rope tow, platter tow, quad chair lift, 20 runs, a tubing area, parking area, lodge, ticket building/office, ski shop, and maintenance shop. There are approximately 15,000 recreation visitor days (one person for one day or part of a day) at the Ski Bowl each year. Skiers enjoy the variety of runs available, and the "small town", unpretentious atmosphere of Bowl. It is located at the end of Forest Road 4200100. The view from the area is very picturesque, with forested hillsides surrounding the runs, and a breathtaking view of the Okanogan Valley from the top of the chair lift.

The forested stands between the ski runs within the ski area boundary have not been actively managed with the exception of maintaining the ski runs and removing hazard trees since the early 1960s. Stands near the top of Little Buck Mountain have not been managed. Concurrently, wildfire has been aggressively suppressed within the area which includes the ski area for nearly a century. As a result, the stands have become very dense, with the number of trees per acre being much higher than what existed historically. Further, the spatial arrangement of the stems and the vertical stratification of the forest canopy have been altered as a result of fire suppression, increasing the risk of surface fires climbing into the overstory canopy.

In the past, the stands were largely open and park-like with widely scattered large diameter trees and scattered clumps of varying age and size regeneration and juvenile trees across the landscape. The stands are now multi-canopied, compromised of more shade tolerant species, with the crowns extending from the ground level to the top of the canopy of the tallest trees that occupy all, or nearly all, of the available growing sites. As stand density has increased over the decades, the health and vigor of individual trees (and whole stands) has been reduced due to the limited availability of moisture, nutrients and sunlight present for utilization by individual trees. The trees have become more susceptible to insect and disease pathogens. Currently, dwarf mistletoe is present in all of the stands in both western larch and Douglas-fir trees of all size and age classes at very high levels of infection. Mountain pine beetle has virtually eliminated the larger diameter lodge pole pine. Many trees have already died, some of which have already fallen to the forest floor, presenting heavy fuel loads.

The chairlift route is within the falling distance of many of the resulting snags, dead tops and diseased trees. If a snag or dead top were to fall on the chair lift's cable system, ski hill operations would be disrupted. If this occurred when the chair is in use, the result could be catastrophic. Snag and hazard tree removal is authorized on a case-by-case basis through the special use permit administration, in accordance with the terms and conditions of the special use permit.

The dense stand conditions, thick understory and heavy fuels between the runs are not conducive to a safe environment for downhill skiing. Currently, there is high potential for skiers and boarders to enter these thick, unmanaged stands, and get trapped or injured with no safe path back to the open slopes. Ski patrol members are not able to patrol these areas safely and extracting injured or trapped skiers or boarders is very difficult.

The forests surrounding the ski area have thick understories, and high ground fuel loadings, putting them at increased risk of wildfire.

Nordic Skiing

The Loup Loup Ski Bowl also includes 23 kilometers of groomed Nordic ski trails (called the North Summit Ski Trails). An additional 46 kilometers of groomed routes are located south of Highway 20, anchored by the South Summit SnoPark. These trail systems are popular, especially with people living in the Methow and Okanogan valleys. There are approximately 100 recreation days on the North Summit trails each year, and approximately 1,800 recreation days on the South Summit system. Dogs are allowed on the trails west of Trail 9 (road 4100000) in the South Summit system. The skiers like these trails because they are less crowded than the ones operated by Methow Trails Association (MTA) in the Methow Valley and less expensive.

The trails follow a network of open and closed roads, with short segments of groomed trails connecting some roads. The trails are typically open from early December until March, depending on the amount of snow. For a list of the trails in the North and South Summit trail systems, the underlying road number, and whether the road is currently open to and drivable by wheeled vehicles review the Recreation Specialist Report.

The trees adjacent to the ski trails on the southerly and westerly side are shading the trails, reducing the rate of snowmelt, and extending the ski season. Young trees directly adjacent to the road create shade from branches that extend close to the ground. Larger tree crowns located on the south side of a Nordic ski trail are blocking mid-day sun to create shade on the trail. Winter solar azimuth and altitude tables were used to assess trees that are providing shade of ski trails during mid-day periods when solar intensity is greatest. For the Methow Valley Ranger District, trees located on the southeast to southwest side of ski trails (a range of 126 to 230 degrees azimuth) with live crowns (branches with live needles) located on a vertical line of sight between 45 to 90 percent from the ski trail are the most effective at shading the trails. Trees located adjacent to the ski trails on the northerly and easterly sides are exposed to solar radiation primarily on the southerly and westerly sides of the tree. This causes tree crowns and boles to heat up and melt snow more rapidly than if the trees were not present at that location.

Snowmobiling

There is a total of 52 miles of groomed snowmobile routes in the analysis area. Forest Roads 4200000 (North Summit) and 4100000 (South Summit) are groomed snowmobile routes that pass through the analysis area. The North and South Summit SnoParks serve as the beginning points for these routes, and have approximately 2,400 recreation days annually (one snowmobiler for one day, or part of a day). In addition, roads 4100300, 4150000, 4150100, and 4150200 are designated open snowmobile routes through areas closed to motorized traffic (including snowmobiles) from October 1st to March 31st each year. The North Summit route to Conconully is the most popular in the analysis area.

The North Summit route travels for a total of approximately 16 miles from the North Summit SnoPark to the town of Conconully (approximately 6 miles are within the analysis area). Road 4235000 is also a groomed route that branches off the 4200000 north of the analysis area. The South Summit route (road 4100000) is approximately 17 miles long, from the South Summit SnoPark to the forest boundary at the southern end of the analysis area. Approximately three-quarters of the analysis area south of Highway 20 is closed to

snowmobiles from October 1st to March 31st each year. The designated open routes through these closed areas (4100300, 4150000, 4150100, and 4150200) total 28.5 miles of open, groomed snowmobile routes. Off-trail, or cross-country snowmobiling is prohibited in these seasonally closed areas.

Approximately two-thirds of the use occurs on weekend days, and one-third is on week days. A typical season will include 32 weekend days and 64 week days. Of the 2,400 snowmobiles over the course of a winter, there are approximately 50 snowmobilers in the analysis area each weekend day, and 12 each week day.

Loup Loup and JR Campgrounds

The Loup Loup Campground was constructed in the 1960s. The 20-acre campground has 25 sites, and is typically approximately 50% full on weekends, and 25% full on week days between Memorial Day and Labor Day. It is located along Road 4200000, approximately one mile from the intersection of Highway 20 and Road 420000. The campground is often filled nearly to capacity during general firearm hunting season in October. The first campers usually arrive in early- to mid-May, and the end of general firearm season marks the end of camping each fall. The campground has a pressurized potable water system, and each site has a parking spur, picnic table, and fire grate. There are two CXT sealed vault concrete outhouses in the campground.

The Loup Loup campground is noted for its big-tree character. Generations of campers have stayed in this campground, and people new to the area are drawn by the picturesque setting of small, quiet, un-crowded campground among large, stately ponderosa pine, Douglas-fir, and western larch. The campground is also popular because if its access to a road network that gives miles of opportunities to drive for pleasure and ride bicycles, open stands that provide excellent hunting opportunities, and cooler temperatures compared to the Methow Valley floor.
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The JR Campground is located directly on Highway 20. This 5-acre campground has 6 sites, each with a picnic table, parking spur, and fire grate. There is a double, wooden outhouse in the middle of the campground. The campground receives very little use because of its proximity to the highway. Conversely, the highway proximity makes it a convenient overnight stop for people traveling through the area.

The forest in JR is similar to the Loup Loup Campground, with large Douglas-fir and western larch dominating the site, with a thick understory. The big trees in each of the campgrounds are increasingly being crowded by second-growth Douglas-fir. The crowded understory is maintaining a high level of insect and disease that is accelerating the development of hazard trees in the medium and large trees in the campground. Some of the large trees have been removed over the past few decades as they became hazardous. Structural defects and disease in the medium-sized trees have led to some of them being removed over time. This has left a stand with an ever decreasing number of large trees, and second-growth trees that would potentially replace the large trees in the future.

Past and current activities that affect the campgrounds include building and campsite maintenance, and hazard tree removal. Each year, the trees within the campgrounds are evaluated for signs of damage or weakness. Those determined to be likely to fall are cut down. The effect of the hazard tree removal is a much safer camping area, an absence of snags within the campgrounds, and a minor reduction in the number of standing trees. This reduction has not been enough to reduce the stress on the remaining trees sufficiently to

improve the health of the forest. Approximately 10 to 20 hazard trees are removed from the Loup Loup Campground each year, and approximately 5 from the JR Campground each year.

Forest Plan Standard and Guideline MA17-19D requires the control of insect and disease infestations to provide a safe environment for recreation users, to protect facilities, and to prevent the spread of introduced pests to the surrounding area. The current approach of only removing trees once they become hazardous is not meeting the direction since it is not controlling the insect and disease infestations. In addition, the forests surrounding the campgrounds have thick understories, and high ground fuel loadings, putting them at increased risk of wildfire.

Horse Camp

People are currently camping with horses along the edge of the North Summit SnoPark in a dispersed fashion. There are no improvements, such as a road through the trees, actual campsites, picnic tables, or fire grates. People park in the SnoPark, and set up camp in the trees next to their vehicles, and often string highlines between trees to secure their stock. The site is dusty, with no shady stops to park vehicles, so it can be uncomfortable on hot summer days. These conditions are limiting the number of people using the area and slowly increasing the footprint of the SnoPark as people crowd as close as possible to the trees.

Dispersed Camping

Some of the people who camp in the project area prefer to not stay in one of the developed campgrounds, but instead pull off one of the roads and set up camp among the trees. This dispersed camping is especially popular during general firearm season in October, and with large groups looking for a place where everyone can camp together throughout the hunting season. Most of these campers stay in some sort of recreational vehicle, although some stay in tents. Most people have their “favorite spots”, and camp there year after year. If their spot is taken when they arrive, they generally move to another spot, or make a new one. The campsites are small – generally less than one-half acre. During general firearm season, in October, nearly all of the existing sites are used, with occasional new ones becoming established. For the remainder of the summer, there is virtually no use of these sites

The structure of the forest, topography, and proximity to desired locations (such as water features) are the main factors influencing the size and location of the dispersed campsites. Surrounding trees and vegetation limit the size of existing sites, and new sites are generally only established on relatively flat ground, in open stands where people can drive a vehicle to a clearing in the forest.

There are currently no limitations on people driving off an existing road to an established or new campsite as long as resource damage is not occurring.

Hunting

Deer hunting during general firearm season in October brings the highest number of people to the project area at one time during the snow-free months. Most hunters come to the area three to five days before the season begins, and set up camp at a dispersed campsite, or in one of the campgrounds. Many stay throughout the season (one to two weeks long), while some just stay for the weekends. Some leave after they get a deer, and others come to the project area to hunt, and stay elsewhere. The hunters drive the roads, walk cross-country, or use ATVs to canvas the area. Portions of the analysis area are closed to motorized

vehicles beginning October 1st, providing a substantial amount of non-motorized hunting area. Many of the people have been coming to the project area for decades, and hunting and camping here has become a family tradition.

All-Terrain Vehicle (ATV) and Off-Highway Vehicle (OHV) Use

ATV/OHV use in the analysis area has been limited, although use does occur. ATVs/OHVs cannot be driven on roads open to licensed vehicles, but are allowed on roads blocked with a berm. ATVs/OHVs can travel cross country in the analysis area through much of the snow-free months, with the exception of areas that are closed in the fall and winter to protect deer winter range and lynx habitat, provide non-motorized hunting areas, and to allow for cross country skiing. These areas are shown on the Okanogan National Forest Travel Plan map, 2005. Refer to that map for details.

ATVs/OHVs can currently be driven on 167.3 miles of closed, decommissioned, or unauthorized roads (maintenance Level 1, decommissioned, or unauthorized), mostly center out of dispersed campsites during general firearm season. There are also user-created trails running through the analysis area where riders travel cross-country to connect with closed and open roads.

Firewood Gathering

Another popular activity in the project area is firewood gathering. The area is close to several towns, has an abundance of roads, and a high tree mortality rate that provides consistent availability and accessibility to firewood. Many residents of the Methow and Okanogan valleys burn wood for heat during the winter, and the demand for firewood is increasing with the increasing valley population.

Firewood can be collected within 200 feet on either side of any open road, except within 300 feet of fish-bearing streams, or 150 feet of non-fish-bearing streams. GIS analysis determined that this equates to approximately 5,123 acres open to firewood cutting.

Highway 20 Corridor

State Highway 20 passes through the analysis area. This two-lane highway is the main route connecting the Methow and Okanogan Valleys. The highway crosses the 4,020-foot Loup Loup Summit approximately half way between the Methow and Okanogan valleys. The route was designated as a state highway in the 1940s, originally graded in 1946, and paved in 1950.

Approximately 584,000 vehicles travel across this section of Highway 20 each year, with the heaviest traffic volumes during the summer months (WSDOT, 2012). Using a conversion factor of 2.5 people per car, this translates to approximately 1,460,000 people per year traveling through the analysis area on Highway 20.

Washington State Department of Transportation does not have an easement across National Forest System Land for the section of Highway 20 in the analysis area. The Forest Service and the DOT have a Memorandum of Understanding to manage the highway corridor, authorizing needed repairs, maintenance, and removal of hazard trees.

Past timber sales and prescribed burns have improved the health of the forested stands along some sections of the highway, reducing the rate of hazard tree development, and the risk of wildfires that could potentially require closing the highway for public safety. Untreated stands along the highway corridor are experiencing accelerated mortality rates in the trees

within 200 feet of either side of the highway. The 2014 Carlton Complex burned along a 2-mile stretch of the highway within the project area, causing widespread mortality adjacent to both sides of the highway. These fire-killed trees may be deemed hazards to travelers on the highway and require removal. Along the portion of the highway unaffected by the fire, stand density and fuel loading puts them at an increased risk of wildfire, increasing the possibility that the highway would need to be temporarily closed in the event of a wildfire.

Power Line Corridor

The 115,000-volt, 3-wire electrical power transmission line bringing electricity to the Methow Valley passes through the analysis area. The Okanogan Country Public Utilities District maintains and operates the 4.7 miles of the line on National Forest System Land under a special use permit, originally issued in 1948. The PUD also maintains a 100-foot wide corridor (for a total of approximately 57 acres) for the lines. The PUD keeps the corridor free of trees, and falls hazard trees that develop along the edges of the corridor.

As with the highway corridor described above, past timber sales and prescribed burns have improved the health of the forested stands along the corridor, reducing the development of hazard trees, while other, untreated sections are experiencing accelerated mortality rates in the trees along the edges of the cleared right-of-way.

A series of roads run through or adjacent to the cleared corridor. The PUD uses these roads to access the power line for repair and maintenance. Road 4108250 crosses Frazer Creek, and the traffic on that road is impacting the fish habitat in the creek.

3.14.3 Environmental Consequences

The Environmental Consequences are the impacts to the human environment that would result from implementing the proposed action or an alternative.

3.14.3.1 No Action Alternative

The no-action alternative would maintain the current recreation opportunities, since no roads would be closed or decommissioned.

Loup Loup Ski Bowl

There would be no change in the number or condition of the runs at the Loup Loup Ski Bowl with the implementation of the No Action Alternative, and gradual change in the structure of the stands between the runs would not directly affect any skier's short-term experience. The number of skiers would fluctuate from year to year, but not be noticeably influenced by the effects of the No Action Alternative. The experience skiers have come to enjoy at the Loup Loup – a small area with a variety of runs, and the friendly "small town" atmosphere – would not change.

The condition of the stands between the runs would continue to deteriorate in the long-term. Trees that become hazardous along the edges of the runs, or around the buildings would be removed under the terms and conditions of the special use permit, but the interior stands would still have a high fuel loading, and downed trees would make rescue or extraction of skiers difficult and dangerous for ski bowl employees.

The ski area would be increasing at risk of wildfire from the surrounding forests as they become more crowded, with increasing fuel loading over time.

Nordic Skiing

The current Nordic skiing trails in the Loup Loup Ski Bowl and south of Highway 20 would continue to be groomed each year. There would be no interruption in the current Nordic skiing opportunities. The conifers on the southerly and westerly side of trails would continue to shade the trails and slow snow melt. Snow around the base of trees adjacent to the trails on the northerly and easterly sides would continue to melt more rapidly in the late winter, potentially shortening the ski season in low snow years.

Snowmobiling

There would be no effect on snowmobilers with implementation of the No Action Alternative. No roads would be plowed or closed, so there would be no temporary reduction in the miles of groomed snowmobile routes. There would also be no change in the road network, so current snowmobiling opportunities on ungroomed roads would continue.

Most of the snowmobile traffic would continue to be on Road 4200000 to Conconully. The groomed snowmobile route on Road 4100000 would be available, as would the designated open routes on roads 4100300, 4150000, 4150100, and 4150200.

There would still be approximately 2,400 snowmobile recreation days in the analysis each winter, with approximately 50 of those on each weekend and holiday, and 12 on the weekdays.

Loup Loup and JR Campgrounds

There would be no short-term effects to the people camping in the campgrounds with the No Action Alternative, since there would be no vegetation management. The campgrounds would remain open, and the gradual change in the forest structure would not diminish the quality of an individual camping experience.

In the long-term, the tree density would continue to increase as existing trees increase in size, and new ones become established. The large trees in the campgrounds would eventually succumb to insects and disease. The stand composition would change over time to thick stands of small Douglas-fir and western larch, with an increasingly high level of insect and disease.

The big tree character would eventually be lost. The campgrounds would remain open, but the number of people using the campgrounds each year might decrease slightly as campers who are specifically looking for places to camp among large trees look elsewhere. This would most likely include the campers who have been coming to the area for decades, and would notice the loss of the big trees. Most of the other reasons for the campgrounds' popularity would not be affected by the No Action Alternative. The Loup Loup Campground would still be a small, un-crowded, quite campground, near hiking and roads, and with cooler temperatures. The JR Campground would continue to be a convenient overnight stop for people traveling through the area.

Horse Camp

A horse campground would not be constructed. People may continue to do dispersed camping with horses in the North Summit SnoPark, but the lack of developed campground facilities would keep the experience rustic, and not provide the type of high-quality camping experience horse enthusiasts are seeking. The footprint of this dispersed use would likely

continue to increase slowly as dispersed campers work to park their vehicles as close to the trees as possible for shade.

Dispersed Camping

The forest structure would continue to thicken with implementation of the No Action Alternative, further confining existing dispersed campsites, and limiting the area where new sites may develop. The use of the campsites would continue to be concentrated during the general firearm season in October, with very little use occurring during the rest of the year. The number of people coming to the project area for dispersed camping would likely decrease over time due to the anticipated decrease in people hunting in the upcoming years. This would result in continued use of the most desirable, existing dispersed sites, with little to no expansion in the amount of area used.

Hunting

There would be no effect on hunting opportunities since no roads would be closed under implementation of the No Action Alternative. The open road network would not change from its current condition, so all the currently open roads could still be used by hunters. The Okanogan Travel Map seasonal closure areas would continue to provide non-motorized hunting areas for those seeking that experience.

All-Terrain Vehicle (ATV) and Off-Highway Vehicle (OHV) Use

There would be no effect to ATV/ORV riders with implementation of the No Action Alternative since there would be no changes to the current road network. There would still be approximately 170 miles of closed, decommissioned, or unauthorized roads (maintenance level 1, decommissioned, or unauthorized) in the analysis area open to ATVs/ OHVs, as well as the off-road areas.

Firewood Gathering

As with the other road-based activities in the analysis area, there would be no effect on firewood gathers, firewood availability, or the amount of area open to firewood gathering with implementation of the No Action Alternative, since there would be no change to the road system. There would be approximately 5,123 acres of land open to firewood gathering. Firewood could still be collected within 200 feet on either side of any open road, except within 300 feet of fish-bearing streams, or 150 feet of non-fish-bearing streams. The analysis area would continue to be a popular place to gather firewood because of its close proximity the Methow and Okanogan valleys.

Highway 20 Corridor

Portions of the Highway 20 corridor would remain overstocked, with increased susceptibility to insect and disease outbreaks, and with accelerated mortality rates leading to ever increasing development of hazard trees. The hazardous trees would still be cut down in accordance with the terms and conditions of the DOT's special use permit, but there would be an ever increasing risk of unidentified hazard trees falling across the highway. The untreated stands would also have an increasing risk of wildfire that could lead to temporary closures of the road during wildfire events.

Power Line Corridor

As with the highway corridor, some stands along the power line corridor would remain overstocked with increased susceptibility to insect and disease outbreaks, and with accelerated mortality rates leading to ever increasing development of hazard trees. The hazardous trees would still be cut down in accordance with the terms and conditions of the

PUD's special use permit, but there would be an ever increasing risk of unidentified hazard trees falling across the power lines. The untreated stands would also have an increasing risk of wildfire that could damage the power lines or poles, and interrupt power delivery to the Methow Valley.

3.14.3.2 Proposed Action

Loup Loup Ski Bowl

The condition of the stands between the runs at the Loup Loup Ski Bowl would be improved with implementation of the Proposed Action. As with the No Action alternative, the number of skiers would fluctuate from year to year, but not be noticeably influenced by the effects of the Proposed Action. The experience skiers have come to enjoy at the Loup Loup – a small area with a variety of runs, and the friendly "small town" atmosphere – would not change.

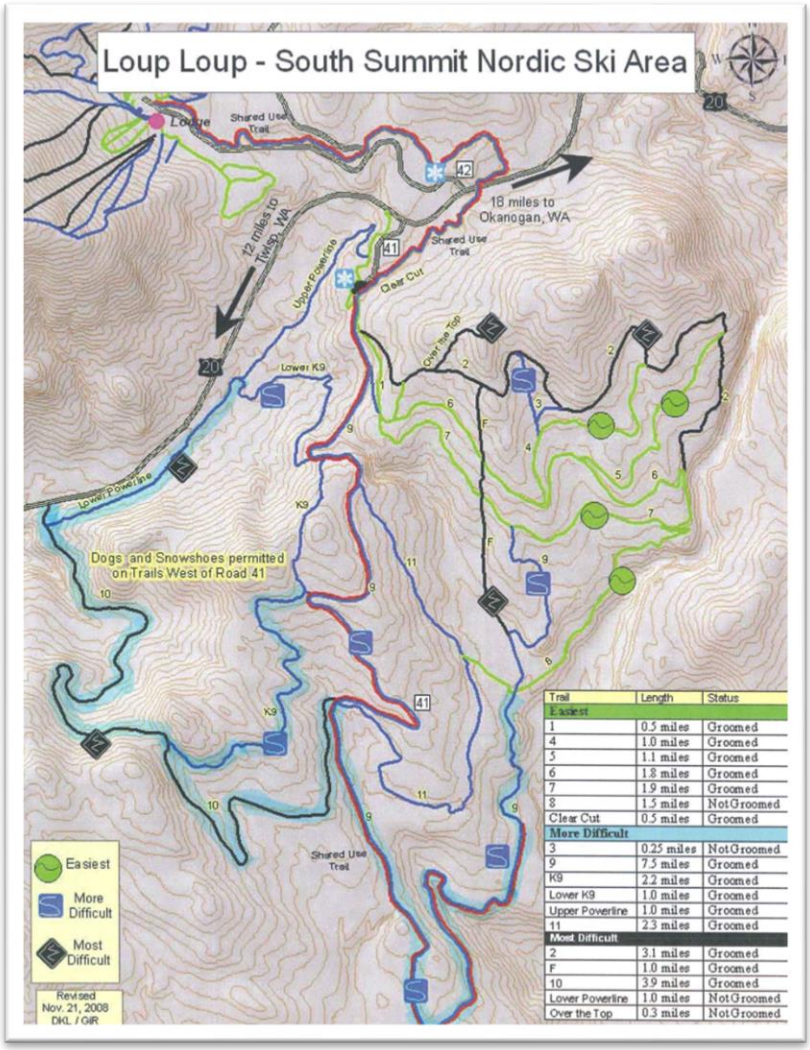
Standing trees 8 inches and less in diameter in the stands between the runs would be cut down, and the slash and downed trees on the ground would be piled and burned. Larger, defective trees posing a hazard in these stands would also be felled. The logs suitable for firewood would be skidded out of the stands over snow, and used by the Ski Bowl as firewood for the ski lodge. This treatment would open the stands considerably, making them much safer for skiers and for ski area employees rescuing or evacuating injured skiers.

The treatments would improve the health of the stands by reducing competition between the remaining trees, and removing the most diseased and structurally damaged larger trees as they become hazardous to ski area employees. This would help perpetuate the large tree character of these stands into the future. The risk of wildfire in and around the ski bowl would be reduced through the fuel reduction activities. This would reduce the possibility the ski area being damaged or destroyed by wildfire.

Nordic Skiing

The current Nordic skiing opportunities in the North and South Summit Nordic trails would be maintained in the long run with implementation of the Proposed Action, although there would be a reduction in amount of groomed routes available for approximately 3 years (the life of the timber sale). Winter logging would be required on several units south of Highway 20, so the lower loop of Trail 9, all of Trail 10, K9 between Trail 9 and Trail 10, and the Lower Powerline of the South Summit ski trails would be closed to skiing for up to three years (the life of the sale) (see Figure 3.14-1 below). This would reduce the kilometers of trail open for skiing by approximately 15 kilometers for those three years, and would likely increase the number of people skiing on the remaining groomed trails. The North Summit ski trails and the remainder of the South Summit trails would not be plowed, and would be groomed and open for skiing while the project is being implemented.

Figure 3.14-1 South Summit Ski Trails with Trails Proposed for Plowing Highlighted in Blue



Trail	Length	Status
Easiest		
1	0.5 miles	Groomed
4	1.0 miles	Groomed
5	1.1 miles	Groomed
6	1.8 miles	Groomed
7	1.9 miles	Groomed
8	1.5 miles	NotGroomed
Clear Cut	0.5 miles	Groomed
More Difficult		
3	0.25 miles	NotGroomed
9	7.5 miles	Groomed
K9	2.2 miles	Groomed
Lower K9	1.0 miles	Groomed
Upper Powerline	1.0 miles	Groomed
11	2.3 miles	Groomed
Most Difficult		
2	3.1 miles	Groomed
F	1.0 miles	Groomed
10	3.9 miles	Groomed
Lower Powerline	1.0 miles	NotGroomed
Over the Top	0.3 miles	NotGroomed

The proposed action would change the current road system serving as the base for the North and South Summit Nordic trail systems, but all existing Nordic trails would continue to be open and groomed after completion of the project. The trails would be approximately 12 feet wide to allow room for the groomer. If any culverts are removed, or other water crossings improved to improve drainage, the resulting water crossing would be passible by the groomer.

Reference the Recreation Specialist Report for figures that list the trail name, road, and proposed action for each system if the proposed action changes the road and maps showing the trail systems on the road network. The Proposed Action would not change the condition of any road located on Washington State Department of Natural Resources Land.

Snowmobiling

There would be no long-term effect on snowmobiling opportunities in the analysis area with implementation of the Proposed Action. All existing groomed snowmobile routes would continue to be groomed in the future.

A Forest Plan amendment would allow some of the designated groomed snowmobile routes to be plowed to allow winter logging in harvest units with soil resource concerns. There would be a short-term, 82% reduction in the miles of groomed routes during the life of the Proposed Action (up to three years) as a result of roads being plowed to allow winter logging of some of the treatment units. The South Summit route (road 4100000) would be plowed from the intersection with 4100500, south to the forest boundary. This would reduce the existing 17 mile groomed snowmobile route to approximately 3 miles. All 28.5 miles of the designated open routes would also be plowed. None of the snowmobile route roads north of Highway 20 would be plowed, so the snowmobiling opportunities in that area would not change from the current condition.

There may be a reduction in the total number of people snowmobiling in the area because of the short-term reduction in groomed routes, but the most popular route (from the North Summit SnoPark to Conconully) would remain open to snowmobiling during project implementation. No reduction in use would be anticipated there, and the use that would have occurred on the routes south of Highway 20 may shift to the more popular route. This would increase the number of snowmobilers on the route to Conconully. Snowmobilers may notice the increase, however since most of the use is currently occurring on that trail, the increase would likely be slight. There would be approximately 50 snowmobiles on the trails on weekend days, and approximately 12 on weekdays.

Loup Loup and JR Campgrounds

Comprehensive vegetation management would occur in the Loup Loup and JR campgrounds with implementation of the Proposed Action. The campground forests would be thinned, selected diseased trees would be felled, as would small trees competing with adjacent large trees. Fuels would be treated by piling and underburning. This would result in campground-adjacent forests that have clumps of varying sizes of overstory and understory, with the large ponderosa pine, western larch, and Douglas-fir more visible than the current condition. Stumps would be cut low, and all ribbons, flagging, and tags visible from the campgrounds would be removed. Refer to the Scenic Quality analysis for more information.

There would be a short term impact to campers since the campgrounds would be closed during project implementation. This design criterion would avoid any potential injury to campers, or damage to private property (vehicles and camping equipment). The design criterion requiring protection of campground facilities and improvements would avoid potential damage campground structures, and avoid the need to restore or reconstruct portions of the campgrounds after completion of the project.

Another short-term impact would be exposure to smoke during prescribed burning activities. The burns would be done during weather conditions that would minimize the potential of smoke settling along the creek, but people camping in the campgrounds during the actual burning would likely smell and see smoke, especially in at night. These effects would only last as long as the units are burning (one to two weeks).

In the long-term, the Proposed Action would remove the existing hazard trees in the campgrounds, and thin the understory vegetation to reduce the competition between the remaining trees. Similar stand treatments would occur around each campground. This would improve the overall health of the stands in the project area, including within the campgrounds by:

- reducing susceptibility of forest stands to insect attacks and disease infection,
- maintaining or enhancing forest health and reducing undesirable stress-related tree mortality,
- reducing risk of wildfire damaging or destroying the campground,
- providing for sustainable vegetation and fuels conditions, and
- maintaining or developing large trees, especially ponderosa pine.

The direct and indirect effects of the Proposed Action would be more space between the trees in the campgrounds, with most small trees removed from around the largest trees. This would reduce the stress on the large trees, and reduce the likelihood that they would become hazardous, and need to be removed in the upcoming years. The thinning would also benefit the moderate-sized trees in the campground. These would also become less susceptible to insect and disease attacks. The reduced competition for water, light, and nutrients would also allow these trees to increase in size, and eventually become the large, stately trees for which these campgrounds are known. This would create a stand condition where there is an increasing component of large trees.

Hazard trees would continue to develop in the campgrounds as trees become mechanically damaged or die, but the rate would be slower than under the No Action Alternative. The large-tree component would be retained over time with the Proposed Action, even as some large trees are removed to keep the people in the campgrounds safe.

The number of people currently using the campgrounds would likely not change as a result of the Proposed Action. The Loup Loup Campground would still be a small, un-crowded, quite campground, near hiking and roads, and with cooler temperatures. The JR Campground would continue to be a convenient overnight stop for people traveling through the area.

<u>Horse Camp</u>

The constructed horse camp would provide an outstanding horse camping opportunity. It would be constructed to all current horse camp standards. The 14-site campground would be constructed on a relatively flat, 15-acre area in the trees next to the North Summit SnoPark. The campground would have a main campground loop road, with campsites meeting all design criteria for horse camping. The gravel-surfaced road would be approximately ½ miles long, 14 feet wide with a 50-foot outside turning radius, 25-foot inside turning radius, and a 28-foot wide, gated entrance. There would be 12 pull-through and 2 back-in sites, each with 28 by 65-foot parking pads to accommodate vehicles with horse trailers. Each campsite would have a picnic table, fire grate, and tent pad, in addition to an area where a highline or hitchrail would be installed. The exterior of the campground would be fenced to keep cattle out.

A sealed vault, concrete outhouse would be installed in the middle of the campground, next to a 5-stall day parking area, and picnic shelter. The pathways between the day-parking area, outhouse, and shelter would be paved to meet accessibility requirement. In addition, a fully accessible mounting ramp would be constructed to allow people in wheelchairs, or

other mobility limitations, to easily mount a horse. All campsites would meet accessibly standards.

Two manure bins would be constructed. A water tank would be buried just uphill from the campground providing a gravity fed system for stock water. No potable water would be provided.

Approximately 65 trees would be removed, flush-cutting the stumps. All disturbed areas would be re-vegetated with native species. Campground entrance and individual site signs would be installed, in addition to a bulletin board at the fee station.

The campground would help meet the demand for horse camping in the local area, and for people from around the state. The location would be convenient for riders from the Okanogan and Methow valleys, allowing more people a high-quality camping experience, and access to riding opportunities perfect for beginner riders, young horses, and anyone wanting an easy ride with friends and family.

Dispersed Camping

In the short-term, the Proposed Action could close some dispersed campsites during project implementation. Some sites could be used as landings, and others are in, or adjacent to treatment units. During project activities, camping would be prohibited in order to ensure camper's safety. The site closures could last 2 to 3 years; however the likelihood that any one site would be closed for that length of time is low. Prescribed burning could also lead to short-term closures of some dispersed campsites; however the closures would be limited to the actual time of burning, generally one to two weeks.

Another short-term impact would be exposure to smoke during prescribed burning activities. The burns would be done during weather conditions that would minimize the potential of smoke settling along the creek, but people camping in many of the dispersed campsites during the actual burning would likely smell and see smoke, especially in at night. These effects would only last as long as the units are burning (one to two weeks).

In the long-term, the Proposed Action would open the forest stands along many of the roads in the project area. Theoretically, this open forest structure would make more area available to dispersed campers. Since the Proposed Action would likely not influence the number of people recreating in the project area, there would be very little, if any change in the pattern of dispersed camping, or the area used by dispersed campers, compared to the No Action Alternative.

Hunting

In the short-term, the Proposed Action would affect hunting in the project area. Some dispersed campsites or campgrounds could be closed during hunting season if harvest or prescribed burning activity is occurring near or in the sites. Roads could also be closed temporarily, as could harvest units. This potential effect would be mitigated by limiting or halting prescribed burning during the hunting season, if possible. Timber hauling would not be allowed on the weekends during the hunting season to minimize disturbance to hunters.

If the prescribed burning units are burned during this hunting season, there would be a larger, short-term impact on hunting. Hunters in the area could also be exposed to smoke from the prescribed burns, especially at night when smoke has a tendency to settle around

the lower parts of the project area, where the developed campgrounds and dispersed campsites are located.

In the long-term, these alternatives would have little effect on hunting opportunities. There would be a reduction in the miles of open road, but newly closed roads would provide more places to ride ATVs. The campgrounds and dispersed campsites would re-open after the sale and burning are completed.

All-Terrain Vehicle (ATV) and Off-Highway Vehicle (OHV) Use

There would be a long-term decrease in the miles of roads available for ATVs/OHVs with implementation of the Proposed Action. There would be approximately 122.2 miles of closed road, compared to the existing 170 miles, which would be a 27% decrease in the miles of closed road where ATVs/OHVs can be driven. A total of 72.2 miles of road would be decommissioned. These decommissioned roads would not be closed to ATVs/OHVs, but the decommissioning process would make them difficult to traverse. The road beds would be re-contoured to match the existing landscape, culverts would be removed, and stream crossings would be reshaped to restore hydrologic function. Debris would also be pulled onto the re-contoured road beds, and the disturbed soil would have a combination of re-vegetation and seeding treatments.

The amount of off-road area open to motorized vehicles, such as ATVs/OHVs would not change with implementation of the proposed action. In the short-term, the Proposed Action would reduce the routes open for ATVs/OHVs when currently closed roads are opened for harvest or prescribed burning activities, and other areas are closed temporarily during activities. The reduction would last for approximately 2 to 3 years.

Another short-term impact would be exposure to smoke during prescribed burning activities. The burns would be done during weather conditions. This would minimize the potential of smoke settling along the creek, but people riding ATVs or OHVs during the actual burning would likely smell and see smoke. These effects would only last as long as the units are burning (one to two weeks).

In the long-term, the harvest and fuel reduction in the Proposed Action would leave more open stands around roads and trails, but this would have little effect on the use patterns. Riders are typically traveling several miles, from destination to destination, or in loops. Use of existing user-created trails and roads would continue, but the newly thinned stands would result in very little change in cross-country traffic.

Firewood Gathering

Firewood could still be collected within 200 feet on either side of any open road, except within 300 feet of fish-bearing streams, or 150 feet of non-fish-bearing streams with implementation of the Proposed Action. The analysis area would continue to be a popular place to gather firewood because of its close proximity the Methow and Okanogan valleys.

In the short-term, the Proposed Action would decrease the areas available for firewood gathering. Some roads and units would be temporarily closed during harvest and prescribed burning activities. The overall effect would be minor, however, since the majority of the analysis area would remain open to access.

Another short-term impact would be exposure to smoke during prescribed burning activities. The burns would be done during weather conditions that would minimize the potential of smoke settling along the creek, but people gathering firewood during the actual burning

would likely smell and see smoke. These effects would only last as long as the units are burning (one to two weeks).

In the long-term, the Proposed Action would cause a 17% reduction in the number of acres open to firewood gathering (from the current 5,123 acres to 4,257 acres) because of the road closures and decommissioning. The supply of potential firewood would likely meet the current demand in this area, however as demand increases in the upcoming years, people would have more difficulty finding firewood in the project area.

Highway 20 Corridor

The safety of people driving through the Highway 20 corridor would be improved with implementation of the Proposed Action. Comprehensive vegetation management would be done, including thinning, fuels reduction and removal of hazard trees. This would result in forests that have clumps of varying sizes of overstory and understory, with the large ponderosa pine, western larch, and Douglas-fir more visible than the current condition. Stumps would be cut low, and all ribbons, flagging, and tags visible from the highway would be removed. Refer to the Scenic Quality analysis for more information.

In the long-term, the Proposed Action would remove the existing hazard trees in the highway corridor, and thin the understory vegetation to reduce the competition between the remaining trees. This would improve the overall health of the stands in the project area, including within the corridor by:

- reducing susceptibility of forest stands to insect attacks and disease infection,
- maintaining or enhancing forest health and reducing undesirable stress-related tree mortality,
- reducing the risk of wildfire temporarily closing the highway,
- providing for sustainable vegetation and fuels conditions, and
- maintaining or developing large trees, especially ponderosa pine.

The direct and indirect effects of the Proposed Action would be more space between the trees in the corridor, with most small trees removed from around the largest trees. This would reduce the stress on the large trees, and reduce the likelihood that they would become hazardous, and need to be removed in the upcoming years. The thinning would also benefit the moderate-sized trees in the corridor. These would also become less susceptible to insect and disease attacks. The reduced competition for water, light, and nutrients would also allow these trees to increase in size. This would create a stand condition where there is an increasing component of large trees.

Hazard trees would continue to develop in the corridor as trees become mechanically damaged or die, but the rate would be slower than under the No Action Alternative. The large-tree component would be retained over time with the Proposed Action, even as some large trees are removed to keep the corridor safe.

Power Line Corridor

The Proposed Action would implement thinning and prescribed fire treatments in some stands adjacent to the powerline corridor. The existing hazard trees in the power line corridor would also be removed. These actions would improve the overall health of the stands by:

- reducing susceptibility of forest stands to insect attacks and disease infection,

- maintaining or enhancing forest health and reducing undesirable stress-related tree mortality,
- reducing the risk of wildfire damaging the power line or poles, interrupting power delivery to the Methow Valley, and
- providing for sustainable vegetation and fuels conditions.

The direct and indirect effects of the Proposed Action would be more space between the trees adjacent to the power line corridor, with most small trees removed from around the largest trees. This would reduce the stress on the large trees, and reduce the likelihood that they would become hazardous, and need to be removed in the upcoming years. The thinning would also benefit the moderate-sized trees in the corridor. These would also become less susceptible to insect and disease attacks. The reduced competition for water, light, and nutrients would also allow these trees to increase in size. This would create a stand condition where there is an increasing component of large trees.

Hazard trees would continue to adjacent to the power line corridor as trees become damaged or diseased, but the rate would be slower than under the No Action Alternative.

Roads needed by the PUD to operate and maintain the power line corridor would be remain open to the PUD under their special use permit. Roads within the powerline corridor that are deemed excess would be decommissioned or closed. Some gates would be installed on roads in the corridor to limit access to administrative use. See Transportation Section for further details.

3.14.3.2.1 Cumulative Effects of Past, Present, and Reasonably Foreseeable Future Actions with the Proposed Action and Alternatives

Past, Present, Ongoing, and Reasonably Foreseeable Future Actions
Actions that overlap the proposed action in both space and time that would have cumulative impacts when considered with the proposed action. The spatial boundary of the cumulative effects analysis is the Methow Valley Ranger District. The temporal boundary is approximately 2020, , and into the future, covering anticipated increases in recreation use as vegetative conditions continue to change, and road closures and decommissioning remain in place.

Past, Present and Ongoing Actions

Past, present, and ongoing actions that are affecting the components of the recreation activities and special use permits are discussed in the Current Condition sub-sections of this report.

Reasonably Foreseeable Future Actions

Future Recreation Use
On-going activities are expected to continue into the future, including alpine and Nordic skiing, camping in campgrounds and dispersed sites, snowmobiling, hunting, and riding OHVs.

The number of visitor days expected in the future was calculated using projected changes included in the Washington State Comprehensive Outdoor Recreation Planning (SCORP) publication "*Estimates of Future Participation in Outdoor Recreation in Washington State*"

(Interagency Committee for Outdoor Recreation 2003). These projected changes were for 10 and 20-year periods based on participation data from the 1999-2000 RCO survey (IAC 2003). These projections took into account NSRE data and projections for the Pacific Northwest Region, demographic trends in Washington State, the local supply of lands available for recreation activities, and other factors. The following figure lists each activity, and projected percentage change in the number of participants compared to current levels, as reported in the Interagency report.

Figure 3.14-2 Projected Increases in Recreation Activities by 2020

Activity	Percent Change in Participants by 2020
Alpine skiing	+10%
Nordic skiing	+10%
Camping in campground	+13%
Camping in dispersed sites	+10%
Snowmobiling	+10%
Hunting	-6%
Riding OHVs	+10%

Using these projections, there will be an approximate 10% in the number of recreation days in the analysis area in 2020, increasing from the current estimated total of 24,300 to 26,730.

Loup Loup Ski Bowl
It is reasonably foreseeable that the Loup Loup Ski Bowl will continue to operate under a ski area special use permit. Ongoing maintenance activities will include hazard tree removal, repair and maintenance of all buildings, maintenance and operation of the ski lift, platter lift, and rope tow, and road maintenance.

Nordic Skiing
It is reasonably foreseeable that the existing Nordic ski trails would continue to be groomed and maintained. Brush and vegetation would be removed from the ski trails as necessary.

Snowmobiling
It is reasonably foreseeable that the existing network of snowmobile trails will be groomed and maintained in the future.

Campgrounds
It is reasonably foreseeable that the Loup Loup and JR campgrounds will stay open, with ongoing operation and maintenance activities such as hazard tree removal, outhouse cleaning and pumping, operation of the water system, general campground cleaning, and mowing.

Travel Management
It is reasonably foreseeable that the Okanogan-Wenatchee National Forest will complete the Travel Management environmental analysis and decision by the end of 2015. This would change access to National Forest System land from “open unless designated closed” to “closed unless designated open”. Motorized vehicles, including ATVs/OHVs and motorcycles would only be allowed on routes designated open to motorized travel. Cross-country travel would be prohibited, as would any motorized travel on roads not designated open. It is reasonably foreseeable that no roads would be opened for unlicensed vehicles,

and no new motorized trails would be designated. This would substantially decrease motorized recreation opportunities in the analysis area.

However, it is reasonably foreseeable that some roads would be open to ATVs/OHVs which are in full compliance with Washington State Law #1632. This law established a licensing procedure for ATVs, referred to as WATVs in the law. This would provide new riding opportunities for people who comply with the provisions in the law, such as a licensed driver, and certain vehicle requirements.

Firewood Demand
It is reasonably foreseeable that the demand for firewood will increase in the foreseeable future as the population of the Methow and Okanogan valleys increases, and the cost of alternative heating sources, such as electricity and propane, increase in the future. The Washington State Department of Transportation projects that the population of Okanogan will increase 30.20% between 2000 and 2030 (WADOT, 2013).

State Highway 20
It is reasonably foreseeable that Highway 20 will remain in place, and be managed under a Memorandum of Understanding between the Forest Service and Department of Transportation. The road bed will be maintained and repaired as necessary, including resurfacing, repairing potholes, and other standard activities. Hazard trees will also be felled as they develop. The road will be plowed each winter. Any debris flows or other damage to the road will be repaired as quickly as possible.

Power Line Corridor
It is reasonably foreseeable that the PUD will continue to operate and maintain the power transmission line under a special use permit. The corridor itself will be kept clear of trees and taller vegetation, and hazard trees that develop along the edge of the cleared corridor will be felled as necessary. The access roads under the power line will remain open, and will be used for operation and maintenance activities. Any damage to the line or poles will be repaired as quickly as possible.

Summary of Cumulative Effects

No-Action Alternative

<u>Loup Loup Ski Bowl</u>
The cumulative effect of all past, present and reasonably foreseeable future actions and the No Action Alternative on the Loup Loup Ski Bowl would be the continued operation of the ski bowl, an increase in the number of people skiing, and an accelerated development of hazard trees along the runs. The vegetation in the stands between the runs would increase in density, and the number of people skiing trying to ski through the stands could increase with the overall increase in use. Hazard trees would be removed in accordance with the terms and conditions of the special use permit, so the area would remain safe for skiers. Over time, the composition of the stands between the runs would shift to thicker stands of smaller trees, making them more difficult to ski through, and more difficult and dangerous for ski bowl employees rescuing or evacuating injured skiers. There would be an elevated risk of wildfire damaging or destroying the Ski Bowl facilities as the surrounding stands have an increase in insect and disease occurrence, and ever increasing fuel levels. This would not meet Purpose and Need #4.

Nordic Skiing

The cumulative effect of all past, present, and reasonably foreseeable future actions and the No Action Alternative on Nordic skiing opportunities would be a continuation of the existing condition. The trails would continue to be groomed, and vegetation would be removed from the trails as necessary. The anticipated increase in the number of people skiing could make the routes slightly more crowded, but the increase would likely be unnoticed by most skiers, would not diminish the skiing experience for most.

Snowmobiling

The cumulative effect of all past, present, and reasonably foreseeable future actions and the No Action Alternative on snowmobiling opportunities would be a continuation of the existing condition. Grooming would continue on the designated routes, and the number of miles of trail would remain constant. The anticipated increase in the number of people snowmobiling could make the routes slightly more crowded, but the increase would likely be unnoticed by most skiers, would not diminish the snowmobiling experience for most.

Campgrounds

The cumulative effect of all past, present, and reasonably foreseeable future actions and the No Action Alternative on the Loup Loup and JR campgrounds would be slightly increased occupancy, but not exceeding the number of sites available. Ongoing campground maintenance, including but not limited to removal of hazard trees, would continue so the campgrounds would be safe for campers. The big tree character would eventually be lost, with the campgrounds stands shifting to thicker, smaller trees. There would be an elevated risk of wildfire damaging or destroying the campgrounds as the surrounding stands have an increase in insect and disease occurrence, and ever increasing fuel levels. No developed horse camping would be offered or available in the analysis area, so people would continue to have the current rustic, less than desirable current experience. This would not meet Purpose and Need #4 or #7.

Dispersed Camping and Hunting

The cumulative effects of all past, present and reasonably foreseeable future actions and the No Action alternative would be a slightly higher occupancy rate in dispersed campsites as the number of dispersed campers increases. The anticipated decline in the number of people hunting would likely reduce the likelihood that new dispersed campsites would be created.

ATV/OHV Use

The cumulative effect of all past, present, and reasonably foreseeable future actions and the No Action Alternative would be that most of the existing ATV/OHV opportunities would be replaced by motorized route decisions made in the Travel Management process. The cumulative effect would be a shift from the current ATV/OHV traffic on closed roads and cross country riding, to designated open roads. ATV/OHV opportunities in the analysis area would remain, however there could be a substantial decrease in overall mileage of open routes.

Firewood Gathering

The cumulative effect all past, present, and reasonably foreseeable future actions and the No Action Alternative would be that maintaining the current amount of area open to firewood gathering would likely provide an adequate supply to meet the anticipated increases in demand because of the relatively slight anticipated increase in local populations.

Highway 20
The cumulative effect of all past, present, and reasonably foreseeable future actions and the No Action Alternative would be increased traffic on the highway, with ongoing maintenance and operation keeping the roadway safe for motorists. Hazard tree removal would continue at an accelerated rate, until all large trees approximately 150 to 200 feet on either side of the road in previously untreated stands become hazardous and are felled. Other road maintenance would keep the highway open. It would continue to be the main connecting route between the Okanogan and Methow valleys. There would be an elevated risk of wildfire causing temporary closures of the highway as the surrounding stands have an increase in insect and disease occurrence, and ever increasing fuel levels. This would not meet Purpose and Need #4.

