CHAPTER 3 – ENVIRONMENTAL CONSEQUENCES

This chapter presents information on the physical, biological, social, and economic environments of the affected project area, and the potential direct, indirect and cumulative effects to those environments due to the implementation of the alternatives. These effects are the scientific and analytic basis for the comparison of alternatives.

Each resource area discloses the direct, indirect and cumulative effects for that resource area. The National Environmental Policy Act defines these as:

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

The Environmental Assessment (EA) herby incorporates by reference the project record (40 CFR 1502.21). The project record contains specialist reports and other technical documentation used to support the analysis and conclusions in this EA. Specialist reports were completed for fire/fuels, vegetation resources, soils, hydrology, fisheries, wildlife, botany, invasive plants, recreation, and heritage resources. Separate biological evaluations and/or biological assessments were completed for botanical species, aquatic species, and terrestrial wildlife species as part of the consultation process with the National Marine Fisheries Service (NMFS) and the U.S. Fish & Wildlife Service (FWS). Full versions of these reports are available in the project record, located at the Barlow Ranger District office in Dufur, Oregon.

Setting the Stage

Since the Billy Bob Hazardous Fuels Reduction project is being prepared under the Healthy Forests Restoration Act, and is within the Wildland Urban Interface, the no action alternative is not required to be developed. Understanding what would occur should no action be taken, however, is as important to gaining an understanding of the effects of the proposed action as well as to helping the readers and the decision maker understand why this project fits the purpose of the Health Forests Restoration Act to:

> *…reduce the risk to communities,…and other at-risk Federal land through…implementing hazardous fuels reduction projects…and…protect, restore, and enhance forest ecosystem components…*

Both the Fire/Fuels (12/4/07) and Silviculture (8/22/07) Specialists Reports, by District Fuels Specialist, Scott MacDonald and District Silviculturist, Kim Smolt respectively, give details on what is expected to occur over time without treatment. Both reports are summarized in this chapter.

Fire / Fuels Management

A more detailed fuels report is located in the project record, located at the Barlow Ranger District. The analysis and conclusions of the report are summarized below. Reference material is contained in the full specialists report.

Existing Conditions

Historical Fire Regimes

Fire suppression efforts of the past 75-85 years have altered stand composition and structure and increased tree and brush densities. In the eastern portion of the project area, a fire regime with frequent fire return intervals of low and moderate intensity, as in the Pine/Pine-Oak fuel vegetation type, the vegetation would consist of well-spaced fire tolerant species such as ponderosa pine, white oak, some western larch, and dry climate Douglas-fir. The shade tolerant, thin barked species such as white fir, lodgepole, and juniper would be thinned out regularly by fire. Stand structure changes include a much higher stocking level of fire tolerant species, an increase of shade tolerant species in the intermediate layer, an increased shrub and reproduction component and fewer openings associated with the natural stands. This change results in stands that are more likely to experience a higher intensity fire, with stand replacing consequences.

The western area of the project area, predominately west of Camp Baldwin, but more specifically west of the 4440 Road, is characterized by a fire regime of mixed severity (areas of low severity, surface fire as well as some high severity, stand-replacing). These areas are primarily between the 4440 and 4430 roads, but also include north facing slopes and riparian areas at the higher elevations, within the moist grand fir, mixed conifer zones. There are areas that likely burned at a low severity due to the presence of mature ponderosa pine in the overstory of the mixed conifer stands, and evidence of past fires can be seen in the fire scars on the large ponderosa pines within these stands. Many large ponderosa pine have been encroached upon the shade tolerant species (photo 1), and are susceptible to mortality due to crown scorch/torching. Historical fire return intervals in these areas are in the 50 years or less (moist Douglas-fir), to the 50 to 100 year fire return interval of the mixed conifer zone (e.g., grand fir, western hemlock, white pine, western larch). These species typically have a low to moderate fire tolerance, as low intensity, high frequency fires do not occur, due to higher moisture amounts and greater fuel loadings.