Power Line Corridor
The cumulative effect of all past, present, and reasonably foreseeable future actions and the No Action Alternative would be the continued operation and maintenance of the power transmission line, and an ongoing supply of power to the Methow Valley. Hazard trees along the cleared power line corridor would be felled as they develop, while vegetation in the corridor itself would continue to be cleared as needed. There would be an elevated risk of wildfire damaging or destroying the power line or poles as the surrounding stands have an increase in insect and disease occurrence, and ever increasing fuel levels. This could temporarily interrupt power delivery to the Methow Valley.

Proposed Action

Loup Loup Ski Bowl
The cumulative effect of all past, present and reasonably foreseeable future actions and the Proposed Action would be the continued operation of the Ski Bowl, with an increase in the number of skiers. The stands between the runs would be more open and hazardous trees in these stands would be removed. This would potentially provide more skiable terrain, which could spread the increased number of skiers out so the runs do not become noticeably more crowded. Hazard trees along the runs would also be removed, so the area would continue to be a safe, enjoyable, “small town” place to ski. The risk of crown fires in the surrounding stands would also be reduced, therefore reducing the risk of the Ski Bowl being damaged by wildfires in the future and meeting Purpose and Need #4.

Nordic Skiing
The cumulative effect of all past, present, and reasonably foreseeable future actions and the Proposed Action would be the Nordic trail network would remain open and groomed, with potentially more encounters between skiers on the trails as the number of skiers increases over time. The increase would likely not be large enough to be noticed by most skiers, and would not diminish the skiing experience. The retained trees along the south and west side of the trails, and the removal of trees on the edge of the north side of trails would help slow snow melt, and potentially extend the ski season in low snow years.

Snowmobiling
The cumulative effect of all past, present, and reasonably foreseeable future actions and the Proposed Action on snowmobiling opportunities would be a continuation of the existing condition. Grooming would continue on the designated routes, and the number of miles of trail would remain constant. The anticipated increase in the number of people snowmobiling could make the routes slightly more crowded, but the increase would likely be unnoticed by most skiers, would not diminish the snowmobiling experience for most. The short-term

closure of some of the trails and the anticipated increase in snowmobilers would not have a cumulative effect on how crowded the trails because the closures would be lifted before any noticeable increase in use.

Campgrounds

The cumulative effect of all past, present, and reasonably foreseeable future actions and the Proposed Action would be the perpetuation of the big tree character in both the Loup Loup and JR campgrounds, with a decrease in the rate of hazard tree development. The number of campers in both campgrounds would slightly increase, but would not exceed the number of sites available. Ongoing campground maintenance, including but not limited to removal of hazard trees, would continue so the campground would be safe for campers. The risk of wildfire in the surrounding stands would be decreased, therefore decreasing the risk that the campgrounds could be damaged or destroyed by uncontrolled wildfires in the future. The North Summit Horse Camp would improve and increase horse camping opportunities in the area, likely increasing the number of people camping in the area, and riding the roads and trails. The proposed action would meet Purpose and Need #4 and #7.

Dispersed Camping and Hunting

The cumulative effects of all past, present and reasonably foreseeable future actions and the Proposed Action would be a slightly higher occupancy rate in dispersed campsites as the number of dispersed campers increases. There would be a slight reduction in the number of available established sites, since access to some would be blocked by road closure or decommissioning. The anticipated decline in the number of people hunting would likely reduce the likelihood that new dispersed campsites would be created.

ATV/OHV Use

The cumulative effect of all past, present, and reasonably foreseeable future actions and the Proposed Action would be that most of the existing ATV/OHV opportunities would be replaced by motorized route decisions made in the Travel Management process. The cumulative effect would be a shift from the current ATV/OHV traffic on closed roads and cross country riding, to designated open roads. ATV/OHV opportunities in the analysis area would remain; however, there could be a decrease in overall mileage of open routes.

Firewood Gathering

The cumulative effect all past, present, and reasonably foreseeable future actions and the Proposed Action would be a 17% reduction in the number of acres available for gathering, with a potential 30.2% increase in demand, based on projected increases in the population of Okanogan County. It could become more difficult to find firewood in the area, however there would be a continuous supply every year as trees die and downed wood becomes available.

Highway 20

The cumulative effect of all past, present, and reasonably foreseeable future actions and the Proposed Action be increased traffic on the highway, with a slower development of hazard trees because of harvest and fuels treatments in the Proposed Action. Large trees would be retained along the roadway, so the view from the highway would still have the desirable big tree/open stand views. Ongoing maintenance and operation would keep the roadway safe for motorists. It would continue to be the main connecting route between the Okanogan and Methow valleys. There would be a reduced risk of wildfire causing temporary closures of the highway because of the harvest and fuel reduction activities in the surrounding stands, thereby meeting Purpose and Need #4.

Power Line Corridor

The cumulative effect of all past, present, and reasonably foreseeable future actions and the Proposed Action would be the continued operation and maintenance of the power transmission line, and an ongoing supply of power to the Methow Valley. Hazard trees along the cleared power line corridor would be felled as they develop, while vegetation in the corridor itself would continue to be cleared as needed. There would be a reduced risk of wildfire damaging the line or poles, and potentially interrupting power delivery to the Methow Valley because of the harvest and fuel reduction activities in the surrounding stands.

3.14.4 Consistency Statement

All alternatives would be consistent with Forest Plan standards and guidelines. The No Action alternative would not change the existing road network, so would be consistent with each standard and guideline. Explanations of how the Proposed Action would comply are provided in the Recreation Specialist Report.

3.15 SCENIC RESOURCES

The following section provides a description of existing conditions along with the direct, indirect, and cumulative effects of the South Summit II Forest and Fuels Project, as analyzed in the South Summit II Forest and Fuels Scenic Resources Report (Jackson 2015), available in the project record.

3.15.1 Issues for Analysis

The following issue was chosen for analysis because it represents cause-effect relationships between the implementation of the alternatives and scenic resources and serve to highlight impacts and trade-offs for the decision maker. Indicators have been selected that provide understandable, quantifiable and responsive measures of the degree of impact that would result from the implementation of the alternatives.

Landscape Scenic Viewsheds

Scenic quality is an important amenity in our lives. People's interests and expectations regarding ecosystems help establish desired aesthetic conditions for the varied landscapes. Scenery provides the setting for all activities experienced by forest visitors. Each recreational setting is comprised of scenic attributes that are derived by the environmental context of topography, geology, and climate. These underlying factors are expressed and highlighted by the scenic attributes that they support. Scenery, just as any other resource, must be cared for and managed for future generations. The activities proposed by the South Summit II Forest and Fuels Project potentially affect the current and future condition of these valued scenic resources. Managing scenery resources involves the process of analyzing effects, implementing scenic character goals and applying scenic conservation design criteria to achieve the Okanogan Forest Plan desired conditions and direction for scenery resources.

The landscape character goal for the South Summit II Forest and Fuels Project area is to maintain a naturally appearing to slightly altered landscape character that expresses predominately natural processes in the scenic viewsheds and travel routes. A transitional approach to move the high density stands towards a lower density, an open mosaic pattern and resilient composition, becoming more fire resilient and ecologically sustainable in time is desirable for the landscape character. Enhancement of large tree viewing opportunities from travel routes, viewpoints, and recreation destinations is desirable. There is opportunity to increase landscape variety by creating and maintaining a series of specific plant stages that leave a diversity of different age classes and a variety of natural appearing open spaces. From a scenery enhancement approach, ecologically sound landscapes can also be aesthetically pleasing as well as sustainable, being reflective of the inherent natural disturbance regimes that are in scale to the appropriate vegetative type, whether it is the natural role of fire, insects and/or disease. When the amount of disturbance exceeds the natural ecosystem parameters, the risk of unnatural catastrophic level disturbances increases and can cause a dramatic change to the existing scenery and landscape character.

Indicators:

- Amount of changes seen on the landscape, including changes affected by the shape, size and arrangement of fuels reduction units, removal of trees, harvest methods, and location of treatment units in a given viewshed and from fixed viewpoints.

- Consistency with Forest Plan standards and guidelines; the resulting scenic integrity level in the short-term and long-term (based on how well the vegetative and prescribed fire treatments meet the established Retention, Partial Retention, Modification and Maximum Modification VQOs).

Analysis Methods: The scenery effects analyses used for this report are those found in the Scenery Management Handbook #701. Scenery management is based on the classic aesthetic factors of form, line, color and texture, as well as the principles of sense of place. "Scenic integrity" measures the amount of natural or socially valued appearance in a landscape along with the amount of visual disturbance that contrasts with and detracts from the appearance (the valued scenic character) existing at the time of measurement.

Analysis Area: The effects to the scenery resources can be short-term and long-term. Short-term is usually less than 5 years, and long-term is 5 years to 50 years. Effects that are eliminated by the natural course of a single growing season are not considered effects because they are so short lived. Most treatments have long-term effects while logging activities such as skidding and slash burning are usually short-term effects lasting less than 5 years. The project analysis area is the area from which the proposed treatments can be visibly discerned. This analysis is done within the project boundary.

The Scenery Management Handbook #701 and the supplemental Appendix J are the sources for scenery resource analysis.

3.15.2 Affected Environment

Existing Landscape Character

Local residents, recreation users and tourists value the scenery within the South Summit II Forest and Fuels Project area. The landscape character is predominately a naturally appearing to slightly altered forested environment viewed in the foreground, middleground and background of the viewsheds. In the project area the landscape variety ranges from the common landscape character type typical of the Okanogan Highlands to unique habitats located throughout the landscape. (USDA 1982).

The South Summit II Forest and Fuels Project is located on the north and south side of Highway 20 by Loup Loup Pass and west to the National Forest boundary. Several road corridors travel through the project area. The project area is nestled into South Ridge and Buck Mountain on the north and the Finley Canyon and Finley Mountain area on the south. Frazer Creek runs along the south side of State Highway 20 adding variety in the scenery. The South Summit II Forest and Fuels Project is not visible from towns or private residences. However, the project area is adjacent to private lands including homes and other developments and Washington State Department of Natural Resources and Washington State Department of Fish and Wildlife managed lands along the wildland-rural interface.

The landform is seen as a rolling moderately varied terrain with low-rounded ridges to steeply dissected mountain ranges located in numerous stream lined valleys. Vegetative patterns vary from areas of highly textured to coarsely textured mosaic openings in the forest canopy with seasonal fall color of western larch, quaking aspen and other riparian hardwoods. The most dominant species are ponderosa pine and Douglas-fir with understory shrubs and grasses along lower to middle elevations, approximately 57% of the project area. In the higher elevations Engelmann spruce and subalpine fir is intermixed with

Douglas-fir and lodgepole pine. Riparian areas add distinct variety in vegetation, fall colors and presence of water. Approximately 82% of the project area is considered a Hot-Dry or Warm-Dry shrub steppe environmental zone; the rest of the landscape is within the Cool-Dry (12%) and Cool to Cold- Mesic (6%) zones in the upper elevations of Leecher Mountain, PolePick Mountain, and the Little Buck Mountain uplands.

Wildfire, fire suppression activities, grazing, vegetation management, road construction, and recreation have been a dominant influence on the existing landscape character of the South Summit II Forest and Fuels Project area. There is a risk of increased spruce budworm defoliation as the populations continue to peak in other areas of the Methow Valley. These insect and disease infestations are changing the landscape character from a healthy green canopy to one that is becoming brown along areas of the viewsheds.

In 2014, the Carlton Complex wildfires (hereafter known as the Carlton Complex) burned through about 70% of the project area with unusual severity and speed. Post-fire Burned Area Reflectance Classification (BARC) data was acquired after the Carlton Complex to evaluate soil burn severity (and, by inference, vegetation burn severity); see Soil Burn Severity map in Appendix J. This data indicates that about 14% of the project area experienced high-severity fire, 18% had moderate-severity fire, 32% had low-severity fire, and 6% did not burn within the fire perimeter. Post-fire field observations showed that most vegetation was severely burned in moderate-severity fire. The remaining 30% of the project area is outside of the fire perimeter and split by a continuous four-mile-wide swath of moderate- to high-severity burned area extending from lower Frazer Creek through Finley Canyon and east to Thrapp Mountain. The uncharacteristically large openings created by this fire will affect future fire behavior in the project area; as fire-killed trees collapse over the next 10-40 years, they will contribute unusually high amounts of large woody debris to more readily ignitable grasses, shrubs, and trees, creating a fuel profile that supports further uncharacteristic fire behavior, increased reburn potential, more severe fire effects as fires have higher residency time on soils, and increased resistance to fire control (USDA 2012, Brown et al. 2003).

When the Carlton Complex created the four-mile-wide opening in the project area, it changed the scale of the South Summit II Forest and Fuels project from a comprehensive 50,000 acre landscape assessment with treatment proposals to an analysis of two isolated areas in the northeast and southeast portions of the project area. Treatments are proposed for most of these areas, with about 90% in Fire Regime I, 7% in Fire Regime III and 3% in Fire Regime IV. Current conditions in all regimes create increased risk to WUI values because proposed treatment units across all fire regimes are adjacent to or near developments such as the Loup Loup Ski Area and Highway 20/powerline corridor, and private and state lands where fire spread would be undesirable because of the risks it creates for these features.

Scenic Attractiveness

"Scenic attractiveness is the primary indicator of the intrinsic scenic beauty of a landscape and of the positive response it evokes in people." Based on commonly held perceptions of the beauty of landform, vegetation pattern, composition, surface water characteristics, and land use patterns and cultural features, the scenery is rated on a three point scale:

- Class A – Distinctive, where landform, vegetation patterns, water characteristics and cultural features combine to provide unusual, unique or outstanding scenic quality.

- Class B – Typical, where landform, vegetation patterns, water characteristics and cultural features combine to provide ordinary or common scenic quality.
- Class C – Indistinctive, where the landscape does not have characteristics that add to the variety, unity, vividness, mystery, intactness, order, harmony or uniqueness of the scenery.

The South Summit II Forest and Fuels Project has areas of Classes A, B, and C in scenic attractiveness. The scenic attractiveness rating is applied to the process of evaluating the value of the area's scenery resource.

Sense of Place

Sense of place is addressed to display how the area is perceived by the public, and to display the physical setting in which the project area lies. *"The identity of a place created by people's social meanings and attachments, including valued scenery and recreation settings, cultural and spiritual values, economic, social and biophysical characteristics.*" Managers using the concept of sense of place must define a specific framework for the definition and use of sense of place. The sense of place for the South Summit II Forest and Fuels Project area is the "big backyard" with a variety of year round seasonal recreation activities that occur including from developed and dispersed camping, hunting, sight-seeing, driving for pleasure, mountain biking, equestrian riding, snowmobile riding, cross country skiing, and other dispersed use.

Existing Scenic Integrity

Every landscape changes over time, in turn, the landscape vegetative character continues to change whether it is actively managed or allowed to naturally evolve. In the South Summit II Forest and Fuels Project area, there has been a change in historic vegetative species and vegetative patterns as described in the forest vegetation narrative. The changes are mainly attributed to past timber sales and fire exclusion. In a majority of the area, the resulting patterns are becoming less sustainable in the long-term due to high risk of future wildfires and existing insect or disease outbreaks that contribute a degraded forested setting for recreation and designated travel route viewsheds within the area. The higher risk of wildfire in the rural interface is discussed in the fire and fuels behavior narrative. The species of vegetation and spatial distribution of plant communities that have been affected by or resulted from fire suppression activities are evident to visitors; however, they are not widely understood to be the result of human intervention in the fire regimes. These effects (different vegetation communities and understory vegetation) are relatively subtle from a visual standpoint and not strongly linked with the more common perception regarding fire, such as black and silver snags, brown needles and black charred trunks. For purpose of scenic analysis, subsequent references to the "effects of fire" refer to the obvious visual evidence that occurs as a direct result of fire rather than the subtle effects of different species of vegetation and spatial distribution of plant communities that are often in advanced succession.

Vegetation patterns have changed from historic composition and pattern through fire suppression, timber harvest, and grazing over the last one hundred years. Much of the South Summit landscape has experienced repeated harvest entries, including extensive stand regeneration and overstory removal harvests. The forest is relatively young and small in height and diameter.

Scenic integrity is the amount of human caused deviation in form, line, color, and texture of a landscape. Scenic integrity serves as a frame of reference for measuring scenic integrity

levels based on the valued attributes of the existing landscape character being viewed. The degrees of integrity vary from VERY HIGH to VERY LOW to UNACCEPTABLY LOW. Scenic Integrity is measured on the Okanogan-Wenatchee National Forest through Visual Quality Objective levels defined by the USFS Visual Management System's Chapter 1 USDA Handbook # 462.

The existing scenic integrity of the South Summit II Forest and Fuels Project area has a range of scenic integrity levels including HIGH (naturally appearing) , MODERATE (slightly altered) and LOW (moderately altered), based on vegetative characteristics. Within the project area there are evidences of past activities. Partial removal treatments can be seen in partial retention areas, where stumps are apparent. Along with the evidence of treatments are the indirect effects of additional variety in color and texture as deciduous shrubs and larch species have grown. Areas of retention visual quality objective are intact. The scenic integrity levels meet the Forest Plan Standards and Guidelines for a natural appearing foreground and middleground from the designated travel routes and viewsheds and areas of moderately altered to slightly altered in some middleground and background areas.

Landscape Scenic Viewsheds

The South Summit II Forest and Fuels Project area has been divided into three separate landscape areas based on landscape visibility, sensitivity levels and visual quality objectives for the scenic travel routes for assessing scenic effects. These three landscape areas are:

1. Highway 20 – Retention Visual Quality Objective (VQO)
2. Loup Loup Ski Bowl and North Summit Forest Road 4200 – Retention VQO
3. South Summit Forest Road 4100 – Retention to Modification and Maximum Modification VQO

The following narrative describes the affected environment for each landscape area.

State Highway 20 – Retention VQO

Highway 20 travels through the project area from the Loup Loup Summit west to the National Forest boundary, for approximately 5 miles. Highway 20 is the main access route between the Methow and Okanogan Valleys. Highway 20 attracts people for driving for pleasure, sight-seeing and year round recreational activities associated with Loup Loup Pass Ski Area, the North and South Summit trailheads, groomed cross-country ski trials, groomed snowmobile trails, camping, road and mountain biking, and numerous dispersed activities.

The JR Campground is located on the north side of Highway 20; the campground is small and rustic and does not receive high amounts of use. It is in a degraded condition needing many facility upgrades to bring it to developed recreational standards. The vegetation around the campground needs to be thinned or managed to reduce fire hazard as well as promote a sustainable forested environment and ecosystem.

The project area is on both sides of the North Cascades Scenic Highway in the foreground and middleground areas, the proposed vegetation management treatment is primarily on the south side of Highway 20. At the Loup Loup pass, the travel corridor goes from an elevation of 4,020 feet down to an elevation of 2,750 feet for a drop of 1,270 feet. Views are predominantly confined to an enclosed tree lined foreground except in a few open areas where distant views of the Cascade Mountains are seen. The view is more open now in areas where the Carlton Complex wildfire burned. At the lower elevations, the forest opens

up to more ponderosa pine dominated stands that allow viewing into the stand. The landform is a steeply sloping ridgeline that has a densely textured landscape in the foreground and middleground. It is enclosed by Little Buck Mountain to the north and Pole Pick Mountain to the south. Frazer Creek runs along the south side of U. S. Highway 20. The project area is not seen from private homes or communities; however the project area is adjacent to private lands along the wildland-rural interface which includes homes and other developments, and Washington State Department of Natural Resources and Washington State Department of Fish and Wildlife managed lands.

The Loup Loup power line corridor (Okanogan PUD) parallels Highway 20 and can be seen at several points where it crosses the highway. The Loup Loup power line corridor has timber stands and burned forest stands/snags around it that are creating potential safety concerns for continued uninterrupted operation due to hazard trees. It is the only power source to the Methow Valley. There is an opportunity to manage fuels and hazard trees along the power line right-of-way to address safety objectives. However, it is important to maintain existing screening between the power line corridor and U.S. Highway 20 to keep the scenic viewshed as natural appearing as possible in areas where healthy trees exist. Along the viewshed, there are areas where the landscape character does not reflect a healthy green canopy in forested stands; the forest is becoming brown and diseased in visual appearance. There are numerous dispersed campsites located under the power line corridor adjacent to Frazer Creek, which are heavily used during hunting season. Negative visual impacts occur to the riparian zone in areas, resulting from the dispersed campsites and from the roads used to access the campsites and the power lines.

On the north side of Highway 20, the Carlton Complex wildfire burned from South Ridge near Bald Mountain to Wolf Canyon and Coyote Ridge area to Highway 20. The fire burn severity on the north side of Highway 20 ranges from predominately unburned/underburned severity with an area of Medium to High viewed in the foreground. On the south side of Highway 20, the first 1.5 miles from South Summit travelling west is out of the fire boundary and is unburned. The landscape character changes to a mixture of unburned/underburned to Low burn severity along both sides of the travel corridor then transitions to medium/high burn severity on both sides of the travel route. The Frazer Creek riparian area and PUD powerline corridor were heavily impacted by the high intensity wildfire creating an area dominated by the visual evidence of wildfire that burned uncharacteristically out of the historic fire regime.

The foreground and middleground area is primarily characterized in the Hot-Dry/Warm-Dry Fire Regime I and II with some areas of Cool-Dry Fire Regime III and Cool-Mesic Fire Regime IV environmental zones. The vegetative landscape character ranges from natural appearing to slightly altered with areas of altered along the power line corridor. The landscape is slightly altered at the summit area where there is evidence of recent thinning activity and underburning.

Loup Loup Ski Bowl and North Summit Forest Road 4200 – Retention VQO

The North Summit Forest Road 4200 is the main travel route accessed from State Highway 20 on the north side of the highway traversing through the project area for approximately 3 ½ miles. It provides access to a developed recreational hub including the North Summit Trailhead, Loup Loup Ski Bowl and Loup Loup Campground. Forest Road 4200 is a graveled two lane surface that is used year round and provides opportunities for driving for pleasure, hunting, dispersed recreational uses, off-road vehicle (ORV) and motorcycle riding. North Summit Forest Road provides access to other primary or secondary travel

routes along the way that access dispersed recreation opportunities including Forest Roads 4225 (South Fork Beaver Creek) and 4235 (Starvation Mountain Forest Road). In the winter North Summit Forest Road 4200 provides access to Loup Loup Ski Bowl and is a popular groomed snowmobile route. In addition, there are groomed cross-country ski trails, snowshoeing and sledding activities in the area.

The project area lies on both sides of the Forest Road 4200 in the foreground area. Views are predominantly confined to an enclosed tree lined foreground except in open areas associated with the Loup Loup Ski Bowl and the North Summit Trailhead, which is located in an old rock quarry site. The power line transmission station is located in a flat area off Forest Road 4200. There are numerous cross country ski trails located along the foreground area that tie into the North Summit Trailhead and Loup Loup Ski Bowl.

The landform of the Loup Loup Ski Bowl and surrounding landscape is composed of a steeply sloping enclosed valley ridgeline that is a densely textured landscape in the foreground around the ski runs. Little Buck Mountain provides the backdrop setting for the ski area. A spring flows through the base of the ski area that goes underground and flows into Frazer Creek and a marshy area to the south of the ski area. The stream bank has been altered from management activities done when the area had a debris flow in 2010. The debris was removed with heavy equipment that cleared vegetation and compacted soils along the stream bank. A short cross country ski loop trail is also located along the stream zone.

The Carlton Complex burned into the edge of this landscape area, and there are small areas of low to medium burn severity located just to the south and west of Little Buck Mountain that may be seen from the Loup Loup Ski area.

The vegetative zone is primarily in the Hot-Dry/Warm-Dry with an area of Cool-Cold/Mesic Moist towards the middleground ridge west of Loup Loup Campground. The vegetative landscape character is natural appearing to slightly altered.

South Summit Forest Road 4100

South Summit Forest Road 4100 is the main travel route accessed off State Highway 20 on the south side of the highway. Forest Road 4100 provides access to the South Summit Trailhead and travels through the project area for approximately 14 miles. It is a two lane graveled road that is used year round and provides opportunities for driving for pleasure, hunting, dispersed use, accessing developed recreation sites in the summer season. It is a popular groomed snowmobile route and cross country ski route in the winter. South Summit Forest Road 4100 provides access to other primary or secondary travel routes along its length that access dispersed recreation opportunities and that eventually connect though private or state lands to the community of Brewster and to State Highway 153 and U.S. Highway 97.

The project area is located on both sides of the South Summit Forest Road 4100 in the foreground and middleground area. The road travels through the project area for approximately fourteen miles. Views are predominantly confined to an enclosed tree lined foreground except in open areas along the ridgetop that allow distant views. The South Summit road is encompassed by Loup Loup Summit, Pole Pick Mountain and Thorpe Mountain being the most prominent mountain peaks along the ridgeline. There are numerous cross country ski trails located along the foreground area that tie into the South Summit Trailhead.

The landform of the landscape is a mountainous ridgeline that is dissected with numerous steeply sloped valleys that provide a diverse topography. In particular, Finley Canyon is a steep narrow canyon located to the west of Forest Road 4100. The vegetative zone is characterized primarily as Warm-Hot/Dry along most of the travel route with large areas of Hot/Dry on the south facing slopes in Finley Creek and Benson Creek. The vegetation transitions to areas of Cool/Dry and Cool-Cold/Mesic-Moist in the upper elevations of Pole Pick Mountain, Finley Mountain, and Mt. Leecher. The vegetative landscape character is a range of natural appearing to slightly altered to altered, resulting from past management activity. There is visual evidence of wildfire throughout various areas of the landscape and evidence of disease and insect infestations that cause portions of the green forest to appear reddish and brown during periods of needle death, especially in the upper elevations.

In areas outside of the Carlton Complex wildfire, there is visual evidence of wildfire throughout various areas of the landscape and evidence of disease and insect infestations that cause portions of the green forest to appear reddish and brown during periods of needle death, especially in the upper elevations. The Carlton Complex wildfire burned through the project area with low to unburned edges along the perimeter, it transitions to areas of medium to high intensity viewed from Highway 20 to Pole Pick, Finley Canyon area and south of Thrapp Mountain. The South Summit travel route is characterized as beginning in unburned areas at Loup Loup Summit for approximately three miles then travels into areas of unburned/underburned to a mixture of Low to medium to high intensity for the next eight miles before transitioning back to Low intensity and back to burned/underburned for the last three miles to the forest boundary.

3.15.3 Environmental Consequences

Thinning trees and associated activities of road construction, temporarily opening closed roads, logging systems, and fuels treatments can affect the scenic resource by altering the naturally established form, line, color, and texture in a given viewshed. The natural landscape character and the existing scenic integrity level (condition) can be affected. Scenic impacts of the change depend on the interactions of the following:

1. Access to stands by existing roads and skid trails.
2. Harvest methods and silvicultural methods.
3. Slash disposal methods.
4. Shape, size, and arrangement of treatment units.
5. Topographical relationship of treatment units to viewer's position and duration of view.
6. Existing landscape character and scenic integrity (The ability of the viewshed to absorb change).
7. Landscape visibility and location in relation to proposed treatment.

Visual absorption capability (VAC) indicates the relative ability of any landscape to accept human alteration without loss of landscape character or scenic integrity level. (USDA FS 1995, Landscape Aesthetics, C-1). The ability of a particular viewshed to absorb change is based on several factors including, but not limited to, soil color, texture of vegetation, slope, and degree of visual screening provided by landform, rockform, vegetative cover and percentage of existing alteration to the viewshed. For example, even-aged dense and uniform stands of trees will not absorb change as easily as an existing uneven-aged stand of trees with multiple small openings that give the landscape a mosaic textured pattern.

Other factors used in VAC analysis include viewer's perception of expectations, viewer's position in the landscape, and duration of view, distance, and proposed activity in terms of scale, size, shape, and distribution. Using VAC, it is possible to rate the project on how easy or difficult it is to blend the activity into the surrounding landscape. VAC is rated in terms of high, medium, or low; high being the easiest to accomplish, low being the most difficult. In general, the South Summit II Forest and Fuels Project has a medium to high VAC rating due to an existing road system, existing mosaic texture vegetative patterns in areas, and the diverse landform with rolling dissected valleys breaking up the continuous ridgelines.

Scenic effects within the South Summit II Forest and Fuels Project area are quantified and interpreted based on how the alternatives change the existing landscape character and scenic integrity level. Landscape character refers to the naturally established landscape patterns that make each landscape identifiable or unique. Scenic integrity is the state of naturalness, or conversely, the state of disturbance created by human activities or alteration. The frame of reference for measuring scenic integrity levels is the valued attributes of the existing landscape character being viewed. The degree of scenic altered condition depends on the amount of changes seen from Highway 20, Loup Loup Ski Bowl and North Summit Forest Road 4200 and South Summit Forest Road 4100. Altered scenic condition in the landscape would be the greatest when most of the trees are removed in a given unit or area. Consequently, the least change would occur when the existing trees are not removed. The character of the landscape would be least affected when most of the existing trees are left intact. Landscape character changes occur similarly to the scenic integrity. The focus will be on the vegetative element of the landscape character.

For purposes of analysis, the following criteria are developed to rate the consequences of the alternatives from high landscape character and scenic condition to moderate landscape character and scenic condition to low landscape character and scenic condition. In the project area, where the Retention visual quality objective is designated, high landscape character and scenic condition is desired. Where the Modification visual quality objective is designated, low landscape character and scenic condition is acceptable. The following table describes the scenic integrity rating criteria and landscape character associated with each.

Figure 3.15-1. Description of High, Moderate, Low and Very Low Landscape Character

Landscape Character	Description
HIGH Landscape Character and Scenic Condition (Desired for all visually sensitive foreground and middle ground areas) Retention Scenic Quality Objective (VQO)	Mosaic landscape patterns, less uniformity. High diversity of structures and variety of spaces. Light treatment to the landscape. Minimal skyline corridors, visible roads, and little mechanical disturbances. Alterations emulate natural appearing patterns. Open spaces with variety of patterns. Areas of dense, mosaic, and clumpy arrangement of textural patterns. Interesting landscapes. **Appears Unaltered.**
MODERATE Landscape Character and Scenic Condition (Desired in foreground and middle-ground areas) Partial Retention Scenic Quality Objective (VQO)	Combination of mosaic and uniform landscape patterns. Some diversity of structure. Moderate variety of spaces and treatment to the landscape. A variety of natural to slightly altered scenic conditions. A variation of natural pattern and interest in the landscape. Some textural patterns and mosaic landscape character are retained. **Appears Slightly Altered.**
LOW Landscape Character and Scenic Condition (Preferred in other landscapes) Modification Scenic Quality	Combination of some mosaic and more uniform landscape patterns. Some diversity of structure. Some variety of spaces. Moderate to higher treatment to the landscape. A variety of natural to slightly altered to altered conditions. A variation of natural

Landscape Character	Description
Objective (VQO)	pattern and interest in the landscape. Some textural patterns are retained. **Appears Moderately Altered.**
VERY LOW Landscape Character and Scenic Condition (Not desirable in any landscape) Maximum Modification Scenic Quality Objective (VQO)	Uniform landscape patterns. Low diversity of structures, little variety of spaces, sameness. Heavy treatment to the landscape. Roads, skyline corridors, and mechanical disturbances dominate scenic conditions. Alterations do not appear natural, heavily altered conditions. Natural patterns are destroyed. Uninteresting, barren and sparse landscapes. **Appears Heavily Altered.**

The concept of treating different areas with various degrees of leave tree combinations provides diversity and variety in the landscape. Scenically, the treatment would emulate and blend with nature. The success of the treatment depends on the number and structure of trees left in a mosaic pattern. In general, larger trees provide a strong vertical structure, creating stronger contrast and emphasizing the character of the area. A variety of openings interwoven throughout the landscape with the mosaic arrangement of leave trees would increase spatial diversity and identity of the area. Scenic quality is highest when a variety of trees are retained.

3.15.3.1 No Action

The No Action Alternative would maintain the existing range of Low to Moderate to High Landscape Character and Scenic Integrity (condition). In the short-term, the landscape would remain as a mosaic pattern of natural appearing to slightly altered and altered landscape character and scenic condition as it currently exists. The vegetative component of the landscape would continue to grow through the pattern of natural succession with a high risk of future disturbance, primarily wildfire. Forest succession that has resulted from fire suppression shapes forest landscapes; the highly textured tree density patterns would continue to dominate the landscape character where they exist. Scenic quality of landscape character and scenic condition would have very low human intervention with nature taking its course. Disturbance to the existing landscape that would occur through mechanical disturbance related to activities of tree removal and prescribed burning would not be done. The opportunity to enhance scenic quality, by improving the forested setting and enhancing large tree character and quaking aspen stands would not be done. A transitional approach to treating the landscape by moving the landscape character towards a more sustainable forest setting that is more resilient to fire; disease and/or insect infestations would not be done. Consequently, the risk of large-scale disturbances, which are already outside of their natural disturbance regime, would remain.

Existing high fuel loadings have the potential to result in a sudden change to the landscape character that could result from a wildfire, which would be seen as a burned area. In the case of wildfire, the landscape character could dramatically change from a forested green setting to an area dominated by the visual evidence of wildfire. Fire intensity patterns would probably range from low to moderate to high viewed in the foreground and middleground from the travel routes. The visual effects of a large scale wildfire would change the landscape character from a highly green textured pattern to a black, brown, and green interwoven landscape pattern. Wildfire visual characteristics would be dominant and evident for 5 to 10 years or more; snags would be created as a result of wildfire. The snags would be dominant for at least 5 years, and then begin to fall and create a jackstraw effect viewed along the travel corridors and would appear visually out of character for a natural appearing landscape. In general, natural forest disturbances that result in extensive areas of dead or

dying trees are perceived negatively. There would be some risk to losing the highly valued large ponderosa pine and Douglas-fir if a wildfire were to occur. A sustainable green scenic forest may not be maintained over time because of this high disturbance risk related to high fuel loadings and potential for catastrophic wildfire.

The landscape would also continue to be affected by insects and diseases, with associated tree mortality and visual impacts to the landscape character. Especially along the State Highway 20 corridor, which is scenic and at high risk for additional tree mortality, the insect and disease infestations would spread beyond areas that are currently affected.

The road system would not be modified to reduce impacts on aquatic habitat and hydrologic function, and would not provide the opportunity to improve scenic integrity by rehabilitating and decommissioning roads. In addition, JR and Loup Loup Campground would not be enhanced by thinning dense forested stands that are currently out of character for a healthy forest with large tree character.

3.15.3.2 Proposed Action

Alternative 2 Effects Common to All Viewsheds

This alternative is fully defined Chapter 2. It includes thinning (commercial, and noncommercial, and ladder fuel reduction) of forest stands, regeneration cutting, tree planting, mastication, machine and hand piling, prescribed burning, changing the transportation system, comprehensively managing the vegetation in JR Campground, Loup Loup Campground and Loup Loup Ski Area, treating hazard trees and fuels along State Highway 20 and Okanogan PUD powerline corridor.

Vegetation removal management activities and associated transportation changes (particularly temporary road construction) would have a direct effect on the landscape character and scenic integrity (condition). Scenic quality is primarily affected by: 1) the type of vegetation treatment proposed and implementation of vegetation treatments, especially logging systems, and 2) prescribed fire and underburning fuels treatments and implementation of surface fuel treatments.

Landscape character is the naturally established landscape pattern that makes each landscape identifiable or unique. For this analysis, focus will be on the vegetative element of the landscape character and the visual effects that would result from proposed thinning, reducing tree density, and visual effects of fuels underburning, pile burning and prescribed fire. The dissected landform of the South Summit II Forest and Fuels Project area has several stream lined valleys that rise to the surrounding ridgelines. This variety in landform provides the opportunity to spatially blend in treatments.

Scenic integrity is measured as the amount of human caused deviation in form, line, color, and texture of a landscape; it serves as a frame of reference for measuring scenic integrity levels based on the valued attributes of the existing landscape character being viewed. In the project area, scenic integrity effects would be seen as the result of changes to landscape character caused by implementation of the vegetation management activities and amount of ground disturbance or vegetation removal in foreground areas of identified travel corridors, and middleground or background views of the area from travel routes, developed recreation trails, Loup Loup Ski Bowl and JR and Loup Loup Campgrounds. Examples of scenic integrity effects include actions such as new skid trails, new or reconstructed roads, fresh tree stumps and slash, blackened tree boles, disturbance to the ground resulting from mechanical activity of cutting trees, and changes to the textured landscape pattern. Overall,

the reduction of fuels and thinning to enhance large tree growth and restoring quaking aspen stands in the landscape would benefit long-term scenic quality by providing a more stable, sustainable forest which is typical of the Northeastern Cascade/Okanogan Highlands vegetative character types.

Landscape Character and Scenic Integrity Positive Elements

1. Enhancement of landscape character would be done by thinning and reducing dense stands of trees, providing variety in spatial distribution of plant communities and moving towards more variety in age classes. Where they exist, large diameter trees would be retained and would stand out as more dominant after removing small trees around them; views into the forest would be more open.
2. Mosaic stand conditions would be maintained or created by leaving tree clumps, canopy gaps, and complex patches of young and understory vegetation.
3. Enhancement of quaking aspen stands would increase scenic quality and variety in the landscape.
4. Potential enhancement of scenery viewing would occur through opening a scenic background vista of the Cascade Mountains in Unit 71 along State Highway 20.
5. Reduction of natural fuels levels would begin the transition of moving the forest setting on a landscape scale towards the sustainable landscape character.
6. Utilization of existing landings, roads, fire lines and natural fuel breaks would reduce further visual impacts associated with implementation. In these areas, visual impacts would be contained within areas already impacted rather than introducing new impacts.
7. Treatment methods of thinning would provide texture changes to the existing dense to mosaic textured landscape and would blend in well.
8. On the landscape scale, using prescribed fire in a timely manner and in phased treatments would reduce the future risk of a potential high intensity wildfire that would affect scenic quality.
9. Fire hazard would be reduced and forest vegetation health and resiliency would be improved around Loup Loup Campground, the Loup Loup Ski Bowl, the North Summit and South Summit Snow Parks, the North Summit cross country ski trails, and the North and South Summit snowmobile trails.

Landscape Character and Scenic Integrity Potential Negative Elements

1. Stumps would be more evident in some foreground areas of travel routes and Loup Loup Campground, the Loup Loup Ski Bowl, the North Summit and South Summit Snow Parks, the North Summit cross country ski trails, and the North and South Summit snowmobile trails and dispersed recreation sites.
2. Coarse woody debris (slash) would be seen along travel routes and Loup Loup Campground, the Loup Loup Ski Bowl, the North Summit and South Summit Sno Parks, the North Summit cross country ski trails, and the North and South Summit Snowmobile trails and dispersed recreation sites before under burning, hand or machine piling, and pile burning is accomplished. This would create a short-term negative visual effect until the material is burned, decomposes or is softened by early successional grasses and forbs. The proposed under burning and pile burning may not entirely eliminate the slash.
3. Prescribed fire has the potential to create larger forms (openings) in the landscape than intended, possibly burn out of the area intended, and/or to burn trees that are desired to be retained for scenic quality or other resource objectives.

Effects of Specific Vegetation Treatment Prescriptions

Detailed descriptions of each of the proposed vegetation treatment types and acreage can be found in Appendix C, with proposed acres also summarized in Chapter 2. Detailed descriptions of the proposed fuels treatment types and acreage can be found in Appendix D, with proposed acres also shown in Chapter 2. Descriptions of proposed transportation system changes can be found in Appendix E and Chapter 2.

HITH - Commercial thinning

Thinning from below opens up the stands by removing the smallest diameter trees, this provides greater viewing distances into the stand which is preferable. The appearance of the stands would be improved by retaining the largest healthiest trees, especially ponderosa pine. There would be a variation of spacing that retains a variety of density patterns and species compositions. The reduction of tree stocking levels would improve the resilience of the stands by reducing stress and ladder fuels, which reduces the risk of high insect and disease epidemic occurrence and stand replacement wildfire. These are benefits that contribute to the improvement of scenic stability when carried out at a landscape scale.

This treatment would create stumps, slash and soil disturbance that would be visible from foreground views. These effects would be minor within the first one to two years. As regrowth of shrubs and grasses occurs these effects would be substantially reduced. Variable density thinning does not create openings that are visible from middleground or background distances. The effects of this prescription would not reduce the scenic integrity of the units.

HPST Commercial thinning with sanitation to create patch openings

Thinning would open up the stands by removing a range of size of trees and would provide greater viewing distances into the stands, which is desirable. The appearance of the stands would be improved by enhancing growth of the largest healthier trees, especially ponderosa pine. There would be a variation of spacing that retains a variety of mosaic density patterns and species compositions. The reduction of tree stocking levels would improve the resilience of the stands by reducing stress and ladder fuels, which reduces the risk of high insect and disease epidemic occurrence and of stand replacement wildfire. These are benefits that contribute to the improvement of scenic stability when carried out at a landscape scale.

This treatment would create stumps, slash and soil disturbance that would be visible from foreground views. These effects would be minor within the first one to two years. As regrowth of shrubs and grasses occurs these effects would be substantially reduced. Variable density thinning does not create openings that area visible from middleground or background distances. The effects of this prescription would not reduce the scenic integrity of the units.

HQAM - Aspen Maintenance

This would be an enhancement for scenic quality by promoting and invigorating the growth of aspen stands that add unique habitat, provide fall color and increase variety in the landscape.

HSTF – Regeneration Harvest

This harvest activity would create a more open landscape, primarily in the upper elevation areas south of the North Summit area. The openings would be small scale compared to the landscape area. The appearance would be a noticeable change to the existing highly

densely textured landscape character. A transitional approach to move the high density stands towards a lower density species pattern and variety in composition would be implemented through harvest management activities and reduction of hazardous fuels and is desirable for landscape character and scenic enhancement. Restoring pattern, structure, and composition appropriate to the fire regime is beneficial for scenic quality.

This treatment would create stumps, slash and soil disturbance that would be visible from foreground views. These effects would be minor within the first one to two years. As regrowth of shrubs and grasses occurs these effects would be substantially reduced except for large stumps that would be visible for many years. The size of the seed tree openings would be visible from middleground or background distances at the higher elevations.

CAMP - Campground thinning
This would be an enhancement for scenic quality by promoting and invigorating the growth of large ponderosa pine stands in a manner that remains visually subordinate, with treatment very light on the ground.

NCT - Noncommercial thinning
This would be an enhancement for scenic quality by promoting and invigorating the growth of large mixed conifer stands in a manner that remains visually subordinate to the landscape character, treatment is very light on the ground. The removal of the diseased trees will reduce the spread of the disease. This treatment would create stumps, slash and soil disturbance visible from foreground views. These effects would be minor within the first one to two years. As regrowth of shrubs and grasses occur these effects would be substantially reduced.

Ladder Fuel Reduction and Associated Fuels Treatments
This treatment reduces stocking levels to promote growth of desirable species, reduce disease, reduce the potential for future insect outbreaks and reduce levels of ladder fuels that increase fire intensity and the occurrence of crown fires. The majority of the landscape area would have understory trees felled, hand-piled and burned or just felled and underburned. A small area would have debris masticated and scattered onsite in areas close to desired overstory trees. A very small area would be felled and scattered then underburned. Low intensity prescribed burning would occur following these treatments in areas that support fire tolerant ecosystems and in drier biophysical environments.

With the treatments scattered over a large landscape scale, direct effects to scenery would be minimal and short-term. Removal of smaller trees opens view into stands. The effects to scenery are limited to foreground view effects of stumps, and slash. A growing season would reduce the effects to the remaining scorched tree trunks, and dead saplings. Fire, at low intensity is a natural occurrence in this area, and its effects do not degrade the scenic quality. This treatment can greatly improve a stands resiliency to large stand replacement fire which can affect the scenic quality.

Fuels Treatments in Noncommercial Thinning Units
The effects of this treatment would be similar to those of underburning-only treatment of natural fuels, however the scorching and soil exposure would usually be more intense. This treatment removes the small saplings and non-crop trees to increase the conditions for fire resistant trees to dominate these stands. Removing these trees would improve the large tree character and opens view into the remaining stands. These effects are consistent with low intensity fire.

Fuels Treatments in Harvest Units
This treatment is similar to the Ladder Fuel Reduction and Associated Fuels Treatments for scenic quality effects and would be an overall benefit by greatly improving a stands resiliency to large stand replacement fire, which can affect the scenic quality.

Fireline to Contain Underburns
This treatment would create stumps, slash and soil disturbance that would be visible from foreground views with a low visual impact. These effects would be minor within the first one to two years. As regrowth of shrubs and grasses occur these effects would be greatly reduced.

Transportation System
Modifying the road system would improve the scenic integrity by rehabilitating and decommissioning old roads and restoring them to a natural condition. See the transportation narrative, Appendix E and Map 3 for locations of proposed road actions. From a scenery perspective, reducing unnecessary roads would be beneficial to improve the scenic landscape setting by reducing linear contrast viewed in the foreground and middleground from designated travel routes. The contrast would be reduced by allowing vegetation to recover within the road corridors, including on unauthorized user-made roads that do not meet design standards and detract from scenery. Other resource impacts that degrade the scenic setting such as soil erosion and compaction and impacts to the aquatic habitat would also be reduced.

JR and Loup Loup Campground
This would be an enhancement for scenic quality by promoting and invigorating the growth of large mixed conifer stands in a manner that would remain visually subordinate to the landscape character, with treatment very light on the ground. The removal of diseased trees would reduce the spread of the disease. This treatment would create stumps, slash and soil disturbance visible from foreground views. These effects would be minor within the first one to two years. As regrowth of shrubs and grasses occur these effects would be substantially reduced.

Loup Loup Ski Area
This would be an enhancement for scenic quality by promoting and invigorating the growth of large ponderosa pine stands in a manner that remains visually subordinate, with treatment very light on the ground. Direct effects to scenery would be minimal and short-term. Removal of smaller trees opens view into stands. The effects to scenery are limited to foreground view effects of stumps, and slash. A growing season would reduce the effects to the remaining scorched tree trunks, and dead saplings. Fire, at low intensity is a natural occurrence in this area, and its effects do not degrade the scenic quality. This treatment would greatly improve a stands resiliency to large stand replacement fire, which can affect the scenic quality.

State Highway 20
This would be an enhancement for scenic quality by promoting and invigorating the growth of large ponderosa pine stands in a manner that remains visually subordinate. Direct effects to scenery would be minimal. Removal of smaller trees opens view into stands and removal of hazard trees or dead and dying trees would enhance scenery by highlighting the healthy green stands. The effects to scenery include views of stumps and slash in areas. A growing season would reduce the effects to the remaining scorched tree trunks and dead

saplings. Fire, at low intensity is a natural occurrence in this area, and its effects do not degrade the scenic quality. This treatment can greatly improve a stands resiliency to large stand replacement fire, which can affect the scenic quality.

Powerline Corridor
This treatment is similar to the State Highway 20 treatment. This would be an enhancement for scenic quality by promoting and invigorating the growth of large ponderosa pine stands in a manner that remains visually subordinate. Controlling access would benefit scenery by allowing the riparian area to become restored and would improve the scenic setting by allowing vegetation to recover along the road corridor and reducing other resource impacts that degrade the scenic setting such as soil erosion and compaction and impacts to the aquatic habitat.

Alternative 2 Effects By Viewsheds
The South Summit II Forest and Fuels Project area has been divided into three separate landscape areas based on landscape visibility, sensitivity levels and visual quality objectives for the scenic travel routes for assessing scenic effects. These three landscape areas are:

1. Highway 20 – Retention VQO
2. Loup Loup Ski Bowl and North Summit Forest Road 4200 – Retention VQO
3. South Summit Forest Road 4100 – Retention to Modification and Maximum Modification VQO

The following narrative describes the environment consequences for each landscape area.

Highway 20 – Retention VQO
The immediate foreground (up to 300' distance zone) and foreground (up to ½ mile distance zone) of Highway 20 travel route are highly sensitive to any new visual impacts. The proposed action would maintain the existing High Landscape Character and Condition and meet the established Visual Quality Objective of Retention foreground and Partial Retention middleground. The proposed action would increase visibility into stands Highway 20 by removing trees in the immediate foreground and foreground, enhancing large tree character, opening up the mid-canopy, and creating greater foreground diversity. The commercial thinning treatments would favor leaving pine species that have the desired large tree character and fire resiliency. This would improve the scenic character and the scenic stability of the area. Landscape character changes would be seen as thinned stands of trees and a more open forested canopy character. The proposed action would improve species composition, stand density, and reduce ladder fuels and canopy closure. Landscape changes would primarily be seen as a texture change from the existing highly textured landscape to a slightly more open landscape pattern. This would result from "heavy" thinning from below the canopy, primarily removing relatively small trees to reduce competition. Stumps would be more evident in some areas of foreground and middleground. Logging systems would be ground based, with both winter and summer season operations. Coarse woody debris (slash) would be seen along the travel route before hand- or machine-piling, and pile burning. This would create a short-term negative visual effect until the material is burned, decomposes or is softened by early successional grasses and forbs. The proposed underburning and pile burning may not entirely reduce the slash. Prescribed fire has the potential to create larger forms (openings) in the landscape than intended, possibly burn outside of the area intended, and/or to burn trees that are desired to be retained for scenic quality or other resource objectives.

These treatments would improve scenic stability from low to high where “all dominant scenery attributes of the valued scenic character are present and are likely to be sustained” (pg. 19, App. J). The appearance of the stands would be improved as they become healthier. This treatment would create stumps, slash and soil disturbance that would be visible from foreground views. These effects would be minor within the first one to two years. As regrowth of shrubs and grasses occurs, these effects would be substantially reduced. This treatment would not create openings that are visible from middleground or background distances. The effects of this prescription would not reduce the scenic integrity of the units as they are expected to be negligible within 2-3 years.

These prescriptions would improve the scenic character by moving stands toward the historic range of variability. More open stands of relatively fire resistant species compositions will improve scenic stability. See the previous section in the proposed action narrative on the summary of general effects for discussion of positive and negative effects for landscape character and scenic integrity.

Reference the Scenic Specialist Report for the vegetation management units and fuels treatments unique to Highway 20 in Management Area 5 and 17.

Summary of Effects

The proposed action alternative would move stands toward desired future conditions which are with historic range of variability, and reduce the risk of uncharacteristic fire, while keeping effects to scenic integrity to a minimum, meeting all standards.

Loup Loup Ski Bowl and North Summit Forest Road 4200 – Retention VQO

The immediate foreground (up to 300’ distance zone) and foreground (up to ½ mile distance zone) of the Loup Loup Ski Bowl and North Summit Forest Road 4200 travel route are highly sensitive to any new visual impacts.

The proposed action would maintain the existing High Landscape Character and Condition and meets the established Visual Quality Objective of Retention foreground and Partial Retention middleground. The proposed action would increase visibility into stands along North Summit Forest Road 4200 for approximately one mile by removing trees in the immediate foreground and foreground, enhancing large tree character, opening up the mid-canopy, and creating greater foreground diversity. The commercial thinning treatments would favor leaving the pine and larch species that have the desired large tree character and fire resiliency. These treatments would improve the scenic character and the scenic stability of the area. Landscape character changes would be seen as thinned stands of trees and a more open forested canopy character. The proposed action would improve species composition, reduce stand density, and reduce ladder fuels and canopy closure.

Landscape changes would primarily be seen as a texture change from a moderately to highly textured green landscape to a slightly more open landscape pattern that would result from “heavy” thinning from below the canopy, primarily removing relatively small trees to reduce competition. Stumps would be more evident in some areas of foreground and middleground. Logging systems would be ground based with summer season operations.

Coarse woody debris (slash) would be seen along travel routes before underburning, hand or machine piling, and pile burning. This would create a short-term negative visual effect until the material is burned, decomposes or is softened by early successional grasses and forbs. The proposed pile burning may not entirely reduce the slash. Prescribed fire has the

potential to create larger forms (openings) in the landscape than intended, possibly burn outside of the area intended, and/or to burn trees that are desired to be retained for scenic quality or other resource objectives.

These treatments would improve scenic stability from low to high where “all dominant scenery attributes of the valued scenic character are present and are likely to be sustained” (pg. 19, App. J). The appearance of the stands would be improved as they become healthier. This treatment would create stumps, slash and soil disturbance that would be visible from foreground views. These effects would be minor within the first one to two years. As regrowth of shrubs and grasses occurs, these effects would be substantially reduced. This treatment would not create openings that area visible from middleground or background distances. The effects of this prescription would not reduce the scenic integrity of the units, as they are expected to be negligible within 2-3 years.

These prescriptions would improve the scenic character by moving stands toward the historic range of variability. More open stands of relatively fire resistant species compositions would improve scenic stability. See the previous section in the proposed action alternative narrative on the summary of general effects for discussion of positive and negative effects for landscape character and scenic integrity.

Reference the Scenic Specialist Report for the vegetation management units and fuels treatments unique to the Loup Loup Ski Bowl and South Summit Forest Road 4200 in Management Area 5 and 17.

Summary of Effects

The proposed action alternative would move stands toward desired future conditions that are within the historic range of variability, and reduce the risk of uncharacteristic fire, while keeping effects to scenic integrity to a minimum, meeting all standards.

South Summit Forest Road 4100 – Retention to Modification and Maximum Modification Effects

The immediate foreground (up to 300’ distance zone) and foreground (up to ½ mile distance zone) of the South Summit Forest Road 4100 travel route are sensitive to any new visual impacts.

The proposed action would maintain the existing Moderate to High Landscape Character and Condition and meets the established Visual Quality Objective of Retention foreground and Partial Retention middleground in designated scenic travel routes. The proposed action would increase visibility into stands along South Summit Forest Road 4100 by removing trees in the immediate foreground and foreground enhancing large tree character, opening up the mid-canopy, and creating greater foreground diversity. The commercial thinning treatments would favor leaving pine and larch species that have the desired large tree character and fire resiliency. This would improve the scenic character and the scenic stability of the area. Landscape character changes would be seen as thinned stands of trees and a more open forested canopy character. The proposed action would improve species composition, reduce stand density, and reduce ladder fuels and canopy closure.

Landscape changes would primarily be seen as a texture change from an evenly textured green landscape to a slightly more open landscape pattern that would result from “heavy” thinning from below the canopy, primarily removing relatively small trees to reduce

competition. Stumps would be evident in some areas of foreground and middleground. Logging systems would be ground based with winter and summer season operations.

Coarse woody debris (slash) would be seen along travel routes before underburning, hand or machine piling, and pile burning. This would create a short-term negative visual effect until the material is burned, decomposes or is softened by early successional grasses and forbs. The proposed underburning and pile burning may not entirely reduce the slash. Prescribed fire has the potential to create larger forms (openings) in the landscape than intended, possibly burn outside of the area intended, and/or to burn trees that are desired to be retained for scenic quality or other resource objectives.

These treatments would improve scenic stability from low to high where “all dominant scenery attributes of the valued scenic character are present and are likely to be sustained” (App. J). The appearance of stands would be improved as they become healthier. This treatment would create stumps, slash and soil disturbance that would be visible from foreground views. These effects would be minor within the first one to two years. As regrowth of shrubs and grasses occurs, these effects would be substantially reduced. This treatment would not create openings that area visible from middleground or background distances. The effects of this prescription would not reduce the scenic integrity of the units, as they are expected to be negligible within 2-3 years.

These prescriptions would improve the scenic character by moving stands toward the historic range of variability. More open stands of relatively fire resistant species would improve the scenic stability. See the previous section in the proposed action alternative narrative on the summary of general effects for discussion of positive and negative effects for landscape character and scenic integrity.

Reference the Scenic Specialist Report for the vegetation management units and fuels treatments unique to the North Summit Forest Road 4100 in Management Area 5 and 17.

Summary of Effects

The proposed action would move stands toward desired future conditions, which are within historic range of variability, and reduce the risk of uncharacteristic fire, while keeping effects to scenic integrity to a minimum, meeting all standards.

3.15.3.3 Cumulative Effects of the Proposed Action

This cumulative effects analysis considers effects of past, present, and reasonably foreseeable future actions within Highway 20, Loup Loup Ski Bowl, North Summit, and South Summit viewsheds. The geographic boundary for this cumulative effects analysis is the South Summit II Forest and Fuels Project Area and the temporal boundary is approximately 10 years following completion of proposed vegetation and fuels management treatments, the amount of time needed for evidence of logging and prescribed burning to soften and blend into the landscape more completely.

Past Actions

Vegetation management has occurred in the past in the South Summit II Forest and Fuels Project Area. There have been numerous timber sales, fuels reduction treatments, and activities associated with hazard tree removal in developed campgrounds and along travel routes. In addition, there have been several large scale wildfires that occurred in the past 10 years that resulted in a more recently burned landscape pattern with a mosaic of burn

intensities. The wildfires have contributed to landscape change as seen from the identified viewsheds.

The activities of past management activities in total combine to maintain the current high scenic integrity levels for the foreground of the designated viewsheds.

Present Actions
Vegetation management will continue to occur as routine hazard tree removal in developed recreation sites and along travel routes.

Fire suppression will continue contributing to the change of vegetation species associated with higher stand densities, different age compositions (primarily undergrowth) and subtle changes that are out of character for each environmental zone.

Reasonably Foreseeable Future Actions
Vegetation management will continue to occur as routine hazard tree removal in developed recreation sites and along travel routes.

Fire suppression will continue contributing to the change of vegetation species associated with higher stand densities, different age compositions (primarily undergrowth) and subtle changes that are out of character for each environmental zone.

Washington DNR has proposed salvage harvesting east of the project area near Thrapp Mountain and in the Texas Creek drainages near the project area.

3.15.3.4 Consistency Statement
The proposed action alternative would maintain High Landscape Character and Scenic Integrity (Condition) and would meet the established Visual Quality Objectives of Retention in Management Area 5 and Management Area 17 with High Visual Significance (ONFP 4-65-69). Foreground landscapes (up to ½ mile distance zone or seen area) would have the visitor perception of a natural appearing environment and would have high scenic integrity. The proposed treatments would be consistent with Forest Plan Standards and Guidelines for Visual Quality.

3.16 HERITAGE RESOURCES

The section below summarizes the existing condition information, along with the direct, indirect and cumulative effects from the South Summit II Forest and Fuels Project, as analyzed in the South Summit II Forest and Fuels Cultural Resources Specialist Report (Smith 2015) available in the project record.

3.16.1 Affected Environment

Cultural resources are fragile, non-renewable resources that chronicle the history of people traversing and utilizing the natural landscape. Cultural resource identification efforts in the South Summit II Area of Potential Effect (APE) have focused on three primary types of resources: prehistoric archaeological sites, historic archaeological sites, and traditional cultural properties (TCPs), which are valued places to contemporary Indian and non-Indian communities. Cultural resource identification efforts have included pedestrian field surveys, literature reviews, traditional cultural properties research, Geographic Information Systems (GIS) analysis, and consultation with American Indian tribes that are historically associated with the area.

Nineteen previous cultural resource surveys and inventory projects have taken place within portions of the South Summit analysis area. These surveys amounted to the discovery of eighteen cultural resource sites. The OWNF defines a cultural resource site as a locus of purposeful and interpretable human activity containing physical manifestations of that activity (i.e. one or more features with or without artifacts; one or more formal tools found in association with other cultural materials; diverse cultural materials in densities beyond the level of one or a few lost artifacts; or physical manifestations of human activity that in the professional opinion of an archaeologist are indicative of purposeful human activity). These resources are typically at least 50 years old and are considered valuable if they have yielded or could yield scientific or scholarly information important in prehistory or history.
In order to meet the requirements set forth in Section 106 of the National Historic Preservation Act (NHPA), as amended, and the Forest's 1997 Programmatic Agreement (PA) with the State Historic Preservation Office (SHPO), an intensive cultural resource inventory of the project APE began in 2012. The OWNF site location probability model was used to identify areas for survey. The model uses a variety of environmental variables such as slope, distance to water, and landform type along with oral and recorded history to predict the likelihood that an area will contain material evidence of past human activity. Sample strategy standards require that intensive, systematic pedestrian survey be applied to no less than 100 percent of high site location probability areas, 35 percent of moderate probability areas, and 5 percent of low probability areas. The South Summit sample survey resulted in the intensive reconnaissance of 3,169 acres. This survey led to the discovery and recordation of eight new cultural resource sites.

A cultural resource survey was also conducted within the 155 acres of state and private lands that were originally included in the proposed South Summit project. Areas of moderate and high site probability, which amounted to approximately 22 acres, were intensively surveyed for cultural resources. This survey resulted in the discovery and recordation of one historic site consisting of a road bed, fence line, debris pile and two fruit trees located.

In addition to sites, 36 isolated occurrences (IO) are located within the South Summit APE. The OWNF defines an IO as a physical manifestation of human activity that does not appear

purposeful and does not meet any criteria for designation as a “site”. Isolates are understood to consist of one or a few accidentally lost or randomly discarded artifacts. All cultural resources found within the South Summit APE date to the late 19th and early 20th centuries. No cultural resources dating to the prehistoric (Pre A.D. 1750) or proto-historic (A.D. 1750-1811) periods have been recorded within the analysis area.

Approximately 10 miles of road segments proposed for closing or decommissioning lie in high-site-probability areas and have not been surveyed for this project as of March 2015. Surveys are planned for spring and summer 2015. No implementation would occur on these road segments until heritage surveys are completed and concurrence obtained from SHPO on the results of the surveys.

The most commonly observed cultural resources within the South Summit analysis area are historic features and artifacts associated with late 19th and early 20th century mining, homesteading, and livestock rearing. These features include cabins, corrals, stock driveways, mines, seasonal camps, refuse dumps, utility corridors, trails, and roads. Following the establishment of tribal reservations and the removal of tribes from the region, the area was opened to public settlement. Miners looking for gold, lead and silver ores and homesteaders hoping for viable land flocked to the region after 1886. Mining districts, like the Methow District, were established in the late 1880s and flourished into active communities and town sites. Mining districts continued to increase in the early 20th century and towns like Twisp, Gloversville, and Ruby were established. Sites in the South Summit project area associated with mining and homesteading include the Rattlesnake Mine, Jay’s Camp, Dunn’s Outpost, the Filer Stage Station, Hobbit Cabin, Benson Cabin, the Upper Hooker Cabin, Frazer Corral and the remains of the Brewster-Pasayten stock driveway (see specialist report for additional information).

As the Euro-American population increased in the area, so did livestock production and the need for grazing lands. Commercial logging in the upper Methow Valley started in the 1920s. At that time, logging was confined to the lower and gentler slopes. Crosscut saws were used to fell trees and horses pulled the logs to camps. As technology improved and trucks were used to transport logs to mills on the valley floor, more of the area was harvested for timber. Government Land Office (GLO) maps from the early 20th century and early Forest Service maps show numerous roads and utility corridors (communication lines) established in the South Summit project area by the 1940s. The Benson Creek road (FS 4150) and the road to the summit of Mt Leecher (4150-100) along with many spur roads were recorded on the 1908 cadastral survey maps. White and brown ceramic insulators and wire have been recorded in trees along these historic roads and are most likely the remains of communication lines.

As communities grew in the area, land management activities including fire prevention became necessary to protect life and property. Following a number of devastating wildfires in the early 1900s the Forest Service actively began establishing lookout towers. During the early 1930s, lookout towers and features were constructed on Leecher Mountain and Thrapp Mountain. Historic phone lines were connected to each tower allowing communication between the lookouts and ranger or guard stations. The Russian Springs Ranger Station was located southeast of the Leecher Mountain lookout site and served the area in resource management and protection. Additional historic sites include a portion of the Chiliwist Trail, the old Loup Loup ski hill, two grave sites, and several rock cairns and blazed trees of unknown association.

Traditional Cultural Properties
The NHPA, NEPA and other authorities require that federal agencies consider the impact of their actions on cultural uses of the natural environment such as those practiced by present-day communities of American Indians. Resources of contemporary tribal interest may include TCPs, areas important for the practice of Indian religion, Indian sacred sites on federal lands, and areas that support cultural uses of the natural environment (i.e. subsistence use of plants or animals). An ethnographic overview was conducted in 2013 for lands within and surrounding the South Summit II APE (see specialist report). The primary purpose of this investigation was to document the presence or absence of TCPs or other areas of traditional or cultural use for the Confederated Tribes of the Colville Reservation. The report summarized a thorough literature review including historic documents, archaeological site records and reports and anthropological texts available through the Washington State Department of Archaeology and Historic Preservation (DAHP), the Okanogan-Wenatchee Heritage Program library, the Okanogan County Historical Society, and the Washington State University Library system. Bibliographic resources pertaining to the region were reviewed for information regarding cultural landscape, traditional world views, traditional religious views and practices, subsistence practices and rituals, the occupancy of land, and the use of resources. The study found no evidence of TCPs or traditional tribal use or gathering areas within the South Summit APE. To date, neither the Confederate Tribes of the Colville Reservation or the Yakama Nation have identified TCPs or traditional gathering or use areas within the project area.

Desired Condition
Complete site avoidance during project implementation is the preferred method of management for cultural resources that have characteristics qualifying them for inclusion on the National Register of Historic Places (NRHP). If the integrity of the cultural resource and/or surrounding areas is altered by project activities, that project is considered to have direct and/or indirect effects on the site. Two alternative actions have been proposed by the Forest as a result of the South Summit project analysis. These actions may potentially have direct, indirect and cumulative effects on the 26 cultural resource sites and 36 isolated occurrences identified within the APE.

3.16.2 Environmental Consequences

3.16.2.1 No Action
Under the No Action alternative, no timber harvest or fuels treatments, road work or other ground-disturbing activities would take place in the South Summit II APE. Ongoing and future activities, such as routine road maintenance, recreation use, grazing, and noxious weed control would occur under current Forest Plan standards. This alternative would have little direct and indirect effects on cultural resources, with no likelihood of timber harvesting or other fuels reduction activities disturbing or damaging cultural resources in the South Summit II project area. Routine resource and infrastructure management would continue under the Forest Plan, which tiers to cultural resource protection and avoidance.

However, as a consequence of no timber harvesting or fuels reduction activities, heavier fuel loads could intensify the risk of wildfires adversely affecting cultural resources by damaging the physical integrity of archaeological sites and historic properties. Ground fires would pose the greatest hazard to fire sensitive cultural resources, as sites with moderate to high fuel loads could experience higher temperature, and longer lasting burn overs. Sites containing combustible materials, such as cabins or corrals, would be most vulnerable to wildfire consumption. Soils subjugated to high and moderate heat intensity become less

stable and in extreme cases, hydrophobic. Unstable soils have the tendency to erode when saturated, exposing subsurface cultural resources, or burying surface artifacts.

3.16.2.2 Proposed Action

The proposed actions include timber harvesting and fuels reduction activities that would ultimately protect National Register eligible cultural resources by reducing the likelihood for high intensity wildfire in the project area. No direct or indirect effects on cultural resources are anticipated given that project activities would be controlled through mitigation measures. These mitigations include protection of cultural resources by either flagging for avoidance or via implementing fuel reduction treatments by hand including where needed, hand line construction or the use of fire retardant materials to protect fire sensitive features in National Register eligible sites. All cut material will be carried off site by hand and no trees will be planted within site boundaries. No debris piles, landing areas, fuel breaks (dozer or hand line), roads or skid trails will be constructed within site boundaries. Timber harvesting equipment or other heavy machinery will not be used within site boundaries, unless the unit is designated for over-snow operations. Cultural resource monitoring would also occur within the APE and at cultural resource sites as project undertakings take place. All project undertakings identified under Alternative 2 will avoid National Register eligible and unevaluated cultural resources per Section 106 of NHPA. Ground-disturbing management activities within the APE currently avoid all known cultural resources.

3.16.2.3 Cumulative Effects of All Alternatives

Past and future forest management projects have the potential to impact cultural resources within the South Summit project area. Typical vegetation management activities, such as timber harvesting, thinning, fuels management, and vegetation reduction, as well as other activities like fence repair, culvert replacement and water feature enhancement can cause surface disturbance that may affect the integrity of cultural resources. Ongoing and future monitoring and inspections of known or newly identified cultural resources in the project area would trigger adjustments in management practices as appropriate to ensure that cultural resources are considered and managed to standard within the project area. As a result, cumulative effects to cultural resources in the project area should be minimal as protection and mitigation measures are implemented. Any potential impacts that cultural resources might incur from foreseeable future actions within the project APE would be mitigated per the 1997 PA with the Washington State SHPO.

3.16.2.4 Consistency Statement

Heritage and Tribal interests are regulated by federal laws that direct and guide the Forest Service in identifying, evaluating and protecting cultural resources. All of the alternatives would comply with federal laws. The Okanogan-Wenatchee National Forest Plan tiers to these laws with no additional standards, therefore the proposed action alternatives meet Forest Plan Standards. With the completion of the cultural resources inventory per Section 106 of the NHPA and under the terms of the 1997 PA with Washington SHPO and by providing the interdisciplinary team with appropriate input as per NEPA, all relevant laws and regulations have been met.

3.17 OTHER REQUIRED DISCLOSURES

CONFLICTS WITH OTHER PLANS, POLICIES, OR OTHER JURISDICTIONS

This project would not conflict with any plans or policies of other jurisdictions, including Tribes and neighboring public and private landowners. This project would not conflict with other policies, regulations, or laws, including the Clean Water Act, Endangered Species Act, National Historic Preservation Act, Magnuson-Stevenson Fishery Conservation and Management Act, and Clean Air Act. Other potential conflicts with plans, policies, or other jurisdictions are discussed below.

3.17.1 SOCIAL GROUPS, CIVIL RIGHTS AND ENVIRONMENTAL JUSTICE

Civil Rights would not be affected by the South Summit II Forest and Fuels project. The project includes timber sale purchaser work, Forest Service contracted work, and Forest Service employee-accomplished work. Under Executive Order 11246 companies with Federal, contracts or subcontracts are prohibited from job discrimination on the basis of race, color, religion, sex, or national origin. The U. S. Department of Agriculture prohibits discrimination in its employment practices based on race, color, national origin, gender, religion, age, disability, political beliefs, sexual orientation, and marital and family status.

Executive Order 12898 (59 Fed, Reg. 7629, 1994) directs Federal agencies to identify and address, as appropriate, any disproportionately high and adverse human health or environmental effects on minority populations and low-income populations. No minority and poor communities are located adjacent to the planning area. Timber sale haul routes would likely pass through the small towns of Winthrop and Twisp, which contain low-income communities. Because the route, on Highway 20, receives regular local, tourist and commercial traffic, the effects on traffic and noise would not be noticeable.

The effects of the proposed action on civil rights and low income or minority communities would be minimal. Employment would be created through both timber sale and service contracts, and contractors/subcontractors are prohibited from discrimination based on race, color, religion, sex, or national origin. Some contracts for this project may be offered under Small Business Administration authorities, which could result in positive employment benefits to minority populations.

The proposed action would not have disparate effects on any consumers, minority groups, women, civil rights, or social/ethnic groups. All contracts would meet Equal Employment Opportunity requirements.

3.17.2 FLOODPLAINS AND WETLANDS

No impacts to designated floodplains or wetlands are projected. Project activities would occur in some RHCAs although not in areas with riparian vegetation; effects are described in the forest vegetation, water resources, aquatic resources, sensitive plants and fuels sections of this chapter. Floodplains and wetlands would be protected through project design details and mitigation measures, which conform to Executive Orders 11988 and 11990.

3.17.3 PRIME RANGE LAND, FARM LAND AND FOREST LAND

The proposed action complies with the Federal Regulations for prime land. Lands within the project area do not qualify as “prime” forest land. Effects to forestland are described earlier in this chapter. The South Summit II Forest and Fuels analysis area does not contain any

prime rangeland or prime farm land, therefore, none of the alternatives would have any effect on prime rangeland and farmland.

3.17.4 INVENTORIED ROADLESS AREAS/POTENTIAL WILDERNESS AREAS

The South Ridge Inventoried Roadless Area (IRA) is located in the northwest of the northern section of the planning area. None of the proposed activities in the South Summit II Forest and Fuels Project would change the roadless character in this IRA. No road construction or tree removal is proposed in the IRA. A map showing the location of the IRA relative to the project area is included in the Project File.

There are no Potential Wilderness Areas (PWA) in or adjacent to the project area.

3.17.5 WILD AND SCENIC RIVERS

There are no Wild and Scenic Rivers within or near the South Summit II Forest and Fuels Planning area.

3.17.6 POTENTIAL OR UNUSUAL EXPENDITURES OF ENERGY

In relation to national and global petroleum reserves, the energy consumption associated with the proposed action would be minor. Fossil fuels used during the operation and transportation phases of the South Summit II Forest and Fuels project would result in an irreversible resource commitment of fossil fuel resources. Energy consumption associated with this project would be negligible at the local, regional or national scale.

3.17.7 AMERICAN INDIAN TREATY RIGHTS

No American Indian Treaty Rights would be affected by the South Summit II Forest and Fuels Project. The Tribal governments for the Confederated Tribes of the Colville Indian Reservation and Yakama Nation were contacted during government to government consultation; no concerns about the project were raised by either tribal government.

3.17.8 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

There are no known substantial, irreversible, or irretrievable commitments of resources connected with the proposed action. Fossil fuel needed for operations and transportation associated with this project would be irreversibly lost, but this is negligible in the context of regional, national or global use.

Chapter 4: Agencies and Persons Consulted

The Forest Service consulted the following individuals, Federal, state and local agencies and tribes during the development of this environmental assessment:

4.1 Agencies

U.S. Fish and Wildlife Service
National Oceanic and Atmospheric Administration – National Marine Fisheries Service
Washington State Historic Preservation Office
Washington State Natural Heritage Program
Washington Department of Fish and Wildlife
Washington Department of Natural Resources
Washington Department of Transportation
Okanogan County PUD

4.2 Tribes

Confederated Tribes of the Colville Reservation
Yakama Nation

4.3 Individuals that Commented

Kris Betty
Nelson Betty
Greg Knott
Byron Lee
Lloyd McGee, Nature Conservancy and
North Central Washington Forest Health Collaborative co-chair
Ginger Reddington
Doug Sherrow
Ginny Sherrow
Vic Stokes
Paul Ward, Yakama Nation and
North Central Washington Forest Health Collaborative co-chair
Jen Watkins, Conservation Northwest
Maurice Williamson, American Forest Resource Council
George Wooten, Conservation Northwest

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Appendix A: Design Criteria and Mitigation Measures

Figure A-1. South Summit II Forest and Fuels Design Criteria and Mitigation Measures

Item	Resource	Goal	Criteria	Harvest Thinning	NCT/LFR Thinning	Piling, Rx Fire, Mastication, & Fireline	Roads	Campground Construction	Tree Planting	Grazing	Hazard Tree Felling
1	Air Quality	Inform public of prescribed fire activities.	Public notification of prescribed burning activities will use applicable strategies described in the current Methow Valley Ranger District Prescribed Fire Public Information Plan.			x					
2	Air Quality	Provide firewood use to local communities	Where slash is accessible from open roads, firewood use will be allowed for one year after commercial and ladder fuel reduction treatments have been completed except where biomass is utilized commercially. Outside of landings, firewood use will not be allowed where slash is hand-piled or machine-piled.			x					
3	Air Quality	Minimize smoke impacts to local communities	Burn implementation will be designed to comply with the current Washington State Smoke Implementation Plan and WA DNR smoke management regulations as applicable.			x					
4	Aquatics	Provide habitat from danger tree removal along Highway 20	Where trees cannot be left on the ground without having portions remaining in the road travel-way, only those portions that extend beyond the existing standing trees will be removed, leaving the tip portions within the core RHCA area to provide habitat benefit.								x

Item	Resource	Goal	Criteria	Harvest Thinning	NCT/LFR Thinning	Piling, Rx Fire, Mastication, & Fireline	Roads	Campground Construction	Tree Planting	Grazing	Hazard Tree Felling
5	Aquatics	Provide woody debris near Frazer Creek from danger tree removal along Highway 20	Where public safety can be maintained, trees identified as danger trees will be felled toward Frazer Creek, left on the ground to provide habitat function, and marked with 'no firewood cutting' signage.								x
6	Aquatics	Meet RHCA coarse woody debris objectives	Trees not designated as included timber that are felled within RHCAs because they pose a safety risk will be left on site when needed to meet coarse woody debris objectives.	x							
7	Aquatics	Ensure activities in wetlands are consistent with RMOs.	Identify wetlands in units before operations to ensure that activities are consistent with applicable design criteria that implement Riparian Management Objectives.								
8	Aquatics	Avoid disturbing large riparian vegetation	Fuels and NCT vegetation treatments will not remove upper canopy layer trees in RHCAs of perennial streams.		x						
9	Aquatics	Restrict further fire impacts to RHCAs in project area affected by Carlton Complex.	No underburning will occur in RHCAs specific to this project.			x					
10	Aquatics	Limit impacts of administrative use of motor vehicles in RHCAs	OHVs used for administrative purposes will not leave existing roadways within the RHCA.			x					

Item	Resource	Goal	Criteria	Harvest Thinning	NCT/LFR Thinning	Piling, Rx Fire, Mastication, & Fireline	Roads	Campground Construction	Tree Planting	Grazing	Hazard Tree Felling
11	Aquatics	Limit cumulative impacts of prescribed fire on riparian resources	No more than 20% of any 6th field sub-watershed will be burned in any single year (Beche et al.2005).			x					
12	Aquatics	Minimize soil disturbance, canopy removal, and mortality of deciduous species in RHCAs	Fire effects within the riparian areas will be closely monitored and implementation techniques will be utilized to limit burn severity. Fire spread into riparian areas is acceptable, however if fire effects becomes unfavorable within the RHCA's, Minimum Impact Suppression Tactics (MIST) would be utilized to suppress fire spread.			x					
13	Aquatics	Limit disturbance of burning in RHCAs	Prescribed fire application in RHCAs in this project would have these RHCA soil burn severity objectives: At least 90% of the burned portion of the RHCA has low severity, no more than 10% has moderate severity, and 0% has high severity as defined in Figure A-6.			x					
14	Aquatics	Limit disturbance of burning on wetlands.	Wetlands will be excluded from burning.			x					
15	Aquatics	Protect ponds that are used for water drafting.	Water drafting sites for dust abatement, road compacting or non-emergency fire use are located at the pond adjacent to the 4100000 road at approximately MP 11.4 and at the pond adjacent to the 4150200 road at approximately MP 0.4. Use of these sites will be in accordance with applicable terms of the WDFW/FS MOU.			x	x				

Item	Resource	Goal	Criteria	Harvest Thinning	NCT/LFR Thinning	Piling, Rx Fire, Mastication, & Fireline	Roads	Campground Construction	Tree Planting	Grazing	Hazard Tree Felling
16	Aquatics	Limit machine piling in RHCAs.	Machine piling within RHCAs is allowed in units 673, 680, and 866 only, and will follow specifications in Figure A-4. Debris in RHCAs in other units will be scattered, or piled outside the RHCA with equipment that reaches in the RHCA from the buffer edge.			x					
17	Botany & Sensitive Plants	Avoid disturbance to soils and vegetation in Sensitive plant sites.	Apply a 50 foot buffer to established Sensitive plant site boundaries. No disturbance to soils or vegetation may occur within these buffers.	x	x						
18	Botany & Sensitive Plants	Maintain shading sufficient shading to protect the microsite conditions.	Where Sensitive plants occur or are suspected to occur near harvest units, maintain shading sufficient to protect the plant's microsite conditions. In most cases the equipment buffer zones for RHCAs will be adequate. The District Botanist will assess the need for additional protection during unit layout.	x							
19	Botany & Sensitive Plants	Avoid regenerating conifers near aspen stands.	Conifer seedlings will not be planted within 50 feet horizontal distance of aspen clones one tenth acre and larger in size (approximately 66 feet by 66 feet and larger)						x		
20	Botany & Sensitive Plants	Reduce conifer competition with aspens.	Conifers smaller than 7 inches DBH will be felled in aspen stands located within harvest treatment units, concurrently or following completion of harvest operations		x						

Item	Resource	Goal	Criteria	Harvest Thinning	NCT/LFR Thinning	Piling, Rx Fire, Mastication, & Fireline	Roads	Campground Construction	Tree Planting	Grazing	Hazard Tree Felling
21	Botany & Sensitive Plants	Reduce conifer canopy closure in aspen stands to reduce competition with aspen and provide trees favorable for wildlife.	Conifer canopy closure within aspen stands ¼ acre and larger in size in harvest units will not exceed approximately 10% following treatment. This will be accomplished by retaining, on average, a maximum of 10 conifer stems per acre larger than 7" DBH following harvest treatment including the adjacent area located within 50 feet of treated aspen stand perimeters. Ponderosa pine and western larch will be the preferred conifer species for retention. The largest conifers, including trees 21" DBH and larger and defective trees most favorable for wildlife will be retained in aspen stands.	x							
22	Botany & Sensitive Plants	Preserve existing aspen trees.	No aspen will be targeted for felling or commercial removal in harvest, noncommercial thinning, and ladder fuel reduction treatment units.	x	x						
23	Botany & Sensitive Plants	Limit cattle access to Sensitive plant habitats.	Burning will retain coarse woody debris in and around sensitive plant habitats.			x				x	
24	Botany & Sensitive Plants	Mitigate impacts to botanical resources in known locations of Sensitive plants.	Refer to internal Botany Design Criteria in Project File for site-specific design criteria.	x	x	x					

Item	Resource	Goal	Criteria	Harvest Thinning	NCT/LFR Thinning	Piling, Rx Fire, Mastication, & Fireline	Roads	Campground Construction	Tree Planting	Grazing	Hazard Tree Felling
25	Botany & Sensitive Plants	Minimize disturbance of Sensitive plant habitat.	Occupied or potentially occupied Sensitive plant habitat will be excluded from burning. Maps and descriptions of specific avoidance areas will be provided (see Internal Design Criteria). Apply a 50 foot buffer to all established Sensitive plant site boundaries.			x					
26	Botany & Sensitive Plants	Minimize impacts to occupied or potentially occupied Sensitive plant habitat, perennially wet sites, and areas with riparian dependent vegetation.	In occupied or potentially occupied Sensitive plant habitat, perennially wet sites, and areas with riparian dependent vegetation: No ground-disturbing activities; sites shall be winter logged following Figure A-2; and no NCT thinning in known Sensitive plant habitat.	x	x	x					
27	Botany & Sensitive Plants	Minimize impacts of piling and burning in aspen stands.	Limited piling and burning will be allowed in aspen stands greater than ¼ acre that occur within harvest units. Piles will be at least 6 feet from the nearest bole and will not exceed 8 feet in diameter. and the area burned will not exceed 15 percent of the aspen stand area. The area burned within an aspen stand will not exceed 15 percent of the stand area.			x					
28	Fuels Management	Ensure mitigation measures are included in burn plans.	Resource Specialists will be given opportunity to read and review burn plans.			x					

Item	Resource	Goal	Criteria	Harvest Thinning	NCT/LFR Thinning	Piling, Rx Fire, Mastication, & Fireline	Roads	Campground Construction	Tree Planting	Grazing	Hazard Tree Felling
29	Fuels Management	Minimize hazards to burn crews, increase holding options, and minimize ground-disturbing fireline construction.	Burn boundaries of underburn units may be extended outside of the harvest boundary (such as extending the unit boundary to a nearby defensible road, cow trail, ridge line, or skid trail). Burn boundaries may not be extended into an RHCA for this project. Coordination with resource specialists will occur during burn planning to assure that required surveys are completed as necessary and relevant design criteria described in this document are followed.			x					
30	Heritage Resources	Provide for site monitoring during implementation in lieu of pre-disturbance survey.	Monitor the construction of the horse campground plus any road closures and decommissioning in high site-probability areas not previously surveyed during the original South Summit heritage survey. A list of activities and locations requiring heritage survey or implementation monitoring is in Figure A-12 in Appendix A. A map showing these locations is in the project file.				x	x			
31	Heritage Resources	Protect known and newly discovered cultural resources.	Activities will avoid Eligible and Unevaluated cultural resources. Contracts will include standard clauses to allow the Forest Service to modify or cancel portions of the contract to protect known and newly discovered cultural resources. If cultural resources are discovered as a result of project activity, all work in the vicinity of the discovery would cease until professionally assessed.	x	x	x	x	x	x	x	x

Item	Resource	Goal	Criteria	Harvest Thinning	NCT/LFR Thinning	Piling, Rx Fire, Mastication, & Fireline	Roads	Campground Construction	Tree Planting	Grazing	Hazard Tree Felling
32	Invasive Plants	Avoid spreading invasive plants with road maintenance.	Road blading, brushing and ditch cleaning in areas with high concentrations of invasive plants will be conducted in consultation with District invasive plant specialists, incorporating invasive plant prevention practices as appropriate. Maps of these sites will be provided by district invasive plant specialists upon request.				x				
33	Invasive Plants	Avoid spreading New Invaders from developing landing sites.	Identify all known New Invader sites in the project area and along access roads on the Timber Sale Area Map. Potential landing sites that are infested with invasive plants classified as New Invaders will be prioritized for pretreatment by the Invasive Plants Specialist. Landings will be constructed away from areas infested with New Invader weeds that have not been pretreated.	x							
34	Invasive Plants	Minimize spread of invasive seeds from gravel, fill, sand, and rock.	Weed-free gravel, fill, sand and rock will be used. District and Forest Weed Coordinators will inspect active gravel, fill, sand stockpiles, quarries, and borrow material for invasive plants before use and transport of the materials. Only gravel, fill, sand, and rock that is judged to be weed free by District or Forest weed specialists will be used. Treat or require treatment of infested sources before any use of pit material.				x	x			

Item	Resource	Goal	Criteria	Harvest Thinning	NCT/LFR Thinning	Piling, Rx Fire, Mastication, & Fireline	Roads	Campground Construction	Tree Planting	Grazing	Hazard Tree Felling
35	Invasive Plants	Restore disturbed native plants and prevent spread of invasive plants	Areas of heavily disturbed soils (including landings, main skid trails, decommissioned temporary roads, and constructed road cut and fill slopes) will be reseeded. The Rangeland Management Specialist, Invasive plant specialist and Botany Specialist will determine the appropriate seed mix, application rates, locations and time of seeding to meet erosion control and invasive plant competition objectives. Native seed will be the first choice in revegetation in areas where the objective is to restore the site to the landscape setting, such as decommissioned roads. Non-native seed may be used to help prevent the establishment of invasive species, in permanently altered plant communities, and in situations where locally collected native seed is not available (USDA Forest Service 2005). Use of non-native seed should be considered an interim non-persistent measure designed to aid the reestablishment of native plants	x			x				
36	Invasive Plants	Minimize spread of invasive species when building fireline.	No fireline construction will occur within existing New Invader invasive plant patches. Populations near proposed containment lines will be identified on Burn Plan maps.			x					

Item	Resource	Goal	Criteria	Harvest Thinning	NCT/LFR Thinning	Piling, Rx Fire, Mastication, & Fireline	Roads	Campground Construction	Tree Planting	Grazing	Hazard Tree Felling
37	Invasive Plants	Minimize spread of invasive species when constructing dozer line.	During dozer line construction, surface vegetation will be scraped away while minimizing damage to live root crowns of native grasses and shrubs. This will allow for rapid post-fire recovery of the fire line, with residual intact roots helping prevent soil displacement and reducing the potential for invasive plant introduction, establishment and spread. The Fuels specialist and Botanist will determine whether spot seeding is necessary to restore the line to its pre-disturbance native vegetation. Seeding would be done according to the Soils seeding mitigation measure.			x					
38	Invasive Plants	Minimize spread of invasive seeds from heavy equipment.	Project actions require the cleaning of all heavy equipment (bulldozers, skidders, graders, backhoes, dump trucks, etc.) prior to entering National Forest System Lands. Language requiring equipment cleaning will be included in contracts.	x		x	x				
39	Range	Maintain cattle in authorized areas.	Contracts will require that all gates will remain closed during work and non-work hours if cattle are authorized in the project area.	x	x		x		x		
40	Range	Maintain fenceline access.	Fence right-of-ways will be cleared of slash produced by harvest or post sale activities. All fence lines will be identified on the contract maps.	x		x					

Item	Resource	Goal	Criteria	Harvest Thinning	NCT/LFR Thinning	Piling, Rx Fire, Mastication, & Fireline	Roads	Campground Construction	Tree Planting	Grazing	Hazard Tree Felling
41	Range	Protect structural range improvements	Existing structural range improvements (fences, gates, water troughs) will be contractually protected under timber sale and LFR contracts and identified and protected during prescribed fire and ladder fuel reduction activities. Do not cut trees that are incorporated into the fenceline. Fences that are cut in order to facilitate logging operations will be repaired to Forest Service standards by the purchaser. Fences damaged will be repaired to original design standards. Fences damaged by the Carlton Complex wildfire that are unrepaired at the time of project implementation will be repaired only back to the fire damaged condition. All fences and water troughs will be identified on the Timber Sale Area Map (Units 34, 68, 673, 676, and 887). Extra care should be taken to locate improvements during treatment activities occurring in the winter due to limited visibility because of the accumulation of snow.	x	x	x					
42	Recreation	Provide recreational access on closed or decommissioned roads.	Road segments identified as currently being used as trails (mountain bikes, cross country skiing, snowmobiles) will be closed or decommissioned in such a way that does not preclude their use for these purposes.				x				

Item	Resource	Goal	Criteria	Harvest Thinning	NCT/LFR Thinning	Piling, Rx Fire, Mastication, & Fireline	Roads	Campground Construction	Tree Planting	Grazing	Hazard Tree Felling
43	Recreation	Prevent undesirable snow melt and improve snow retention on ski trails to provide high quality skiing.	Remove conifers less than 21" DBH in harvest units located immediately adjacent to nordic ski trails with tree crowns or boles which absorb solar radiation and cause undesirable (tree well) snow melt on ski trails. These trees typically are located on or adjacent to the northwest, north, or northeast side (approximate azimuth range of 315 to 45 degrees) of Nordic ski trails.	x	x						
44	Recreation	Increase snow accumulation on ski trails and provide high quality skiing.	Remove conifers less than 21" DBH in harvest units with crowns or large branches that hang directly over and prevent snow from accumulating on nordic ski trails.	x							
45	Recreation	Reduce conflict with recreational traffic and provide additional public safety during peak vacation periods.	Log hauling will be prohibited on weekends and federal holidays.	x							
46	Recreation	Protect shade for Nordic ski trails to improve snow retention and provide high quality skiing.	Retain conifers in harvest units, noncommercial thinning, and ladder fuel reduction units which provide shade for snow retention on nordic ski trails during the months of January to mid-March. Shade providing trees will typically be located on the southeast, south, or southwest side (approximate horizontal azimuth range of 135 to 225 degrees) of ski trails.		x	x					

Item	Resource	Goal	Criteria	Harvest Thinning	NCT/LFR Thinning	Piling, Rx Fire, Mastication, & Fireline	Roads	Campground Construction	Tree Planting	Grazing	Hazard Tree Felling
47	Recreation	Protect and retain nordic ski trail signs and improvements.	Retain trees on which trail identification signs, directional signs, trail maps, information boards are mounted.	x	x	x					
48	Recreation	Protection of improvements.	All campground and Loup Loup Ski Bowl facilities and improvements (ski lodge, lifts, buildings, etc.) would be protected during all harvest and fuel reduction activities to prevent damage to the features, and avoid the possibility of post-project repair or replacement.	x	x	x					
49	Recreation	Reduce conflicts with recreation users.	Campgrounds would be closed to campers and other recreationists during all harvest & prescribed fire activities to avoid any potential injury to people or damage to private camping equipment or vehicles. All fuels reduction activities would be done before or after the Loup Loup Ski Bowl closes for the ski season.	x		x					
50	Scenic	Minimize scenic impact of landings.	When possible, locate landings out of the immediate foreground (or seen area) in Management Area 5 Retention allocation areas, or screen as much as possible where vegetation is available and consistent with fuels treatment objectives, or use existing landings where they exist and seed after project is complete, leave wood on site and scatter.	x							

Item	Resource	Goal	Criteria	Harvest Thinning	NCT/LFR Thinning	Piling, Rx Fire, Mastication, & Fireline	Roads	Campground Construction	Tree Planting	Grazing	Hazard Tree Felling
51	Scenic	Minimize the amount of paint seen from areas of scenic concern.	Use ITM (individual tree marking) of “cut” trees in harvest units located in or adjacent to the Loup Loup Ski Area, campgrounds, and Highway 20, so that painted trees will be removed during harvest operations. .	x							
52	Scenic	Avoid dominating lines that may be perceived as “unnatural”.	Use irregular clumping and feathering of unit edges to avoid introducing dominating lines that could result from creating small patch openings.	x							
53	Scenic	Reduced evidence of treatments on leave trees.	Maintain diversity and variety in sizes of leave trees in clumps and masses on a landscape scale. Mechanical damage to existing leave trees to be minimal.	x							
54	Scenic	Maintain a landscape composed of a variety of textures and patterns.	Maintain the highly textured sky line, ridgelines and dominating patterns of the swales.	x							
55	Scenic	Clean-up evidence of treatments in immediate foreground of travel routes.	When the project is complete, remove ribbons, tags, and stakes that are visible from the Loup Loup viewshed Highway 20, Loup Loup Ski Area and Loup Loup Campgrounds. Low stumps (8”or less) will be required on harvest units 80, 82, 88, and 93. Woody debris cleanup would take place in the immediate foreground area (up to 300’ of seen area from Loup Loup Viewshed Highway 20, Loup Loup Ski Area and ski trails and Loup Loup Campground). Stumps and woody debris left would be	x	x						x

Item	Resource	Goal	Criteria	Harvest Thinning	NCT/LFR Thinning	Piling, Rx Fire, Mastication, & Fireline	Roads	Campground Construction	Tree Planting	Grazing	Hazard Tree Felling
			subordinate to the landscape.								
56	Scenic	Enhance forested setting near Loup Loup Campground.	Thin dense thickets of stands and exposing large tree character for viewing near Loup Loup Campground.	x							
57	Scenic	Enhance landscape character.	Promote different age class of tree species and thinning to expose large ponderosa pine and Douglas-fir tree boles and quaking aspen stands for viewing along travel routes.	x							
58	Scenic	Minimize impacts of fireline in viewsheds.	Methods used to control prescribed burns should not dominate naturally established form, line, color and texture of the area in MA-5 and MA-17 viewsheds.			x					
59	Scenic	Retain variety of overstory and understory along roads.	Leave clumps of varying sizes of overstory and understory along the foreground travel routes of Highway 20, South Summit Forest Road 42 and North Summit Forest Road 41.	x	x	x					
60	Scenic	Minimize the visual impact of treatments and provide a roaded natural recreation experience.	Manage the foreground of travel routes of Highway 20, Loup Loup Ski Area, ski trails, and Loup Loup Campground to minimize the visual impact of project activities.	x	x	x					x

Item	Resource	Goal	Criteria	Harvest Thinning	NCT/LFR Thinning	Piling, Rx Fire, Mastication, & Fireline	Roads	Campground Construction	Tree Planting	Grazing	Hazard Tree Felling
61	Scenic	Maintain scenic quality around campgrounds, trails and other routes used for year round recreation.	Retain shade retention and scenic quality in the immediate foreground (up to 300') to meet scenic values and maintain shade on Nordic & snowmobile routes for winter use.	x	x	x					x
62	Scenic	Minimize visual impacts of powerline along Highway 20.	Maintain screening of powerline running along Highway 20.	x	x	x					
63	Silviculture	Avoid livestock grazing disturbance of regeneration.	Repeated livestock grazing will be discouraged in regeneration harvest units for a period of three to five years following tree planting. Implementation of the following practices would provide seedling protection, promote tree seedling establishment, and increase the likelihood that acceptable tree stocking levels are promptly attained following planting: avoid placing salt blocks in or adjacent to tree planting units; avoid seeding grass species that would encourage livestock grazing (forage mix) in or adjacent to tree planting units; avoid seeding grass species that are highly competitive for soil moisture with planted tree seedlings.							x	

Item	Resource	Goal	Criteria	Harvest Thinning	NCT/LFR Thinning	Piling, Rx Fire, Mastication, & Fireline	Roads	Campground Construction	Tree Planting	Grazing	Hazard Tree Felling
64	Silviculture	Provide suitable breeding partners for genetic select trees.	Five to ten suitable breeding partners will be retained within 120 feet of genetic select trees. Suitable breeding partners include vigorous, disease free, and well-formed cone producing trees of the same species of the select tree. Mechanical damage to nearby breeding partner trees will be avoided during harvest and fuels treatment operations.	x							
65	Silviculture	Protect genetic select trees.	Retain and protect all live genetic select trees in the project area. Operation of wheeled or tracked heavy equipment within 30 feet of designated genetic select trees will be avoided to prevent bole, crown, and root damage.	x	x						
66	Silviculture	Protect residual trees.	Treatments will be identified and designed to limit damage to the boles, live branches, and terminal leaders of residual trees during harvest and mechanical fuels treatment operations. Protection measures including using skid trail rub trees, line-pulling, harvester/forwarder (cut-to-length) logging, and seasonal operating restrictions, may be required to protect residual trees during periods when they are highly susceptible to mechanical damage. Leave trees located adjacent to skid trails will not be used as rub trees.	x		x					