The fire regime concept is a generalized method of characterizing the historical role fire played in an ecosystem, describing fire effects and vegetative conditions that likely contributed to historical fire behavior (i.e., flame length, fire size, and crowning/scorching potential). The fire regime concept does not provide a means to judge the role of fire as either beneficial or detrimental.

Three historical fire regimes (Agee, 1993) are thought to have existed in Billy Bob Hazardous Fuels Reduction Project, Analysis Area: 1) low severity, Fire Regime I (Pine-Oak); 2) mixed severity, Fire Regime III (dry climate Douglas-fir); and 3) moist grand fir/mixed conifer. The Fire Regime III zones on the Mt. Hood National Forest have been further refined based on earlier analysis work using Fire Groups (pre-fire regime), and they are classified as Fire Regime IIIA (<50 years, mixed severity), Fire Regime IIIB (50 to 100 years, mixed severity), and Fire

Regime IIIC (100 to 200 years, mixed severity). Based on the historical role of fire in the plant communities, and field observations of stands within the project area, a much smaller portion of the landscape contained fuels that are highly susceptible to stand-replacement fire.

Stand development within the ponderosa pine/oak types was associated with frequent, light surface fire (<35 year fire-free intervals), from lighting ignitions as well as Native American burning. This scenario is referred to as the Low Severity Fire Regime. Historically, stand development within the mixed conifer plant associations were associated with both crown fire and mixed severity surface fires with a relatively short return (5-50 year fire-free intervals). This scenario is similar to the Moderate Severity Fire Regime (Fire Regime 3) described by Agee (1993). Currently, much of the area within the mixed conifer and pine-oak types would likely contribute to high severity fire, except areas that were previously underburned or mechanically treated within the past 10 to 15 years.

Meadows, shrub-scablands, and non-forest areas, are classified as fire regime 2, moderate severity for the grass fuel type; some of the plantations within the project area fall in to this category due to low survival of planted trees and predominant grass and shrub fuels within the stand.

Fire history for the non-Forest Service ownership (Camp Baldwin and private) near the planning area was not collected. Some burning of piles (landing and machine) from thinning has occurred on the private ownership over the past 20 years, but there are no records of escapes or other uncontrolled fire events from these operations. Several large fires have occurred in or near the private land/Camp Baldwin area in the past 100 years; the Football Fire of 1982 (approx. 1 ½ miles W/NW Camp Baldwin), and the Dog River Fire of 1908 (approx. 3 miles west of Camp Baldwin). These were generally wind driven from the west, and mixed to high severity events. There is physical evidence of past fire occurrence in the untreated stands, such as burned snags and fire scars in the large ponderosa pines (See Figure 3-1).

Further historical evidence comes from the 1916 to 1930 fire atlas. There was an un-named fire in 1916 that reached 330 acres NW of Camp Baldwin. In 1924 there were two fires in Dog River drainage of 300 acres and 115 acres, as well as a 200 acre fire approximately one-mile south of Camp Baldwin, near the 44-4450 junction. Fire history between 1931 and 1960 is currently unavailable, but there is reference to successful fire control efforts from district letters prior to 1970 (Surveyors Ridge LSR, 1997). Based on the above numbers, small fires do occur in or near the Camp Baldwin area about every 10 to 25 years (the last being the Football Fire, 1982). Initial attack fire suppression capabilities have increased in efficiency as equipment, training, and response has increased, so the large fire occurrence has most likely dropped over the last 30 years within the planning area. The historical evidence does point to the potential of a large fire occurrence depending on start frequency, location, availability and response time of suppression resources.

Figure 3-1: Physical evidence of past fire occurrence in the untreated stands. (Left) Burnt snag with grand fir Reproduction Unit 5. (Right) Fire scar in large ponderosa pine, grand fir reproduction encroachment, Unit 6.

Condition Class

Condition Class is a current method of quantifying the stand structure or fire in ecosystem, and it relative condition compared to historical, non-suppression, of a given area. See Table 3-1 for definitions of the three levels.