Item	Resource	Goal	Criteria	Harvest Thinning	NCT/LFR Thinning	Piling, Rx Fire, Mastication, & Fireline	Roads	Campground Construction	Tree Planting	Grazing	Hazard Tree Felling
67	Silviculture	Provide effective site preparation for tree seedling planting and survival.	Prescribed fire treatments in regeneration harvest units will be designed to provide approximately 25 percent mineral soil exposure that is uniformly distributed within each unit to provide for adequate planting sites.			x					
68	Silviculture	Minimize mortality of genetic select trees.	Prescribe fire treatments will be designed to minimize bole char, crown scorch, or root damage to genetic select trees. Treatments will be designed to retain live crown ratios of 50 percent or greater for suitable breeding partners located within 120 feet of genetic select trees and limit mortality following burning.			x					
69	Silviculture	Minimize openings in forest canopy.	Openings in the forest canopy created by prescribed burning in non-regeneration harvest units and mechanical fuels reduction treatment units generally will not exceed five percent of the total area burned for that unit. Treatments will be designed to limit individual created opening sizes to 1/4 acre (approximately 100 feet by 100 feet) in the visual foreground and 1/2 acre (approximately 150 feet by 150 feet) in all other areas.			x					
70	Silviculture	Avoid areas with high post-fire tree mortality.	Harvest treatment units will avoid extensive areas (larger than one acre) which experienced high levels of tree mortality associated with high or moderate BARC burn severity during the Carlton Complex wildfire of 2104. Fire-created openings within harvest units would be considered	x							

Item	Resource	Goal	Criteria	Harvest Thinning	NCT/LFR Thinning	Piling, Rx Fire, Mastication, & Fireline	Roads	Campground Construction	Tree Planting	Grazing	Hazard Tree Felling
			canopy gaps which are a treatment objective of restoring the historic spatial pattern of trees. Live tree retention levels of harvest units with fire created openings would not be reduced. Fire-killed trees within harvest units which are standing or down at the time of timber marking will not be designated for removal during harvest operations. Snags in harvest units will be protected in the timber sale contract with the Leave Dead Standing contract provision. Snags felled to mitigate danger tree safety hazards associated with timber harvest operations will remain on site and not be removed from timber harvest units								
71	Soils	Rehabilitation of burn piles following burning.	Rehabilitation of burn piles following prescribed burning treatments may include seeding, use of coarse woody debris if bare soil is exposed, weed treatment, etc.	x							

Item	Resource	Goal	Criteria	Harvest Thinning	NCT/LFR Thinning	Piling, Rx Fire, Mastication, & Fireline	Roads	Campground Construction	Tree Planting	Grazing	Hazard Tree Felling
72	Soils	Avoid disturbing soils while not impacting winter recreation.	Ground based logging operations would occur over a slash mat and restoration activities would be performed following implementation in order to ensure compliance with regional and forest plan standards. A specific restoration plan should be written for each individual unit and implemented following all proposed treatments. Restoration activities could include: seeding or planting skid trails; coarse woody debris placement on skid trails (placed over 65−70% of the skid trail surface to a depth of 2−3", about 22−25 tons/acre; slash and coarse woody debris on the skid trail would be compacted so that it is in contact with the soil surface; litter, duff, soil, and woody debris displaced from the trail would be placed on the skid trail). Other possible restoration activities: tilling or subsoiling (could be applied on a site specific basis but may not be feasible with soil types found in the project area); spreading forest litter or topsoil over skid trails.	x							
73	Soils	Provide for effective use of slash mats mitigate soil concerns.	Logging over a slash mat would occur only under the following conditions: there is enough slash to consistently keep 6 inches of slash over 65-70% of the tire footprint of the skidder and following treatment there would be 2-3 inches of slash left on skid trails.	x							

Item	Resource	Goal	Criteria	Harvest Thinning	NCT/LFR Thinning	Piling, Rx Fire, Mastication, & Fireline	Roads	Campground Construction	Tree Planting	Grazing	Hazard Tree Felling
74	Soils	Reduce compaction of soil during felling and forwarding.	During felling operations in summer harvest units, available slash will be placed on approved log removal routes. Forwarder equipment will operate on placed slash during log removal.	x							
75	Soils	Limit detrimental soil compaction and displacement and provide an alternative to limitations and requirements of summer operations.	Winter operations are required in some units to minimize soil impacts. The snow depth, distribution, and air temperature conditions must be such that ground-based operations maintain the following combination of snow depth and frozen soil conditions under the wheels or tracks/treads of equipment at all times. Winter soil specifications are listed in Figure A-11.	x							
76	Soils	Prevent soil erosion and support vegetation recovery.	Soil damaged by burning of landing piles in harvest units will be mechanically rehabilitated and revegetated with certified weed-free seed. Damage determinations will be made according to guidelines established by the Soil Scientist. Seeding on landings will be done by the timber sale purchaser prior to pile burning and by the District Invasive Plant specialist after pile burning. Soil under machine piles in harvest and fuels units will be seeded after burning if post-burn inspection indicates that vegetative recovery is unlikely. Seeding need determinations will be made according to guidelines established by the Soils Scientist.	x							

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77	Soils	Reduce compaction from treatments.	Decompact landings, seed and place woody debris on landings. Slash would be placed over 65−70% of the landing surface to a depth of 2−3 inches (approximately 22−25 tons/acre).	x							
78	Soils	Reduce the level of detrimental soil disturbance and restore compacted and displaced soils toward more desirable conditions.	Active soil restoration measures will be used as needed: Detrimentally compacted soils will be actively restored in treatment units where greater than 15% of the area has been affected such as landings, portions of multiple-pass skid trails that converge into landings, and other segments that incur heavy compaction. Decompaction may be done with an excavator or other equipment approved by the Timber Sale Administrator. Post-treatment assessment and confirmation of active restoration needs will be made by a Forest Service soil scientist during harvest activities. See Figure A-10 for details.	x		x					

Item	Resource	Goal	Criteria	Harvest Thinning	NCT/LFR Thinning	Piling, Rx Fire, Mastication, & Fireline	Roads	Campground Construction	Tree Planting	Grazing	Hazard Tree Felling
79	Soils	Mitigate erosion risk by using waterbars and ensure waterbar effectiveness.	Waterbars will be installed on fireline and skid trails with bare soil or very thin vegetative cover at the end of harvest operations or prior to entering into seasonal shutdowns or periods of extended inactivity. Timely completion of waterbars will divert runoff from seasonal rain or snow fall. Construct to a minimum of 1.5 to 2 feet in height (2 feet high on the steeper skid trails), and a minimal depth of 18 inches, without using pushed-up soils. Some variation in waterbar size may occur but they must be large enough to function properly. Install at a 45 degree angle to either the left or right of the trail to disperse water on the down slope or lower side of the trail. A herringbone pattern of alternating water bars may be necessary on steeper slopes. Driving on or damaging waterbars with heavy equipment will be avoided to minimize the potential for failure. If damage occurs, waterbars will be repaired to bring them back up to the minimum design height. % Slope and Spacing: 2-10% slope = 150' spacing. 11-20% slope = 120' spacing. 21-34% slope = 90' spacing. ≥ 35% slope = 80' spacing.	x		x					

Item	Resource	Goal	Criteria	Harvest Thinning	NCT/LFR Thinning	Piling, Rx Fire, Mastication, & Fireline	Roads	Campground Construction	Tree Planting	Grazing	Hazard Tree Felling
80	Soils	Limit erosion and sediment delivery.	Place woody debris on skid trails where necessary. Site factors that would indicate a need for woody debris include but are not limited to continuous grades, water concentrating topography, proximity to wet or riparian areas, and ground disturbance that bares soil.	x							
81	Soils	Avoid excess skidder damage.	Tractor skidder/forwarder operations will be confined to slopes that are 35% or less except for pitches of 150 feet or less of steeper ground. No side hill travel of skidder/forwarder equipment will take place on these steeper pitches to avoid excess soil damage. Machinery will be excluded from any areas with extended pitches greater than 150 feet that exceed 35 percent. Operation on short steep pitches will only occur if adequate ground vegetation is present.	x							

Item	Resource	Goal	Criteria	Harvest Thinning	NCT/LFR Thinning	Piling, Rx Fire, Mastication, & Fireline	Roads	Campground Construction	Tree Planting	Grazing	Hazard Tree Felling
82	Soils	Provide adequate soil stability.	Summer harvesting operations will be conducted during periods of sufficient and not excessive soil moisture, as assessed by a soils scientist and Timber Sale Administrator, to provide adequate soil stability (See Figure A-9). The following requirements apply to summer logging operations and are intended to maintain the level of detrimental soil disturbance within harvest units to 15 percent or less: Single-pass felling equipment trails will be located a minimum of 40 feet apart. Use old skid trails where available. Soil Group 2 soils (see Soil Group Map in the soils specialist report) with ash caps that are prone to compaction will be actively restored if extended lengths of rutting or compaction occur. Multiple-pass skidding equipment trails will be located a minimum of 100 feet apart except where they converge at landings. Multiple-pass trail locations will be designated and approved by Timber Sale Administrator prior to operations. Scatter slash on the first 100' of skid trail entrances, including where skid trails access landings.	x							
83	Soils	Prevent erosion at landings.	Organic debris will be placed along margins of landings as needed to prevent erosion.	x							

Item	Resource	Goal	Criteria	Harvest Thinning	NCT/LFR Thinning	Piling, Rx Fire, Mastication, & Fireline	Roads	Campground Construction	Tree Planting	Grazing	Hazard Tree Felling
84	Soils	Rehabilitate previous disturbance.	The Timber Sale Administrator shall take into consideration that use of existing landings and skid trails, especially those currently causing resource damage, will allow for immediate mitigation and post-use rehabilitation of landing location and associated roads/skid-trails within the constraints of timber harvest contract administration.	x							
85	Soils	Minimize soil disturbance from skidding.	Designated skid trails would be used for all ground based logging. Skid trails from prior harvest would be used to the maximum extent possible except where skid trails are located on slopes 35% or greater	x							
86	Soils	Minimize impacts of temp road stream crossings.	Temporary stream crossing will be designed to handle expected flows during life of use and will be installed to minimize disturbance to stream banks and channel with material placed there removed following use of the crossing and placed in a stable location to prevent sediment from entering the stream. Erosion control measures will be in place during and after use of the crossing.				x				
87	Soils	Protect soil at ski area.	Any cut trees and downed logs removed from Loup Loup Ski Bowl would be skidded over snow using a snowmobile or snocat.	x	x						
88	Soils	Minimize soil compaction, erosion, DSD, and displacement.	Soils and range staff will assess soil conditions before turning out cows to keep units under R6 DSD measures and reduce overall impacts to soils.							x	

Item	Resource	Goal	Criteria	Harvest Thinning	NCT/LFR Thinning	Piling, Rx Fire, Mastication, & Fireline	Roads	Campground Construction	Tree Planting	Grazing	Hazard Tree Felling
89	Soils	Restore firelines to reduce erosion, minimize movement of wood, inhibit use for recreation.	Fuels and botany staff will assess fireline to determine if spot seeding is necessary to restore the line to its pre-disturbance natural vegetation. If seeding is required, emphasis will be on establishing native vegetation. Some small trees (generally < 10” dbh) and some down logs may be cut and/or moved along the fireline to prevent undesirable fire spread but no material will be removed from the site. Fireline rehab will include methods that prevent public use as hiking trails, bike routes, motorcycle routes, etc.			x					
90	Soils	Monitor to assess ground cover recovery.	Monitor specified units after completion of prescribed fire treatments to assess ground cover recovery and potential for soil erosion.			x					
91	Soils	Minimize bare soil created by pile burning.	Hand and machine piles may be up to 6-8 feet in diameter to localize areas of soil disturbance to less than ~50 sq. ft. Pile burning should occur when soils are moist to minimize duff consumption and high-severity burn impacts on soils. Where feasible, build piles where soil disturbance already exists (i.e. on old landings, roads, or skid trails) to prevent new areas of detrimental soil disturbance.		x	x					
92	Soils	Minimize soil impacts of temporary roads.	After use, temporary roads will be treated through actions that may include decompaction, re-contouring, seeding, scattering slash on surface, and blocking the entrance.				x				

Item	Resource	Goal	Criteria	Harvest Thinning	NCT/LFR Thinning	Piling, Rx Fire, Mastication, & Fireline	Roads	Campground Construction	Tree Planting	Grazing	Hazard Tree Felling
93	Soils	Monitor to assess effectiveness of design criteria and assess need for further soil restoration.	Monitor specified units to ensure they meet Regional Soil Quality Standards and Forest Plan Standards post-treatment. Units shall not exceed 20% detrimental soil disturbance post-project.	x		x					
94	Soils	Minimize soil disturbance from slash piling.	Machine pilling within harvest units will be accomplished by piling debris (i.e. using an excavator or grapple-piler), not by pushing debris with bladed equipment.			x					
95	Soils	Retain organic matter to protect the soil from rain splash impacts, erosion, soil moisture holding capacity, and solar surface heating (especially on south-facing slopes).	Machine and hand-pile burning should be done during times of high soil moisture when post-burn conditions would result in no more than 20% bare soils (excluding natural conditions) within a burn unit within 2 years following treatment implementation. Desired outcome includes retention of organic matter across at least 80% of the unit. Underburning in regeneration harvest units is likely to consume more than 80% ground cover for the purposes of exposing bare soil to facilitate reforestation.			x					

Item	Resource	Goal	Criteria	Harvest Thinning	NCT/LFR Thinning	Piling, Rx Fire, Mastication, & Fireline	Roads	Campground Construction	Tree Planting	Grazing	Hazard Tree Felling
96	Soils	Minimize new detrimental soil disturbance from machine piling equipment.	Machine-piling equipment will use existing skid trails whenever possible and make single passes to collect debris that is reachable from skid trail. Machinery will operate on slash whenever possible. No new detrimental soil disturbance will occur from machine-piling and burning. Coarse woody debris requirements would still be met as stated in Figure A-3. Where total debris up to 9: diameter is ≤ 10 tons/acre, no machine piling would occur to help retain wood for soil productivity. The soil disturbance classes are described in Figure A-8; Class 2 and Class 3 are considered detrimental.			x					
97	Soils	Limit the impact of mastication equipment on new areas or on unstable slopes.	Operation of mastication equipment would occur on existing trails wherever possible. Stationary skid turns and side-slope movement of mastication equipment between trails would be minimized. Mastication equipment would be restricted from operating in areas with more than 35% average slope except for areas with short pitches (40−45% less than 100 feet), unless reviewed by the Forest soil scientist.			x					
98	Soils	Limit the impact of mastication on the soil.	Mastication would be limited to periods when dry conditions, snow depth or frozen ground is adequate to protect soils over 85% of the unit. Operation of mastication equipment would be minimized in low fuel areas except to cross those areas to access locations where higher fuel concentrations			x					

Item	Resource	Goal	Criteria	Harvest Thinning	NCT/LFR Thinning	Piling, Rx Fire, Mastication, & Fireline	Roads	Campground Construction	Tree Planting	Grazing	Hazard Tree Felling
			exist.								
99	Soils	Allow for recovery of burned soils in mastication unit.	Mastication will be deferred for 3 years after the Carlton Complex wildfire (till fall 2017 at the earliest) to allow for surface litter to recover before masticating equipment is used.			x					
100	Soils	Meet coarse woody debris objectives.	Leave coarse woody material on site in all forested portions of units at the following post-treatment rates as described in Figure A-3. **In all zones,** mechanically scarred trees would be left standing to provide wood recruitment. These trees as well as snags would be counted as down woody material.	x	x	x					
101	Soils	Prevent soil erosion and weed invasion and promote vegetation recovery.	Livestock entry into underburned units will be regulated by the Range Specialist implementing grazing allotment Annual Operating Instructions.			x					
102	Soils	Provide for coarse woody debris retention during prescribed fire activities.	Coarse Woody Material (CWM) larger than 15 inches in diameter will not be intentionally ignited during hand lighting operations. However, once hand crews light the fire, the fire may burn into large CWM and combust various pieces.			x					
103	Soils	Provide for nutrients to enhance soil.	Allow time for nutrients to leach from slash prior to burning. The slash will be left through one winter after cutting to allow for initial decomposition and nutrient leaching.								
104	Soils	Reduce soil and vegetation	Where possible, use Minimum Impact Suppression Tactics (MIST) to reduce soil								

Item	Resource	Goal	Criteria	Harvest Thinning	NCT/LFR Thinning	Piling, Rx Fire, Mastication, & Fireline	Roads	Campground Construction	Tree Planting	Grazing	Hazard Tree Felling
		disturbance.	and vegetation disturbance.								
105	Transportation	Minimize soil impacts from temporary roads.	To minimize detrimental soil disturbance, temporary roads will be constructed to minimal standards necessary for safe use and decommissioned/rehabilitated following completion of harvest activities. Rehab activities may include decompaction, re-contouring, slashing, and seeding to speed recovery of soil and limit unauthorized OHV use.				x				
106	Transportation	Limit hazards to non-motorized use.	Barriers installed on roads which will be open for non-motorized or non-motor vehicle use will be designed so they do not pose a hazard.				x				
107	Transportation	Provide range permittees access on closed or decommissioned roads.	Road segments currently identified in Appendix E of the EA as necessary access for range permittees will be designated as Administrative Access Routes, and be closed or decommissioned in such a way that does not preclude travel by cows and horses and, as appropriate, could accommodate limited ATV access for maintenance of stock tanks or other legitimate reasons for authorized individuals only.				x				

Item	Resource	Goal	Criteria	Harvest Thinning	NCT/LFR Thinning	Piling, Rx Fire, Mastication, & Fireline	Roads	Campground Construction	Tree Planting	Grazing	Hazard Tree Felling
108	Transportation	Ensure road decommissioning at stream crossings provide a natural hydrology.	Stream crossings will be decommissioned by: dewatering the site or isolating it from flowing waters to prevent delivery of sediment to watercourses in accordance with the WDFW/FS MOU; excavating the fill and restoring slopes and stream channels to mimic the natural stream channel and banks and restore the natural valley configuration; placing and shaping excavated material into cutbanks near the crossing in such a way that sediment-laden runoff can be managed; and/or placing large woody material and/or large rocks as necessary for streambed substrates to mimic the natural streambed characteristics upstream and downstream of the crossing removal.				x				
109	Transportation	Define the circumstances when a culvert will not be removed for long-term road closures.	Roads placed into ML-1 (closed) status may have culverts removed unless: culvert was recently installed and adequately designed to pass a 100-year storm event and any expected debris; culvert is located very close to the road barrier; culvert is in good condition and has a very deep fill; culvert is on a loop road with potential need for fire egress.				x				

Item	Resource	Goal	Criteria	Harvest Thinning	NCT/LFR Thinning	Piling, Rx Fire, Mastication, & Fireline	Roads	Campground Construction	Tree Planting	Grazing	Hazard Tree Felling
111	Transportation	Apply appropriate level of road closure (ML 1) activities.	Activities implemented when closing roads (changing to Maintenance Level 1) may include but are not limited to: blading and shaping the road surface to restore proper cross-slope, reinstalling drain dips and installing waterbars, spreading slash or debris over the road surface, and blocking the road with an earthen berm.				x				
112	Transportation	Evaluate and apply appropriate level of road decommissioning activities.	Roads identified for decommissioning will be evaluated by engineering staff and site-specific prescriptions for decommissioning developed with input from other resource specialists will be provided as appropriate. Evaluation will include existing drainage structures, slope stability of fill and cut slopes, signs of erosion, adequacy of vegetation, etc. If no issues are identified that need to be addressed, further decommissioning activities will not occur and road records will be changed to indicate the road segment is decommissioned. Existing site conditions for each road segment will dictate whether light, medium or heavy road decommissioning practices are applied as described in Figure A-7.				x				

Item	Resource	Goal	Criteria	Harvest Thinning	NCT/LFR Thinning	Piling, Rx Fire, Mastication, & Fireline	Roads	Campground Construction	Tree Planting	Grazing	Hazard Tree Felling
113	Transportation	Limit hazards to public during project implementation.	Some existing closed roads could be used for ATV or snowmobile access for a short period during burn preparation and implementation to transfer equipment and supplies needed for prescribed burning. No additional public access will be provided. Roads used for administrative access via OHV or snowmobile would remain closed to public use following project activity.			x	x				
114	Water Quality	Limit use of heavy equipment in RHCAs.	No mastication treatment will occur in RHCAs.		x	x					
115	Water Quality	Reduce compaction and control erosion in hazard tree removal along Highway 20.	Use of heavy equipment off-road in the RHCA on the upland side of stream will be mitigated by decompacting compacted ground and using appropriate erosion control measures including silt fencing, reseeding, etc.	x							
116	Water Quality	Avoid soil or riparian damage.	All danger tree mitigation taking place within the stream-side of RHCA and occurring within the RHCA will be done without offroad use of heavy equipment. Any yarding will be done in a manner which does not cause soil or riparian vegetation damage, which may include winter conditions (snow/frozen ground).	x							x
117	Water Quality	Avoid destabilizing slopes.	For summer harvest units, when necessary to cut benched skid trails within outer RHCAs (outside of the No Treatment buffer), cut benches will be re-contoured, stabilized, and restored the same operating season.	x							

Item	Resource	Goal	Criteria	Harvest Thinning	NCT/LFR Thinning	Piling, Rx Fire, Mastication, & Fireline	Roads	Campground Construction	Tree Planting	Grazing	Hazard Tree Felling
118	Water Quality	Minimize impact of new landings in RHCAs	If landings are constructed or re-constructed in RHCAs, suitable erosion control measures or other retention methods will be installed prior to landing construction and will remain in place during harvest operations. Any landings used within RCHAs will be scarified, seeded, and organic debris will be scattered over them after harvest activities are complete	x							
119	Water Quality	Minimize disturbance of RHCA buffers downslope of existing roads.	If a harvest unit occurs within a RHCA and utilizes an existing road as its downslope unit boundary, new landings below that roadway will not be approved for use unless they are outside the no-cut buffers described in Figure A-2.	x							
120	Water Quality	Avoid disturbing RHCAs with disturbed buffers.	Avoid designating landings in areas where the adjacent riparian buffer strip is not well vegetated or is in a disturbed condition.	x							
121	Water Quality	Avoid disturbance of RHCAs from landings with slopes.	Areas within RHCAs where mean site slope exceeds 5% will not be approved for use as landings.	x							
122	Water Quality	Minimize disturbance of RHCAs from landings.	The Timber Sale Administrator shall weigh the relative ground disturbance area considering skid distance, landing size, slope of landing area, slope and vegetated cover condition of riparian buffer strip, and other factors. There may be cases where total number of landings within RHCAs is not the best metric for reducing impacts via	x							

Item	Resource	Goal	Criteria	Harvest Thinning	NCT/LFR Thinning	Piling, Rx Fire, Mastication, & Fireline	Roads	Campground Construction	Tree Planting	Grazing	Hazard Tree Felling
			ground disturbance within RHCAs.								
123	Water Quality	Avoid disturbance of riparian areas from landings.	No landings would be located or used that occur within no-treatment buffers identified in Figure A-2. New landings will not be constructed within RHCAs unless other practicable locations outside the RHCA (first priority) or existing landings inside the RHCA (2nd priority) are not available.	x							
124	Water Quality	Ensure proper road drainage occurs after snow plowing.	Snow plowing will include water drainage outlets appropriately spaced, constructed and maintained in the dike of snow or berm caused by snow removal operations. Water drain holes will be placed to obtain surface drainage without discharging on erodible fills. Typically, snow removal will be conducted in such a way as to keep the dozer blade a minimum of 2 inches above the road surface.				x				
125	Water Quality	Filter and trap sediment.	The Timber Sale Administrator or other authorized personnel shall consider the requirement to place slash in drainage features to provide additional sediment trapping/filtration function. These locations may include natural drainage swales in the unit or below the road, ditch lines where anticipated flows would not put the roadway prism at risk of failure, skid trails, etc.	x			x				

Item	Resource	Goal	Criteria	Harvest Thinning	NCT/LFR Thinning	Piling, Rx Fire, Mastication, & Fireline	Roads	Campground Construction	Tree Planting	Grazing	Hazard Tree Felling
126	Water Quality	Avoid using surfactants.	Water may be used to pre-wet riparian vegetation in RHCAs before burning. Surfactants and foams in water will not be used within 100 feet of the edge of wetted channels, lakes or wetlands. Engines which have had surfactant in their tanks will not draft directly from Frazer and Benson Creeks (contain listed fish habitat) and must use an auxiliary pump to fill.			x					
127	Water Quality	Minimize production of sediment in areas near streams.	All thinning and yarding activities within RHCAs will maintain > 90% pre-treatment vegetative ground cover in the RHCA as provided by trees, shrubs, grasses, sedges and duff.	x	x	x	x				
128	Water Quality	Prevent drainage to streams from leaks or spills of hazardous materials and petroleum products.	For all operations using heavy machinery, equipment, or gas-powered tools, measures will be in place to contain accidental spills of hazardous materials and petroleum products. Any liquid fueled equipment designed to be operated while stationary (i.e. pumps, generators, lighting units, etc.) and any petroleum, oil, or lubricant containers within an RHCA must be staged, stored, and operated within adequate secondary storage to preview contamination of the soil in the event of a leak or spill. Mobile motorized equipment will not be refueled nor have maintenance performed within the RHCA.	x		x	x				

Item	Resource	Goal	Criteria	Harvest Thinning	NCT/LFR Thinning	Piling, Rx Fire, Mastication, & Fireline	Roads	Campground Construction	Tree Planting	Grazing	Hazard Tree Felling
129	Water Quality	Protect stream temperatures by avoiding new openings in inner RHCAs, provide sediment filtration, as well as other resource functions.	Project would apply no treatment within inner buffer of RHCAs. Buffers vary according to RHCA category/water resource and slope, with details presented in Figure 2-A.	x	x	x					
130	Wildlife	Limit impact of prescribed burning on northern goshawk nesting and habitat.	Prescribed burning may be considered if it can be accomplished outside the northern goshawk nesting season (March through August), and if high canopy closures and overstory trees would be retained.			x					
131	Wildlife	Provide thermal and hiding cover for mule deer.	In fuels units and noncommercial thinning retain areas of dense (>50% canopy closure) multistoried canopy cover, complex patches, and clumpiness (or best available) to provide thermal and hiding cover for mule deer across 15-20% of the fuels treatment footprint including connectivity corridors, in patches from 0.1 acre to multiple acres.		x						
132	Wildlife	Provide protection for northern goshawk nests found during contract activities.	Follow Forest Plan forest-wide standard 6-12 for accipiters.	x	x						

Item	Resource	Goal	Criteria	Harvest Thinning	NCT/LFR Thinning	Piling, Rx Fire, Mastication, & Fireline	Roads	Campground Construction	Tree Planting	Grazing	Hazard Tree Felling
133	Wildlife	Provide mature and old forest stand structure for northern goshawk PFAs.	Silvicultural and prescribed fire prescriptions in northern goshawk PFAs should move stand structures toward mature and old forest structure and provide a variety of canopy closures and stand conditions across the PFA. Prescribed burning may be considered in nest stands if it can be accomplished outside the nesting season (March through August), and if high canopy closures and overstory trees would be retained. Post-project, where handpiling/burning is scheduled in PFAs with low amounts of coarse woody debris and other cover for small mammals, 2 hand piles/acre would be left unburned.	x	x						
134	Wildlife	Provide undisturbed breeding habitat for northern goshawks.	Wildlife biologist will conduct field surveys for northern goshawk during project implementation where their presence is suspected. If nests are located: a nest stand and post-fledging area (PFA) will be delineated, and activities in nest stands and PFAs would not occur from March through August depending on distance from active nest and potential for disturbance to nesting goshawks. See internal design criteria list.	x	x						

Item	Resource	Goal	Criteria	Harvest Thinning	NCT/LFR Thinning	Piling, Rx Fire, Mastication, & Fireline	Roads	Campground Construction	Tree Planting	Grazing	Hazard Tree Felling
135	Wildlife	Provide undisturbed breeding habitat for Western Gray Squirrels.	Wildlife biologist will conduct field surveys for Western Gray Squirrel. If nests are located: Protect all nests and nest trees suspected to contain natal nests with a 50' no-cut buffer, and retain a 50% or greater canopy closure within 350' of a nest; provide stringers of trees with interlocking crowns between natal nest sites, forage areas, and water; and avoid disturbance between March 1 and August 31 within 400' of natal nests.	x	x						
136	Wildlife	Provide arboreal travel and balance fungal production and mast crop production for Western Gray Squirrels.	In harvest units, retain groups of trees (3 or more) with interlocking canopies to provide arboreal travel, as well as more open conditions to balance fungal production and mast crop production. Fuels LFR units would retain 20% of the area in an untreated condition in patches from 0.1 to multiple acres, to provide for arboreal travel for squirrels and other wildlife needs.	x	x						
137	Wildlife	Retain snags.	Only those trees meeting the criteria presented in USDA Field Guide for Danger Tree Identification and Response 2008 shall be felled during hazard tree felling activities.	x			x				x
138	Wildlife	Provide wildlife needs including thermal cover, hiding cover, and connectivity.	In harvest units, retain complex patches, clumpiness, and canopy gaps in accordance with Restoration Strategy guidelines, to serve a number of wildlife needs including thermal cover, hiding cover, diversity and connectivity.	x							

Item	Resource	Goal	Criteria	Harvest Thinning	NCT/LFR Thinning	Piling, Rx Fire, Mastication, & Fireline	Roads	Campground Construction	Tree Planting	Grazing	Hazard Tree Felling
139	Wildlife	Retain snags and large trees ≥21" during underburning.	Treatments will be designed to retain at least 90 percent of live trees 20 inches diameter at breast height (DBH) and larger in areas where prescribed burning is conducted (Wright et al. 2003). Slash accumulations around snags and live trees 20 inches DBH and greater will be no deeper than one foot within an 8 feet radius of the bole to reduce scorch and cambium heating during prescribed fire underburn treatments.			x					
140	Wildlife	Retain snags in moderate- to high-severity burned areas within harvest units.	Where harvest units have small inclusions of moderate to high-severity burned soils, merchantable fire-killed trees which are standing or down at the time of harvest will not be targeted for removal. Snags in harvest units will be protected in the timber sale contract with the Leave Dead Standing contract provision. Snags felled to mitigate danger tree safety hazards associated with timber harvest operations will remain onsite.	x							x
141	Wildlife	Retain large trees and large down wood for management indicator species (MIS).	For harvest units in MRs, retain all large trees >21" dbh (or the largest overstory component available), snags and large down wood >12 inch diameter. Retain defective and diseased trees that may provide cavities.	x		x					
142	Wildlife	Provide for Western Gray Squirrels habitat.	Retain denser forest in riparian areas and in clumps and patches across the landscape	x	x	x					

Item	Resource	Goal	Criteria	Harvest Thinning	NCT/LFR Thinning	Piling, Rx Fire, Mastication, & Fireline	Roads	Campground Construction	Tree Planting	Grazing	Hazard Tree Felling
143	Wildlife	Provide large trees and woody debris.	Retain large trees >21”, snags, and large woody debris ≥ 12" diameter.	x		x					
144	Wildlife	Allow for recovery of deer winter range post-fire.	In fuels units within deer winter range, defer LFT thinning treatments at least 3 years after the Carlton Complex (2017) to assess levels of adequate cover before LFR thinning.	x							

Figure A-1. South Summit Stream Descriptions and RHCA Buffer Designations

Terminology	Scour/ Deposition?	Flow presence	LMRP Stream Class	PACFISH RHCA Category	Min. RHCA designation (PACFISH)
Ephemeral drainage feature	No	Infrequent/perhaps less than once/year	N/A	N/A	N/A
Intermittent stream	Yes	On annual basis, spring typically, capable of defining a channel	Class IV	Category 4	100', each side
Perennial non-fish-bearing (PNFB) stream	Yes	Year-round	Class II or III, depends on fish use	Category 2	150', each side
Perennial fish-bearing stream	Yes	Year-round	I or II, depends on fish use	Category 1	300', each side
Wetlands, waterbodies < 1 acre	n/a	P or seasonal	N/A	Category 4	100' from edge
Wetlands, waterbodies >1 acre	n/a	P or seasonal, typically P	N/A	Category 3	150' from edge

Figure A-2. RHCA Thinning Treatments: General Design Criteria.

Stream Flow Regime	PACFISH designated RHCA management zone. All treatments must maintain or help achieve RMOs	Harvest Treatment Buffer	Saw/LFR/NCT Treatment	Landing Const., Pile Burning
Ephemeral Drainage Features	PACFISH does not designate RHCAs for ephemeral drainage features.	No buffer/minimum skid trails up-down draws, minimize/mitigate crossings	No buffer for LFR/NCT cutting of understory trees (<8”)	Avoid new landings/ piles directly within lowpoint of draws.
Intermittent Streams (defined by presence of defined channel, scour/deposition)	**Category 4** - From the intermittent stream channel and the area to the top of the inner gorge, or the outer edges of the riparian vegetation, or to a distance equal to the height of one site-potential tree, or **100 feet slope distance (200 feet total, plus stream)**, whichever is greatest.	*Buffer* – 50ft for 0-10% slopes *Buffer* – 70ft for 11-25% slopes *Buffer* – 90ft for 26-35% slopes	10-foot buffer or inner gorge (>35%), whichever is greater, for LFR/NCT cutting of understory trees (<8”)	Mitigated Landing locations and designated landing locations/avoidance areas (REF TO RHCA LANDING GUIDELINES)
Perennial non-fish-bearing streams	**Category 3** - From the edges of the active stream channel to the top of the inner gorge, or to the outer edges of the 100-year flood plain, or to the outer edges of riparian vegetation, or to a distance equal to the height of one site-potential tree or **150 feet slope distance (300 feet total, plus stream),** whichever is greatest	Buffer - 100ft for <35% slopes	50-foot buffer or inner gorge (>35%), whichever is greater, for LFR/NCT cutting of understory trees (<8”)	
Perennial fish-bearing streams	**Category 1** - From the edges of the active stream channel to the top of the inner gorge, or to the outer edges of the 100-year floodplain, or to the outer edges of riparian vegetation, or to a distance equal to the height of two site-potential trees, or **300 feet slope distance (600 feet total, plus stream)**, whichever is greatest.			
Ponds, Lakes, Wetlands >1 acre	**Category 3** - From waterbody or wetland to the outer edge of riparian veg., or to extent of seasonally saturated soil, or a distance equal to height of one site-potential tree, or 1**50 feet slope distance** from the edge of wetland/waterbody, whichever is greatest.			
Ponds, Lakes, Wetlands <1 acre	**Category 4** - From waterbody/wetland to outer edge of riparian vegetation, or to extent of seasonally saturated soil, or to distance equal to height of one site-potential tree, or **100 feet slope distance** from edge of the wetland, pond or lake, whichever is greatest.			

Figure A-3. Post-Treatment Coarse Woody Debris Criteria by Environmental Zone (Graham et al 1998). See Design Criteria 100.

Environmental Zone	CWD Post-treatment
Cool Cold-Mesic Zones	Following treatments, 12-25 tons/acre of down woody material >3" diameter would be left on site. Mechanically scarred trees would be left standing to provide wood recruitment. These trees as well as snags would be counted as down woody material. Approximately 0.5-5 tons/acre of material <3" diameter would be left on site.
Warm Dry and Cool Dry Zone	Following treatments, 12-18 tons/acre of down woody material >3" diameter would be left on site. Mechanically scarred trees would be left standing to provide wood recruitment. These trees as well as snags would be counted as down woody material. Approximately 0.5-3 tons/acre of material <3" diameter would be left on site.
Hot Dry Zones	Following treatments, 5-15 tons/acre of down woody material >3" diameter would be left on site. Mechanically scarred trees would be left standing to provide wood recruitment. These trees as well as snags would be counted as down woody material. Approximately 0.5-3 tons/acre of material <3" diameter would be left on site.

Figure A-4. Prescribed Fire Treatments in RHCAs in Watersheds of LOW Aquatic Sensitivity

Stream Flow Regime	PACFISH designated RHCA management zone. All treatments must maintain or help achieve RMOs	Hand Pile Burning	Machine Pile Burning	Rx Underburning
Ephemeral Drainage Features	N/A	Avoid/minimize piles directly within low point of draws.	Minimize crossings; do not use 'gut' of draw as travel-way for equipment. Perpendicular crossings. Avoid piles directly within low point of draws	None proposed
Intermittent Streams	Category 4 - Minimum 100 feet slope distance (200 feet total, plus stream), see above	Same as Harvest Rx	Permitted in outer 50' of 150' RHCA. Not permitted anywhere where mesic riparian vegetation dominates.	
Perennial non-fish-bearing streams	Category 3 - Minimum 150 feet slope distance (300 feet total, plus stream), see above	50ft, above inner gorge (>35%), beyond mesic riparian vegetation, whichever is greater.	**None permitted unless upland of roadway inside unit.** Not permitted anywhere inside RHCA where mesic riparian vegetation dominates.	
Perennial fish-bearing streams	Category 1 – Minimum 300 feet slope distance (600 feet total, plus stream), see above.			
Ponds, Lakes, Wetlands >1 acre	**Category 3** – Minimum 1**50 feet slope distance** from edge, see above.		Permitted in outer 50' of 150' RHCA. Not permitted anywhere where mesic riparian vegetation dominates.	
Ponds, Lakes, Wetlands <1 acre	**Category 4** - Minimum **100 feet slope distance** from the edge, see above.		None proposed	

Figure A-5 – Prescribed Fire Treatments in RHCAs in Watersheds of HIGH Aquatic Sensitivity

<table>
<tr><th>Stream flow regime</th><th>PACFISH designated RHCA management zone. All treatments must maintain or help achieve RMOs</th><th>Hand Pile Burning</th><th>Machine Pile Burning</th><th>Rx Underburning</th></tr>
<tr><td>Ephemeral Drainage Features</td><td>N/A</td><td>Avoid/minimize piles directly within low point of draws.</td><td>Minimize crossings; do not use ‘gut’ of draw as travel-way for equipment. Perpendicular crossings. Avoid piles directly within low point of draws</td><td rowspan="7">None proposed</td></tr>
<tr><td>Intermittent Streams</td><td>Category 4 - Minimum 100 feet slope distance (200 feet total, plus stream), see above</td><td>Same as Harvest Rx</td><td rowspan="6">None proposed</td></tr>
<tr><td>Perennial non-fish-bearing streams</td><td>Category 3 - Minimum 150 feet slope distance (300 feet total, plus stream), see above</td><td rowspan="5">50ft, above inner gorge (>35%), beyond mesic riparian vegetation, whichever is greater.</td></tr>
<tr><td>Perennial fish-bearing streams</td><td>Category 1 – Minimum 300 feet slope distance (600 feet total, plus stream), see above.</td></tr>
<tr><td>Ponds, Lakes, Wetlands >1 acre</td><td>Category 3 – Minimum 150 feet slope distance from edge, see above.</td></tr>
<tr><td>Ponds, Lakes, Wetlands <1 acre</td><td>Category 4 - Minimum 100 feet slope distance from the edge, see above.</td></tr>
</table>

Figure A-6. RHCA Soil Burn Severity Descriptions (see Design Criteria 13)

Severity	Definition	% Post-burn
Low	Light ground char where litter is scorched, charred, or consumed, but the duff is left largely intact. Woody debris accumulation is partially consumed or charred. Mineral soil is not changed. Fire severity in forest ecosystems is low if the litter and duff layers are scorched but not altered over the entire depth.	At least 90%
Moderate	Litter on forest sites is consumed and the duff is deeply charred or consumed, but the underlying mineral soil surface is not visibly altered. Light colored ash is present. Woody debris is mostly consumed, except for logs, which are deeply charred.	No more than 10%
High	Duff is completely consumed and the top of the mineral soil is visibly reddish or orange on severely burned sites. Color of soil below one cm is darker or charred from organic material. The char layer can extend to a depth of 10cm or more. Logs can be consumed or deeply charred, and deep ground char can occur under slash concentrations or burned-out logs. A soil texture in the surface layers is changed and fusion evidenced by clinkers can be observed locally.	0%

Figure A-7. Road Decommissioning Definitions (see Design Criteria 112)

Decommissioning Type	Definition
Light	Light decommissioning may consist of: blocking the entrance to the road, decompacting the surface of the road, installing waterbars, reestablishing former drainage patterns, scattering slash and woody debris and restoring vegetation or other methods designed to meet the specific conditions associated with the road. Site conditions on road segments where light decommissioning activities would be applied typically include gentle sideslopes and ridgetop locations and well established vegetation on stable sidecast fills on gentle sideslopes.
Medium	Medium decommissioning may consist of: blocking the entrance to the road, removing cross drain culverts and small fills; decompacting the surface of the road, pulling back road shoulders and placing and shaping the material into cutbanks, installing waterbars, reestablishing former drainage patterns, scattering slash and woody debris and restoring vegetation or other methods designed to meet the specific conditions associated with the road. Site conditions on road segments where medium decommissioning activities would be applied typically include moderate sideslope locations, cross drain culverts and small fills and sidecast fills on moderate sideslopes.
Heavy	Heavy decommissioning may consist of: blocking the entrance to the road, removing stream culverts and fills (restoring slopes and stream channels to match adjacent conditions upstream and downstream), removing unstable fills and completely eliminating the roadbed by restoring natural contours and slopes, reestablishing former drainage patterns, scattering slash and woody debris and restoring vegetation or other methods designed to meet the specific conditions associated with the road. Site conditions on road segments where heavy decommissioning activities would be applied typically include steep sideslope locations and close proximity to streams, stream crossings and large fills, sidecast fills on steep sideslopes and potentially unstable fills.

Figure A-8. Soil Disturbance Classes

Class	Soil Surface Description	Soil Compaction Description
Class 0 (Undisturbed)	No evidence of past equipment operation. No depressions of wheel tracks evident Forest floor layers present and intact. No management-generated soil erosion. Litter and duff layers not burned. No soil char. Water repellency may be present.	None
Class 1	Faint wheel tracks or slight depressions evident and are <5 cm. deep. Forest floor layers present and intact. Surface soil has not been displaced and shows minimal mixing with subsoil. Low burn severity: Litter charred, or consumed. Duff largely intact. Water repellency is similar to pre-burn conditions. Depth of char <1cm.	Compaction in the surface soil is slightly greater than observed under natural conditions. Concentrated from 1-10 cm in depth. Change in soil structure from crumb or granular structure to massive or platy structure, restricted to the surface 0-10 cm. Platy structure is non-continuous.
Class 2	Wheel tracks or depressions are 5 to 10 cm deep. Forest floor layers partially intact or missing. Surface soil partially intact and may be mixed with subsoil. Moderate burn severity: Duff deeply charred or consumed. Surface soil water repellency increased compared to the pre-burn condition. Depth of char 1-5cm.	Increased compaction is present from 10 – 30 cm in depth. Change is soil structure from crumb or granular structure to massive or platy structure, restricted to the surface 10 – 30 cm. Platy structure is generally continuous. Large roots may penetrate platy structure, but fine and medium roots may not.
Class 3	Wheel tracks and depressions highly evident with depth >10 cm. Forest floor layers are missing. Evidence of surface soil removal, gouging, and piling. The majority of surface soil has been displaced. Surface soil may be mixed with subsoil. Subsoil partially or totally exposed. High burn severity: Duff and litter layer completely consumed. Surface soil is water repellent. Depth of char > 5 cm. Surface reddish or orange in places.	Increased compaction is deep in the soil profile (>30 cm in depth). Change in soil structure from granular structure to massive of platy structure extends beyond 30 cm. in depth. Platy structure is continuous. Roots do not penetrate platy structure.

Figure A-9. Dry and Wet Soil Designations for Summer Harvest. Yellow highlights indicate soil conditions to avoid during summer harvest.

% Soil Moisture (Increases Downward)	Coarse Soil Types Loamy sands, fine sandy loam, very fine sands, coarse sands	Light Soil Types Fine sandy loams, sandy loams, very fine sandy loam	Medium Soil Types (<35% clay) Sandy clay loam, loam, silt loam, sandy clay loam, clay loam	Heavy Soil Types (>35% clay) Clay loam, sandy clay, silty clay loam, clay
Dry soils	Dry, loose, single grained flows thru fingers	Dry, loose, flows thru fingers	Powdery, dry, sometimes slightly crusted but breaks down into powdery conditions	Hard, baked, cracked sometimes has loose crumbs on surface
Slightly moist soil	Still appears dry, will not form a ball with pressure	Still appears to be dry; will not form a ball	Somewhat crumbly, but will hold together from pressure	Somewhat pliable; will form ball under pressure. At plastic limit.
Moist soil	Still appears dry, will not form a ball with pressure	Tends to ball under pressure but seldom will hold together	Forms a ball and is very pliable, sticks readily if high in clay.	Easily ribbons out between fingers, has a slick feeling. At plastic limit.
Very moist soil	Tends to stick together slightly, sometimes forms a very weak ball	Forms a weak ball breaks easily, will not stick. Plastic limit or nonplastic.	Forms a ball and is very pliable, sticks readily if high in clay. Exceeds plastic limit.	Easily ribbons out between fingers, has a slick feeling. Exceeds plastic limit.
Wet soils	Upon squeezing, free water may appear. Wet outline is left on hand. Nonplastic.	Upon squeezing free water may appear. Wet outline left on hand.	Can squeeze out free water. Wet outline left on hand.	Puddles and free water forms on surface. Wet outline left on hand.

Figure A-10. Active Soil Restoration Measures

Active restoration of activity-generated soil compaction in harvest units will be done if compaction levels exceed Forest Plan standards and guidelines following harvest. Active restoration will require fracturing and loosening compacted layers to a depth of at least 12 to 15 inches, roughening the soil surface and placing vegetation plugs and other organic material along detrimentally disturbed skid trails and landings to establish and promote vegetation growth. Adequate soil moisture, as assessed by a Forest Service Soil Scientist, will be present to ensure vegetation establishment success. Operations will be conducted so as to avoid damaging residual tree boles and roots.

Where soil is displaced creating ruts greater than 6 inches in depth, the rutted area will be repaired. Soil will be pulled in to fill the ruts or slash will be placed in the rutted area. Areas where compaction layers may occur beneath displaced soils, as determined by a Forest Service Soil Scientist, will be decompacted through active restoration. This commonly occurs on slopes less than 35 percent slope in Soil Group 2. Because of equipment operability limitations, areas of displacement on slopes greater than 35 percent will be covered with slash, other organic material, soil and rocks to effectively slow or restrict water runoff. This measure will avoid soil puddling on low relief slopes and minimize water channeling on steep slopes.

Figure A-11. Soil Specifications for Winter Harvest

The following conditions apply to harvesting in winter conditions: Eight inches of compact snow or a combination of compacted snow and hard frozen ground equaling 8 inches will be required. Prior to approval of winter logging operations, a Soil Scientist and Timber Sale Administrator will assess suitable snow and soil conditions. Periodic assessments will be conducted during the winter operating period, especially during warming trends.

Overnight temperatures should drop to < 25°F and afternoon temperatures should stay below 35°F to maintain frozen conditions. Afternoon temperatures can exceed 35°F for short periods if previous night time temperatures are below 20°F.

Designated snow trails will be constructed prior to operations to promote freezing of the ground beneath main skid trails to ensure stable operating conditions. If skid trails begin thawing and show signs of rutting and water runoff, main skid trails will be relocated to suitable snow and frozen soil conditions. If suitable conditions do not exist, operations will be curtailed until conditions meet requirements. Single and multiple-pass logging equipment trails will be located a minimum of 40 feet apart except where they converge such as landings.

Trail locations will be designated and approved prior to operating. If average, pre-compacted snow depth along the proposed trail is more than 8 inches, pre-trailing can be done whether or not the soil is frozen. If pre-compacted snow depth is less than 8 inches; pre-trailing should be done only if the soil is solidly frozen in the top 1 inch or more. Otherwise, pre-trailing should be delayed until more snow falls to accumulate to the 8 inch or more depth. To further aid soil protection, pre-trailing should be done using an “easy-does-it” approach, including slow ground speeds and steady movements. Avoid spinning tires and bouncing equipment around on trails as much as possible. Adequate pre-trailing air temperatures generally are in the low 20’s or colder. For more information about pre-trailing conditions, consult with the soil scientist.

Figure A-12. Locations Requiring Cultural Resource Surveys or Implementation Monitoring

The proposed North Summit Horse Campground requires monitoring by a Cultural Resource Technician or Archaeologist during implementation.

The following roads in the project area lie in high-site-probability areas and were not surveyed for heritage resources as of March 2015. These roads must be surveyed before project implementation according to the Decision Notice. All other roads in high-site-probability locations that would be changed by the project were surveyed for South Summit I or other valid surveys. A map of these road locations is available in the Final Document project file under the Heritage folder. The priority for surveying are the pre-disturbance-decommissioning roads, and the haul routes (where “Haul Route” = “yes”).

Haul Route	Sum of Miles
No	**7.29**
4100240	0.22
4100305	0.01
4100310	0.01

4100320	0.06
4100370	0.10
4100400	0.01
4100450	0.16
4100455	0.06
4100456	0.17
4100457	0.07
4100460	0.55
4100528	0.15
4100562	0.06
4100820	0.03
4100825	0.29
4100830	0.03
4108650	0.13
4120275	0.15
4125110	0.05
4150120	0.14
4150130	0.03
4150135	0.66
4150145	0.18
4205100	0.13
4207103	0.05
4100000-0.74L-1	0.18
4100000-10.16L-1	0.15
4100000-2.71R-1	0.17
4100000-2.80L-1	0.06
4100000-3.85L-1	0.10
4100000-3.85L-2	0.02
4100030-0.70R-1	0.47
4100030-0.79L-1	0.10
4100100-0.94L-2	0.06
4100110-0.28L-1	0.01
4100175-0.5R-1	0.02
4100185-1.00-1	0.27
4100185-1.00-2	0.08
4100185-1.00-3	0.02
4100240-A	0.06
4100250-2.98L-1	0.04
4100302-0.34R-1	0.11
4100302-0.44L-1	0.06
4100302-0.44L-2	0.06
4100450-0.82R-1	0.03
4100500-2.28R-1	0.25

4100600-0.11L-1	0.05	
4100600-0.11L-2	0.10	
4100810-0.15L-1	**0.03**	**Pre-disturbance-decommissioning road**
4100810-0.27L-1	**0.24**	**Pre-disturbance-decommissioning road**
4108650-0.62L-1	0.03	
4150100-0.97L-1	0.08	
4150135-0.35R-1	0.03	
4150135-0.60R-1	0.14	
4150135-0.80R-1	0.53	
4150135-0.80R-2	0.16	
4150300-1.47R-1	0.04	
4150325-0.1L-1	0.02	
PUD-OK 4108650	0.01	
Yes	**2.76**	
4100110	0.27	
4100115	0.10	
4100150	0.07	
4100175	0.85	
4100185	0.05	
4100487	0.07	
4100493	0.04	
4205110	0.16	
4100000-3.85L-1	0.06	
4100000-3.85L-2	0.01	
4100000-3.97R-1	0.06	
4100000-4.66L-1	0.04	
4100110-0.28L-1	0.05	
4100175-0.5R-1	0.02	
4100175-1.32L-1	0.06	
4100185-1.00-1	0.22	
4100195-0.26R-1	0.12	
4100195-0.26R-2	0.08	
4100400-0.34L-1	0.07	
4100400-0.57R-1	0.13	
4100400-0.57R-2	0.03	
P4205110-1.12R-1	0.05	
Unknown 1	0.08	(T32N R23E S 14, NE 1/4. See map for location)
Unknown 2	0.01	(T32N R23E S 14, SE 1/4. See map for location)
Unknown 3	0.06	(T32N R23E S 10, SE 1/4. See map for location)
Grand Total	**10.05**	

Appendix B: Proposed Harvest and Non-Harvest Forest Vegetation Treatment Units

Figure B-1. Harvest Treatment Units.

Unit	Acres	Harvest Treatment	Logging Season	Mgt Area	Aspen Acres	RHCA Acres	Connectivity Corridor Treatment Acres	Environmental Zone	Stand Number	Current Stand Structure	FPOG* Acres	Fuels** Treatments
27	3.1	HITH	Winter	25	0	0	0	Warm-Dry	378	YFMS	0	Landing Pile
34	33.5	HITH	Winter	25	0.2	0	0	Warm-Dry	405	YFMS	0	Landing Pile
40	107.6	HITH	Winter	25	0	0	0	Warm-Dry	409	YFMS	0	Machine Pile/Burn Piles
42	69.6	HITH	Winter	25	0	0	0	Warm-Dry	407	YFMS	0	Landing Pile
48	126.6	HITH	Winter	25	0	0	0	Warm-Dry	455	YFMS	0	Landing Pile
51	26.3	HITH	Winter	25	0.6	0.8	0	Warm-Dry	455	YFMS	0	Machine Pile/Burn Piles
52	200.3	HPST	Winter	25	3.3	0	0	Warm-Dry	481	YFMS	0	Machine Pile/Burn Piles
60	25.9	HPST	Winter	5	0	0	0	Cool-Mesic	521	MSLT	25.6	Landing Pile
61	9.1	HQAM	Winter	5	2	0.3	0	Cool-Mesic	521	MSLT	9.1	Machine Pile/Burn Piles
65	27.7	HPST	Winter	5	0	0.1	0	Warm-Dry	521	MSLT	27	Landing Pile

Unit	Acres	Harvest Treatment	Logging Season	Mgt Area	Aspen Acres	RHCA Acres	Connectivity Corridor Treatment Acres	Environmental Zone	Stand Number	Current Stand Structure	FPOG* Acres	Fuels** Treatments
68	340.9	HITH	Summer /CTL	25	4.3	0	0	Warm-Dry	522	YFMS	0	Machine Pile/Burn Piles
70	27.4	HPST	Winter	5	0	0	0	Warm-Dry	521	MSLT	23.7	Landing Pile
73	23.8	HPST	Summer /CTL	5	0	0	0	Warm-Dry	538	YFMS	0	Machine Pile/Burn Piles
79	20.2	HITH	Winter	5	0.2	0	0	Warm-Dry	626	MSLT	18.3	Machine Pile/Burn Piles
80	26.2	HITH	Summer /CTL	5	0	0	2.7	Warm-Dry	626	MSLT	26	Machine Pile/Burn Piles
82	26.4	HITH	Summer /CTL	5	0.2	0	0	Warm-Dry	626	YFMS	0	Machine Pile/Burn Piles
88	32.6	CAMP	Summer /CTL	17	0.2	0	1.5	Warm-Dry	626	MSLT	32.2	Machine Pile/Burn Piles
91	11.7	HITH	Winter	5	0	0.3	0.3	Warm-Dry	544	YFMS	0	Machine Pile/Burn Piles
92	25.2	HITH	Winter	5	0	1.5	0.6	Warm-Dry	574	YFMS	0	Machine Pile/Burn Piles
93	1.9	CAMP	Optional	17	0	0	0	Warm-Dry	626	MSLT	1.9	Machine Pile/Burn Piles

Unit	Acres	Harvest Treatment	Logging Season	Mgt Area	Aspen Acres	RHCA Acres	Connectivity Corridor Treatment Acres	Environmental Zone	Stand Number	Current Stand Structure	FPOG* Acres	Fuels** Treatments
95	15.2	HITH	Summer /CTL	17	0	0	0.1	Warm-Dry	626	MSLT	15.2	Machine Pile/Burn Piles
560	6.3	HPST	Winter	5	0	0	0	Cool-Mesic	521	MSLT	6.3	Landing Pile
580	11.0	HITH	Summer /CTL	5	0	0	2.1	Warm-Dry	626	YFMS	0	Machine Pile/Burn Piles
618	6.0	HITH	Winter	14	0	0	0	Warm-Dry	136	UR	0	Machine Pile/Burn Piles
635	11.5	HITH	Winter	25	0	0	0	Warm-Dry	55	UR	0	Machine Pile/Burn Piles
638	22.7	HITH	Winter	14	0	0.2	0	Warm-Dry	90	SECC	0	Machine Pile/Burn Piles
639	24.8	HPST	Winter	14	0.5	0	0	Warm-Dry	90	SECC	0	Machine Pile/Burn Piles
641	26.6	HPST	Winter	14	0.1	0	0	Warm-Dry	135	UR	0	Machine Pile/Burn Piles
642	4.1	HITH	Winter	14	0	0	0.1	Warm-Dry	198	UR	0	Landing Pile
643	6.6	HITH	Winter	14	0	0	0.8	Warm-Dry	198	UR	0	Machine Pile/Burn Piles

Unit	Acres	Harvest Treatment	Logging Season	Mgt Area	Aspen Acres	RHCA Acres	Connectivity Corridor Treatment Acres	Environmental Zone	Stand Number	Current Stand Structure	FPOG* Acres	Fuels** Treatments
644	52.9	HPST	Winter	14	1.1	0	0	Warm-Dry	190	YFMS	0	Machine Pile/Burn Piles
645	21.6	HITH	Winter	14	0	0	1.2	Warm-Dry	198	UR	0	Machine Pile/Burn Piles
650	7.5	HITH	Winter	14	0	0	0	Hot-Dry	662	SECC	0	Landing Pile
655	8.7	HITH	Winter	14	0	1	0	Warm-Dry	292	YFMS	0	Machine Pile/Burn Piles
656	4.5	HPST	Winter	14	0	0	0	Warm-Dry	190	YFMS	0	Landing Pile
661	28.0	HPST	Winter	25	1.6	0	0	Warm-Dry	173	YFMS	0	Landing Pile
662	43.3	HPST	Winter	25	0.2	0	0	Warm-Dry	146	YFMS	0	Machine Pile/Burn Piles
663	3.3	HITH	Winter	25	0	0	0	Warm-Dry	146	YFMS	0	Machine Pile/Burn Piles
664	56.0	HPST	Winter	25	1.6	0.8	0	Warm-Dry	137	YFMS	0	Machine Pile/Burn Piles
665	16.0	HITH	Winter	25	0.2	0.5	0	Warm-Dry	161	YFMS	0	Landing Pile
666	2.4	HITH	Winter	25	0	0	0	Warm-Dry	178	YFMS	0	Landing Pile
668	22.6	HSTF	Winter	25	0.2	0	0	Warm-Dry	179	YFMS	0	Underburn

Unit	Acres	Harvest Treatment	Logging Season	Mgt Area	Aspen Acres	RHCA Acres	Connectivity Corridor Treatment Acres	Environmental Zone	Stand Number	Current Stand Structure	FPOG* Acres	Fuels** Treatments
669	3.9	HITH	Winter	14	0	0	0	Warm-Dry	181	SEOC	0	Landing Pile
673	27.1	HQAM	Winter	25	1.5	12.4	0	Warm-Dry	69	YFMS	0	Machine Pile/Burn Piles
674	97.4	HITH	Winter	25	0	0	0	Warm-Dry	69	YFMS	0	Machine Pile/Burn Piles
675	67.0	HITH	Winter	25	0	0	0	Warm-Dry	83	YFMS	0	Machine Pile/Burn Piles
676	7.5	HSTF	Winter	25	1.3	0	0	Warm-Dry	118	YFMS	0	Underburn
677	11.5	HITH	Winter	25	0.3	0	0	Hot-Dry	122	YFMS	0	Machine Pile/Burn Piles
680	67.0	HITH	Winter	25	2.5	7.5	5.6	Warm-Dry	125	YFMS	0	Machine Pile/Burn Piles
682	49.6	HITH	Winter	25	0.8	0	0	Warm-Dry	83	YFMS	0	Machine Pile/Burn Piles
683	35.8	HITH	Winter	25	0.1	0	0	Warm-Dry	83	YFMS	0	Machine Pile/Burn Piles
684	4.9	HQAM	Winter	25	0.8	0	0	Warm-Dry	76	YFMS	0	Machine Pile/Burn Piles

Unit	Acres	Harvest Treatment	Logging Season	Mgt Area	Aspen Acres	RHCA Acres	Connectivity Corridor Treatment Acres	Environmental Zone	Stand Number	Current Stand Structure	FPOG* Acres	Fuels** Treatments
685	74.5	HITH	Winter	25	0.1	0.7	0	Hot-Dry	97	YFMS	0	Machine Pile/Burn Piles
686	20.3	HITH	Winter	25	0	0.1	0	Warm-Dry	97	YFMS	0	Machine Pile/Burn Piles
687	38.2	HITH	Winter	25	0.5	0	0	Hot-Dry	97	YFMS	0	Machine Pile/Burn Piles
690	48.5	HITH	Winter	14	0	0	0	Hot-Dry	292	YFMS	0	Landing Pile
693	61.9	HITH	Winter	25	0	0	0	Warm-Dry	187	YFMS	0	Landing Pile
697	45.8	HITH	Winter	25	1	1.1	2.4	Warm-Dry	161	YFMS	0	Landing Pile
698	30.2	HSTF	Winter	25	0	0	0.1	Warm-Dry	146	YFMS	0	Underburn
809	4.2	HITH	Winter	14	0	0	0	Warm-Dry	154	SECC	0	Landing Pile
844	9.7	HSTF	Winter	14	0	0.1	0	Warm-Dry	190	YFMS	0	Underburn
861	5.4	HPST	Winter	25	0.3	0	0	Warm-Dry	173	YFMS	0	Landing Pile
865	5.2	HITH	Winter	25	0	0	0	Warm-Dry	161	YFMS	0	Landing Pile
866	5.1	HITH	Winter	25	1	3.1	1.3	Warm-Dry	183	YFMS	0	Landing Pile
886	7.5	HPST	Winter	25	0	2.2	0	Warm-Dry	97	YFMS	0	Machine Pile/Burn Piles

Unit	Acres	Harvest Treatment	Logging Season	Mgt Area	Aspen Acres	RHCA Acres	Connectivity Corridor Treatment Acres	Environmental Zone	Stand Number	Current Stand Structure	FPOG* Acres	Fuels** Treatments
887	51.6	HPST	Winter	25	1.7	0	0	Hot-Dry	83	YFMS	0	Machine Pile/Burn Piles
Total	**2347.4**				**28.4**	**32.7**	**18.8**				**185.3**	

***FPOG:** Okanogan Forest Plan old growth.
****Fuels Treatments:** All units with machine piling will also have a landing pile.

Figure B-2. Harvest Treatment Descriptions

Type	Total Acres	Treatment	Description
HITH	1,590	Commercial thinning	Harvest thinning of sawtimber-sized conifers (7” to 9” DBH and larger) and non-sawtimber conifers (less than 7” DBH if economical) to maintain and restore elements of historic forest stand structures including tree density, large and old trees, species composition, and spatial patterns (tree clumps, canopy openings, and individual trees).
HPST	612	Commercial thinning with dwarf mistletoe treatment	Harvest thinning of sawtimber and non-sawtimber-sized conifers to restore elements of historic forest stand structures and reduce disease levels (primarily dwarf mistletoe). Removal of diseased and other less desirable trees may create individual canopy openings up to one half acre in size.
HQAM	41	Quaking aspen maintenance with commercial thinning	Harvest of conifers competing with aspen trees for sunlight and soil moisture to maintain or improve vigor of aspen clones and initiate aspen sprouting. Includes commercial thinning of adjacent sawtimber sized conifer areas without aspen located within HQAM unit boundaries.
HSTF	70	Regeneration Harvest	Regeneration harvest of conifers with retention of individual and groups of overstory and desirable understory trees for structural diversity. Reforestation will be achieved by planting conifer seedlings and natural seeding following harvest.
CAMP	35	Campground thinning	Harvest thinning of sawtimber and non-sawtimber sized conifers to maintain or improve vigor of residual trees and to maintain and restore elements of historic forest stand structures. Remove hazard trees that could fall on high use areas and high value targets including campsites, structures, road ways, and parking areas.

Figure B-3. Logging Season Descriptions

Season	Total Acres	Description
Winter	1,869	Must complete logging during winter conditions to minimize soil disturbance.
Summer/CTL	476	Must complete logging with a cut to length logging system prior to winter trail grooming.
Optional	2	Able to log either season.

Figure B-4. Stand Structure Descriptions

Stand Structure	Total Harvest Acres	Description
SI	0	Stand Initiation.
SECC	59	Stem exclusion closed canopy.
SEOC	4	Stem exclusion open canopy.
YFMS	2015	Young forest multi-strata (also referred to as Multi-strata without large trees).
UR	76	Understory reinitiation.
MSLT	193	Multi-strata with large trees

Figure B-5. Non-Commercial Thinning Units. Resulting debris would be treated as needed by hand-piling and pile-burning.

Unit	Acres	Treatment Unit Name	Mg Area	Aspen Acres	RHCA Acres	Environmental Zone	Stand Number	Current Stand Structure
300	62.1	LITTLE LAKE 8,9,10	25	0	4.4	Cool-Dry	648	SI
302	4.9	CHILIWIST 2	5	0	0	Warm-Dry	562	SEOC
303	44.0	POWER 1	5	6.8	3	Warm-Dry	567	UR
304	53.2	POWER 3	5	0	0.7	Warm-Dry	545	UR
305	59.6	POLE PICK 5	5	0	0	Cool-Dry	537	SI
308	2.0	POLE PICK 8	5	0	0	Cool-Dry	500	SI
313	4.1	JAY 3	25	0	1.2	Warm-Dry	601	UR
317	22.3	SECTION 25 #2	25	0	0.2	Warm-Dry	683	SI
328	84.3	ELK 1,2	5	0	0	Warm-Dry	537	SI
329	19.9	CHILIWIST 1	5	0	0	Cool-Mesic	566	SI
330	11.0	CHILIWIST 3	5	0	0	Cool-Dry	557	SI
331	15.1	CHILIWIST 4	5	0	0	Cool-Dry	554	SI
332	29.2	YOCKEY 10	14	0.6	0	Cool-Mesic	86	SI
333	31.9	YOCKEY 11	14	0.4	0	Cool-Mesic	81	SI
334	23.6	YOCKEY 13	14	0	0	Cool-Dry	67	SI
335	35.6	YOCKEY 7	14	6	10.9	Warm-Dry	116	SI
336	20.6	YOCKEY 9	14	1.4	5.7	Cool-Mesic	96	SI
337	16.3	JAY 4,5	25	0.9	1.6	Warm-Dry	156	SI
338	9.3	JAY 6	25	0	0.8	Warm-Dry	682	SI
339	6.8	JAY 8,7	25	0.1	0.8	Warm-Dry	165	SI
340	26.9	JAY 9,13	25	1.9	0.6	Warm-Dry	149	SI
341	22.0	LEECH 2B	14	0	0	Warm-Dry	730	SI
342	5.7	HOOK 2A	14	0	0	Warm-Dry	167	SI

Unit	Acres	Treatment Unit Name	Mg Area	Aspen Acres	RHCA Acres	Environmental Zone	Stand Number	Current Stand Structure
343	13.9	HOOK 2B	14	0	0	Warm-Dry	167	SI
344	19.9	HOOK 2C	14	0.7	0.3	Warm-Dry	167	SI
345	20.2	HOOK 4B	25	0	0	Warm-Dry	176	SEOC
346	13.3	HOOK 4D	25	0	0.5	Warm-Dry	181	SEOC
347	39.8	HOOK 4F	25	0	0.7	Warm-Dry	160	SI
348	19.1	ELECTRIC II #22	5	0	0	Warm-Dry	574	SI
349	87.4	OVERWOOD 1	5	0.5	0	Warm-Dry	537	SI
350	139.5	OVERWOOD 2	5	1	0	Warm-Dry	496	SI
Total	**963.7**			**20.3**	**31.4**			

Figure B-6. Non-harvest Treatment Descriptions

Type	Acres	Treatment	Description
NCT	964	Noncommercial thinning	Non-harvest thinning of conifers less than 7” to 9” DBH to reduce inter-tree competition, promote the desired tree species composition, maintain existing overstory trees, and reduce disease

Figure B-7. Post-fire Tree Planting Units

Planting Unit Number	Unit Acres	Management Areas	RHCA Treatment Acres	Primary Environmental Zone
901	72	26	11	Cool-dry
902	22	5, 26	0	Hot-dry
903	40	5	27	Warm-dry
904	176	5	39	Warm-dry
905	167	5	1	Cool-dry
906	204	5	5	Cool-dry
907	50	5	0	Warm-dry
908	432	5, 25	5	Cool-dry
909	1,206	14, 25	2	Cool-dry
910	457	14, 25	3	Warm-dry
911	66	14, 26	1	Warm-dry
912	66	14	11	Warm-dry
913	62	14	0	Warm-dry
914	364	25	8	Warm-dry
915	372	25	12	Warm-dry
916	661	25	3	Warm-dry
917	1,115	14, 25	9	Cool-dry
918	523	14	0	Warm-dry
919	1,088	14, 25	8	Warm-dry
920	281	14	0	Warm-dry
921	35	14	0	Warm-dry
922	236	14	6	Warm-dry
923	151	14	4	Warm-dry
924	17	25	0	Warm-dry
925	59	14	2	Hot-dry
926	219	14	4	Cool-dry
927	16	5	12	Warm-dry

Planting Unit Number	Unit Acres	Management Areas	RHCA Treatment Acres	Primary Environmental Zone
928	69	14	4	Hot-dry
929	3	14	7	Warm-dry
930	37	14	2	Warm-dry
Total	8,264		182	

Appendix C: Description of Vegetation Management Treatments

Commercial Thinning (HITH)

A harvest activity that would fell and remove sawtimber size conifers to maintain and restore the sustainability and resiliency of treated forest stands as directed by the Okanogan-Wenatchee National Forest Restoration Strategy (USFS 2012). Trees seven to nine inches diameter at breast height (dbh) and larger would be harvested to maintain and restore elements of historic forest stand structures including tree density, large and old trees, species composition, and spatial patterns (including tree clumps, individual trees, and canopy openings) to increase stand and landscape resiliency to natural disturbances including forest insect attacks, tree diseases, and wildfires. Trees less than seven to nine inches dbh which exceed desired tree density levels also would be removed at the time of logging if favorable market conditions exist.

Figure C-1 displays the desired range of post-harvest tree density levels and the spatial arrangement of residual trees for proposed commercial thinning units. Plant association groups in the South Summit analysis area are listed in Figure C-2 and described in the *Field Guide for Forested Plant Associations of the Wenatchee National Forest* (Lillybridge et al. 1995).

Figure C-1. South Summit Desired Tree Stocking Levels in Commercial Thinning Units

Plant Association Group(s)	Approximate trees per acre retained	Maximum distance between boles of residual "clumped" trees
Hot-dry ponderosa pine and Douglas-fir	30 - 40	20 feet
Warm-dry and warm-mesic Douglas-fir	40 - 50	20 feet
Cool-dry Douglas-fir and subalpine fir	40 - 50	20 feet
Cool-mesic Douglas-fir and subalpine fir	50 - 60	20 feet

Desired post-harvest stocking levels for conifers seven to nine inches dbh and larger would range between 30 to 60 trees per acre depending on the predominant plant association group which occurs in each commercial thinning unit. Stocking levels would be lower in units with the less productive hot-dry plant associations; higher in the warm-dry, warm-mesic, and cool-dry plant associations; and highest in the more productive cool-mesic plant associations. Figure B-1 (Appendix B) lists environmental zone information which correlates with the plant association groups for all proposed vegetation treatment units.

The desired spatial pattern or horizontal arrangement of residual trees can best be described in terms of individual trees, tree clumps, and canopy openings (ICO) (Churchill et al., 2013; Larson and Churchill, 2012; Larson et al., 2012). A clump of trees is defined as two or more trees in close enough proximity that a portion of their crowns are interlocking. Figure C-1 displays a maximum distance between tree boles that will be used to determine whether or not adjacent trees are part of a clump. Approximately 65 percent of residual trees in commercial thinning units will be retained in clumps with a spacing of 20 feet or less between leave trees. A leave tree is considered part of a clump if it is located 20 feet or less from at least one other leave tree. Approximately 35 percent of residual trees will be retained as individual trees which are located more than 20 feet away from all other leave trees. Canopy openings will be comprised of those areas where the distance between residual tree boles is 2 times the maximum “clumped” tree distance (40 feet) and greater.

Figure C-2 Plant Association Groups in the South Summit Vegetation Treatment Units

Plant Association Group	Plant Association[1]
hot–dry ponderosa pine	ponderosa pine/pinegrass-bluebunch wheatgrass
hot–dry ponderosa pine	ponderosa pine/bitterbrush-bluebunch wheatgrass
hot–dry Douglas-fir	Douglas-fir/bitterbrush
hot–dry Douglas-fir	Douglas-fir/bitterbrush/ bluebunch wheatgrass
hot–dry Douglas-fir	Douglas-fir/bitterbrush/pinegrass
hot–dry Douglas-fir	Douglas-fir/pinegrass-bluebunch wheatgrass
hot–dry Douglas-fir	Douglas-fir/common snowberry/ bluebunch wheatgrass
warm–dry Douglas-fir	Douglas-fir/bearberry-bitterbrush
warm–dry Douglas-fir	Douglas-fir/bearberry
warm–dry Douglas-fir	Douglas-fir/bearberry/pinegrass
warm–dry Douglas-fir	Douglas-fir/mountain snowberry
warm-mesic Douglas-fir	Douglas-fir/common snowberry
warm-mesic Douglas-fir	Douglas-fir/common snowberry/pinegrass
cool–dry Douglas-fir	Douglas-fir/pinegrass
cool–dry Douglas-fir	Douglas-fir/pachistima/pinegrass
cool–dry Douglas-fir	Douglas-fir/pachistima
cool–dry Douglas-fir	Douglas-fir/shiny-leaf spirea/ pinegrass
cool–dry subalpine fir	Subalpine fir/pinegrass
cool–dry subalpine fir	Subalpine fir/pachistima
cool–dry subalpine fir	Subalpine fir/pachistima/pinegrass
cool-mesic Douglas-fir	Douglas-fir/dwarf huckleberry

Plant Association Group	Plant Association[1]
cool-mesic Douglas-fir	Douglas-fir/low huckleberry
cool-mesic Douglas-fir	Douglas-fir/low huckleberry/pinegrass
cool-mesic subalpine fir	Subalpine fir/twinflower
cool-mesic subalpine fir	Subalpine fir/dwarf huckleberry
cold–dry subalpine fir	Subalpine fir/grouse huckleberry/pinegrass

1. Lillybridge et al. 1995

Generally, the largest and most vigorous conifers (with regard to height, bole diameter and live crown volume) of the most preferred species groups in a given area would be retained to achieve the target or desired stocking levels and spatial pattern of residual trees. Ponderosa pine and western larch would be the highest priority conifer species group for restoration and retention; the Douglas-fir/Engelmann spruce species group would be second highest priority; the lodgepole pine/subalpine fir species group would be third priority. Live defective trees and dying trees would be retained throughout vegetation management treatment units to provide cavity dependent habitat. Complex patches which include large snags, live defective trees, large and old trees, or large dwarf mistletoe infected trees would be retained. Retention criteria for live trees, legacy trees, defective trees, and dying trees within all vegetation management units are provided later in this document. No aspen or cottonwood would be harvested. Aspen stands greater than one quarter acre in size included within commercial thinning harvest units would receive the quaking aspen maintenance (HQAM) treatment described later in this document.

All large conifers 21 inches dbh and larger and old trees 18 inches dbh and larger with an estimated age of 150 or more years (based on criteria described in Van Pelt 2008) would be retained throughout all vegetation management treatment units including commercial thinning units.

Commercial Thinning with Dwarf Mistletoe Treatment (HPST)

A harvest activity that would fell and remove sawtimber size trees to maintain and restore elements of historic forest stand structures and reduce disease levels (primarily dwarf mistletoe) in “younger” trees to increase stand and landscape resiliency to natural disturbances. Small trees, generally less than seven to nine inches dbh, which exceed desired tree density levels also would be removed at the time of logging if favorable market conditions exist. The commercial thinning harvest treatment described in the previous section would be applied throughout areas that are stocked with vigorous and relatively disease-free trees. Young and mature trees (estimated age of less than 150 years) 20 inches dbh and smaller with moderate to heavy dwarf mistletoe infections (dwarf mistletoe infection ratings generally > 2) (Hawksworth 1977) would be harvested throughout treatment units to achieve commercial thinning treatment tree retention objectives (including heterogeneous spatial patterning of residual trees) and reduce the proportion and severity of infected trees in treated stands. All large conifers 21 inches dbh and larger and old trees 18 inches dbh and larger with an estimated age of 150 or more years (based

on criteria described in Van Pelt 2008) would be retained. Aspen stands greater than one quarter acre in size included within commercial thinning harvest units would receive the quaking aspen maintenance (HQAM) treatment described later in this document.

Removal of diseased and other less desirable trees may create openings in the tree canopy that would occupy up to 25 percent of an individual harvest unit. Openings generally one to two tree lengths wide (approximately one-tenth to one-half acre in size) would be created in areas where the majority of merchantable trees are damaged or diseased and not desirable for retention. Desired post-harvest stocking levels for conifers in areas of openings, therefore, could be up to 25 percent less than the respective commercial thinning residual tree stocking numbers displayed in Figure C-1.

Quaking Aspen Maintenance (HQAM) with Commercial Thinning

Harvest competing conifers in designated Aspen Maintenance units and aspen stands greater than one-quarter acre in size located within all other commercial thinning and commercial thinning with sanitation harvest treatment units. Remove encroaching conifers to reduce competition for sunlight and soil moisture to maintain or improve the vigor of existing aspen clones and stimulate sprouting of new aspen stems. No aspen or other deciduous broadleaf trees would be harvested.

Conifer removal for aspen maintenance treatment will be implemented within aspen stands and an adjacent 50 foot wide buffer located outside of aspen stand perimeters. Desired treatment objectives include 10 percent or less canopy closure contributed by conifers following treatment within and immediately adjacent to aspen stands. Implementation of this objective will be achieved by retaining a maximum stocking level of ten conifer sawtimber size trees (seven to nine inches dbh and larger) per acre following harvest within aspen stands and a 50 foot wide buffer located adjacent to aspen stand perimeters. All large conifers 21 inches dbh and larger old trees 18 inches dbh and larger with an estimated age of 150 or more years (based on criteria described in Van Pelt 2008) would be retained in aspen stands and the adjacent buffers even if conifer stocking exceeds the desired maximum retention level.

Ponderosa pine and western larch are the preferred conifer species to retain within and adjacent to aspen stand perimeters. The largest conifers and trees with the highest restoration priority would be favored for retention. Conifers would be retained in clumps when possible to attain conifer canopy closure objectives. Live defective conifers with favorable characteristics for wildlife habitat would also be favored for retention within and adjacent to aspen stands.

Conifer dominated areas within Aspen Maintenance treatment unit boundaries which are located outside of aspen stands greater than one-quarter acre in size and more than 50 feet away from aspen stand perimeters would be treated with the Commercial Thinning (HITH) harvest treatment previously described in this section

of the report.

Non-merchantable conifers, generally less than seven to nine inches dbh, remaining following harvest will be felled to reduce competition with live aspen stems greater than or equal to seven feet tall in aspen maintenance treatment units and not removed from the site.

Seed Tree Regeneration (HSTF)
A regeneration harvest treatment with retention of individual and clumps of overstory trees and desirable understory trees for structural and biological diversity. The majority of merchantable sawtimber size conifers seven to nine inches dbh and larger would be harvested in stands with high levels of dwarf mistletoe infected and suppressed trees to create site conditions which are favorable for the regeneration of early seral tree species (including ponderosa pine and aspen) and disease free Douglas-firs. Trees less than seven inches dbh also would be removed at the time of logging if favorable market conditions exist. No aspen or cottonwood trees would be harvested.

Seed tree treatment objectives include retention of approximately ten conifer trees per acre average for structural and biological diversity. All conifers 21 inches dbh and larger would be retained. In addition, ponderosa pines and dwarf mistletoe free Douglas-firs which are among the largest trees remaining in these units (generally 16 inches dbh and larger) would also be retained as individual trees and in clumps to achieve the desired tree retention numbers.

Following harvest, all remaining diseased, damaged, or suppressed conifers less than nine inches dbh would be felled to prepare the site for prescribed burning and reforestation. Dwarf mistletoe infected Douglas-fir trees greater than or equal to 21 inches dbh with an estimated age of less than 150 years (based on criteria described in Van Pelt 2008) may be girdled or felled and retained on site in order to prevent infection of Douglas-fir natural regeneration that becomes established following harvest. Reforestation would be accomplished by planting of ponderosa pine seedlings grown from locally adapted seed to ensure prompt establishment of ponderosa pine regeneration, natural seeding of Douglas-fir, and suckering of aspen stems from clones within regeneration harvest units. Conifer seedlings would be planted in microsites associated with tree stumps, down logs, and other shade providing woody debris at an approximate rate of 150 seedlings per acre with an estimated survival rate of 70 percent. Regeneration establishment would be monitored following planting and certified within five years of harvest completion. The minimum acceptable stocking level for reforestation certification is 100 vigorous conifer seedlings per acre.

Although not reasonably foreseeable under NEPA, seed tree regeneration harvest units most likely would be evaluated for noncommercial thinning treatment needs approximately 10 to 20 years after completion of reforestation treatments.

Campground Thinning

Harvest thinning treatment of sawtimber size conifers (seven to nine inches dbh and larger) to maintain or improve the vigor of residual trees and provide for public safety in the Loup Loup and JR Campgrounds. The commercial thinning (HITH) harvest treatment criteria previously described in this section of the report would be applied to maintain or improve tree vigor in the developed campgrounds. Hazard trees that could fall on high use areas and high value targets including campsites, parking areas, road ways, and structures would be felled regardless of size and removed from the campground. Hazard trees will be assessed and removed following criteria in the publication *Long-Range Planning for Developed Sites in the Pacific Northwest: The Context of Hazard Tree Management* (Harvey and Hessburg 1992).

Noncommercial Thinning (NCT)

This is a non-harvest thinning treatment of conifer seedlings, saplings, and pole size trees growing in areas that were planted or naturally regenerated approximately ten to 30 years ago. Conifers (less than seven to nine inches dbh) would be thinned with chainsaws to approximately 70 to 110 trees per acre to improve or maintain the vigor of residual trees, promote the desired tree species composition and spatial patterns, maintain existing overstory trees, and reduce disease infection of residual trees. Tree species retention preferences are described later in this document under live tree retention criteria. No aspen or cottonwood trees would be cut. Understory conifers (less than seven to nine inches dbh) growing within 30 feet horizontal distance of vigorous overstory conifers (generally 16 inches dbh and larger) or aspens would be felled to maintain overstory trees and aspen for structural diversity and to reduce the spread of dwarf mistletoe into the understory. Approximately 20 percent of the area in each NCT unit would be excluded from thinning in patches 0.1 acre and larger in size. Tree diameter cutting limits would be adjusted (reduced) as needed to retain clumpiness of residual trees. Slash created by thinning would be lopped and scattered or hand piled and burned as needed.

Live Tree Retention Criteria In Forest Vegetation Management Treatments

Live tree and defective tree retention criteria will be based upon the species and physical characteristics of trees.

Deciduous broadleaf tree species including quaking aspen, black cottonwood, and alder:

- Retain all deciduous broadleaf trees. Deciduous trees incidentally felled during implementation of vegetation management treatments will be excluded from harvest.

Large conifers and old conifers:

- Retain all conifers 21 inches dbh and larger and old conifers 18 inches dbh and larger with an estimated age of 150 or more years (based on criteria described in Van Pelt 2008).

Conifer species preferences for retention listed in descending order of restoration priority:

1. Ponderosa pine and western larch.
2. Douglas-fir and Engelmann spruce.
3. lodgepole pine and subalpine fir.

Conifer physical characteristics preferences for retention (trees 20 inches dbh and smaller) listed in descending order of retention priority:

1. Dominant or codominant crown class trees not infected with dwarf mistletoe.
2. Dominant or codominant trees with low severity dwarf mistletoe infection (Hawksworth severity rating of 1 for Douglas-fir and western larch and 2 or less for all other species).
3. Dominant or codominant trees with moderate severity dwarf mistletoe infection (Hawksworth severity rating of 2-3 for Douglas-fir and western larch and 3 for all other species).
4. Intermediate crown class trees not infected with dwarf mistletoe.
5. Intermediate crown class trees with low severity dwarf mistletoe infection (Hawksworth severity rating of 1 for Douglas-fir and western larch and 2 or less for all other species).

Live Defective Tree and Snag Retention Criteria for Harvest Treatments

Live defective trees with evidence of stem decay and snags will be retained throughout harvest units to provide dead tree and cavity dependent wildlife habitat plus a recruitment source for future snags and coarse woody debris. Unstable trees which pose a safety hazard to employees involved with harvest operations, Forest Service employees, and the public will not be retained. Tree stability will be evaluated according to criteria provided in a *Field Guide for Danger Tree Identification and Response* (Toupin and Barger 2005).

Live defective tree retention criteria:

- Apply the tree species and physical characteristics preferences described in the Live Tree Retention Criteria section.
- Retain trees that have as many of the following qualities as possible:
  1. A tree that is currently being used by cavity nesting wildlife.
  2. A tree with substantial defect and evidence of stem decay at a bole diameter of 10 inches and larger. Examples include a broken top, dead top, lightning scar, basal scar, and forked, bent, or twisted tree bole. Commandra rust infected ponderosa pines and western larch or Douglas-firs with dead tops are highly desirable for retention.
  3. All deciduous broadleaf trees with defects will be retained.
  4. A tree located in a group of other live or dead trees that will be retained in a structurally complex patch.

Snag retention criteria:

- Minimum height of 10 feet and minimum dbh of 10 inches.
- Leave all dead trees standing in harvest units that do not pose a safety hazard to private employees involved with harvest operations, Forest Service employees, and the public.
- Ponderosa and lodgepole pines that recently have been successfully attacked by pine bark beetles (trees may have green needles and show no evidence of pitching out beetles) will be considered dead trees and excluded from harvest. Retain these trees for dead tree and cavity dependent habitat.
- It is highly desirable to retain dead trees in a group of live defective or dead trees to form a structurally complex patch.

Appendix D: Proposed Fuels Units Treatment Information

Refer to Key below for further information:

Figure D-1. Fuels Treatment Units (Separate from Harvest or Noncommercial Thinning Units)

Unit Number	Acres	Mgt Area	RHCA Acres	Environmental Zone	4/ Dominant Stand Structure	FPOG Acres	xx/ Fuels Treatments***
077	111	5	1	Hot-Dry	UR	-	LFR < 8, HP
405	44	17, 25	-	Cool-Dry, Hot-Dry	YFMS	2	LFR <8, HP
406	33	17	-	Cool-Dry	YFMS	-	LFR <8, HP
407	19	17	-	Cool-Dry	YFMS	-	LFR <8, HP
408	14	17	-	Cool-Dry	YFMS	-	LFR <8, HP
409	10	17	-	Cool-Dry	YFMS	-	LFR <8, HP
412	513	5, 25	-	Cool-Dry, Hot-Dry	LOMS, YFMS, UR	14	LFR < 8, HP
415	63	5, 17	10	Hot-Dry	LOMS	45	LFR <8, HP
418	90	5, 17	-	Cool-Dry, Hot-Dry	SEOC	-	LFR <8, HP
419	216	5, 25	-	Cool-Dry, Hot-Dry	LOMS, UR, YFMS	91	LFR < 8, HP
427	271	5, 25	4	Cool-Dry, Hot-Dry	UR	-	LFR < 5, MAST or HP

Unit Number	Acres	Mgt Area	RHCA Acres	Environmental Zone	4/ Dominant Stand Structure	FPOG Acres	xx/ Fuels Treatments***
443	108	14	16	Hot-Dry	SECC, YFMS	-	LFR <8, HP
445A	45	14	13	Hot-Dry	YFMS	-	LFR <8, HP
445B	71	14	11	Hot-Dry	YFMS	-	LFR < 8, HP
448	47	25	-	Hot-Dry	SECC, SEOC, YFMS	-	LFR <8, HP
451	262	14	13	Hot-Dry	UR, YFMS	-	LFR < 8, HP
452A	297	14	6	Hot-Dry	UR, YFMS	-	LFR < 8, HP
452B	180	14	6	Hot-Dry	UR, YFMS	-	LFR < 8, HP
452C	918	14, 25	21	Hot-Dry	UR, YFMS	-	LFR < 8, HP
454	53	25	1	Hot-Dry	YFMS	-	LFR <8, HP
455	48	25	7	Hot-Dry	YFMS	-	LFR <8, HP
456	330	25	-	Hot-Dry	YFMS	-	LFR < 8, HP
459	215	25	14	Hot-Dry	YFMS	-	LFR <8, HP

Unit Number	Acres	Mgt Area	RHCA Acres	Environmental Zone	4/ Dominant Stand Structure	FPOG Acres	xx/ Fuels Treatments***
461	33	25	-	Cool-Dry, Hot-Dry	YFMS	-	LFR <8, HP
462	948	25	32	Hot-Dry	YFMS	-	LFR <8, HP
463	88	14	2	Hot-Dry	UR	-	LFR <8, HP
464	81	14	-	Hot-Dry	SECC	-	LFR <8, HP
467	75	14	-	Hot-Dry	UR	-	LFR <8, HP
474	54	5	-	Cool-Dry, Hot-Dry	LOMS	35	LFR <8, HP
478	359	14	14	Cool-Dry, Hot-Dry	UR, YFMS	-	LFR < 8, HP
479A	110	14	5	Hot-Dry	SEOC, UR	-	LFR < 8, HP
479B	278	14	-	Cool-Dry, Hot-Dry	SECC	-	LFR < 8, HP
484	53	25	1	Hot-Dry	YFMS	-	LFR <8, HP

Unit Number	Acres	Mgt Area	RHCA Acres	Environmental Zone	4/ Dominant Stand Structure	FPOG Acres	xx/ Fuels Treatments***
487	25	5, 17	-	Cool-Dry, Hot-Dry	LOMS	21	LFR < 8, HP
492	85	25	6	Hot-Dry	YFMS	-	LFR <8, HP
493	51	5	6	Hot-Dry	LOMS	50	LFR <8, HP
495	30	25	2	Hot-Dry	YFMS	-	LFR <8, HP
496	16	14	-	Cool-Dry	SECC, UR	5	LFR < 8, HP
632	229	14, 25	17	Hot-Dry	UR, YFMS	-	LFR <8, HP
679	70	25	1	Hot-Dry	YFMS	-	LFR <8, HP
701	30	14	0	Hot-Dry	SECC	-	LFR < 8, HP
705	15	14	0	Hot-Dry	SECC	-	LFR <8, HP

KEY:

Mgt Area: Management Area from 1989 Okanogan National Forest Land and Resource Management Plan

RHCA: Riparian Habitat Conservation Area FPOG: Forest Plan Old Growth

Stand Structure:

- SI = Stand Initiation
- SECC = Stem exclusion, closed canopy
- SEOC = Stem exclusion, open canopy
- YFMS = Young forest, multi strata
- UR = Understory re-initiation
- LOMS = Late old multi-strata
- MSLT = Multi-strata with large trees

Figure D-2. Ladder Fuel Reduction and Prescribed Fire Treatment Descriptions in Fuels Units

Type	Acres	Treatment	Description
LFR < 5, MAST	300	Ladder fuel reduction thinning, followed by mastication to reduce slash created by thinning.	Remove trees less than 5” DBH around residual trees > 8” DBH to reduce surface-to-crown fire pathway, leaving clumps and gaps of small-diameter trees following relevant design criteria. Grind and shred debris created by ladder fuel
LFR < 8, HP	6300	Ladder fuel reduction thinning, followed by hand-piling slash created by thinning activities. Burn piles after curing.	Remove trees less than 8” DBH to reduce surface-to-crown fire pathway, leaving clumps and gaps of small-diameter trees following relevant design criteria. If post-thinning fuel loading warrants, hand-pile debris within thinning unit boundary following relevant design criteria. In some units, may precede planned underburning where thinning debris is too heavy to reduce by underburning

Appendix E: Transportation System Proposal

Figure E-1. South Summit II Transportation Plan

Road Number	New Forest System Road Number	BMP	EMP	Segment Length	Current ML	During Harvest ML	After Harvest ML	Post Project ML	Haul Route
4100000		0.00	16.52	16.52	4	3	3	3	H
4100000		16.52	16.90	0.38	4	4	4	4	H
4100000-0.52L-1		0.00	0.11	0.11	1	1	1	D	
4100000-0.74L-1	Note 1	0.00	0.25	0.25	1	2	1	1	H
4100000-0.74L-1	Note 1	0.25	0.47	0.22	1	1	1	1	
4100000-0.74L-1		0.47	0.70	0.23	1	1	1	D	
4100000-0.82R-1		0.00	0.17	0.17	1	2	D	D	H
4100000-0.87R-1		0.00	0.11	0.11	1	1	1	D	
4100000-1.38L-1		0.00	0.07	0.07	1	1	1	D	
4100000-1.43R-1		0.00	0.07	0.07	1	2	D	D	H
4100000-10.04L-1		0.00	0.10	0.10	1	1	1	D	
4100000-10.16L-1		0.00	0.31	0.31	1	1	1	D	
4100000-10.16L-1		0.00	0.31	0.31	1	1	1	D	
4100000-16.52R-1		0.00	0.33	0.33	1	1	1	D	
4100000-16.52R-1		0.33	0.56	0.23	1	1	1	D	
4100000-16.8L-1	Note 1	0.00	0.10	0.10	2	2	2	2	
4100000-2.71R-1		0.00	0.24	0.24	1	1	1	D	
4100000-2.80L-1	Note 1	0.00	0.15	0.15	1	1	1	1	
4100000-3.29R-1		0.00	0.70	0.70	1	2	D	D	H
4100000-3.50L-1		0.00	0.19	0.19	1	2	D	D	H
4100000-3.85L-1		0.00	0.20	0.20	1	1	1	D	
4100000-3.85L-1		0.20	0.52	0.32	1	2	D	D	H
4100000-3.85L-2		0.00	0.16	0.16	1	2	D	D	H
4100000-3.85L-2		0.16	0.38	0.22	1	1	1	D	
4100000-3.97R-1		0.00	0.32	0.32	1	2	D	D	H
4100000-3.97R-1		0.32	0.59	0.27	1	2	D	D	H
4100000-4.13L-1		0.00	0.11	0.11	1	1	1	D	
4100000-4.66L-1		0.00	0.12	0.12	1	1	1	D	
4100000-4.66L-1		0.12	0.64	0.52	1	2	D	D	H
4100015		0.00	0.20	0.20	1	1	1	1	
4100020		0.00	0.26	0.26	2	2	2	1	
4100025		0.00	0.23	0.23	1	1	1	1	
4100030		0.00	3.39	3.39	2	2	2	2	

Road Number	New Forest System Road Number	BMP	EMP	Segment Length	Current ML	During Harvest ML	After Harvest ML	Post Project ML	Haul Route
4100030-0.29R-1		0.00	0.16	0.16	1	1	1	D	
4100030-0.49R-1		0.00	0.11	0.11	1	1	1	D	
4100030-0.70R-1		0.00	0.49	0.49	1	1	1	D	
4100030-0.79L-1		0.00	0.10	0.10	1	1	1	D	
4100030-1.37L-1	Note 1	0.00	0.37	0.37	1	1	1	1	
4100030-1.4L-1		0.00	0.31	0.31	1	1	1	D	
4100030-1.61L-2		0.00	0.11	0.11	1	1	1	D	
4100030-1.61L-3		0.00	0.08	0.08	1	1	1	D	
4100030-1.67L-1	Note 1	0.00	0.28	0.28	1	1	1	1	
4100030-1.67L-1		0.28	0.58	0.30	1	1	1	D	
4100030-1.67L-4		0.00	0.14	0.14	1	1	1	D	
4100030-1.67R-1		0.00	0.08	0.08	1	1	1	D	
4100030-1.78L-1		0.00	0.12	0.12	1	1	1	D	
4100030-1.97L-1	Note 1	0.00	0.51	0.51	1	1	1	1	
4100030-1.97L-1	Note 1	0.51	0.64	0.13	1	1	1	1	
4100030-1.97L-1	Note 1	0.64	0.87	0.23	1	1	1	1	
4100030-1.97L-2		0.00	0.25	0.25	1	1	1	D	
4100030-1.97L-3		0.00	0.08	0.08	1	1	1	D	
4100030-2.39L-1	Note 1	0.00	0.29	0.29	1	1	1	1	
4100100		0.00	2.24	2.24	2	2	2	2	H
4100100		2.24	2.45	0.21	2	2	2	2	
4100100-0.35L-1		0.00	0.26	0.26	1	2	D	D	H
4100100-0.94L-1		0.00	0.70	0.70	1	2	D	D	H
4100100-0.94L-2		0.00	0.13	0.13	1	2	D	D	H
4100100-0.94L-2		0.13	0.45	0.32	1	1	D	D	
4100110		0.00	1.40	1.40	1	2	1	1	H
4100110-0.28L-1		0.00	0.40	0.40	1	2	1	D	H
4100110-0.28L-1		0.40	0.79	0.38	1	1	1	D	
4100115		0.00	0.67	0.67	1	2	1	1	H
4100115		0.67	0.80	0.13	1	2	1	1	H
4100150		0.00	1.24	1.24	2	2	2	1	H
4100150		1.24	1.60	0.36	2	2	2	1	H
4100150		1.60	1.70	0.10	2	2	2	1	
4100175		0.00	1.70	1.70	1	2	1	1	H
4100175-0.5R-1		0.00	0.12	0.12	1	2	1	D	H
4100175-0.5R-1		0.12	0.23	0.11	1	1	1	D	