Table 3-1: Condition Class Attributes

Condition Class	Attributes	Example Management Options
Condition Class 1	• Fire regimes are within or near an historical range. • The risk of losing key ecosystem components is low • Fire frequencies have departed from historical frequencies (either increased or decreased) by no more than one return interval. • Vegetation attributes (species composition and structure) are intact and functioning within an historical range.	Where appropriate, these areas can be maintained within the historical fire regime by treatments such as fire use.

Condition Class	Attributes	Example Management Options
Condition Class 2	• Fire regimes have been moderately altered from their historical range. • The risk of losing key ecosystem components has increased to moderate. • Fire frequencies have departed (either increased or decreased) from historical frequencies by more than one return interval. This change results in moderate changes to one or more of the following: fire size, frequency, intensity, severity, or landscape patterns. • Vegetation attributes have been moderately altered from their historic ranges.	Where appropriate, these areas may need moderate levels of restoration treatments, such as fire use and hand or mechanical treatments, to be restored to the historical fire regime.
Condition Class 3	• Fire regimes have been significantly altered from their historical range. • The risk of losing key ecosystem components is high. • Fire frequencies have departed (either increased or decreased) by multiple return intervals. This change results in dramatic changes to one or more of the following: fire size, frequency, intensity, severity, or landscape patterns. • Vegetation attributes have been significantly altered from their historical ranges.	Where appropriate, these areas need high levels of restoration treatments, such as hand or mechanical treatments. These treatments may be necessary before fire is used to restore the historical fire regime.

The project area is characterized, based on mapping and field verification, primarily in a condition class 3, either from stand structure at the west end of the project area, or from a lack of natural fire occurrence in the lower elevation Fire Regime 1. Estimated amounts of the area and condition class are in Table 3-2. Currently, almost 60 percent of the project area is in Condition Class III, either from lack of fire within fire adapted ecosystems, or stand conditions considered “out of whack” either from past management practices or lack of management within these areas. Many areas in condition class 1 are previously treated stands, plantations, or large riparian type areas. The overall planning area, incorporating the Priority 1, 2, and 3 areas, is approximately condition class 3 over about 70 percent of the area, primarily from the Camp Baldwin area eastward, with the condition class 2 and 1 areas westward of Camp Baldwin (due to higher elevation and stand structure).

Table 3-2: Condition Class in Project Area

Condition Class	Percent of Area (approx.)
Condition Class 1	34%
Condition Class 2	9%
Condition Class 3	57%

The condition class change on a landscape level is less than 20 percent of the overall planning area involved, but would modify the stands adjacent to the private land (WUI) from current condition class 3 to a condition class 2 or 1, and maintain some of the existing condition class 1 areas previously treated.

Identified Wildland Urban Interface (WUI) areas, either through the federal register or an approved County Wildfire Protection Plan, are areas to be treated as part of the Healthy Forest Restoration Act, and therefore do not need to show a change in the condition class at the landscape level to be treated. Future treatments within the larger planning area (primarily east of Camp Baldwin) may provide for a substantial change in condition class, and as such would be analyzed in more detail at that time.

Current Fire Hazard/Fire Risk

The probability of fire in the future can be estimated by combining fire risk and fire hazard. Fire risk is the chance that a fire would occur. It is normally obtained through fire history analysis (average number of fires for a given area). Fire hazard is the fuel, topography, and weather conditions that affect fire spread and intensity. Fuel is the only parameter that can be directly manipulated to reduce or increase the amount of fire spread and intensity.

Fire Risk

Most fires within this planning area have been quickly suppressed at less than ten acres with the majority of the fires less than 1 acre. Between 1985 and 2006, a total of six wildfires have occurred within the planning area, and another 32 within three miles of the planning area. Based on historical averages, a wildfire ignition would occur within or adjacent to the planning area once every five to six years. Prior to 1985, the historical records reference the Football fire (1982), the Dog River fire (1908); records of other earlier fires from 1931 to 1960 are currently unavailable, The past six fires have all been less than a quarter acre in size, totaling 1.5 acres within the planning area or 0.1 percent of the area. Prescribe fire activities have occurred in the planning area over the past 15 years on approximately 1150 acres or 15 percent of the 7900 acres in the planning area. Approximately 700 acres of the underburned areas met fuel reduction objectives.