Road Number	New Forest System Road Number	BMP	EMP	Segment Length	Current ML	During Harvest ML	After Harvest ML	Post Project ML	Haul Route
4100175-1.32L-1		0.00	0.30	0.30	1	2	D	D	H
4100185		0.00	1.39	1.39	1	2	1	1	H
4100185-0.38R-1		0.00	0.23	0.23	1	2	D	D	H
4100185-1.00-1		0.00	0.47	0.47	1	1	1	D	H
4100185-1.00-1		0.47	1.33	0.86	1	2	D	D	
4100185-1.00-2		0.00	0.28	0.28	1	1	1	D	
4100185-1.00-3		0.00	0.20	0.20	1	1	1	D	
4100195		0.00	1.01	1.01	2	2	2	2	H
4100195		1.01	1.34	0.33	2	2	2	2	H
4100195		1.34	1.51	0.17	2	2	2	2	
4100195-0.26R-1		0.00	0.27	0.27	1	2	D	D	H
4100195-0.26R-1		0.27	0.37	0.10	1	2	D	D	H
4100195-0.26R-2		0.00	0.47	0.47	1	2	D	D	H
4100195-0.77R-1		0.00	0.04	0.04	1	2	D	D	H
4100195-0.82L-1		0.00	0.33	0.33	1	1	1	D	
4100200		0.00	1.33	1.33	1	2	2	1	
4100200		1.33	1.50	0.17	1	2	1	1	H
4100200-0.79L-1		0.00	0.42	0.42	1	1	1	D	
4100200-1.33R-1		0.00	0.44	0.44	1	1	1	D	
4100230		0.00	0.67	0.67	2	2	2	2	
4100240		0.00	0.15	0.15	2	2	2	2	
4100240		0.15	0.38	0.23	2	2	2	1	
4100240		0.38	0.50	0.12	2	2	2	D	
4100240-A	Note 1	0.00	0.16	0.16	1	1	1	1	
4100250		0.00	0.68	0.68	2	2	2	2	
4100250		1.47	1.98	0.51	1	1	1	1	
4100250		1.98	3.47	1.49	1	1	1	1	
4100250-0.11L-1		0.00	0.41	0.41	1	1	1	D	
4100250-0.65R-1	Note 1	0.42	0.58	0.16	2	2	2	1	
4100250-0.65R-2	Note 1	0.00	0.15	0.15	1	1	1	1	
4100250-0.65R-3	Note 1	0.00	0.07	0.07	1	1	1	1	
4100250-1.75R-1	Note 1	0.18	0.45	0.27	1	1	1	1	
4100250-2.98L-1	Note 1	0.00	0.45	0.45	1	1	1	1	
4100290		0.00	0.65	0.65	1	1	1	1	
4100290		0.65	1.70	1.05	1	1	1	1	
4100290-0.09L-1		0.00	0.15	0.15	1	1	1	D	

Road Number	New Forest System Road Number	BMP	EMP	Segment Length	Current ML	During Harvest ML	After Harvest ML	Post Project ML	Haul Route
4100290-0.38R-1		0.00	0.07	0.07	1	1	1	D	
4100290-0.38R-1		0.07	0.13	0.06	1	1	1	D	
4100290-0.57L-1		0.00	0.16	0.16	1	1	1	D	
4100300		0.00	9.65	9.65	2	2	2	2	
4100300-0.46L-1		0.00	0.17	0.17	1	1	1	D	
4100300-1.26L-1		0.00	0.37	0.37	1	1	1	D	
4100300-1.29R-1		0.00	0.23	0.23	1	1	1	D	
4100300-3.19R-1		0.00	0.13	0.13	1	1	1	D	
4100300-3.19R-2		0.00	0.19	0.19	1	1	1	D	
4100302		0.00	1.11	1.11	2	2	2	2	
4100302		0.98	1.26	0.28	1	1	1	D	
4100302-0.34R-1		0.00	0.72	0.72	1	1	1	D	
4100302-0.44L-1		0.00	0.57	0.57	1	1	1	D	
4100302-0.44L-2		0.00	0.11	0.11	1	1	1	D	
4100302-0.44L-3		0.00	0.49	0.49	1	1	1	D	
4100305		0.00	0.40	0.40	1	1	1	1	
4100310		0.00	0.20	0.20	1	1	1	1	
4100315		0.00	1.20	1.20	2	2	2	2	
4100317		0.00	1.015	1.02	2	2	2	1	
4100320		0.00	0.49	0.49	1	1	1	1	
4100335		0.00	0.42	0.42	1	1	1	1	
4100340		0.00	1.00	1.00	2	2	2	1	
4100340		1.00	1.42	0.42	1	1	1	1	
4100340-1.21R-1		0.00	0.43	0.43	1	1	1	D	
4100342		0.00	0.40	0.40	1	1	1	1	
4100342-1	Note 1	0.00	0.15	0.15	1	1	1	1	
4100345		0.00	1.62	1.62	1	1	1	1	
4100347		0.00	1.37	1.37	1	1	1	1	
4100350		0.00	0.27	0.27	1	1	1	1	
4100350		0.27	1.36	1.09	1	1	1	1	
4100355		0.00	1.31	1.31	1	1	1	1	
4100365-0.51R-1		0.00	0.30	0.30	1	1	1	D	
4100370		0.00	0.79	0.79	2	2	2	2	
4100370		0.79	1.09	0.30	2	2	2	D	
4100370		1.09	1.79	0.70	2	2	2	2	
4100370		1.79	2.27	0.48	1	1	1	1	

Road Number	New Forest System Road Number	BMP	EMP	Segment Length	Current ML	During Harvest ML	After Harvest ML	Post Project ML	Haul Route
4100370		2.27	2.80	0.53	1	1	1	D	
4100375		0.00	0.50	0.50	2	2	2	2	
4100380		0.00	0.59	0.59	2	2	2	1	
4100395		0.00	0.21	0.21	2	2	2	2	
4100400		0.00	1.32	1.32	2	2	2	2	H
4100400		1.32	1.34	0.02	2	2	2	2	H
4100400		1.34	1.48	0.14	2	2	2	1	H
4100400		1.48	1.65	0.17	2	2	2	1	
4100400		1.65	2.21	0.56	2	2	2	1	
4100400		2.21	2.55	0.34	2	2	2	1	
4100400-0.08R-1	Note 1	0.00	0.74	0.739	1	1	1	1	
4100400-0.08R-1	Note 1	0.74	1.05	0.311	1	1	1	1	
4100400-0.08R-1	Note 1	1.05	1.72	0.674	1	1	1	1	
4100400-0.08R-1	Note 1	1.72	1.87	0.142	1	1	1	1	
4100400-0.08R-1	Note 1	1.87	2.74	0.871	1	1	1	1	
4100400-0.08R-2	Note 1	0.00	0.42	0.42	1	1	1	1	
4100400-0.08R-2	Note 1	0.42	0.84	0.42	1	1	1	1	
4100400-0.34L-1	Note 1	0.00	1.08	1.08	1	2	2	2	H
4100400-0.34L-1	Note 1	1.08	1.20	0.12	1	2	2	2	H
4100400-0.34L-1	Note 1	1.20	2.93	1.72	1			2	
4100400-0.57R-1	Note 1	0.00	1.15	1.15	1	2	1	1	H
4100400-0.57R-2		0.00	0.12	0.12	1	2	D	D	H
4100400-0.57R-3	Note 1	0.00	0.05	0.05	1	2	1	1	H
4100400-0.57R-3	Note 1	0.05	0.50	0.45	1			2	
4100400-0.57R-4	Note 1	0.00	0.31	0.31	1	2	1	1	H
4100400-0.57R-4	Note 1	0.31	0.38	0.07	1	1	1	1	
4100400-0.57R-5	Note 1	0.00	0.12	0.12	1	1	1	1	
4100400-0.57R-5	Note 1	0.12	0.18	0.06	1	2	1	1	H
4100400-0.74L-1	Note 1	0.00	0.23	0.23	1	1	1	1	
4100420		0.00	0.07	0.07	2	2	2	2	
4100425		0.00	0.10	0.10	1	2	2	2	H
4100425		0.47	0.70	0.23	1	2	1	1	H
4100425		0.53	1.10	0.57	1	2	2	2	H
4100425-1.09R-1	Note 1	0.10	0.53	0.43	1	2	2	2	H
4100425-1.09R-2		0.00	0.23	0.23	1	2	D	D	H
4100425-1.28R-1	Note 1	0.00	0.20	0.20	1	2	1	1	H

Road Number	New Forest System Road Number	BMP	EMP	Segment Length	Current ML	During Harvest ML	After Harvest ML	Post Project ML	Haul Route
4100425-1.28R-1		0.20	0.35	0.15	1	2	D	D	H
4100450		0.00	0.88	0.883	2	2	2	2	
4100450		0.88	1.01	0.124	1	2	2	1	
4100450		1.01	3.77	2.763	1	1	1	1	
4100450-0.12R-1		0.00	0.11	0.11	1	1	1	D	
4100450-0.27R-1		0.00	0.05	0.05	1	1	1	D	
4100450-0.82R-1		0.00	1.21	1.21	1	1	1	D	
4100455		0.00	0.65	0.65	1	1	1	1	
4100456		0.00	0.26	0.26	1	1	1	1	
4100456		0.26	0.32	0.05	1	1	1	D	
4100457		0.00	0.38	0.38	1	1	1	1	
4100458		0.00	0.60	0.60	1	1	1	1	
4100458-0.21L-1		0.00	0.56	0.56	1	1	1	D	
4100460		0.00	0.69	0.69	2	2	2	1	
4100465		0.00	0.16	0.16	1	1	1	D	
4100467		0.00	0.81	0.81	1	1	1	1	
4100467-0.83L-1		0.00	0.29	0.29	1	1	1	D	
4100470		0.00	0.90	0.90	1	1	1	1	
4100470-0.16L-1		0.00	0.09	0.09	1	1	1	D	
4100475		0.00	0.72	0.72	1	1	1	1	
4100485		0.00	1.28	1.28	2	2	2	2	H
4100485-0.52R-1		0.00	0.07	0.07	1	2	D	D	H
4100487		0.00	0.10	0.10	1	2	1	1	H
4100487-1		0.00	0.26	0.26	1	2	D	D	H
4100489		0.00	0.10	0.10	1	2	1	1	H
4100491		0.00	0.10	0.10	1	2	1	D	H
4100493		0.00	0.38	0.38	1	2	1	1	H
4100495		0.00	0.37	0.37	1	2	1	1	H
4100495-0.58L-1		0.00	0.10	0.10	1	1	D	D	
4100500		2.37	4.49	2.12	2	2	2	2	
4100500		0.00	1.19	1.19	2	2	2	2	H
4100500		1.19	2.37	1.18	2	2	2	2	
4100500		4.49	5.27	0.78	2	2	2	1	
4100500		5.27	6.98	1.71	2	1	1	1	
4100500-1.01L-1		0.00	0.11	0.11	1	1	D	D	
4100500-2.28R-1	Note 1	0.00	0.33	0.33	1	1	1	1	

Road Number	New Forest System Road Number	BMP	EMP	Segment Length	Current ML	During Harvest ML	After Harvest ML	Post Project ML	Haul Route
4100500-3.79R-1	Note 1	0.00	0.13	0.13	1	1	1	1	
4100500-3.79R-1		0.12	0.19	0.07	1	1	1	D	
4100500-5.25R-1		0.00	0.51	0.51	1	1	1	D	
4100515		0.00	0.20	0.20	1	2	1	D	H
4100515-0.08L-1		0.00	0.17	0.17	1	1	D	D	
4100525		0.00	1.21	1.21	1	1	1	1	
4100526		0.00	0.62	0.62	1	1	1	1	
4100526-0.11L-1		0.00	0.29	0.29	1	1	1	D	
4100526-0.22R-1		0.00	0.46	0.46	1	1	1	D	
4100528		0.00	0.50	0.50	1	1	1	1	
4100535		1.94	2.46	0.524	2	2	2	2	
4100535		0.00	1.94	1.939	2	2	2	2	
4100535		2.46	2.52	0.055	2	2	2	2	
4100535		2.52	3.25	0.733	2	2	2	2	
4100535-0.13L-1		0.00	1.07	1.07	1	1	1	D	
4100535-0.63L-1		0.00	0.14	0.14	1	1	1	D	
4100535-0.63L-1		0.14	0.32	0.18	1	1	1	D	
4100535-0.63L-1		0.32	0.90	0.58	1	1	1	D	
4100535-0.93R-1		0.00	0.16	0.16	1	1	1	D	
4100535-2.42R-1	Note 1	0.00	0.49	0.49	1	1	1	1	
4100535-2.42R-2		0.00	0.03	0.03	1	1	1	D	
4100550		0.00	0.06	0.06	1	1	1	1	
4100550		0.06	0.60	0.54	1	1	1	1	
4100555		0.00	0.20	0.20	1	1	1	1	
4100555		0.20	0.26	0.06	1	1	1	1	
4100555		0.26	0.40	0.14	1	1	1	D	
4100555-0.04R-1		0.00	0.43	0.43	1	1	1	D	
4100562		0.00	0.83	0.83	1	1	1	1	
4100575		0.00	0.29	0.29	1	1	1	1	
4100575		0.29	0.63	0.34	1	1	1	D	
4100600		0.00	2.75	2.75	2	2	2	2	H
4100600-0.11L-1	Note 1	0.00	0.16	0.16	2	2	2	2	
4100600-0.11L-1	Note 1	0.16	0.53	0.37	2	2	2	2	
4100600-0.11L-1		0.53	0.59	0.07	2	2	2	D	
4100600-0.11L-1	Note 1	0.59	0.79	0.20	2	2	2	2	
4100600-0.11L-2		0.00	0.10	0.10	1	1	1	D	

Road Number	New Forest System Road Number	BMP	EMP	Segment Length	Current ML	During Harvest ML	After Harvest ML	Post Project ML	Haul Route
4100600-0.61L-1		0.00	0.22	0.22	1	2	D	D	H
4100600-0.61L-2		0.00	0.11	0.11	1	2	D	D	H
4100600-0.61L-3		0.00	0.18	0.18	1	2	D	D	H
4100600-0.61L-4		0.00	0.60	0.60	1	2	D	D	H
4100600-0.61L-5		0.00	0.29	0.29	1	1	D	D	
4100610		0.00	0.50	0.50	1	1	1	1	
4100615		0.00	0.97	0.97	2	2	2	2	H
4100615-0.40L-1		0.00	0.19	0.19	1	2	D	D	H
4100620		0.00	0.57	0.57	2	2	2	1	
4100620		0.57	0.74	0.16	2	2	2	D	
4100620-0.25L-1		0.00	0.24	0.24	1	1	1	D	
4100622		0.00	0.20	0.20	1	1	1	1	
4100622-1		0.20	0.27	0.07	1	1	1	D	
4100630		0.00	0.50	0.50	2	2	2	2	H
4100630		0.50	1.52	1.01	2	2	2	2	
4100630		1.52	2.06	0.54	2	2	2	1	
4100630-0.51L-1		0.00	0.49	0.49	1	1	1	D	
4100635		0.00	1.70	1.70	2	2	2	1	
4100635-1.3L-1		0.00	0.04	0.04	1	1	1	D	
4100635-1.3R-1		0.00	0.11	0.11	1	1	1	D	
4100637		0.00	0.13	0.13	1	1	1	1	
4100637		0.13	0.50	0.37	1	1	1	D	
4100639		0.00	0.10	0.10	1	1	1	1	
4100705		0.00	0.82	0.82	2	2	2	2	
4100705		0.82	1.50	0.68	2	2	2	2	H
4100705-0.84R-1		0.00	0.15	0.15	1	2	D	D	H
4100705-0.84R-2		0.00	0.04	0.04	1	2	D	D	
4100705-1.24L-1		0.00	0.05	0.05	1	1	1	D	
4100715		0.00	0.40	0.40	1	2	1	1	H
4100715-1		0.00	0.50	0.50	1	2	D	D	H
4100750		0.00	0.87	0.87	2	2	2	2	H
4100750		0.87	0.92	0.05	2	2	2	2	
4100760		0.00	0.30	0.30	1	2	D	D	H
4100770		0.00	0.30	0.30	1	2	1	1	H
4100770-0.13R-1		0.00	0.16	0.16	1	1	1	D	
4100770-1		0.00	0.40	0.40	1	2	D	D	H

Road Number	New Forest System Road Number	BMP	EMP	Segment Length	Current ML	During Harvest ML	After Harvest ML	Post Project ML	Haul Route
4100775		0.00	0.35	0.35	1	1	1	1	
4100775		0.35	0.64	0.29	1	2	1	1	H
4100775-0.29R-1		0.00	0.13	0.13	1	1	1	D	
4100775-0.33R-1		0.00	0.09	0.09	1	1	1	D	
4100775-0.59R-1	Note 1	0.00	0.21	0.21	1	2	1	1	H
4100780		0.00	0.74	0.74	2	2	2	2	
4100782		0.00	0.67	0.67	2	2	2	2	
4100782-0.67R-2	Note 1	0.00	0.53	0.53	1	1	1	1	
4100785		0.00	0.40	0.40	2	2	2	2	
4100790		0.00	0.30	0.30	1	1	1	1	
4100800		0.00	0.10	0.10	3	3	3	3	
4100810		0.00	1.24	1.24	2	2	2	2	
4100810		1.24	1.49	0.25	2	2	2	2	H
4100810-0.15L-1		0.00	0.36	0.356	1	2	D	D	H
4100810-0.15L-1		0.36	0.65	0.296	1	D	D	D	
4100810-0.15L-1		0.65	0.85	0.198	1	D	D	D	
4100810-0.27L-1		0.00	0.41	0.41	1	D	D	D	
4100810-0.77L-1		0.00	0.12	0.12	1	1	1	D	
4100810-1.10L-1		0.00	0.26	0.26	1	D	D	D	
4100810-1.10L-1		0.26	0.37	0.11	1	D	D	D	
4100810-1.10L-1		0.37	0.54	0.17	1	D	D	D	
4100810-1.26R-1	Note 1	0.00	0.13	0.13	2	2	2	2	
4100815		0.00	1.20	1.20	2	2	2	2	
4100820		0.00	0.60	0.60	2	2	2	1	
4100825		0.00	0.40	0.40	1	1	1	1	
4100830		0.00	0.50	0.50	2	2	2	1	
4100830-0.05L-1		0.00	0.09	0.09	1	1	1	D	
4108650		0.00	0.84	0.84	2	2	2	D	
4108650		0.00	0.84	0.84	2	2	2	2	
4108650		0.84	1.12	0.28	2	2	2	D	
4108650		1.79	1.92	0.13	2	2	2	2	
4108650-0.01R-1	Note 1	0.00	0.06	0.06	2	2	2	2	
4108650-0.10L-1		0.00	0.33	0.33	1	1	1	D	
4108650-0.31R-1	Note 1	0.00	0.15	0.15	2	2	2	2	
4108650-0.62L-1		0.00	0.25	0.25	1	1	1	D	
4108650-0.73L-1		0.00	0.10	0.10	1	1	1	D	

Road Number	New Forest System Road Number	BMP	EMP	Segment Length	Current ML	During Harvest ML	After Harvest ML	Post Project ML	Haul Route
4108650-0.78L-1		0.84	1.13	0.29	1	1	1	D	
4108650-1.13L-1		0.00	0.31	0.31	1	1	1	D	
4108665		0.00	0.47	0.47	2	2	2	2	
4108665		0.47	0.78	0.31	2	2	2	2	
4108670		0.00	0.37	0.37	2	2	2	2	
4108670		0.37	0.71	0.342	2	2	2	2	
4108670		0.71	1.03	0.32	2	2	2	2	
4108670		1.03	1.22	0.19	2	2	2	2	
4108670-1.30R-1	Note 1	0.00	0.15	0.15	2	2	2	2	
4120270		0.00	1.83	1.83	2	2	2	2	
4120270		1.83	2.30	0.47	1	1	1	1	
4120270		2.30	2.56	0.26	1	1	1	1	
4120270		2.60	3.62	1.02	1	1	1	1	
4120270-3.08R-1	Note 1	0.00	0.69	0.69	1	1	1	1	
4120270-3.65R-1	Note 1	0.00	0.57	0.57	1	1	1	1	
4120270-3.68L-1	Note 1	0.00	0.51	0.51	1	1	1	1	
4120275		0.00	0.40	0.40	2	2	2	2	
4120275		0.40	1.10	0.70	1	1	1	1	
4120290		0.00	0.23	0.23	2	2	2	D	
4125100		1.37	1.74	0.37	2	2	2	2	
4125110		0.08	0.35	0.28	2	2	2	D	
4150000		0.00	5.39	5.39	3	3	3	3	H
4150000		5.39	7.74	2.35	3	3	3	3	
4150000-2.49L-1		0.00	0.07	0.07	1	1	1	D	
4150000-2.93R-1		0.00	0.46	0.46	1	2	D	D	H
4150000-4.50L-1		0.00	0.03	0.03	1	1	1	D	
4150000-5.81R-1		0.00	0.46	0.46	D	D	D	D	
4150000-7.22L-1		0.00	0.02	0.02	1	1	1	D	
4150000-7.46L-1		0.00	0.05	0.05	1	1	1	D	
4150000-7.69L-1		0.00	0.70	0.70	1	1	1	D	
4150000-7.69L-2		0.00	0.61	0.61	1	1	1	D	
4150000-8.50L-1		0.00	0.07	0.07	1	D	D	D	
4150000-8.54R-1		0.00	0.08	0.08	1	1	1	D	
4150000-8.54R-1		0.08	0.97	0.89	1	1	1	D	
4150100		0.428	0.63	0.201	3	2	2	2	
4150100		0.63	2.32	1.690	3	2	2	2	

Road Number	New Forest System Road Number	BMP	EMP	Segment Length	Current ML	During Harvest ML	After Harvest ML	Post Project ML	Haul Route
4150100		0.00	0.43	0.428	3	2	2	2	H
4150100		2.32	4.06	1.741	3	2	2	2	
4150100		4.06	5.06	1.002	2	2	2	2	
4150100-0.41L-1		0.00	0.36	0.36	1	1	1	D	
4150100-0.97L-1		0.00	0.10	0.10	1	1	1	D	
4150100-2.48L-1		0.00	0.21	0.21	1	1	1	D	
4150100-2.78R-1		0.00	0.69	0.69	1	1	1	D	
4150100-3.57R-1		0.00	0.49	0.49	1	1	1	D	
4150100-3.57R-2		0.00	0.41	0.41	1	1	1	D	
4150100-3.84L-1	Note 1	0.00	0.28	0.28	1	1	1	1	
4150100-3.92L-1		0.00	0.08	0.08	1	1	1	D	
4150110		0.00	0.58	0.577	2	2	2	2	
4150110		0.58	0.74	0.164	2	2	2	2	
4150110		0.74	1.30	0.556	2	2	2	2	
4150110		1.30	2.23	0.926	2	2	2	2	
4150115		0.00	0.24	0.24	1	1	1	1	
4150115-0.38L-1		0.00	0.38	0.38	1	1	1	D	
4150120		0.00	0.32	0.32	1	1	1	1	
4150125		0.00	0.32	0.318	1	1	1	D	
4150125		0.32	0.71	0.389	1	1	1	1	
4150130		0.00	0.10	0.10	1	1	1	D	
4150135		0.00	0.77	0.766	1	1	1	1	
4150135		0.77	1.01	0.235	1	1	1	D	
4150135		1.01	1.53	0.518	2	2	2	2	
4150135-0.35R-1	Note 1	0.00	0.43	0.43	1	1	1	1	
4150135-0.60R-1		0.00	0.53	0.53	1	1	1	D	
4150135-0.60R-2		0.00	0.12	0.12	1	1	1	D	
4150135-0.80R-1		0.00	0.57	0.57	1	1	1	D	
4150135-0.80R-2		0.00	0.16	0.16	1	1	1	D	
4150140		0.00	0.40	0.40	1	1	1	1	
4150145		0.00	0.30	0.30	1	1	1	1	
4150150		0.00	0.15	0.15	1	1	1	D	
4150150		0.15	0.70	0.55	1	1	1	1	
4150155		0.00	0.50	0.50	1	1	1	1	
4150155-0.23L-1		0.00	0.59	0.59	1	1	1	D	
4150165		0.00	0.60	0.60	1	1	1	1	

Road Number	New Forest System Road Number	BMP	EMP	Segment Length	Current ML	During Harvest ML	After Harvest ML	Post Project ML	Haul Route
4150175		0.00	1.51	1.51	1	1	1	1	
4150175-0.90L-1	Note 1	0.00	0.12	0.12	1	1	1	1	
4150178		0.00	0.19	0.19	1	1	1	D	
4150178		0.19	0.50	0.31	1	1	1	1	
4150179		0.00	0.20	0.20	1	1	1	1	
4150180		0.00	0.24	0.243	1	1	1	1	
4150180		0.24	0.31	0.070	1	1	1	1	
4150180		0.31	0.49	0.179	1	1	1	D	
4150180		0.49	0.75	0.259	1	2	D	D	H
4150185		0.00	2.11	2.11	1	1	1	1	
4150187		0.00	0.76	0.76	1	1	1	1	
4150187		0.76	1.07	0.31	1	1	1	D	
4150190		0.00	0.60	0.60	1	1	1	D	
4150195		0.00	0.40	0.40	1	1	1	1	
4150200		0.00	1.17	1.173	2	2	2	2	H
4150200		1.17	2.28	1.108	2	2	2	2	
4150200		2.28	5.50	3.222	2	2	2	2	
4150200-0.51L-1		0.00	0.21	0.21	D	D	D	D	
4150200-2.28L-1		0.00	0.33	0.33	1	1	1	D	
4150200-3.81R-1		0.00	0.21	0.21	1	1	1	D	
4150215		0.00	0.10	0.10	1	2	D	D	H
4150230		0.00	0.44	0.440	1	1	1	1	
4150230		0.44	0.66	0.220	1	1	1	1	
4150232		0.00	0.79	0.79	1	1	1	1	
4150232		0.79	1.03	0.23	1	1	1	1	
4150232-0.20R-1		0.00	0.21	0.21	1	1	1	D	
4150232-0.31L-1		0.00	0.57	0.57	1	1	1	D	
4150250		0.00	0.50	0.50	1	1	1	D	
4150255		0.00	0.13	0.127	1	1	1	1	
4150255		0.13	0.29	0.157	1	1	1	D	
4150255		0.29	0.58	0.293	1	1	1	D	
4150255		0.58	0.77	0.186	1	1	1	D	
4150255		0.77	0.97	0.196	1	1	1	D	
4150255		0.97	1.38	0.411	1	1	1	D	
4150258		0.00	0.06	0.06	1	1	1	1	
4150258-0.3-1		0.00	0.38	0.38	1	1	1	D	

Road Number	New Forest System Road Number	BMP	EMP	Segment Length	Current ML	During Harvest ML	After Harvest ML	Post Project ML	Haul Route
4150258-0.3-2		0.00	0.36	0.36	1	1	1	D	
4150259		0.00	0.67	0.67	1	D	D	D	
4150264		0.00	3.31	3.31	1	1	1	1	
4150264-0.67L-1		0.00	0.11	0.11	1	1	1	D	
4150265		0.00	1.14	1.140	2	2	2	2	
4150265		1.14	3.38	2.236	1	1	1	1	
4150265		3.38	4.68	1.297	1	1	1	D	
4150270		0.00	1.07	1.07	1	1	1	1	
4150275		0.00	0.50	0.50	1	1	1	1	
4150277		0.00	0.94	0.94	1	1	1	1	
4150280		0.00	1.20	1.20	2	2	2	2	
4150290		0.00	1.34	1.34	1	1	1	1	
4150292		0.00	0.35	0.35	1	1	1	1	
4150295		0.00	0.20	0.20	1	1	1	D	
4150295		0.20	0.90	0.70	1	1	1	1	
4150300		0.00	3.10	3.10	3	2	2	2	H
4150300-0.07R-1		0.00	0.75	0.75	1	2	D	D	H
4150300-0.12R-1		0.00	0.71	0.707	1	1	1	D	
4150300-0.12R-1		0.71	1.15	0.441	1	2	D	D	H
4150300-0.12R-2		0.00	0.14	0.14	1	2	D	D	H
4150300-1.47R-1	Note 1	0.00	0.29	0.295	1	2	1	1	H
4150300-1.47R-1	Note 1	0.29	1.24	0.950	1	1	1	1	
4150300-1.47R-2		0.00	0.08	0.08	D	D	D	D	
4150300-1.63L-1		0.00	0.44	0.44	D	D	D	D	
4150300-1.63L-2		0.00	0.22	0.22	1	1	1	D	
4150300-2.62R-1		0.00	0.22	0.22	1	1	1	D	H
4150310		0.00	0.66	0.657	1	2	1	1	H
4150310		0.66	1.48	0.574	1	1	1	1	
4150310		1.48	1.94	0.47	1	1	1	D	
4150325		0.00	1.25	1.25	2	2	2	1	
4150325-0.1L-1	Note 1	0.00	0.60	0.60	1	1	1	1	
4150400		0.00	1.67	1.666	2	2	2	2	
4150400		1.67	2.21	0.542	2	2	2	2	H
4150400-2.23-1	4150400	2.23	2.70	0.473	2	2	2	2	
4150400-2.23-1	4150400	2.70	2.83	0.124	2	2	2	2	
4150400-0.18R-1		0.00	0.99	0.991	1	2	D	D	H

Road Number	New Forest System Road Number	BMP	EMP	Segment Length	Current ML	During Harvest ML	After Harvest ML	Post Project ML	Haul Route
4150400-0.18R-1		0.99	1.08	0.091	1	2	D	D	H
4150400-0.18R-1		1.08	1.15	0.068	1	2	D	D	
4150400-0.75L-1		0.00	0.40	0.403	1	1	1	D	
4150400-1.06L-1		0.00	0.48	0.48	1	1	1	D	
4150400-1.34R-1		0.00	0.59	0.595	1	2	D	D	H
4150400-1.34R-1		0.0.59	0.0.91	0.311	1	1	1	D	
4150500		0.00	2.00	2.00	1	1	1	1	
4150500-0.14L-1		0.00	0.12	0.12	1	1	1	D	
4150500-0.18R-1		0.00	0.15	0.15	1	1	1	D	
4150500-0.96R-1	Note 1	0.00	0.54	0.54	1	1	1	1	
4150500-0.96R-1		0.54	1.09	0.55	D	D	D	D	
4150500-1.02R-1		0.00	0.14	0.14	D	D	D	D	
4150500-2.00-1		0.00	0.44	0.44	1	1	1	D	
4150502		0.00	0.88	0.884	1	1	1	1	
4150502		0.88	1.15	0.271	1	1	1	D	
4150502-0.19R-1		0.00	1.28	1.28	1	1	1	D	
4150502-0.21R-1		0.00	0.29	0.29	D	D	D	D	
4150502-0.42L-1		0.00	0.03	0.03	1	1	1	D	
4150502-0.56L-1		0.00	0.13	0.13	1	1	1	D	
4150502-0.90-1		0.00	0.62	0.62	1	1	1	D	
4150505		0.00	0.54	0.54	1	1	1	D	
4150505		0.54	1.15	0.60	1	1	1	1	
4150505-0.39L-1		0.00	0.41	0.41	1	1	1	D	
4150575		0.00	0.29	0.289	2	2	2	1	
4150575		0.29	.98	0.522	2	2	2	D	
4150575-0.72L-1		0.00	0.58	0.58	1	1	1	D	
4150575-0.75L-1		0.00	0.43	0.43	1	1	1	D	
4150575-1		1.10	1.38	0.28	1	1	1	D	
4151100		0.00	2.90	1.385	2	2	2	2	
4151100		2.90	5.69	1.318	2	2	2	1	
4151120		0.00	0.28	0.277	1	1	1	1	
4151120		0.28	0.43	0.146	1	1	1	D	
4151130		0.00	0.44	0.439	2	2	2	2	
4151130		0.44	0.69	0.255	2	2	2	D	
4200000		0.00	1.10	1.104	5	5	5	5	H
4200000		1.10	1.26	0.159	5	3	3	3	H

Road Number	New Forest System Road Number	BMP	EMP	Segment Length	Current ML	During Harvest ML	After Harvest ML	Post Project ML	Haul Route
4200000		1.26	1.45	0.191	4	3	3	3	H
4200000		1.45	2.91	0.561	4	3	3	3	
4200000-0.25L-1	Note 1	0.00	0.13	0.13	2	2	2	2	
4200000-0.25L-3	Note 1	0.00	0.04	0.04	2	2	2	2	
4200000-0.25R-1	Note 1	0.00	0.05	0.05	1	1	1	1	
4200000-0.25R-2	Note 1	0.00	0.04	0.04	1	1	1	1	
4200000-0.76R-1		0.00	0.08	0.08	1	1	1	D	
4200010		0.00	0.20	0.20	2	2	2	2	
4200010**		0.00	0.00	0.00	New Road	New Road	New Road	2	
4200010-0.10R-1	Note 1	0.00	0.21	0.21	2	2	2	2	
4200010-0.10R-1	Note 1	0.21	0.49	0.28	1	1	1	1	
4200010-0.10R-2	Note 1	0.00	0.04	0.04	2	2	2	2	
4200015		0.00	0.50	0.50	1	1	1	1	
4200015-0.15R-1		0.00	0.20	0.20	1	1	1	D	
4200015-0.41R-1		0.00	0.16	0.16	1	1	1	D	
4200020		0.00	0.60	0.60	1	1	1	D	
4200100		0.00	0.81	0.811	5	5	5	5	H
4200100		0.81	0.95	0.145	5	5	5	5	
4200100		0.95	1.04	0.093	5	5	5	5	
4200100		1.04	1.10	0.060	2	2	2	2	
4200100		1.10	1.37	0.270	2	2	2	1	
4200100-0.70R-1		0.00	0.14	0.14	1	1	1	D	
4200100-1.26R-1		0.00	0.16	0.16	1	1	1	D	
4200103		0.00	0.60	0.60	2	2	2	2	H
4200103-0.07R-1	Note 1	0.00	1.30	1.30	2	2	2	2	
4200103-0.47L-1		0.00	0.24	0.24	1	2	D	D	H
4200104		0.00	0.20	0.20	2	2	2	1	H
4200104-0.05R-1		0.00	0.07	0.07	1	1	1	D	
4200105		0.00	0.19	0.19	2	2	2	2	H
4200105		0.19	1.70	1.51	2	2	2	1	
4200110		0.00	1.50	1.50	2	2	2	2	
4200115		0.00	0.50	0.50	2	2	2	1	
4200125		0.00	0.30	0.30	2	2	2	1	
4200125-0.28L-1		0.00	0.16	0.16	1	1	1	D	
4200128		0.00	0.10	0.10	1	1	1	D	

Road Number	New Forest System Road Number	BMP	EMP	Segment Length	Current ML	During Harvest ML	After Harvest ML	Post Project ML	Haul Route
4200133		0.00	0.80	0.80	1	1	1	1	
4200133-0.41R-1		0.00	0.52	0.52	1	1	1	D	
4200134		0.00	0.90	0.90	1	1	1	D	
4200135		0.00	0.13	0.131	1	2	1	1	H
4200135		0.13	0.61	0.483	1	1	1	1	
4200135		0.61	0.80	0.193	1	1	1	1	
4200135		0.80	1.34	0.538	1	1	1	1	
4200136		0.00	0.29	0.29	1	1	1	D	
4200138		0.00	0.40	0.40	1	1	1	D	
4200140		0.00	0.60	0.60	1	1	1	D	
4200150		0.00	0.39	0.39	3	2	2	2	H
4200151		0.00	0.40	0.40	2	2	2	2	H
4200152		0.00	0.20	0.20	2	2	2	2	H
4200155		0.00	0.21	0.205	2	2	2	2	H
4200155		0.21	0.39	0.182	2	2	2	2	
4200155-1		0.39	0.64	0.245	1	1	1	D	
4200165		0.00	0.27	0.27	2	2	2	2	
4200200		0.00	3.90	3.90	2	2	2	2	
4200210		0.00	1.10	1.10	2	2	2	2	
4200210-0.98L-1	Note 1	0.00	0.38	0.38	1	1	1	1	
4200211		0.00	0.50	0.50	1	1	1	1	
4200212		0.00	0.50	0.50	1	1	1	1	
4200215		0.00	1.06	1.058	2	2	2	2	
4200215		1.06	1.46	0.400	2	2	2	1	
4200215-0.70L-1		0.00	0.17	0.17	1	1	1	D	
4200215-0.87R-1		0.00	0.04	0.04	1	1	1	D	
4200216		0.00	0.23	0.23	1	1	1	1	
4200218		0.00	0.30	0.30	2	2	2	D	
4200220		0.00	0.86	0.86	1	1	1	1	
4200251		0.00	0.40	0.40	1	1	1	1	
4200260		0.00	2.60	2.60	2	2	2	1	
4200264		0.00	1.30	1.30	2	2	2	1	
4205100		0.00	0.51	0.510	1	1	1	1	
4205110		0.51	0.91	0.401	2	2	2	1	H
4205110		0.91	1.38	0.470	2	1	1	1	
4205110		1.38	1.71	0.330	2	2	2	2	

Road Number	New Forest System Road Number	BMP	EMP	Segment Length	Current ML	During Harvest ML	After Harvest ML	Post Project ML	Haul Route
4205110		1.71	1.77	0.064	2	2	2	2	H
4205110-0.18L-1		0.00	0.13	0.13	1	1	1	D	
4205110-0.81L-1		0.00	0.11	0.11	1	1	1	D	
4205110-0.81L-1	Note 1	0.11	0.52	0.41	1	1	1	1	
4205110-1.00L-1	Note 1	0.00	0.13	0.13	1	1	1	1	
4205110-1.00L-2	Note 1	0.00	0.50	0.50	1	1	1	1	
4205110-1.00L-3	Note 1	0.00	0.48	0.48	1	1	1	1	
4205130		0.00	0.11	0.11	3	2	2	2	H
4206102		0.00	0.20	0.20	1	1	1	1	
4206102		0.20	0.63	0.43	1	1	1	1	
4206102-0.04R-1	Note 1	0.00	0.26	0.26	1	1	1	1	
4206102-0.12R-1	Note 1	0.00	0.36	0.36	1	1	1	1	
4206102-0.12R-1		0.36	0.44	0.09	1	1	1	D	
4206102-0.12R-1		0.44	0.88	0.44	1	1	1	D	
4206102-0.12R-2		0.00	0.25	0.25	1	1	1	D	
4207103		0.00	1.10	1.099	2	2	2	2	
4207103		1.10	2.15	1.050	1	D	D	D	
4207110		0.00	3.30	3.30	2	2	2	2	
P4150215-0.21L-1		0.00	0.21	0.21	PROPOSED	2	D	D	H
P4205110-1.12R-1		0.00	0.19	0.19	PROPOSED	2	D	D	H
PUD-OK 4108650		1.12	1.79	0.67	2	2	2	D	
PUD-OK 4108650		1.12	1.79	0.67	2	2	2	2	
PUD-OK 4108650-1.24L-1		0.00	0.05	0.05	2	2	2	2	
PUD-OK 4108650-1.35L-1		0.00	0.10	0.10	1	1	1	D	
PUD-OK 4108665-0.05R-1		0.00	0.10	0.10	2	2	2	2	
PUD-OK 4108665-0.28L-1		0.00	0.19	0.19	2	2	2	2	
PUD-OK 4108665-0.41L-1		0.00	0.41	0.41	2	2	2	2	
PUD-OK 4108665-0.41L-2		0.00	0.07	0.07	2	2	2	2	

Note 1: To prevent the possibility of duplicating road numbers some will be assigned after this decision is finalized.

Figure E-1 KEY:
BMP: Beginning Milepost
EMP: Ending Milepost
Current ML: Current maintenance level
During Harvest ML: maintenance level during harvest activities
Post Harvest ML: maintenance level after harvest activities are completed
Post Project ML: maintenance level once South Summit II project is completed
PROPOSED: Proposed temporary road construction for use during harvest activity
D: Decommission
H: Road used as haul route

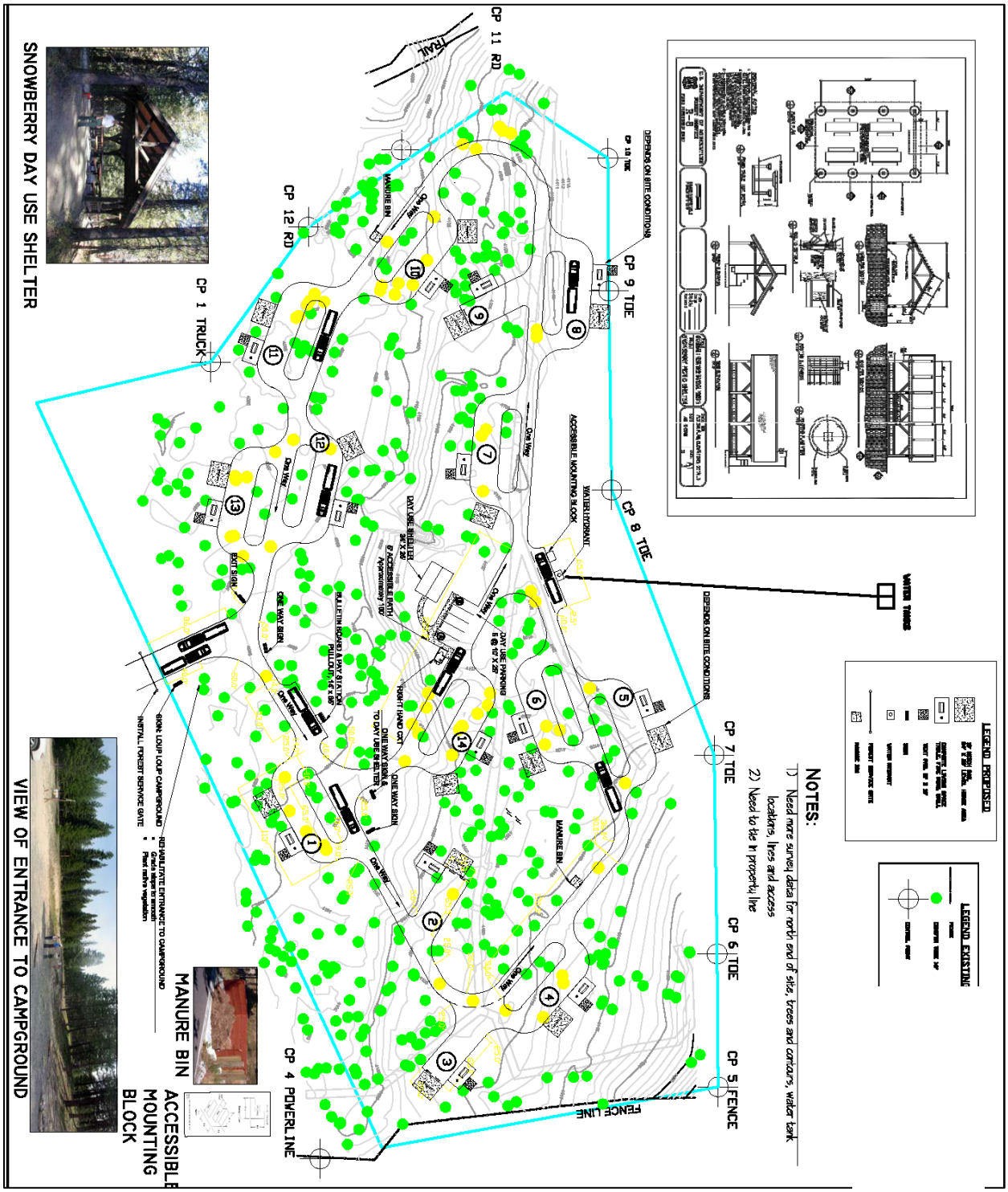
Pre-Disturbance Decommissioning
The following roads would be decommissioned before ground-disturbing activities started in the project.

Figure E.2 Proposed Pre-Disturbance Road Decommissioning

Road	Drainage	Length (miles)
4100810-0.27L-1	Frazer Cr	0.4
4100810-0.15L-1	Frazer Cr	0.5
4100810-1.10L-1	Frazer Cr	0.54
4150259	Benson Cr	0.7
4150000-8.50L-1	Benson Cr	0.1

New Road Construction and Gate Installation
Figure E.3 show the location of new road construction proposed in this project at the North Summit Horse Campground. The location of 200 feet of new road in Frazer Creek is shown on the Proposed Transportation System map in Appendix J. In addition, gates would be installed at appropriate locations on the 4108650, 4100810, and 4100810, and 4108650-0.31R-1 roads to limit possible sediment production and control illegal firewood cutting in riparian areas. **Figure E.3 Proposed North Summit Horse Campground: Site Plan with**

New Road Construction



Culvert Replacement and Upsizing

Figure E-4 lists the locations, numbers, and types of culverts that would be installed as proposed in this project.

Figure E-4 Proposed Culvert Work

Culvert Road Location	Number of Culverts	Type of Work
4100300	2	Install
4100500	1	Upsize
4150000	4	Upsize
4150200	1	Upsize

Administrative Use Access Trails

Figure E-5 lists the roads that would have administrative use access designations to facilitate range management activities.

Table E-5 Roads Proposed for Administrative Use Access Trails for Range

Road Number	Maintenance Level 1 Miles	Decommissioned Miles	Total Miles	Administrative Access Type
4100110	1.3		1.3	Motorized
4100115	0.1		0.1	Motorized
4100200	1.5		1.5	Motorized
4100250	1.5		1.5	Motorized
4100340	0.4		0.4	Motorized
4100342	0.4		0.4	Motorized
4100342-1	0.1		0.1	Motorized
4100370	0.5	0.5	1.0	Motorized
4100400-0.57R-1	0.5		0.5	Motorized
4100450	2.9		2.9	Motorized
4100500	2.5		2.5	Motorized
4100562	0.8		0.8	Motorized
4100630	0.5		0.5	Motorized
4100820	0.5		0.5	Motorized
4150140	0.4		0.4	Motorized
4150165	0.6		0.6	Motorized
4150185	1.6		1.6	Motorized
4150230	0.4		0.4	Motorized
4150232	0.8		0.8	Motorized
4150270	1.1		1.1	Motorized
4150575	0.3		0.3	Motorized
4151100	1.3		1.3	Motorized
4200133	1.0		1.0	Motorized
4205110	0.9		0.9	Motorized
4207103		1.0	1.0	Non-Motorized
Grand Total	**21.9**	**1.6**	**23.5**	

Road Conversion to Nordic Trail

Figure E-6 lists the roads that would be taken off of the NFS system and converted to Nordic ski trails in the project area.

Figure E-6 Proposed Road to Nordic Trail Conversions

Underlying Road Number	Length (miles)
4100000-16.52R-1	0.6
4100715-1	0.5
4200100-1.6R-1	0.2
4200125-0.28L-1	0.2
4200215-0.70L-1	0.2
4200215-0.87R-1	0.04
4200218	0.24
Total	**1.98**

Figure E-7 lists roads for which the Forest Service is entering into a Road Right-of-Way Construction and Use Agreement (informally known as Cost-Share) with the state of Washington (WDNR). These roads would be added to the NFS road system and managed by the Forest Service.

Figure E-7: New Cost-Share Roads

Road	New Forest System Road Number	Length (miles)
4100250		2
4100250-0.65R-1	4100251	0.6
4100250-1.75R-1	4100256	0.2
4100406		0.04
4100400-0.08R-1	4100405	0.4
4108650		0.6
4108670		1.2
4108670		0.3

4100425		0.1
Total		5.4

Figure E-8: Roads for which USFS is acquiring Easements from Washington State DNR

Road	New Forest System Road Number	Length (miles)
4100405		0.04
4100400		0.2
Total		0.24

Transportation System Definitions

Transportation System Maintenance Levels

Maintenance levels define the level of service provided by, and maintenance required for, a specific road. Maintenance levels must be consistent with road management objectives and maintenance criteria. Roads assigned to maintenance levels 2-5 are either constant service roads or intermittent service roads during the time they are open to traffic.

Level 1. Assigned to intermittent service roads during the time they are closed to vehicular traffic. The closure period must exceed 1 year. Basic custodial maintenance is performed to keep damage to adjacent resources to an acceptable level and to perpetuate the road to facilitate future management activities. Emphasis is normally given to maintaining drainage facilities and runoff patterns. Planned road deterioration may occur at this level. Roads receiving level 1 maintenance may be of any type, class, or construction standard, and may be managed at any other maintenance level during the time they are open for traffic. However, while being maintained at level 1, they are closed to vehicular traffic, but may be open and suitable for nonmotorized uses.

Level 2. Assigned to roads open for use by high clearance vehicles. Passenger car traffic is not a consideration. Traffic is normally minor, usually consisting of one or a combination of administrative, permitted, dispersed recreation, or other specialized uses. Log haul may occur at this level. Appropriate traffic management strategies are either to (1) discourage or prohibit passenger cars or (2) accept or discourage high clearance vehicles.

Level 3. Assigned to roads open and maintained for travel by a prudent driver in a standard passenger car. User comfort and convenience are not considered priorities. Roads in this maintenance level are typically low-speed, single lane with turnouts and spot surfacing. Some roads may be fully surfaced with either native or processed material.

Level 4. Assigned to roads that provide a moderate degree of user comfort and convenience at moderate travel speeds. Most roads are double lane and aggregate surfaced. However, some roads may be single lane. Some roads may be paved and/or dust abated.

Level 5. Assigned to roads that provide a high degree of user comfort and convenience. These roads are normally double lane, paved facilities. Some may be aggregate surfaced and dust abated.

Decommissioning -- Road decommissioning is defined as “activities that result in the stabilization and restoration of unneeded roads to a more natural state”. Decommissioning includes applying various treatments, including one or more of the following: reestablishing former drainage patterns, stabilizing slopes, and restoring vegetation; blocking the entrance to a road or installing water bars; removing culverts, reestablishing drainages, removing unstable fills, pulling back road shoulders, and scattering slash on the roadbed; completely eliminating the roadbed by restoring natural contours and slopes; and other methods designed to meet the specific conditions associated with the unneeded road.

Unauthorized Roads - Unauthorized Roads are roads that are not part of the National Forest System Roads (NFSR). Often, these roads were originally part of the NFSR constructed for access to timber sale areas as part of timber sale contract work. The roads may or may not have been planned for closure or decommissioning after use. Some of these roads may have been reconstructed or opened since their initial construction to use for project access (prescribed burning, wildfire suppression, silvicultural treatments, etc.) or illegally opened for various purposes by the public (firewood, hunting, etc.).

Temporary Roads - Temporary Roads would be constructed to the minimum standards necessary to access units for harvest activities while still providing adequate resource protection. These roads would be decommissioned following harvest activities and the ground put back into productive use.

Appendix F: Harvest Unit Soils Effects

Figure F-1. Current Disturbance and Expected Effects from Proposed Winter Harvest Activities

Unit	Acres	Vegetation Treatment	Prescribed Fire Treatment	Harvest Season	Existing DSD (acres)	DSD % in each unit	Potential Disturbance Following Proposed Activities	
							Estimated % of the unit*	Acres
027	3	CT	HP/LP	Winter	>1	11	3	0.09
034	34	CT	HP/LP	Winter	4	13	3	1.02
040	108	CT	HP/LP	Winter	19	18	3	3.24
042	70	CT	HP/LP	Winter	10	14	3	2.1
048	127	CT	HP/LP	Winter	19	15	3	3.81
051	26	CT	MP/LP	Winter	4	16	3	0.78
052	200	CT-DMT	MP/LP	Winter	28	14	3	6
060	26	CT-DMT	HP/LP	Winter	4	17	3	0.78
061	9	AM	MP/LP	Winter	2	19	3	0.27
065	28	CT-DMT	HP/LP	Winter	5	17	3	0.84
068	341	CT	MP/LP	Summer	31	9	8-10%	27.2-34.1
070	27	CT-DMT	HP/LP	Winter	4	16	3	0.81
073	24	CT-DMT	MP/LP	Summer	1	4	8-10%	1.9-2.4
079	20	CT	MP/LP	Summer	1	5	8-10%	1.6-2
080	26	CT	MP/LP	Summer	1	4	8-10%	2.1-2.6
082	26	CT	MP/LP	Summer	1	4	8-10%	2.1-2.6
088	33	CGT	MP	Summer	1	3	8-10%	2.6-3.3
091	12	CT	MP/LP	Winter	2	16	3	0.36
092	25	CT	MP/LP	Winter	3	11	3	0.75
093	2	CGT	MP	Optional	>1	5	3	0.06
095	15	CT	MP/LP	Summer	>1	3	8-10%	1.2-1.5
560	6	CT-DMT	HP/LP	Winter	1	11	3	0.18
580	11	CT	MP/LP	Summer	>1	3	8-10%	0.88-1.1
618	6	CT-DMT	MP/LP	Winter	1	13	3	0.18
635	12	AM	MP/LP	Winter	2	15	3	0.36
638	23	CT	MP/LP	Winter	4	18	3	0.69
639	25	CT	MP/LP	Winter	3	11	3	0.75
641	27	CT	MP/LP	Winter	3	13	3	0.81
642	4	CT	HP/LP	Winter	>1	12	3	0.12
643	7	CT	MP/LP	Winter	1	16	3	0.21
644	53	CT	MP/LP	Winter	8	15	3	1.59
645	22	CT	MP/LP	Winter	3	14	3	0.66
650	8	CT	HP/LP	Winter	2	20	3	0.24

Unit	Acres	Vegetation Treatment	Prescribed Fire Treatment	Harvest Season	Existing DSD (acres)	DSD % in each unit	Potential Disturbance Following Proposed Activities	
							Estimated % of the unit*	Acres
655	9	CT	MP/LP	Winter	2	18	3	0.27
656	4	CT-DMT	HP/LP	Winter	1	14	3	0.12
661	28	CT-DMT	HP/LP	Winter	4	14	3	0.84
662	43	CT-DMT	MP/LP	Winter	5	12	3	1.29
663	3	CT-DMT	MP/LP	Winter	>1	12	3	0.09
664	56	CT-DMT	MP/LP	Winter	7	12	3	1.68
665	16	CT	HP/LP	Winter	2	13	3	0.48
666	2	AM	HP/LP	Winter	>1	11	3	0.06
668	23	STR	Underburn	Winter	3	14	3	0.69
669	4	CT	HP/LP	Winter	1	15	3	0.12
673	27	AM	MP/LP	Winter	4	15	3	0.81
674	97	CT	MP/LP	Winter	10	10	3	2.91
675	67	CT	MP/LP	Winter	7	11	3	2.01
676	7	STR	Underburn	Winter	1	14	3	0.21
677	11	CT	MP/LP	Winter	2	15	3	0.33
680	67	CT	MP/LP	Winter	9	14	3	2.01
682	50	CT	MP/LP	Winter	5	11	3	1.5
683	36	CT	MP/LP	Winter	5	13	3	1.08
684	5	AM	MP/LP	Winter	1	14	3	0.15
685	74	CT-DMT	MP/LP	Winter	7	10	3	2.22
686	20	CT-DMT	MP/LP	Winter	3	16	3	0.6
687	38	CT	MP/LP	Winter	5	14	3	1.14
690	49	CT	HP/LP	Winter	7	15	3	1.47
693	62	CT	HP/LP	Winter	7	12	3	1.86
697	46	CT	HP/LP	Winter	6	14	3	1.38
698	30	STR	Underburn	Winter	4	13	3	0.9
809	4	CT	HP/LP	Winter	1	14	3	0.12
844	10	STR	Underburn	Winter	1	11	3	0.3
861	5	CT-DMT	HP/LP	Winter	1	11	3	0.15
865	5	CT	HP/LP	Winter	1	10	3	0.15
866	5	AM	HP/LP	Winter	1	18	3	0.15
886	8	CT-DMT	MP/LP	Winter	1	14	3	0.24
887	52	CT	MP/LP	Winter	6	12	3	1.56

Key:
Vegetation Treatment
- AM: Aspen Maintenance Thin
- CGT: Campground Thin
- CT: Commercial Thin
- CT-DMT: Commercial Thin with Dwarf Mistletoe Treatment
- STR: Seed Tree Regeneration Thin

Prescribed Fire Treatment:
- HP/LP: Hand-pile LFR debris in unit, burn hand piles; Burn landing pile
- MP: Machine-pile harvest debris within unit; burn machine piles. No landing pile.
- MP/LP: Machine-pile harvest debris within unit, burn machine piles; Burn landing pile
- UB: Underburn harvest debris to prepare site for planting

Figure F-2. Current Disturbance and Expected Effects from Proposed Summer Harvest Activities

Unit Number	Acres	Burned Acres	Soil Burn Severity	LogSeason
068	341	65	light to moderate	Summer
073	24	0	none	Summer
079	20	2	light	Summer
080	26	0	none	Summer
082	26	0	none	Summer
088	33	0	none	Summer
093	2	0	none	Optional
095	15	0	none	Summer
580	11	2	light	Summer

Figure F-3. Estimated Detrimental Soil Disturbance by Treatment Types

Proposed Action Combinations*	Detrimental Disturbance Coefficients (%)
LFR and summer Mastication	10%
Winter harvest, LFR, Underburn	3%
Winter harvest, LFR, MP &B	3%
Summer Harvest, LFR, and MP & B	10%
Summer Harvest (slash mat), LFR, MP & B	8%
Winter harvest, landing pile, LFR& HP	3%
Summer harvest, landing pile, LFR& HP	8-10%

Appendix G: Botanical Species

Figure G-1. Region 6 Regional Forester Special Status Species Documented or Suspected to Occur on the Okanogan-Wenatchee National Forest (2011). Includes some former Sensitive species documented on the Forest. Key to "Presence on Forest": D = Documented; S = Suspected

	Vascular Species		
Scientific Name	**RFSSSStatus**	**Presence on Forest***	**Habitat**
Agrostis mertensii Northern Bentgrass	Sensitive	D	Mainly alpine meadows above 7000 ft. elevation. Mesic to moist meadow habitats near streams and wetlands.
Antennaria parvifolia Nutall's Pussy-toes	Sensitive	D	Dry, open places, openings in Ponderosa pine forests, on sand and gravel substrates, often riparian in the foothills of the Columbia basin.
Astragalus arrectus Palouse Milk-vetch	Sensitive	D	Regional endemic to Columbia basin, Palouse, and west-central ID. Grassy hillsides, sagebrush flats, river buffs to open PIPO forests.
Astragalus microcystis Least Bladdery Milk-vetch	Sensitive	S	In eastern Washington, on gravelly to sandy areas from riverbanks to open woods from 1400 ft. to 6200 ft. elevation.
Botrychium ascendens Upward-lobed Moonwort	Sensitive/ Federal Species of Concern	D	From 2100 ft. to 6000 ft. in moist microsites; meadows, and moist deciduous and conifer forests.
Botrychium crenulatum Crenulate Moonwort	Sensitive/ Federal Species of Concern	D	Moist riparian habitats from 3100 ft. to 5800 ft. in elevation.
Botrychium hesperium Western Moonwort	Sensitive	D	Moist to dry meadows from low elevation prairies to alpine meadows. Documented at 6900 ft.
Botrychium lineare Slender Moonwort	Sensitive/ Federal Species of Concern	S	Associated with moist to dry meadows from low elevation prairies to alpine meadows.
Botrychium paradoxum Twin-spiked Moonwort	Sensitive/ Federal Species of Concern	D	Associated with dry meadows in floodplains in gentle to flat terrain between 5600 ft. and 6450 ft. elevation. In other areas of the state it is found between 2800 ft. and 6550 ft. elevation in a variety of habitats which include sagebrush (Artemisia) habitat, dry meadow communities associated with floodplains and stream terraces, and moist coniferous forests in association with western red cedar, western hemlock, and grand fir.
Botrychium pedunculosum Stalked Moonwort	Sensitive/ Federal Species of Concern	S	Known sites in the state occur between 2460 ft. and 6200 ft. elevation in moist riparian areas, and moist to dry meadows.
Carex atrosquama (C. atrata var. atrosquama) Blackened Sedge	Strategic	D	Wet to moist soils along outlet streams, in wet subalpine and alpine meadows above 6100 ft.
Carex capillaris Hair-like Sedge	Sensitive	D	Moist meadows along sandy lake shores from 3800 ft. to 6500 ft. Also stream banks and wet ledges in moderate to high elevations up to about tree line.
Carex chordorrhiza Cordroot Sedge	Sensitive	D	Wetland at 4480 ft. in the Subalpine fir forest zone.
Carex comosa	Sensitive	D	Associated with floating mats of vegetation in muck and peat wetlands. Marshes, lake-shores, and wet

	Vascular Species		
Scientific Name	**RFSSSStatus**	**Presence on Forest***	**Habitat**
Bristly Sedge			meadows from 50 ft. to 2000 ft. elevation.
Carex gynocrates Yellow Bog Sedge	Sensitive	D	Sphagnum bogs, forested wetlands and other wet marshy places between 2600 ft. and 3800 ft.
Carex heteroneura var. *epapillosa* Different-nerve Sedge	Sensitive	D	Stream margins in open forests and moist meadows in the subalpine to alpine zones.
Carex macrochaeta Large-awned Sedge	Sensitive	S	Moist or wet, open places, seepage areas, around waterfalls, in wet meadows, and along streams and lakes.
Carex magellanica ssp. irrigua Poor Sedge	Sensitive	D	Fens, bogs, shady wet meadows, shrub wetlands, and marshes, often growing in peat soil, at 1640 to 7000 ft. (500 to 2134 m) elevation.
Carex media (C. norvegica) Intermediate Sedge	Sensitive	D	Wet stream banks, subalpine and alpine rich moist forb meadows. .
Carex pauciflora Few-flowered Sedge	Sensitive	S	Associated with Western hemlock, Mt Hemlock, Western red cedar, and Pacific silver fir.
Carex proposita Great Smokey Mt. Sedge	Sensitive	D	Rocky alpine and subalpine habitats often at tree line.
Carex rostrata Beaked Sedge	Sensitive	S	Around ponds and swampy meadows, mid to high elevations.
Carex scirpoidea ssp. scirpoidea Northern Single- Spike Sedge	Sensitive	D	Moist alpine meadows bordering talus slopes, dry to moist meadows, and talus with some soil development between 5900 ft. and 7600 ft.
Carex stylosa Long-styled Sedge	Sensitive	S	Saturated and seasonally flooded fibrous and sphagnum peat soils or sloping wetlands with surface Seepage; silver fir and mountain hemlock zone.
Carex sychnocephala Many-headed Sedge	Sensitive	D	Associated with permanently saturated, moist, or wet soils along lake shores and marshes from 1000 ft. to 3000 ft. elevation.
Carex tenuiflora Sparse-leafed Sedge	Sensitive	D	At 5800 ft. in a bog/fen wetland.
Carex vallicola Valley Sedge	Sensitive	D	Moist to moderately dry slopes from the foothills to moderate elevations in the mountains, often with sagebrush or aspen.
Castilleja cryptantha Obscure Indian Paintbrush	Sensitive/ Federal Species of Concern	D	High elevation meadows.
Chaenactis thompsonii Thompson's chaenactis	Sensitive	D	Mid-montane forest habitats with subalpine fir, Douglas-fir and whitebark pine.
Claytonia lanceolata ssp. *pacifica* Pacific lance-leaved springbeauty	Sensitive	S	Subalpine habitat
Coeloglossum viride Long-bract frog orchid	Sensitive	D	Mesic to wet forests, grassy slopes, shores, bogs and swamps in the lowland and mountain zones.
Chrysosplenium	Sensitive	D	Found in gentle terrain along steam banks and seeps or other wet sites in forests with densely vegetated creek bottoms, damp

	Vascular Species		
Scientific Name	**RFSSSStatus**	**Presence on Forest***	**Habitat**
tetrandrum Northern Golden-carpet			mossy hummocks.
Cicuta bulbifera Bulb-bearing Water Hemlock	Sensitive	D	Between 1930 ft.-3700 ft. in elevation in muck soils or standing water associated with marshes, stream, lake, or pond margins where *Carex utriculata* is often the dominant sedge.
Coptis aspleniifolia Spleenwort-leaved Goldthread	Sensitive	S	Pacific silver fir and Mountain hemlock forest habitats.
Cryptogramma stelleri Steller's Rockbrake	Sensitive	D	Seeps and moist shaded places in cliff crevices in moderate to steep slopes 3000 ft. to 6000 ft.
Cypripedium parviflorum Yellow Lady's Slipper	Sensitive	D	Bogs, wet forest habitats, and in the channeled scablands of eastern WA., around ponds and in low, moist areas, generally in close association with red osier dogwood and aspen between 2100 ft. and 3440 ft. elevation.
Delphinium viridescens Wenatchee Larkspur	Sensitive/ Federal Species of Concern	D	This is a Wenatchee Mountain endemic found in dry Ponderosa pine/Douglas fir forests in mesic to moist sites.
Draba aurea Golden Draba	Sensitive	D	Well drained alpine meadows that are seasonally moist, krummholz, dry meadow, and talus slope habitats between 6800 ft. to 7400 ft. Favors southerly aspects.
Draba cana Lance-leafed Draba	Sensitive	D	Alpine fell fields on mid to upper slopes frequently in steep terrain from 5900 ft. to 7800 ft., dry rocky exposures.
Dryas drummondii var. *drummondii* Yellow Mountain Avens	Sensitive	S	In calcium rich areas between 2000 ft. and 6750 ft. in elevation, in open gravelly areas often above tree line or at lower elevations along streams.
Erigeron salishii Salish Fleabane	Sensitive	D	Alpine species found on typically flat, southerly exposed ridge lines, mountain tops, fell fields, and upper slopes from 6800 ft. to 8690 ft.
Eriophorum viridicarinatum Green-keeled Cottongrass	Sensitive	D	At 6000 ft. elevation in fens/bogs, wet meadows, and wetland margins.
Eritrichium nanum var. elongatum Pale Alpine Forget-me-not	Sensitive	D	Alpine ridges in relatively stable granitic scree. Associated with alpine cushion plant communities on gentle slopes, in exposed gravelly soil between 7300 ft.-8300 ft.
Eurybia merita Arctic aster	Sensitive	S	Subalpine
Gentiana douglasiana Swamp gentian	Sensitive	D	Subalpine – alpine species, in relatively shaded moist meadows, bogs, and ephemeral seeps. Associated with conifers and alpine forbs on gentle slopes between 3000 and 7000 ft. elevation.
Gentiana glauca Glaucous Gentian	Sensitive	D	Wetland transition zones on hummock topography, seeps. In wetlands basins and on alpine benches between 6800 and 8000 ft.
Gentianella tenella ssp. *tenella* Slender Gentian	Sensitive	D	Subalpine and alpine meadows and wetlands with gently sloping terrain between 6800 ft. and 7100 ft., on southerly aspects.
Geum rivale Water Avens	Sensitive	D	Open lodgepole pine and Engelmann spruce at 6440 ft.

	Vascular Species		
Scientific Name	**RFSSSStatus**	**Presence on Forest***	**Habitat**
Geum rossii var. depressum Ross's Avens	Sensitive	D	High elevation alpine or krummholz habitat.
Hackelia hispida var. disjuncta Sagebrush Stickseed	Sensitive	D	Dry forest and shrub steppe habitats, often in rocky bluffs and cliff micro-habitats. Rocky talus between 600 and 2100 feet.
Hackelia venusta Showy Stickseed	Federally Endangered	D	Found in dry open bunchgrass forest habitats, and adjacent cliffs.
Heterotheca oregona var. *oregona* Oregon Goldenaster	Sensitive	D	Sand and gravel bars along rivers. In Washington, this species was found on a sandy riverbank at the edge of a Douglas fir-ponderosa pine forest at 2600 ft.
Howellia aquatilis Howellia	Federally Threatened	S	Small, vernal ponds, although some of the ponds may retain water throughout the year. Soils are rich in organic matter and frequently contain partially decomposed leaves, stems, and wood, between 10 ft. and 2300 ft.
Illiamna longisepala Longsepal Globemallow	Sensitive	D	Sagebrush/bitterbrush steppe to ponderosa pine forests in the low to mid elevations between 500 ft. to 4500 ft. Dry, open hillsides, gravelly streamsides and open ponderosa pine forests.
Juncus howellii Howell's Rush	Sensitive	D	Moist area at the base of a basalt cliff at 2840 ft.
Loiseleuria procumbens Alpine Azalea	Sensitive	D	Above 6000 ft. in heather communities.
Luzula arcuata ssp. *unalaschcensis* Curved Woodrush	Sensitive	D	Above 7000 ft. in moist boulder talus crevices above timberline and often near mountain summits.
Lycopodium dendroideum Treelike Clubmoss	Sensitive	S	Between 800 ft. and 3650 ft. in the moist forests.
Mimulus pulsiferae Pulsifer's Monkey-flower	Sensitive	D	Found in seasonally moist rock out crops and moist depressions in flat terrain in ponderosa pine and dry Douglas-fir forest types. In seasonally moist, open places often in exposed mineral soil from the foothills and valleys to the mid elevations east of the Cascades.
Mimulus suksdorfii Suksdorf's Monkey-flower	Sensitive	D	Known from a steep talus and scree slope above timberline at 7100 ft. with a south aspect. It is suspected to occur in wet to dry open places from the lowlands to high in the mountains.
Montia diffusa Branching montia	Sensitive	D	Moist forests at lower elevations
Nicotiana attenuata Coyote Tobacco	Sensitive	D	Dry sandy bottom lands, dry rocky washes, and in other dry open places from 400 ft. to 10,000 ft. Has been reported to occur with basin wildrye and common weedy species such as mullein, knapweed, Russian thistle, and cheatgrass.
Oxytropis monticola Slender Crazyweed	Sensitive	S	Documented in alpine habitat in N. Central WA. Suspected habitat is wide ranging from mesic to dry meadows, grassy slopes, sandy or gravelly riverbanks and terraces, and forest opening from lowlands and steppe to alpine zones.
Parnassia kotzebuei Kobzebue's Grass-of-Parnassus	Sensitive	D	4800 ft. to 6700 ft. elevation on north aspects in moderate to steep terrain associated with cliff edges and at the base of talus slopes in moist seeps.
Pedicularis rainierensis Mt. Rainier Lousewort	Sensitive	D	Moist alpine meadows, open coniferous forests, and on rocky slopes. Often it grows near streams, and it is known to occur throughout some lake basins.
Pellaea brachyptera Sierra Cliff-brake	Sensitive	D	Known from 1100 ft. to 2500 ft. elevation in the state. Habitat is associated with dry rocky slopes low to mid elevations in open bunchgrass communities with scattered ponderosa pine.

	Vascular Species		
Scientific Name	**RFSSSStatus**	**Presence on Forest***	**Habitat**
Pellaea breweri Brewer's Cliff-brake	Sensitive	D	7500 ft., rock crevices, ledges, and talus slopes. Less often in open rocky soil from the foothills to about tree line, on serpentine in WA.
Penstemon eriantherus var. *whitedii* Whited's Penstemon	Sensitive	D	West facing slopes of small canyons, and in dry and rocky habitats in the foothills of the Cascade Range and in the Columbia Basin from 525 to 3835 feet.
Petrophytum cinerascens Chelan Rockmat	Sensitive/ Federal Species of Concern	D	Only known from gneissic cliffs along the Columbia River in dry rocky habitat.
Phacelia minutissima Dwarf Phacelia	Sensitive/ Federal Species of Concern	D	Found at mid elevations in the mountains.
Physaria didymocarpa var. *didymocarpa* Common Twinpod	Sensitive	D	Dry forest habitat.
Pilularia americana American Pillwort	Sensitive	D	Middle zones of vernal pools from 1930 to 2310 feet elevation.
Pinus albicaulis Whitebark pine	Sensitive	D	Alpine species frequently found on dry southern exposures and exposed windswept ridges, often on very thin soils. 4,000 to 11,000 feet elevation
Platanthera chorisiana Choris' Bog-orchid	Sensitive	S	Wettest regions of sphagnum bogs and along streamsides, and on moss-covered rocks. 2540 - 4300 ft.
Platanthera obtusata Small Northern Bog-orchid	Sensitive	D	Damp to wet places in forests, marshes, bogs, meadows, and along streambanks. 800 to 5000 ft.
Platanthera sparsiflora Canyon bog-orchid	Sensitive	D	Open wet areas, seeps, bogs at low to mid elevations.
Polemonium viscosum Skunk Polemonium	Sensitive	D	Above 6300 ft. Favors flat to gentle terrain in alpine talus, fell fields in glacial cirques, summits, and shoulder slopes.
Potentilla nivea Snow Cinquefoil	Sensitive	D	Found above 7000 ft. on flat to gently sloping topography in alpine meadows, fell fields, and rock outcrops along alpine ridges and summits
Pulsatilla patens ssp. *multifida* Cutleaf anemone	Sensitive	D	Ponderosa pine communities, dry hillsides.
Pyrrocoma hirta var. *sonchifolia* Sticky Goldenweed	Sensitive	D	Meadows and open wooded slopes in the foothills, at moderate elevations. 4700 ft. in Washington.
Ribes oxyacanthoides ssp. *irriguum* Idaho Gooseberry	Sensitive	D	Along streams, meadow openings, and slopes of moist to dry canyons 3000 to 5000 feet.
Rotala ramosior Lowland Toothcup	Sensitive	D	Damp areas in fine sand and silt. Wet, swampy places, lakes and pond margins, and along free flowing river reaches between 200 to 2259 ft.
Rubus arcticus ssp.	Sensitive	D	Open wetlands and wet meadows within spruce dominated forests at 5900 ft.

	Vascular Species		
Scientific Name	**RFSSSStatus**	**Presence on Forest***	**Habitat**
acaulis Nagoonberry			
Salix glauca ssp. *glauca* var. *villosa* Glaucous willow	Sensitive	D	Perennial streams, stream banks, and marshes in draws, floodplains, and glacial cirques and valleys between 5200 ft. and 5850 ft. in gentle to flat topography.
Salix maccalliana Maccalls Willow	Sensitive	D	Bogs, fens, swamps, and marshes in open, low-lying sites. 2400 to 3000 feet.
Salix pseudomonticola False mountain willow	Sensitive	S	Moist fens, treed bogs, and river floodplains.
Sanicula marilandica Black Snake-root	Sensitive	D	Moist floodplains and woods, marsh edges and old riverine channels in gentle to flat topography with silty and sandy river bottoms, between 1800 and 3400 ft.
Saxifraga cernua Nodding Saxifrage	Sensitive	D	Boulder talus above 6500 ft. in thin moist soils and moist scree.
Saxifragopsis fragarioides Strawberry Saxifrage	Sensitive	D	Dry forest.
Sidalcea oregana var. *calva* Wenatchee Mt Checker-mallow	Federally Endangered	D	Dry forest and moist meadows, stream margins generally within ponderosa pine forest.
Silene seelyi Seely's Silene	Sensitive/ Federal Species of Concern	D	Shaded crevices in ultramafic to basaltic cliffs and rock outcrops, and occasionally among boulders in talus. Occurs from 1500 to 6300 feet in elevation.
Sisyrinchium sarmentosum Pale blue-eyed grass	Sensitive	S	Occurs primarily in open wet meadows, sometimes in association with perennial streams and within a mosaic that includes coniferous forested wetlands. Grasses and sedges commonly dominate the habitats. 2100 to 6100 feet elevation.
Spiranthes diluvialis Ute Ladies'-tresses	Federally Threatened	S	Floodplains, channels, streambanks, springs, seeps, lake and pond margins where soils are likely alkaline, periodically flooded, and moist throughout the growing season. Elevations range between1500 and 7000 ft.
Spiranthes porrifolia Western Ladies-tresses	Sensitive	D	Between 5400 and 6800 ft. in glacial cirque wetlands, bogs, and fens. Also in vernally moist seeps in otherwise dry rocky habitats.
Trifolium thompsonii Thompson's Clover	Sensitive/ Federal Species of Concern	D	Endemic to southeastern Chelan County and adjacent Douglas County, WA. Open grassland and open ponderosa pine forest.
Vaccinium myrtilloides Velvet-leaf Blueberry	Sensitive	D	Mid-slope in open semi-mature Engelmann spruce forests in a well-developed moss layer at around 3500 ft. Dry to moist, sandy or rocky clearings and open woods, sphagnum bogs, and swamps.
Viola renifolia Kidney-leaved violet	Sensitive	D	Generally found in moist forested sites, and sometimes along ditches or streams. May be found from lowland coniferous forest to subalpine slopes.

Figure G-2. Region 6 Survey and Manage Species (2011) documented or suspected on the Forest.

Species	Category	Forest	Habitat
Botrychium montanum Mountain moonwort VASCULAR PLANT	Category A	D	Dark coniferous forests, usually with Western red cedar. Near streams and swamps from 3300 to 9800 ft. elevation.
Schistostega pennata MOSS	Category A	D	On mineral soil in shaded pockets of overturned tree roots, often with shallow pools of standing water at the base of the root wad. It also grows attached to rock or mineral soil around the entrance to caves, old cellars and animal burrows.
Tritomaria exsectiformis LIVERWORT	Category B	D	Dry to moist, partially shaded soil or litter and soil in rock crevices. Also on rock and decaying wood. One site is next to a low gradient stream in a subalpine cirque basin.
Tetraphis geniculata MOSS	Category A	S	Moist coniferous forest with large down logs, and occasionally on peaty banks in moist coniferous forests from sea level to subalpine elevations.
Dendriscocaulon intricatulum LICHEN	Category B	S	Mesic to moist forests in the upper western hemlock and lower pacific silver fir zone (30-2170 ft.). Primarily in mature and old-growth Douglas-fir, hemlock, and pacific silver fir where it is epiphytic on lower twigs of suppressed understory hemlock and pacific silver fir. Less frequently on subalpine fir.
Dermatocarpon meiophyllizum LICHEN	Category E	D	On rocks along stream banks and lake sides where frequently wetted.
Leptogium burnetia var *hirsutum* LICHEN	Category A	S	Infrequent over trees and rare over mossy outcrops in sheltered intermountain forests.
Leptogium cyanescens LICHEN	Category A	D	Tree bark of both conifers and hardwoods, logs, mossy rocks in sheltered humid, cool microsites of intermountain forests.
Nephroma bellum LICHEN	Category F	D	Restricted to moist forests with strong Pacific coastal influence. Substrate is often riparian hardwoods.
Peltigera pacifica LICHEN	Category E	S	Mossy logs, tree bases, soil and rocks in low elevation moist forest habitats.
Tholurna dissimilis LICHEN	Category B south of the Columbia River	D	On twigs and branches of exposed conifers in humid subalpine and alpine habitats. Mostly on exposed subalpine ridges and peaks, occasionally at low to mid elevations in cool moist sites.
Albatrellus ellisii FUNGI	Category B	D	On ground, under conifers.
Clavariadelphus occidentalis FUNGI	Category B	D	On soil or duff under conifers or mixed coniferous deciduous forest.
Clavariadelphus sachalinensis FUNGI	Category B	D	On soil or duff under mixed conifers. Moist forests or riparian zones.
Cudonia monticola FUNGI	Category B	D	On Spruce needles and conifer debris.
Gomphus bonarii FUNGI	Category B	D	Hidden in deep humus under pine and *f*ir species.
Gomphus kauffmanii FUNGI	Category B	D	Hidden in deep humus under pine and *f*ir species.
Gyromytra califonrica FUNGI	Category B	D	In conifer woods; fruiting in humus or on rotting wood in moist areas.
Leucogaster citrinus FUNGI	Category B	D	Found in association with roots of white fir*,* subalpine fir, lodgepole pine, western white pine*,* Douglas-fir*, and* western hemlock from 656 to 918 ft. elevation.
Ramaria amyloidea	Category B	D	On humus or soil under fir species, Douglas-fir and western hemlock.

FUNGI			
Ramaria aurantiisiccescens FUNGI	Category B	D	On humus or soil under fir species, Douglas-fir and western hemlock.
Ramaria largentii FUNGI	Category B	D	Fruits in humus or soil and matures above the surface of the ground. Associated with fir species, Douglas-fir and western hemlock, and western white pine.
Ramaria rubrievanescens FUNGI	Category B	D	In humus or soil. Associated with pine species.
Ramaria rubripermanens FUNGI	Category B	D	In humus or soil. Associated with pine species.
Sarcodon fuscoindicus FUNGI	Category B	D	On the ground in association with hemlock and pine species.
Spathularia flavida FUNGI	Category B	D	In clusters or fairy rings on litter or woody debris of conifer and hardwood forests.

Heritage Program (WNHP) Site Database, Flora of the Pacific NW by Hitchcock and Cronquist, and Field Guide to Washington's Rare Plants 2000 cooperatively produced by WNHP and Spokane District BLM. Plant names and acronyms taken from the Plants Database (www.plants.usa.gov).

Appendix H: Invasive Plant List and Characteristics

Figure H-1. New and potential invaders found within or adjacent to Project area.

New Invaders		Potential Invaders (on private land)
Within project area	**On Private and Forest Lands Adjacent to Project Area**	
Hoary alyssum-B	Russian Knapweed-B	Bohemian knotweed-B
Whitetop-C	Spotted knapweed-B	Scotch thistle-B
St. Johnswort-C	Hawkweed species-B	Yellow starthistle-B
Oxeye daisy-C	Common tansy-C	
Dalmatian toadflax-B		
Sulfur cinquefoil-B		
Houndstongue-B		

Figure H-2. New Invaders within Project Area

Species	Characteristics
hoary alyssum *Berteroa incana*	A member of the mustard family; can be an annual, biennial or perennial; toxic to horses; spreads rapidly due to the high number of seeds per plant; most abundant in disturbed sites but is also found in meadows and pastures and along roadsides; well adapted to dry conditions, particularly in area with sandy to gravelly soils.
whitetop *Carderia draba*	A deep rooted perennial reproducing from root segments and seeds; highly competitive with other species once it becomes established; will set seed by early summer.
St. Johnswort *Hypericum perforatum*	A perennial reproducing by seed or short rhizomes; easily established on roadsides; very slow in spreading off of roadside; difficult to control; biological control available.
oxeye daisy leucanthemum vulgare	An aggressive perennial; invader of open forest, meadows and roadsides; strong sprouting from roots with branched rhizomes; reproduces vegetatively along rhizomes and by seed.
dalmatian toadflax *Linaria dalmatica*	A perennial reproducing by seed and rhizomes; it is aggressive on roadsides and rangeland; difficult to control.
sulfur cinquefoil *Potentilla recta*	A competitive long-lived perennial; unpalatable to grazing animals reducing forage for livestock and wildlife; adapted to a wide range of environmental conditions; reproduces by seed and uses early emergence to establish.
houndstongue *Cynoglossum officinale*	A biennial; seeds are 4 prickly nutlets (seeds) that attach to people, livestock, vehicles, for easy dispersal; a very strong competitor with desirable forage; generally non-palatable but toxic properties capable of poisoning livestock; shade tolerant and thrives in wetter grasslands.

Figure H-3. New Invaders on Forest Land adjacent to Project Area

Species	Characteristics
Russian knapweed *Acroptilon repens*	A creeping perennial; reproduces from seed and vegetative root buds; toxic to horses; very competitive in heavier soils of bottomlands; invades degraded areas dominating the plant community.
spotted knapweed Centaurea maculosa	A short-lived perennial; tolerates shade; spread by vehicles, wind, animals; highly competitive.
orange and yellow (meadow) Hawkweed *Hieracium aurantiacum, Hieracium pratense*	A perennial with creeping stolons; forms dense patches and rapidly invades new areas; mostly vegetative reproduction; dispersed by wind, animals, and people, seeds not carried far by the wind - presumably dispersed > 1 km, minute barbs on the seeds stick to fur, clothing and vehicles; suitable habitat well above 5000 ft. in mountain meadows.
common tansy *Tanacetum vulgare*	Spreads mainly by seeds, and less commonly from creeping rhizomes, to form dense clumps of stems; an invader of disturbed sites; commonly found on roadsides, fence rows, pastures, stream banks and waste areas.

Figure H-4. Potential Invaders

Species	Characteristics
Bohemian knotweed *Polygonum bohemicum*	An escaped ornamental becoming increasingly common along stream corridors and rights-of-way in Washington; a perennial with spreading rhizomes, can reach 8 feet in height and is often shrubby, very aggressive, capable of crowding out all other vegetation, rarely established from seed, primary spread is through mechanical movement of plant parts; several sites in Methow, Chewuch, and Twisp River Valley bottoms.
scotch thistle *Onopordum acanthium*	A biennial that often grows 8 feet or more in height and 6 feet in width; a problem on western rangelands; can form dense stands of the large, spiny plants and constitute a barrier to livestock movement; spreads rapidly; thrives in well-drained sandy soils; plants produce 8,400 to 40,000 seeds, dispersed by wind, humans, water, livestock, and wildlife.
yellow starthistle *Centaurea solstitialis*	A winter annual with long sharp spines; a deep taproot; performs best in deep silt loams on south slopes but high adaptability to most arid rangelands; abundant seed production - 150,000 per plant per season; seeds are plumed and plumeless, plumed seed is spread by wind

Appendix I
Response to Public Comments

Public scoping was started on December 29, 2014, and the Preliminary South Summit Forest and Fuels EA was mailed on March 6, 2015. A notice of EA availability for a 30-day comment period was published in the Wenatchee World newspaper on March 6, 2015. Eight responses from six parties were received during public scoping and during the 30-day comment period as noted below. Responses to comments received during the scoping period were incorporated into the preliminary EA or provided below. Comments received during the 30-day comment period are provided below with references to the final EA.

Ginger Reddington Email

All comments received during scoping period.

Comment 1: We use a lot of the closed roads for loop riding on the horses and mountain bikes. Will this be allowed with the changes? What is a decommissioned road? Would we still be allowed to use it for hiking, horses, and mountain bikes?

Response: Closed or decommissioned roads may be available for horseback and mountain bike riding in the project area. Decommissioned roads are described in the EA.

Reference: EA, Appendix E.

Comment 2: I do hope you close the "off road to 4 wheelers and motorcycles". Speed limits: vehicles and motorcycles going up Benson Creek are going way over 25 mph

Response: Decisions on road access by 4-wheelers and motorcycles are part of the upcoming Travel Management decision and are not within scope of this EA. Changing the speed limit of vehicles on forest roads is outside the scope of the project.

Reference: EA, Chap. 1, Purpose and Need.

Comment 3: Will you keep Benson Creek in its present wide bodied streambed (after floods design)? Neighbors were given a permit to dig out Benson after the last flood that has filled with sediment again. Thus they are in danger again.

Response: Wetland or stream channel modifications on National Forest lands or private lands are outside of the scope of this project. Protective measures available to downstream landowners are available through the Okanogan County Conservation District.

Reference: EA, Chap. 1, Purpose and Need.

Comment 4: Is there a plan to put a culvert back in Yockey Rd where Benson took it out?

Response: Yes; proposed culvert installation at that location is included in this EA.

Reference: EA Chapter 2, Chapter 3.10, Appendix E

Betty and Sherrow Letter

All comments received during scoping period.

Comment 1: I request that you intensify replanting and soil erosion avoidance activites within the Finley Canyon watershed. Reducing future sediment transport into the Wenner Lakes/Finley Canyon watershed should be specifically stated and addressed. Identify areas where mud and debris flows occurred on the forest lands, and take actions to dissipate flow, settle out sediment, and restore vegetation.

Response: BAER roadwork is occurring in the project area during 2015 and will address some of the drainage issues along roads in the project area, including some in the Finley Canyon watershed. There are over 8000 acres of proposed tree planting within the project area, including portions of the Finley Canyon watershed, which will aid in erosion control once the trees become established. Culvert installation and upsizing in 8 locations will help restore drainage and road stability.

Reference:

Comment 2: I request that you expand the planting boundaries to replace forest, especially on the north and west slopes of Finley Mountain, to the limits of the forest prior to the fire.

Response: Additional tree planting areas located on the north and west slopes of Finley Mountain were identified since scoping occurred. Criteria used to identify post-fire tree planting units are described in the EA in Section 3.2.1. Due to economic, logistical, and biological (seedling survival) considerations, planting trees to restore forest cover to pre-fire limits in all areas of interest is not feasible.

Reference:

Comment 3: Please describe and depict the areas that will receive soil stabilization activities that you are making to achieve your stated objectives of "soil protection and sediment reduction".

Response: The phrase "objectives for soil protection and sediment reduction" described in this comment is taken out of context from the scoping letter. The scoping letter mailed to the public describes the objectives the project would meet by amending specified Forest Plan standards and guidelines to carry out proposed treatments, which are not a specific focus of the project purpose and need. As written in the scoping letter, meeting the "Soil protection" objective would necessitate amending the forest plan to allow for plowing portions of Rd 41; allow temporary winter operations in deer winter range; and allow more than 15% of the area to have puddling, displacement, or compaction. Meeting the "sediment reduction" objective would necessitate amending fine sediment standards to allow for a temporary increase in sediment during project activities (i.e. road decommissioning).

Reference: E.A., Chapter 2

Vic Stokes Letter

All comments received during scoping period.

Comment 1: I would like someone to explain how I as a cattle allotment permittee have contributed to unhealthy forests and severe wildfire behavior when I have followed the standards and guidelines for management in my allotment management plan.

Response: In the early part of the 20th century, widespread grazing of cattle, sheep, and horses occurred over most of the project area. Reductions in fine fuel loading by grazing kept ignitions from spreading in many areas, even without active fire suppression. Consequently, the role of natural fires in reducing fuels and thinning understory brush and trees were minimized. In addition, bare soil created by grazing provided further opportunities for tree seedlings to grow in areas where ground cover and vegetation would have otherwise outcompeted and prevented them from establishing. The combined effect of reduced fine fuels and increased conifer development during this period contributed to creating denser forests. These overstocked stands were protected further by increasingly effective fire suppression in the latter half of the 20th century to present day. The current effects from cattle grazing on wildfires have been minimized in recent decades. This is due to a considerable drop in the number of cattle grazed in the project area and improved range management practices, including pasture rotation and monitoring.

Reference: EA Section 3.3, pp 61-62

Comment 2: I would like to have the chance to sit down with the appropriate people and discuss closures and how they may affect management on our allotment. Will I have administrative approval to travel on closed roads (by ATV) to access areas where improvements such as fences, water developments, and salt grounds need to be maintained?

Response: Approximately 24 miles of closed roads (ML 1) in the project area provide vital access to range improvements such as fences and water developments, or provide the only means of moving cattle up steep terrain from one pasture to another. The proposed action would provide for Administrative Use Access Routes to be established on these roads which would include authorization for permittees. Refer to Appendix E for a list of road segments that would be designated as Administrative Use Routes to facilitate range administration.

Reference: EA, p. 206

Comment 3: With the large areas to be reforested: will these areas be reforested to the appropriate spacing that reflects the climate and soils of the South Summit? Will you be able to keep the forest healthy by applying continued treatments when needed? Will you plan for post planting and thinning in say, 15 to 20 years?

Response: Approximately 150 seedlings per acre would be planted in reforestation units with an expected survival rate of 70%. This would attain desired stocking levels of conifer regeneration (100 or more trees per acre) for dry forest sites in the project area.

Tree stocking levels in this range would minimize the need to thin reforested areas prior to the time that commercial harvest or prescribed fire treatments could be applied to maintain forest health. The need for future thinning in 15-20 years is outside of the timeframe of this decision and would be evaluated at that point in the future.

Reference: EA Appendix J: South Summit II Forest and Fuels Proposed Treatment Units map. Section 3.2.3.2, Reforestation of Areas Deforested by the Carlton Complex wildfire. Section 2.5, Monitoring Plan.

Comment 4: As many of the trees that died in the fire fall, will there be actions planned to keep future fires from decimating the area again because of the fuel loading?

Response: Vegetation and fuels management proposed in the project area are planned for approximately ten years; beyond this timeframe, this analysis and decision do not cover future fuels management. Future land management decisions in the project area would be covered by a new analysis and decision.

Reference: N/A

Comment 5: Will you continue to have prescribed fires to keep fire on the landscape?

Response: Prescribed burning, specifically underburning, continues to have a role in restoration activities. It is not proposed in this project except for in regeneration units because the need to treat surface fuels across much of the project area has been diminished by the Carlton Complex fire. In addition, further underburning in this project outside of regeneration harvest units was dropped to minimize creation of bare soil in a heavily impacted landscape during its recovery period.

Reference: N/A

Comment 6: What will some of these actions mean to me and my family as we continue to be permittees in the future?

Response: The proposed commercial harvest would open the canopy and create a flush of transitory range creating an increase in forage and browse that is available for grazing by permitted livestock. However, an increase in transitory forage production would be slight relative to the increase in transitory forage expected in the burned area. The transportation system changes would have the potential to restrict access for grazing allotment management. Some roads provide the only reasonably efficient access to rangelands within a grazing allotment for administration, livestock management, and for maintenance of improvements. The proposed action would provide for Administrative Use Access Routes to be established on roads that are vital for grazing allotment management. Proposed harvest thinning and post-harvest fuels management treatments would improve fire resiliency of treated stands and reduce the risk of wildfire to the remaining forested stands reducing the potential impacts of wildfire to livestock grazing.

Reference: E.A. Page 216, 219, 206, 48, 161

Comment 7: Do you have plans to do more monitoring on use of dirt bikes/ATVs?

Response: Monitoring dirt bikes and ATV use is not within the scope of this project.

Reference: N/A

Comment 8: What will aspen regeneration mean to me as a permittee?

Response: Aspen regeneration is anticipated to be rapid and abundant in many areas of the project area due to recent fire activity. Informal monitoring of post-fire aspen regeneration within grazing allotments across the Methow Valley Ranger District has found that burned aspen stands regenerate quickly and with few cattle impacts. After a 2-5 year delay of grazing to provide for vegetation recovery, there would be a very low potential for cattle to impact treatment objectives. No fencing of aspen stands is proposed.

Conservation Northwest Letter

Comments 1-17 and 19-24 were received during the scoping period. Comments 18, 25, and 26 were received during the 30-day comment period.

Comment 1: Was a landscape evaluation conducted as defined in the Forest Restoration Strategy following the Carlton Fire Complex, or was another method used to identify the current changed conditions and reset the desired conditions for vegetation patterns on the landscape both in stands with structure and spatial pattern?

Response: The method used to evaluate departure of current forest vegetation conditions (stand structures) from estimated historical conditions (HRV) is described in the EA. This evaluation does not address spatial pattern of stand structures.

Reference: EA Section 3.2.1.

Comment 2: The EA should clearly outline the analysis used to guide implementation of Purpose and Need #1, and link the proposed actions by unit to fulfilling the ecological restoration needs and desired conditions for the landscape as well as fuels management objectives in the WUI.

Response: Findings of the project area stand structure assessment are described in the EA. Effects of proposed vegetation management and fuels treatments with regard to forest vegetation departure from historic conditions are described in the EA.

Reference: Section 3.2.2, Forest Vegetation Conditions: Departure from Historic Stand structures and Lack of Resilience to Natural Disturbance.
Section 3.2.3.2, Forest Vegetation Conditions: Departure from Historic Stand structures and Lack of Resilience to Natural Disturbance.
Section 3.3.3.2: Fuels & Fire Behavior, Proposed action effects on project area and WUI.

Comment 3: Did any of the BAER post-fire assessments on restoration priorities on the landscape get integrated into this project if they overlapped the project area?

Response: This project included BAER recommendations to upsize or replace road culverts in 8 locations in the project area.

Reference: E.A., Chapter 2 and Appendix E

Comment 4: The EA should clearly indicate how the WUI is defined in the project area, and how the prescriptions may differ within the WUI from dry forest restoration prescriptions elsewhere in the project area.

Response: WUI is defined in the Fuels Specialist report and in the EA. There is little differentiation in the types and effects of treatments inside versus outside of WUI because the entire project area is considered WUI. Treatment effects are described for specific management concerns such as Forest Plan Old Growth, Riparian Habitat Conservation Areas, and in the main fire regimes present in proposed treatment units.

Reference: EA Section 3.3.2

Comment 5: The EA should clearly define how the district will utilize and define burn severity of trees and its relationship to tree marking in the project. Will prescriptions focus only on burned-dead trees in the project area, or also include green trees that survived through the fires in units that burned?

Response: Harvest treatment units would avoid extensive areas (larger than one acre) which experienced high levels of tree mortality associated with high or moderate BARC burn severity during the Carlton Complex wildfire. Fire-killed trees within harvest units which are standing or down at the time of timber marking will not be designated for removal during harvest operations. Snags in harvest units will be protected in the timber sale contract with the Leave Dead Standing contract provision. Snags felled to mitigate danger tree safety hazards associated with timber harvest operations would remain on site and not be removed from timber harvest units. Fire created openings within harvest units would be considered canopy gaps which are a treatment objective of restoring the historic spatial pattern of trees. Live tree retention levels of harvest units with fire created openings would not be reduced. The desired number of live trees per acre retained would be based on the total acres in each unit including fire created openings.

Reference: Design Criteria for harvest treatments in areas burned by the fire are described in Appendices A and C of the EA and section 3.2.3.2, Forest Vegetation Conditions: Departure from historic stand structures and lack of resilience to natural disturbance.

Comment 6: The EA should clearly identify units that overlap areas where the fire burned, and at what severity the fire burned in that area.