Fire occurrence data for this planning area is shown below. Current data layers available for analysis do not have fire cause or size in the data tables (exception being the 1916-1930 fire atlas data). Most fires within the larger Mile Creeks and Surveyors Ridge Analysis areas have occurred outside the Billy Bob planning area, fairly evenly distributed from the north, west and south directions. Due to larger, private agricultural lands to the east, fire starts have been limited by the reduced public access.

Human-caused fire risk within and outside the planning area would likely increase in the future, due to increasing populations and higher public use of our National Forests. This increase is impossible to quantify. Consequently, the Forest Service assumes that all fire risk would remain about the same in the future. The values in Table 3-3 are all based on the number of fires/year for comparison purposes.

Table 3-3: Number of Fires / Year

1985-2006	Total Fires	Fires/Year (22 years)
Inside boundary of Planning Area	6 (Human 6, Lightning 2)	0.27/year
Outside the Planning Area, 3 miles	32	1.45/year
Total for Planning Area – Inside & Out	38	1.73/year

The above numbers do not include the larger fires before 1985, but are noted earlier, showing the potential for large fire occurrence (greater than 200 acres) roughly every 10 to 25 years. The above data does not include any Oregon State Department of Forestry fire data; although there is a historical potential for an ignition to occur on state lands and move onto federal jurisdiction, from a northerly or easterly direction (Sheldon Ridge, School Marm, and Browns Creek fires). The summer of 2006 also brought to the forefront a concern from a large fire started within the Highway 35 corridor: the Blue Grass Fire. Shortly after the fire started a long-term risk assessment was performed, and there was an 87 percent chance, initially, of this large fire either pre-heating the west aspect of the valley or spotting across to Surveyor Ridge region and potentially burning into The Dalles Watershed (Blue Grass Long Term Fire Assessment, Evers, 2006). This included the Dog River drainage portion, which is only three miles west of the project area. Fire behavior potential from this occurrence is covered in the fire hazard section.

Fire Hazard

Current fuel profiles within project area generally reflect a moderate to high susceptibility to stand-replacement fire. A stand replacement fire would burn with severity that reduces basal area by at least 50 percent. Stands within the area were rated on a relative scale, by their potential to burn with stand replacing characteristics.

Fire hazard was determined by using the thirteen National Forest Fire Laboratory (NFFL), (and in some cases the recently added 27 fuel models), slope, and aspect, and based on the potential fire behavior in these areas. All areas with no fuel, identified as fuel model 1, or previously successful fuel treatments were classified as low hazard (regardless of slope and aspect). All areas identified as fuel models 5 (plantations) and 9 (pine-oak) with slopes less than 30 percent and an aspect of east, northeast, north or northwest were classified as moderate hazard. Areas identified as fuel models 9, 10, and TU5 with slopes greater than 30 percent or an aspect southeast, south, southwest, or west were classified as high hazard. All other fuel models regardless of slope and aspect were classified as high hazard. (See Tables 3-4 and 3-5 for more details.)

Table 3-4: Susceptibility of Stand Replacing Fires

Susceptibility to Stand Replacing Fire	Percent of Project area (Acres)
Low	0% (0)
Moderate	45% (646)
High	55% (764)

Table 3-5: Fire Hazard Characteristics

	Low Susceptibility	Moderate Susceptibility	High Susceptibility
Fire Behavior Characteristics	Low intensity surface fire; crown fire unlikely < 4 ft FL <100 BTU/FT/S	Severe surface fire; torching, spotting likely; potential for crown fire 4-8 ft. FL 100-500 BTU/FT/S	Probable crown fire, severe surface fire; extreme fire behavior likely >8 ft FL and >500 BTU/FT/S
Representative Fuel Model (FM) Descriptions	FM 1, FM 2/9, FMTU1 treated; non-vegetated areas	FM 5, FM 6 , FM 9, FM10 if on E, NE, N or NW aspects or < 30% slopes	FM 9 & FM 10, FMTU5 if on SE, S SW, or W aspects or slopes > 30%; FM 4; FM 11; FM 12; FM 13
Initial Attack Considerations	Direct attack probable with hand crews	Direct attack not possible with hand crews; mechanized equipment use probable	Direct attack not feasible with ground/air resources
Stand Level Effects	Short-term effects; low intensity mosaic created; <20% overstory mortality	Torching within stand creates patches or mortality and mosaic within stand; 20-60% overstory mortality	Greater than 70% of stand burned; >70% overstory mortality
Landscape Level Effects	Minimal long-term effects on soils, watershed, and productivity	Possible long-term effects on soils, watershed, and productivity, greater effects if in riparian areas	Probable long-term effects on soils, watershed, and productivity, especially in riparian areas
Visual Effects on Landscape	Visual effects not readily apparent	Initial visual impression is of a cleaning of ground fuels and reprod; new openings in canopy and new snags	Initial visual impression is destruction of 50% fuels/vegetation, stand structure re-iniated.
Burning Conditions & Fire Effects	Severe summer weather (97%) could increase fire size	Severe summer weather could produce active crown fire – low crown base height	Normal summer weather could produce severe intensity fires, active crown fire

Abbreviations: FL= flame length, feet, based on fuel loading and amount of fuel available; ROS = Rate of Spread, Chains/hour (1 chain = 66’), depends on slope, wind, and fuels available; FM= Fuel Model

Fire behavior for this planning area can be characterized by assigning one of the thirteen standardized NFFL fuel models as described by Anderson (1982), or using the additional 27 fuel models by Scott & Burgan (2005). These fuel models relate to varying levels of flame lengths and rates of spread for given weather, fuel conditions (loading), fuel moisture (percent of oven dry weight in water), and topography. Fuel models consider primarily zero to three-inch fuel size classes, and estimate behavior, based on fuel group (grasses, brush, timber, slash), fuel loading, the quantity of fuels (generally measured in tons per acre), and the distribution among the fuel particle size classes (0 to 3 inches). Fuel load and depth are important properties for predicting whether a fire would be ignited, and its rate of spread and intensity. The criteria for choosing a fuel model include the fact that fire burns in the fuel stratum best suited to support the fire (Anderson, 1982). The majority of the planning area can be described by five different fuel models; 2, 5, 6, 9, TU1, 10, TU5, and 11.

Fuel Model 2 is generally for grass meadows or could be representative of wheat/agriculture fields on private land (which are not prevalent or in large enough areas to be a concern – not used for fire behavior comparison on project – reference only).

- Fuel Model 5 can characterize areas with dense Bitterbrush, Ceanothus, or Manzanita, as well as some plantations.
- Fuel Model 6 may be used for the same fuel types as fuel model 5 depending on time of year and moisture in plants.
- Ponderosa pine and pine associated stands are normally a Fuel Model 9, and previously treated stands fall under more of a Fuel Model TU1, grass under timber overstory (desired condition from fire behavior model outputs).
- Fuel Model 10 represents litter beneath a timber stand, generally associated with mixed conifer, fir species, or any stand with a high percentage of down and dead material.
- Fuel Model TU5 is also used for timbered stands with an understory as would be found in the mixed conifer stands NW and West of Camp Baldwin, as well some of the areas in or adjacent to riparian areas along 8 Mile and Ramsey creeks.
- Stands with light logging slash can be characterized by Fuel Models 11 or 12 depending on loading of down material.

A full description of these fuel models and associated fire behavior characteristics can be found in "Aids to Determining Fuel Models for Estimating Fire Behavior" (Anderson, Hal E.; April 1982: GTR INT-122), also in “Standard Fire Behavior Fuel Models: A Comprehensive Set for Use with Rothermel’s Surface Fire Spread Model” (Scott, Joe H. & Burgan, Robert E.; June 2005: RMRS-GTR-153).