Response: Appendix J of the draft EA provides a map which displays proposed treatment units and another map which displays burn severity in the project area. The draft EA summarizes the proportion of proposed harvest treatments located inside and outside of the wildfire area. A detailed list of estimated burn severity within proposed treatment units is on file at the District office in the project Forest Vegetation Specialist report, Appendix G. Approximately 68% of proposed harvest treatment acres are located outside of the Carlton wildfire perimeter. Approximately 15% of proposed harvest treatment acres are located within the fire perimeter and classified as unburned. Approximately 17% of proposed harvest treatment acres are located within the fire perimeter and classified as low severity burning. Less than 1% (10 acres) of proposed harvest treatment acres within the fire perimeter are classified as moderate burn

severity. Approximately two acres of proposed harvest treatments within the fire perimeter are classified as high burn severity. About 15% of stand-alone fuels units burned in the Carlton Complex. Of this amount, about 8% burned with moderate or high severity according to BARC mapping. These areas are scattered within areas that burned with low severity and would not be thinned. The remaining 92% of burned areas within fuels units experienced low severity fire that didn't change the vegetation structure.

Reference: Section 3.2.3.2, Section 3.3.2, Appendix J

Comment 7: Large and very large fire tolerant species should be retained in addition to the promotion the Purpose and Need speaks to in the designated Old Growth areas. Identify any project area locations that can promote these conditions both in open and closed canopy conditions?

Response: Proposed vegetation management treatments and effects, including treatments in forest plan old growth and late and old structure stands are described in the EA. Proposed vegetation management treatments would retain all existing large trees 21 inches dbh and larger on site and promote the development of additional large trees.

Reference: EA Section 3.2.3.2 and Appendix C

Comment 8: Removal of understory canopy would cause a direct reduction of shading from their removal. The "Everett Study" (sic) should be acknowledged that describes riparian areas in the Methow as having slightly longer fire intervals than adjacent uplands, with correspondingly higher severity.

Response: The "Everett" study is referenced in the Fuels Specialist's report and in the E.A.

Reference: E.A., Section 3.3.2

Comment 9: The EA should include additional pro-active actions that will minimize increases in sediment delivery to streams and stabilize soils in the project area.

Response: BAER roadwork is occurring in the project area during 2015 and will address some of the drainage issues along roads in the project area, including some in the Finley Canyon watershed. There are over 8000 acres of proposed tree planting within the project area, including portions of the Finley Canyon watershed, which will aid in erosion control once the trees become established. Culvert installation and upsizing in 8 locations will help restore drainage and road stability.

Reference: N/A

Comment 10: The EA should outline any additional considerations made to the travel analysis from South Summit I following the fire including short term risks to resources (i.e. increased risk to hydrology), including areas that may be a higher priority for implementation in the changed condition.

Response: The travel analyses from South Summit I and II are very similar with the exception that a few more unauthorized roads were discovered after the Carlton Complex wildfire; these are proposed for decommissioning. A PUD road along Frazer Creek is now proposed for decommissioning and a drivable dip over Frazer Creek is proposed to allow for this road to be decommissioned. The road network was analyzed by the BAER team for short term risks from roads to hydrologic resources. The recommendations that were approved will be instituted in 2015. Road decommissioning implementation time schedules are based upon available budget and risk to resources. The road network has been prioritized for work as money becomes available. Details on proposed transportation actions are listed in the EA.

Comment 11: The EA should break out system roads (including Level 1 closed roads) from unauthorized routes [as compared to how they are described in the scoping letter]. Unauthorized roads should be decommissioned since no necessary use for management was determined for these routes during South Summit I.

Response: The EA distinguishes system roads from unauthorized routes. Even in the original South Summit proposal, there were unauthorized roads identified to be added to the system. Standard procedure is to decommission any roads not needed for the transportation system. Further meaningful classification of UA-roads would require complete field analysis of the roads.

Reference: EA, Chapter 2, page 19-21; Chapter 3.10, page 200-206; Appendix E, p. 408.

Comment 12: The EA should indicate how many of the Level 1 roads that will not be used during project implementation are in a hydrologically closed status consistent with the forest roads policy, versus how many segments and miles will require work to be brought into that state.

Response: The roads policy was only put in place in December 2013 and it was a significant change from previous management direction. Most, if not all roads in the project area did not meet this direction when it was put into place and there has not been enough time to act on this direction; therefore, very few if any of the ML-1 roads in the project area currently meet that standard.

Reference: N/A.

Comment 13: Will hazard tree removal also be conducted along roads and trails in the project area through this project? If so, large snags removed should be retained first for restoration objectives in the post-fire landscape including projects to reduce sedimentation, improve hydrology, and assist effectiveness of road closure along restored roadbeds before considered for commercial value. The number of snags should be quantified in the EA to account for its potential impact.

Response: Hazard tree felling across the burned portion of the project area was considered as an alternative, but eliminated from further study because Forest Service Manual direction allows for hazard tree removal along roads used for timber hauling described below as “Hazard Tree Removal along Haul Routes.” Hazard tree felling along the Highway 20 corridor and in campgrounds is included and analyzed in this document. Public firewood gathering is anticipated to remove hazard trees along open system

roads where consistent with the current firewood policy. Remaining hazard trees would be felled at up to 2 trees per mile of road per year. These actions are expected to be sufficient to remove hazard trees where firewood gathering is not allowed along open roads. Debris from hazard tree removal may be used for restoration objectives on a case-by-case basis, considering potential impacts to soils caused by operating machinery in burned areas. The number of hazardous snags requiring removal along Highway 20 is estimated by WA Department of Transportation staff to be approximately 150 trees along the 2 miles of high-severity fire along the state highway within National Forest lands in the project area. The number of hazard tree snags removed elsewhere in the project area will depend on personal judgement of firewood gatherers felling snags, and the hazardous nature of dead trees at the time of timber harvest operations.

Reference: EA, Chapter 2, p. 12, 13, 14, 20

Comment 14: Will this be a stewardship contract to retain receipts from the commercial value in stands to go towards restoration?

Response: The forest currently plans to offer the timber sale as a stewardship contract that may include road decommissioning and ladder fuel reduction thinning depending on the value of the timber receipts. A suite of funding sources would likely be used to accomplish the majority of the restoration work for this project.

Reference: N/A.

Comment 15: During South Summit I, we found numerous opportunities for aspen management that were not included in the project. We suggest inclusion of these opportunities in this project area. George Wooten can provide spatially explicit suggestions in the project area. Addendum: the "spatially explicit suggestions" from George were in respect to requesting that wetland restoration activities be added to SS2.

Response: This information was not received in a timely manner to conduct required cultural resource and botanical surveys to incorporate into the proposed action. The information has been provided to wildlife and botany specialists on the district for use in future projects.

Reference: N/A.

Comment 16: The EA should provide detail on location of planting, species mix, planting density to mimic long-term desired conditions, and plans to monitor and maintain the site over time.

Response: The location proposed post-fire tree planting units are displayed in Appendix J of the EA (South Summit II Forest and Fuels Proposed Treatment Units map). Planting density, species mix, estimated survival, and desired stocking levels are described in the EA. Monitoring of seedling survival and tree stocking is described in the EA.

Reference: E.A., Section 3.2.3.2, and Section 2.5

Comment 17: We are concerned about the use of Benson Creek as a haul road for safety reasons. The lower 2 miles should be avoided as a haul route. This portion also

needs to include better location of water diversions in the form of better location and proper sizing of culverts, dips, and water bars. Any use of this road during the project should include dust abatement measures and safety precautions, and a full restoration plan to restore the road post-project. Roads 345, 347, and 350 (north side of Finley Mtn) are likely to contribute to erosion or slope failure; these should be considered for restoration of hydrologic continuity.

Response: The lower 2 miles of Benson Creek Road (FS Road 4150) on National Forest lands will not be used as a haul route west of its junction with the 4150-300 road. This section of FS Road 4150 is scheduled for BAER road maintenance in 2015. All roads used for commercial operations will be assessed by a qualified engineer for maintenance or reconstructions needs to make the road safe for the intended commercial operation. The thusly developed roads package becomes part of the timber purchaser's responsibility with all work required to be done prior to commercial use of the road. Roads 345, 347, and 350 on the north side of Finley Mtn are all closed (ML 1) roads that would stay in this designation post-project. These roads are currently inaccessible due to road failures caused by post-fire storm damage; they will be assessed once the 4100-300 road is re-opened by planned BAER work in summer 2015.

Reference: E.A., Appendix E, Figure E-1.

Comment 18: We seek greater detail on the prescriptions for regeneration, and strongly suggest that even within those units there should be allowances to maintain sufficient snags, logs, and green trees (individuals or clump) for wildlife habitat in these openings.

Response: Prescriptions for proposed regeneration harvest treatments are described in the EA.

Reference: E.A., Chapter 3.2.3.2 and Appendix C

Comment 19: Regarding landing piles: the EA should address the risks of potential soil disturbance and invasive plants in landing burn scars if the piles are burned instead of sold for biomass. The EA should potentially consider firewood use or chipping instead of pile burning.

Response: Soil burn severity at landing piles and invasive plants at landings are described in the EA. Design Criteria #76 in Appendix A addresses soil restoration at landings. Design Criteria #2 allows for firewood extraction from landings prior to burning to help mitigate air quality impacts from burning debris. Chipping wood at landings is generally not cost-effective because of the cost of re-opening and re-closing roads, lack of commercially available means to chip the volume of wood typically at landings.

Reference: EA, Soils, Section 3.8, p. 139, 143. Appendix A.

Comment 20: The EA should describe a monitoring plan to ensure that implementation and monitoring occurs.

Response: Monitoring proposed by this project is described in the EA.

Reference: E.A., Chapter 2.5 (Monitoring); Appendix A (Design Criteria); Chapter 3 (specialist report summaries).

Comment 21: In South Summit I, the following 3 resolutions were agreed on; we will be looking at the EA to see that these are upheld:

1. On units where summer harvest is proposed within intermittent channels, instead of a variable width buffer of 50-100 feet, we would provide a full 100-foot buffer.
2. Road 4100000-2.8L-1 will be decommissioned, not in ML1, post-project.
3. 5 stream crossings will be identified with the greatest potential to impact aquatic resources; these will be rock armored within 5 years to reduce their sediment inputs.

Response: Resolutions reached during the objection period for the original South Summit project do not apply to South Summit II because it is a new proposal.

Reference: N/A

Comment 22: We urge you to obtain the most recent maps of gray squirrel sighting locations from WDFW. We recommend that allowances be made to conserve gray squirrel habitat consistent with WDFW recommendations.

Response: Units in Benson Creek near gray squirrel observations have been dropped, except for one unit in Yockey Creek. Mitigations consistent with WDFW's Recovery Plan (2007) and Management Recommendations (2010) have been incorporated into the project.

Reference: Page 31-32, Wildlife specialist report.

Comment 23: Management of MA14 has changed because of the fire. Where overstory trees have been killed in these areas, there may no longer be a need for an amendment to thin in these areas. Consideration should be given to assuring that natural regeneration of bitterbrush is successfully occurring or planting might be warranted.

Response: Units were dropped where thinning was no longer needed. Bitterbrush planting is not a part of this project, but may occur later if the need exists and funds are available.

Reference: N/A

Comment 24: What specific design elements will be used to ensure protection of aquatic resources within the project area?

Response: Refer to Appendix A for design criteria specific to aquatics and water quality resource concerns.

Reference: E.A., Appendix A, Pgs. 333-386

North Central WA Forest Health Collaborative Letter

All comments were received during the scoping period.

Comment 1: How will burn severity and the relationship to green tree marking be determined?

Response: Harvest treatment units would avoid extensive areas (larger than one acre) which experienced high levels of tree mortality associated with high or moderate BARC burn severity during the Carlton Complex wildfire. Fire-killed trees within harvest units which are standing or down at the time of timber marking will not be designated for removal during harvest operations. Snags in harvest units will be protected in the timber sale contract with the Leave Dead Standing contract provision. Snags felled to mitigate danger tree safety hazards associated with timber harvest operations would remain on site and not be removed from timber harvest units. Fire created openings within harvest units would be considered canopy gaps which are a treatment objective of restoring the historic spatial pattern of trees. Live tree retention levels of harvest units with fire created openings would not be reduced. The desired number of live trees per acre retained would be based on the total acres in each unit including fire created openings.

Reference: Design Criteria for harvest treatments in areas burned by the fire are described in Appendices A and C of the EA and section 3.2.3.2, Forest Vegetation Conditions: Departure from historic stand structures and lack of resilience to natural disturbance.

Comment 2: What specific design elements will be used to protect aquatic resources within the project area?

Response: Refer to Appendix A for design criteria specific to hydrology and aquatics resource concerns.
Reference: E.A., Appendix A (Pages 333-386)

Comment 3: Will snag retention be accomplished on a 100-acre basis, per OWNF Forest Plan, or a per-acre basis?

Response: Snags would be removed as hazard trees within units if necessary, but this loss is expected to be minor and snags levels would not be measurably affected. Retention of large snags, down wood, and large trees by use of leave clumps, buffers and patches is a key mitigation for loss of snags as hazard trees. Snags would be retained wherever possible. Harvest treatment units would avoid extensive areas (larger than one acre) which experienced high levels of tree mortality associated with high or moderate BARC burn severity during the Carlton Complex wildfire of 2104. Fire killed trees within harvest units which are standing or down at the time of timber marking will not be designated for removal during harvest operations. Snags in harvest units will be protected in the timber sale contract with the Leave Dead Standing contract provision. Snags felled to mitigate danger tree safety hazards associated with timber harvest operations would remain on site and not be removed from timber harvest units. Fire created openings within harvest thinning units would be considered canopy gaps which are a treatment objective of restoring the historic spatial pattern of trees. Live tree retention levels of harvest thinning units with fire created openings would not be reduced. The desired average number of live trees per acre would be retained based on the total acres in each unit with fire created openings.

Reference: N/A

Comment 4: Will this be a stewardship contract, and if so, what additional activities will be included?

Response: At this time, the forest plans to offer the timber sale as a stewardship contract. Additional activities that would be included in the stewardship contract may include road decommissioning and ladder fuel reduction thinning depending on the value of the timber receipts.

Reference: N/A

Comment 5: What is the scope of hazard tree removal along roads and trails in the project area?

Response: Hazard tree felling across the burned portion of the project area was considered as an alternative, but eliminated from further study because Forest Service Manual direction allows for hazard tree removal along roads used for timber hauling described below as "Hazard Tree Removal along Haul Routes." Hazard tree felling along the Highway 20 corridor and in campgrounds is included and analyzed in this document. Public firewood gathering is anticipated to remove hazard trees along open system roads where consistent with the current firewood policy. Remaining hazard trees would be felled at up to 2 trees per mile of road per year. These actions are expected to be sufficient to remove hazard trees where firewood gathering is not allowed along open roads. Debris from hazard tree removal may be used for restoration objectives on a case-by-case basis, considering potential impacts to soils caused by operating machinery in burned areas. The number of hazardous snags requiring removal along Highway 20 is estimated by WA Department of Transportation staff to be approximately 150 trees along the 2 miles of high-severity fire along the state highway within National Forest lands in the project area. The number of hazard tree snags removed elsewhere in the project area will depend on personal judgement of firewood gatherers felling snags, and the hazardous nature of dead trees at the time of timber harvest operations.

Reference: EA, Chapter 2, p. 12, 13, 14, 20

Greg Knott Email

Comment was received during the 30-day comment period.
Comment 1: I appreciate the opportunity to review your plans for the South Summit which certainly needs your help.

Response: Comment noted.

Reference: N/A.

Byron Lee Email

Comment was received during the 30-day comment period.
Comment 1: The proposed project appears to me to be well-considered and reasonable, and I am in favor of it being done. I concur that the proposal selected is reasonable and should be carried out.

Response: Comment noted.

Reference: N/A.

Maurice Williamson/American Forest Resource Council Letter

All comments were received during the 30-day comment period.

Comment 1: AFRC does not support the proposed amendment for MA5-17E and MA1417B (amend to allow for motorized vehicles between Dec. 1 and March 31) because the goals for the management area are being met (as explained in the reason for the amendment).

Response: In order for an exception to be made to this Forest Plan standard, which is needed to allow winter hauling to occur, the goals of the management area as they pertain to the resource being protected, must be met despite the exception. I believe that that deer would not be negatively affected in the management area if the standard is set aside by an amendment. If the amendment is not sought, no winter haul can occur.

Reference: EA, Chapter 3.9

Comment 2: AFRC does not support the proposed amendment for Soil & Water 13-10 (amend to allow for >15% soil disturbance) because the mitigations are sufficient to meet the standard.

Response: This amendment was removed, as it was no longer needed for South Summit II. This amendment was in the first pre-wildfire evaluation of South Summit for units that had high soil disturbance. Upon further review during the 30-day comment period, the project soils specialist determined that those units have been dropped out of South Summit II project because they were burned in the summer of 2014.

Reference: E.A., Chapter 2 (Forest Plan Amendments); Chapter 3.8 (Soils)

Comment 3: AFRC does not support the proposed amendment for MA5-6A and MA14-6A (amend to allow thermal cover below prescription) because the Oka-Wen is not being consistent with other forests, which do not require an amendment for harvest which did not cause the existing condition. The amendment would be appropriate for the one management area where thermal cover would be reduced by 1%.

Response: The Forest Plan standard for cover in management areas 14 and 5 must be amended in order to allow a further reduction to occur, since the cover totals are already below the standard.

Reference: N/A

Comment 4: AFRC does not support the proposed amendment for Protection, Restoration, and Maintenance of Old Growth Stands, if these are no longer old growth stands because of the fire.

Response: All proposed harvest treatments in Forest Plan Old Growth (FPOG) would occur in stands which were not affected by the Carlton Fire or were not substantially altered by the fire and still meet FPOG conditions.

Reference: E. A., Chapter 2, pgs. 15,18. Appendix B, Figure B-1 Harvest Treatment Units (FPOG * Acres).

Comment 5: Harvest of DMT-infected trees > 21" DBH is proposed (sic). Retention of all other trees > 21" DBH does not make sense and will not accomplish the establishment of seral species. Commercial thinning with DMT treatment will be relatively ineffective since you plan to leave trees > 21" dbh. The project should allow removal of mistletoe infected 21" trees.

Response: As a matter of clarification, the proposed action does not include harvest of any trees, including dwarf mistletoe infected trees, ≥ 21" dbh. Proposed regeneration harvest treatments would retain approximately 10 trees per acre, including all trees ≥ 21" dbh (which happen to be predominantly dwarf mistletoe free ponderosa pines) and the largest disease free conifers < 21" dbh (which also happen to be predominantly ponderosa pines), for structural diversity. The few dwarf mistletoe infected Douglas-firs ≥ 21" dbh retained would be girdled or felled and left on site following logging to provide snag and down log habitat and prevent disease infection of Douglas-fir trees which become established via natural seeding following site preparation and planting. Ponderosa pine seedlings would be planted following harvest to establish stands comprised of primarily early seral trees.

The Okanogan-Wenatchee Forest Restoration Strategy of 2012 (FRS) provides direction that old trees will be retained and to achieve old, large tree restoration objectives. The vast majority of shade-tolerant conifers (i.e. Douglas-firs) ≥ 21" dbh in late and old structure (LOS) stands and all other stands with proposed harvest thinning treatments are considered large and old trees (estimated age of > 150 years) based on criteria of the FRS and will be retained to meet FRS objectives. Removal of shade tolerant conifers < 21" dbh and retention of early seral conifers (i.e. ponderosa pine and western larch) of all size classes in LOS, Forest Plan Old Growth, and all other stands with proposed harvest thinning treatments are expected to be effective at maintaining and enhancing early seral tree species and achieving fuel reduction objectives while maintaining LOS stands and old growth structural attributes.

Reference: E.A., Section 3.2.3.2 , Forest Vegetation Conditions: Departure from historic stand structures and lack of resilience to natural disturbance, Seed Tree Regeneration. Appendix C. Seed Tree Regeneration (HSTF).
The Okanogan-Wenatchee National Forest Restoration Strategy: adaptive ecosystem management to restore landscape resiliency. Appendix B.

Comment 6: We urge salvage of a higher proportion of the burned area. Not harvesting in severely burned areas shows a lack of willingness to use site specific judgement and is a contributor to the loss of acreage to be treated.

Response: Salvage harvesting was an alternative that was considered but not developed further because by the time the contract would be ready for award/ harvesting, it was estimated that the trees would have lost most of their value. This estimate is based on direct input from timber industry representatives.

Reference: EA, Chapter 2.1: Alternatives considered but eliminated from detailed study.

Comment 7: There is no justification to use soil disturbance as a proxy for soil productivity. The EA over-reacts to soil issues. There is nothing from monitoring that

indicates that soil productivity or forest growth has been reduced by previous harvest. The discussion of soil productivity, erosion, etc. is disjointed and contradictory.

Response: Soil disturbance such as compaction, rutting, and erosion have been shown to reduce tree growth and site production in many studies (please see the link provided and references cited in the paper that discuss this connection at length). It is not just erosion or compaction alone that reduces soil and site productivity, but rather a combination of many factors that can reduce soil productivity in forested ecosystems. Most, if not all the time, it takes many decades to observe soil productivity changes, as these changes are not instantaneous. Research is on-going to measure the effects of management activities on forest soils (such as the North American Long-Term Soil Productivity Study that is currently in its 20th year).

Reference: http://forest.moscowfsl.wsu.edu/smp/docs/docs/Elliot_1-57444-100-0.html.

Comment 8: The EA does not adequately address Douglas-fir bark beetle. There should have been an analysis done on the Douglas-fir beetle as there was for spruce budworm risk.

Response: A preliminary Douglas-fir beetle assessment was conducted in the project area including campgrounds following the fire. Forest Service forest pest management personnel based out of the Wenatchee Forest Science Laboratory will monitor insect activity including Douglas-fir beetles in the Carlton wildfire area during the 2015 field season and at least two subsequent years. A combination of tree sampling on fixed radius plots and pheromone traps will be employed in locations where mixed conifer old growth stands remain after the fire to provide information on tree colonization and insect flight patterns and species diversity. If monitoring results indicate that Douglas-fir beetles are likely to cause unacceptable damage, the Forest Service would analyze the costs, benefits, and environmental effects of implementing an MCH anti-aggregation pheromone treatment to reduce tree mortality. From a recent a historical context, Douglas-fir beetle populations following the Tripod Fire of 2006 did not increase to levels that warranted an MCH application to reduce tree mortality, even though stands with large Douglas-fir trees were present in and adjacent to the fire area following the fire.

Reference: N/A

Comment 9: There is no adjustment of the current vegetative cover when the harvest operations would commence. The effects of a harvest operation should be reflective of the re-vegetation season.

Response: The discussion of ground cover vegetation was to connect the reduction of stream sediment and erosion to plant growth and the return of soil biological processes over the next several years. Ground cover re-establishment was not used to restrict any timber harvest guidelines.

Reference: N/A

Comment 10: Paragraph 3.5.2 is inappropriate since it is highly unlikely that any west-side firm would bid on this project.

Response: Paragraph 3.5.2 is intended to describe log markets and our recent experience in offering timber sales over the past 3 years.

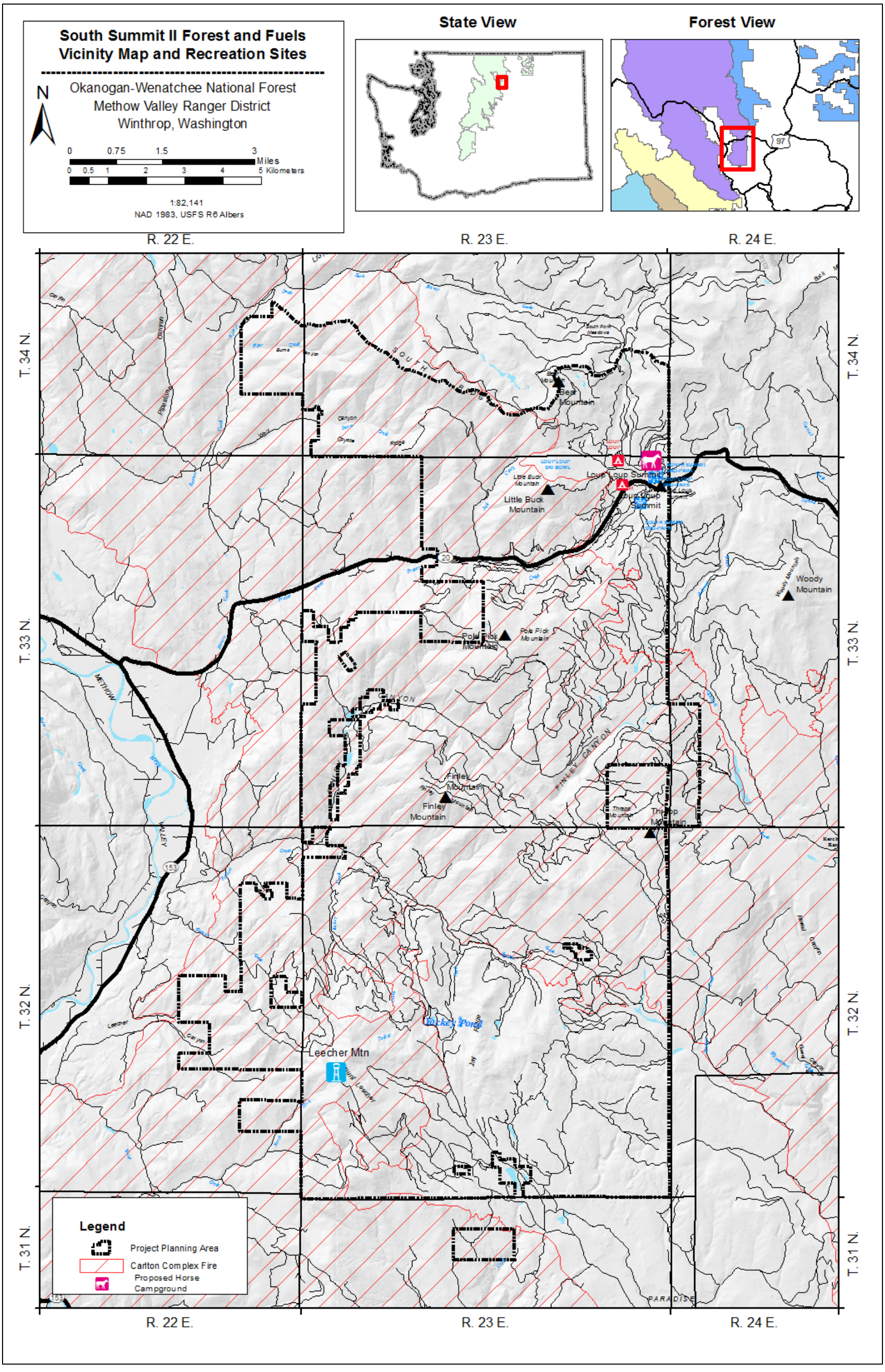
Reference: N/A

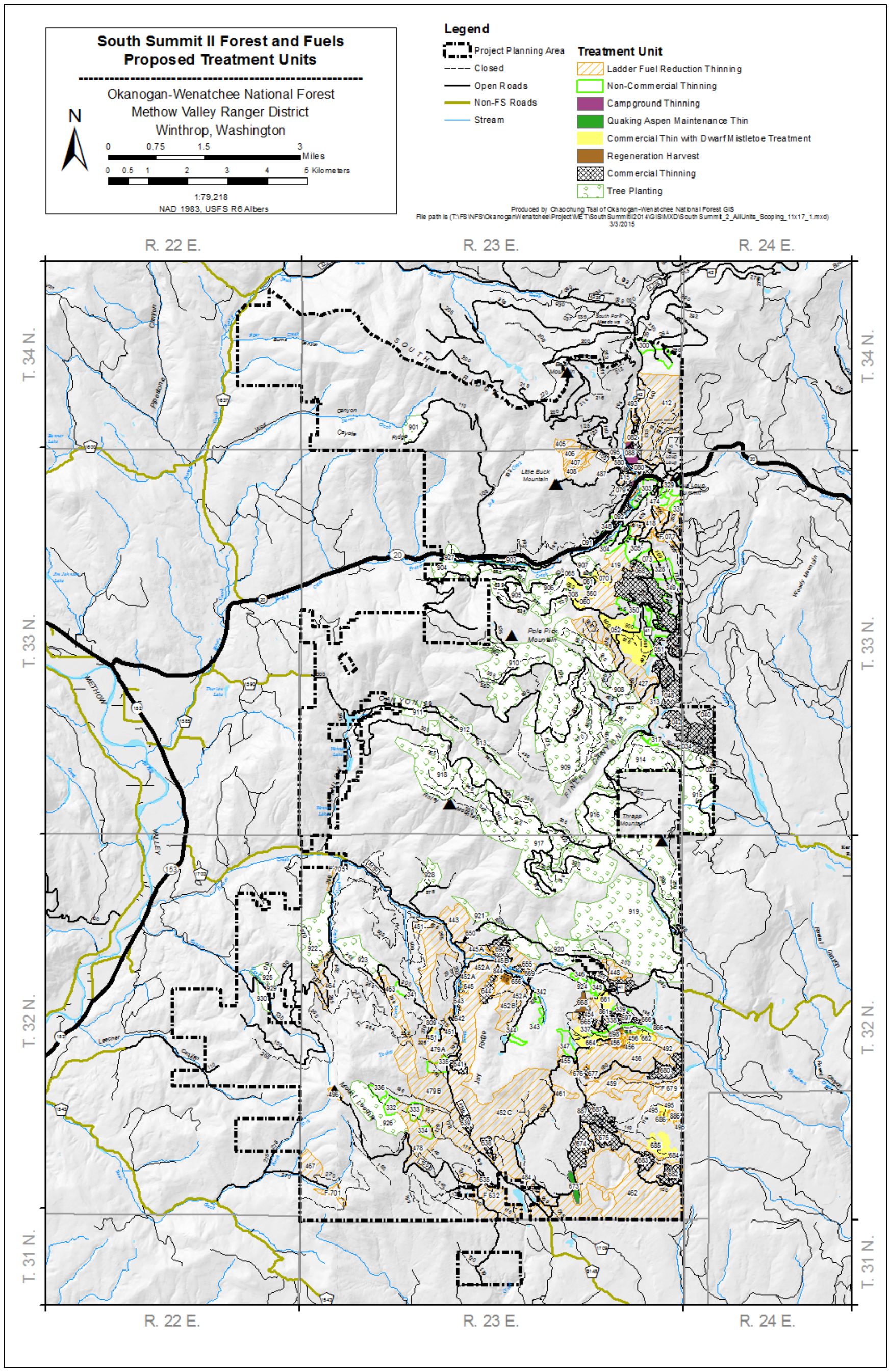
Comment 11: When replanting trees, it would seem logical to follow the "skip and gap" construct.

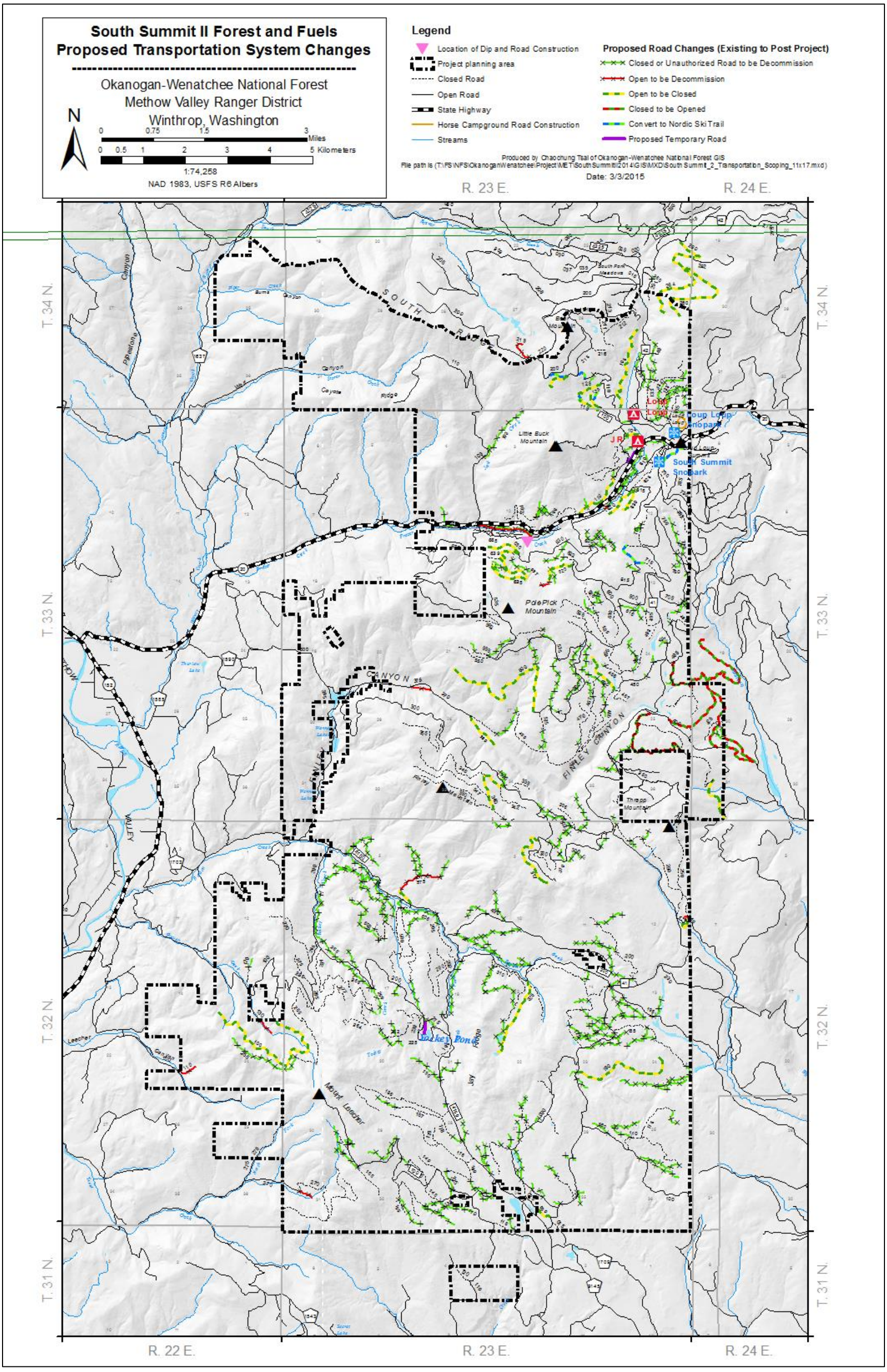
Response: Exterior tree planting unit boundaries incorporated landscape scale "skips" based on topography (ridgetops, steep slopes, and rocky unplantable areas) riparian areas, and road access. Seedlings will be planted in microsites adjacent to large stumps, down logs, and rocks to mimic historic patterns of tree distribution and encourage a non-uniform distribution of planted seedlings. Conifer seedlings would not be planted within 50 feet of areas occupied by aspen suckers which will provide gaps in conifer distribution. Seedling survival typically is not uniform throughout planting units and seedling mortality is expected to be concentrated in areas with harsh site conditions which will provide gaps in conifer distribution. Contiguous areas up to 2 acres in size with less than desired or no stocking at all identified during seedling monitoring would not be replanted to maintain gaps caused by low or no seedling survival.

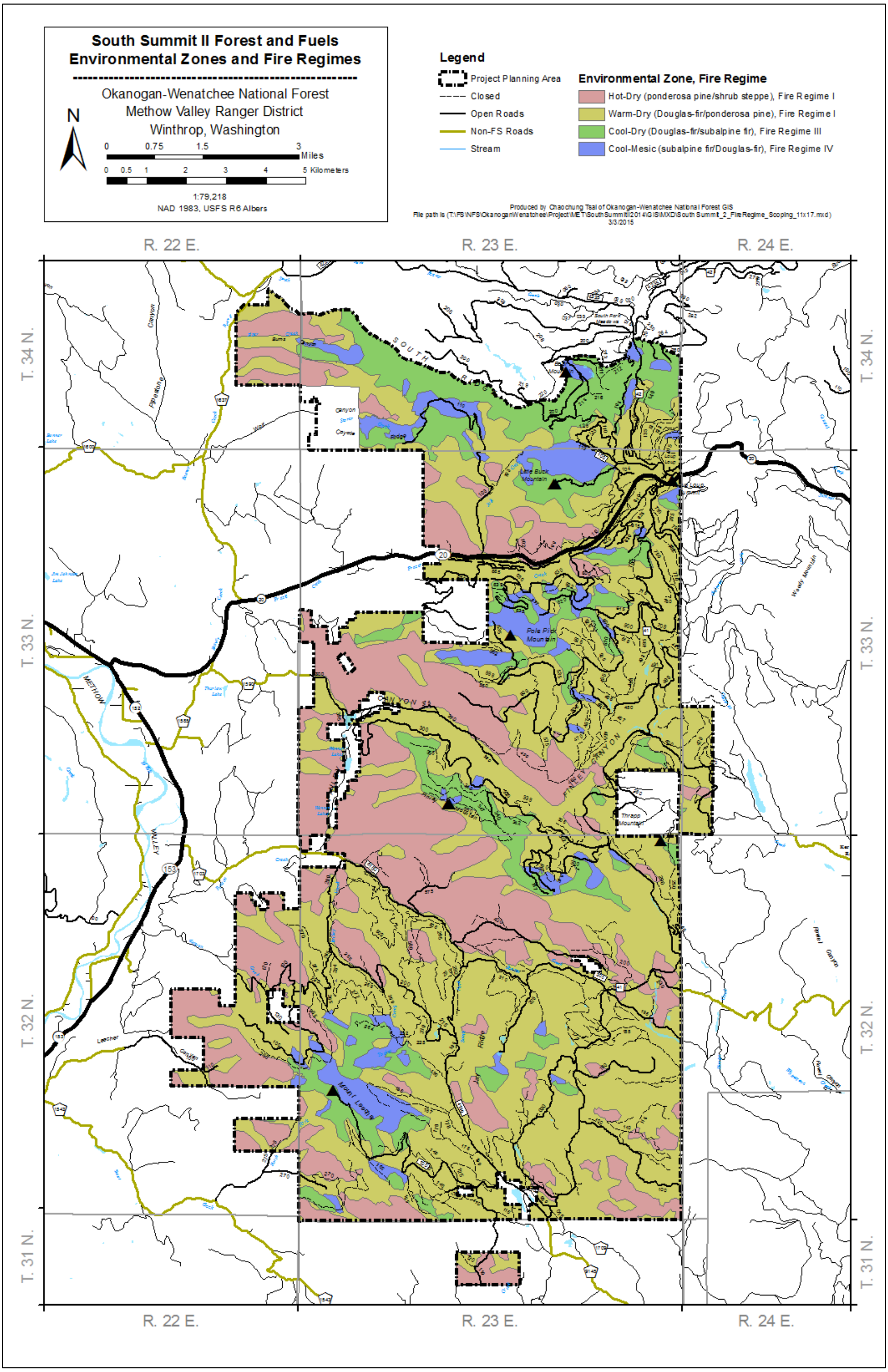
Reference: Section 3.2.1, Reforestation of Areas Deforested by the Carlton Complex wildfire, Analysis Methods. Appendix A, Design Criteria and Mitigation Measures Item #19.

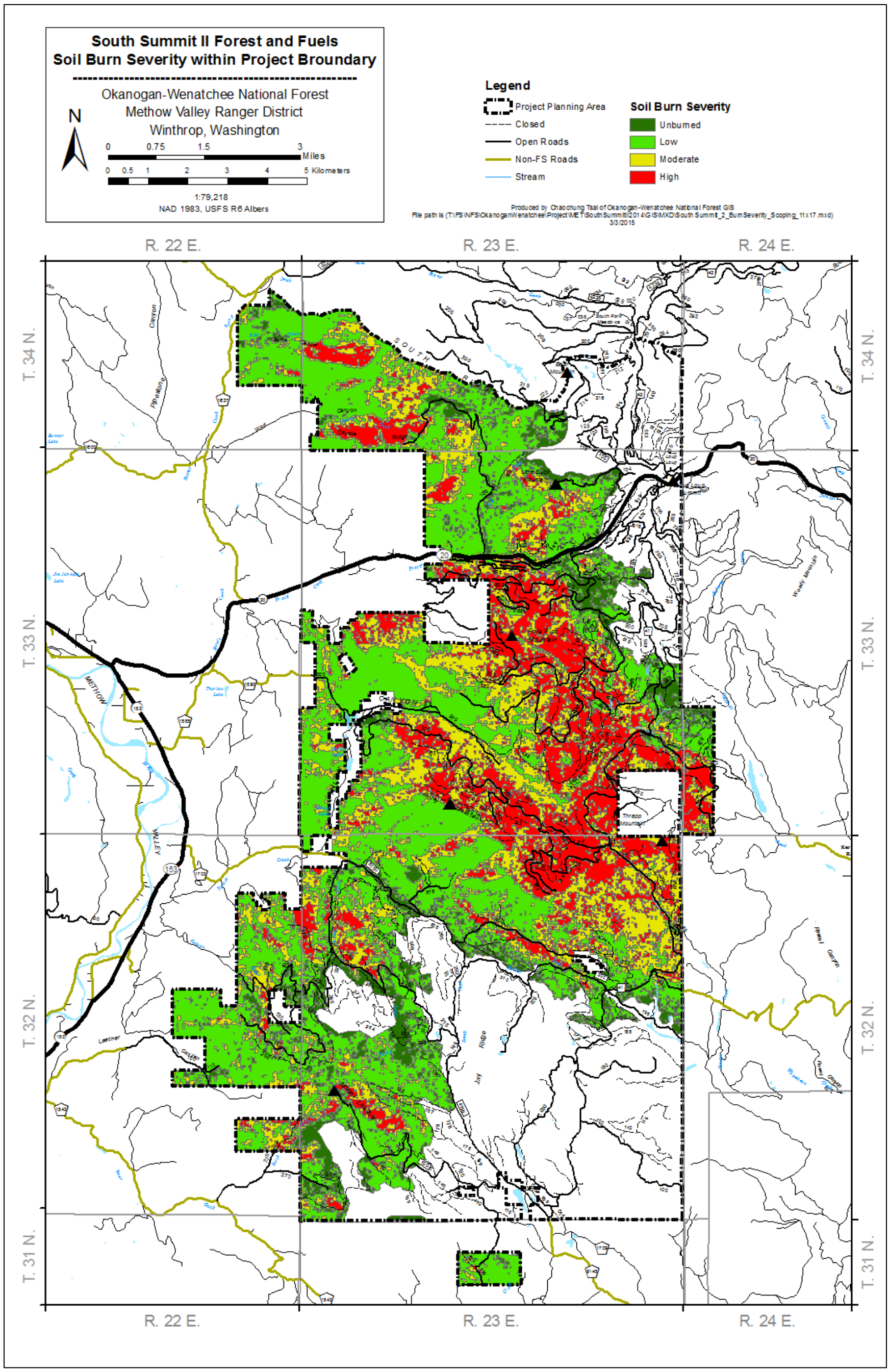
Appendix J: Project Maps


South Summit II Forest and Fuels
Vicinity Map and Recreation Sites
Okanogan-Wenatchee National Forest
Methow Valley Ranger District
Winthrop, Washington
N
0 0.75 1.5 3 Miles
0 0.5 1 2 3 4 5 Kilometers
1:82,141
NAD 1983, USFS R6 Albers
State View
Forest View
R. 22 E.
R. 23 E.
R. 24 E.
T. 34 N.
T. 33 N.
T. 32 N.
T. 31 N.
Bear Mountain
Loup Loup Summit
Little Buck Mountain
Woody Mountain
Pole Pick Mountain
Finley Mountain
Thrasp Mountain
Leecher Mtn
Legend
Project Planning Area
Carlton Complex Fire
Proposed Horse Campground


South Summit II Forest and Fuels
Proposed Treatment Units
Okanogan-Wenatchee National Forest
Methow Valley Ranger District
Winthrop, Washington
N
0 0.75 1.5 3 Miles
0 0.5 1 2 3 4 5 Kilometers
1:79,218
NAD 1983, USFS R6 Albers
Legend
Project Planning Area
Closed
Open Roads
Non-FS Roads
Stream
Treatment Unit
Ladder Fuel Reduction Thinning
Non-Commercial Thinning
Campground Thinning
Quaking Aspen Maintenance Thin
Commercial Thin with Dwarf Mistletoe Treatment
Regeneration Harvest
Commercial Thinning
Tree Planting
Produced by Chaochung Tsai of Okanogan-Wenatchee National Forest GIS
File path is (T:\FS\NFS\Okanogan\Wenatchee\Project\METT\SouthSummitII\2014\GIS\MXD\South Summit_2_AllUnits_Scoping_11x17_1.mxd)
3/3/2015
R. 22 E.
R. 23 E.
R. 24 E.
T. 34 N.
T. 33 N.
T. 32 N.
T. 31 N.
SOUTH
METHOW
VALLEY
Little Buck Mountain
Pole Pick Mountain
Thrapp Mountain
Wooly Mountain


South Summit II Forest and Fuels
Proposed Transportation System Changes
Okanogan-Wenatchee National Forest
Methow Valley Ranger District
Winthrop, Washington
N
0 0.75 1.5 3 Miles
0 0.5 1 2 3 4 5 Kilometers
1:74,258
NAD 1983, USFS R6 Albers
Legend
Location of Dip and Road Construction
Project planning area
Closed Road
Open Road
State Highway
Horse Campground Road Construction
Streams
Proposed Road Changes (Existing to Post Project)
Closed or Unauthorized Road to be Decommission
Open to be Decommission
Open to be Closed
Closed to be Opened
Convert to Nordic Ski Trail
Proposed Temporary Road
Produced by Chaochung Tsai of Okanogan-Wenatchee National Forest GIS
File path is (T:\FS\NFS\Okanogan\Wenatchee\Project\MET\SouthSummitII\2014\GIS\MXD\SouthSummit_2_Transportation_Scoping_11x17.mxd)
Date: 3/3/2015
R. 23 E.
R. 24 E.
T. 34 N.
T. 33 N.
T. 32 N.
T. 31 N.
R. 22 E.
R. 23 E.
R. 24 E.
SOUTH RIDGE
Little Buck Mountain
Pole Pick Mountain
CANYON
FINLEY CANYON
Thrapp Mountain
Mount Leecher
Jackey Pond
Loop
Loop
Loop
Loop
JR
South Summit Snopark


South Summit II Forest and Fuels
Environmental Zones and Fire Regimes
Okanogan-Wenatchee National Forest
Methow Valley Ranger District
Winthrop, Washington
N
0 0.75 1.5 3 Miles
0 0.5 1 2 3 4 5 Kilometers
1:79,218
NAD 1983, USFS R6 Albers
Legend
Project Planning Area
Closed
Open Roads
Non-FS Roads
Stream
Environmental Zone, Fire Regime
Hot-Dry (ponderosa pine/shrub steppe), Fire Regime I
Warm-Dry (Douglas-fir/ponderosa pine), Fire Regime I
Cool-Dry (Douglas-fir/subalpine fir), Fire Regime III
Cool-Mesic (subalpine fir/Douglas-fir), Fire Regime IV
Produced by Chaochung Tsai of Okanogan-Wenatchee National Forest GIS
File path is (T:\FS\NFS\Okanogan\Wenatchee\Project\MET\SouthSummitII\2014\GIS\MXD\South Summit_2_FireRegime_Scoping_11x17.mxd)
3/3/2015
R. 22 E.
R. 23 E.
R. 24 E.
T. 34 N.
T. 33 N.
T. 32 N.
T. 31 N.
Pole Pine Mountain
Little Buck Mountain
Mount Lassen
Thrapp Mountain
METHOW
VALLEY
SOUTH RIDGE
PINEY CANYON


South Summit II Forest and Fuels
Soil Burn Severity within Project Broundary
Okanogan-Wenatchee National Forest
Methow Valley Ranger District
Winthrop, Washington
N
0 0.75 1.5 3 Miles
0 0.5 1 2 3 4 5 Kilometers
1:79,218
NAD 1983, USFS R6 Albers
Legend
Project Planning Area
Closed
Open Roads
Non-FS Roads
Stream
Soil Burn Severity
Unburned
Low
Moderate
High
Produced by Chaochung Tsai of Okanogan-Wenatchee National Forest GIS
File path is (T:\FS\NFS\Okanogan\Wenatcheel\Project\MET\SouthSummitII\2014\GIS\MXD\South Summit_2_BurnSeverity_Scoping_11x17.mxd)
3/3/2015
R. 22 E.
R. 23 E.
R. 24 E.
T. 34 N.
T. 33 N.
T. 32 N.
T. 31 N.
METHOW
VALLEY
SOUTH
Thrasp Mountain