The predicted fire behavior characteristics for fuel models in the planning area are estimated based on the 97th percentile fire weather for the area (generally worse case weather conditions), and was determined using the weather observations from Pollywog Remote Automated Weather

Station (RAWS) located within The Dalles Watershed, approximately five miles north of Camp Baldwin. These weather observations were recorded at 2:00 PM each afternoon during the fire season (June 1 to October 15) from 1985 to 2006. This information was collated and analyzed using the FireFamily plus software. Adjustments to wind effects have been made, due to sheltering that has occurred with the Pollywog RAWS, lowering actual winds observed at the project area, as well as onsite weather observations taken during field surveys for the past two seasons. Predicted winds from the Pendleton weather service can vary from calm to 15 mph, with gusts as high as 35 mph (20 foot winds), for the area around Camp Baldwin.

BEHAVE Plus (fire behavior prediction computer program) runs were done to show potential fire behavior characteristics. Predictions are characterized by flame lengths measured in feet. Fires with flame lengths of less than four feet can generally be attacked at the head or on the flanks from personnel using hand tools. Fires with flame lengths of less than four feet are generally characterized by low to moderate intensity fires. Fires with flame lengths of greater than four feet are too intense for direct attack on the head by personnel using hand tools. Hand fireline would not generally hold these types of fires. Equipment such as Dozers, Engines, and Air Tankers are required for any degree of success in preventing fire spread. Fires with flame lengths greater than eight feet need to be attacked indirectly, usually resulting in larger fires and greater costs.

The fire behavior predictions were computed using the BEHAVE program, which is based on the fire spread model by Rothermel (1972). The fire behavior estimates below have an accuracy of plus or minus a factor of two (i.e., Flame Length (FL) = 4 feet, then the accuracy is between 2 feet and 8 feet). The weather and topographical inputs used for these predictions are detailed in Tables 3-6, 3-7 and 3-8.

Table 3-6: 97^{th} Percentile Weather

Characteristic	97^{h} Percentile Value
Slope	<30%
Aspect	E/SE
Wind Direction	Westerly (NW, W, SW)
20’ Windspeed	11 MPH (per RAWS in Dalles Watershed)
Midflame Wind Speed	0-16 mph (average= 8mph), onsite gusts to 15 mph eyelevel
Temperature	92 degrees
Relative Humidity	11%
1 hr. fuel moisture	3% (2.71%)
10 hr. fuel moisture	3% (3.43%)
100 h. fuel moisture	6% (5.54%)
1000 hr. fuel moisture	8% (7.64%)
Woody fuel moisture	60%
Herbaceous fuel moisture	30%
ERC	78
June 1^{st} thru Oct. 15 for 1985-2006 - Pollywog RAWS	

Note: 20 foot Windspeed at RAWS is 11mph, with an average midflame at 3.3mph, 8mph eyelevel is approx. 27 mph at 20’
Used onsite wind data observed over past 2 years, as well as daily weather from Pendleton for winds at project area.

Table 3-7: Fire Behavior Characteristics - 97th Percentile Weather Conditions (average 4 mph eyelevel wind)

Fuel Model	5	6	9	TU1	10	TU5	11
Flame Length (ft.)	7.1	6.5	3	2.1	5.9	8.2	3.7
Rate of Spread (ch/hr)	28.4	32.0	7.7	3.4	9.4	9.8	5.8
Size in 2 hour (ac)	151.5	196.8	11.2	2.2	16.8	18.5	6.5

The above fire behavior is based on the 20' winds from the Pollywog RAWS. Note Ch = chain (66')

Table 3-8: Fire Behavior Characteristics - 97th Percentile Weather Conditions (average 8 mph eyelevel wind)

Fuel Model	5	6	9	TU1	10	TU5	11
Flame Length (ft.)	11.1	10.0	5.2	3.2	9.1	11.7	5.2
Rate of Spread (ch/hr)	75.5	81.6	24.5	8.6	24.7	21.6	12.7
Size in 2 hour (ac)	643.5	752.8	67.5	8.4	69.3	53.4	18.5

The above table is based on worse case exposure, from onsite observations and Pendleton weather information.

The fire behavior predictions indicate that a direct attack of a surface fire by personnel with hand tools would be ineffective except in Fire Model 9, TU1, and 11 (See Table 3-9). Although fuel models 9, TU1, and 11 have flame lengths of less than 4 feet, and fuel model 10 is less than 6 feet (all under the 4 mph winds), they also contain pockets of fuel model 5 and 6 which produces flame lengths of 7 plus feet and 6 plus feet respectively, which would make a direct attack with hand tools ineffective. Direct attack with Engines, Dozers, and Air Tankers would be effective if the fire stayed in the surface fuels and did not produce spot fires out ahead of the main fire or moved into the aerial fuels (crowns). If a fire start was immediately detected and initial attack resources were on scene within 30 minutes, there would be a high probability that suppression actions would be effective, but after two hours, a fire would be fairly well established and more difficult to contain. The first resources to arrive at the fire would most likely be engines and due to limited access to some areas, they may not be able to utilize the engines immediately or directly. Air resources, if available, could take as long as 60+ minutes to arrive on scene (assuming availability), and mechanical resources could be longer depending on availability of operators and overhead. Treating the fuel model 10 and TU5 units, and moving towards a fuel model 9 or TU1, allows for better suppression operations, even at an 8 mph eyelevel wind, as direct attack is probable and has a greater likelihood of success than if facing suppression operations in the other fuel model conditions/types. (See Figures 3-2 and 3-3 for examples of fuel models and CBH.)

Figure 3-2: Fuel model example. Large ponderosa pine (24”+) with grand fir understory. CBH to grand fir is <3’ (unit 5) CBH to ponderosa pine from surface is approximately 40-50 feet, but CBH from grand fir to ponderosa pine is <20’ Flame Lengths from grand fir reproduction could be in excess of 50’.

Figure 3-3: Fuel loading in Unit 6. Similar fuels are found in most of the proposed commercial treatment stands. Photo A – Large ponderosa pine with approx. 14” grand fir, CBH is 3’. Photo B – Same tree pair, note grand fir encroachment of ponderosa pine, CBH of <10’.

Table 3-9: Fuel Model – Fire type based on Crown Base Height (4 mph and 8 mph eyelevel)

Crown Base Height	9		TU1		10		TU5		11	
	4mph	8mph	4mph	8mph	4mph	8mph	4mph	8mph	4mph	8mph
1’	Torching	Torching	Torching	Torching	Torching	Crowning	Torching	Crowning	Torching	Crowning
4’	Torching	Torching	Surface	Torching	Torching	Crowning	Torching	Crowning	Torching	Crowning
7’	Surface	Torching	Surface	Surface	Torching	Crowning	Torching	Crowning	Surface	Crowning
10’	Surface	Torching	Surface	Surface	Torching	Crowning	Torching	Crowning	Surface	Crowning
13’	Surface	Torching	Surface	Surface	Surface	Crowning	Torching	Crowning	Surface	Crowning
16’	Surface	Surface	Surface	Surface	Surface	Crowning	Torching	Crowning	Surface	Surface
19’	Surface	Surface	Surface	Surface	Surface	Crowning	Torching	Crowning	Surface	Surface

Crown base height (CBH) was looked at for initiation of a fire in the aerial component, as well as fire intensity. Data for the canopy bulk density was taken from Stereo Photo Guide for estimating Canopy Fuel Characteristics in Conifer Stands (RMRS-GTR-145, 2005), to assist in fire behavior predictions of crown fire behavior. The Douglas-fir /ponderosa pine (fuel model 9 and TU1) and Mixed Conifer (fuel model 10, TU5, and 11) sections were used to determine canopy bulk density, and then the BEHAVE model was used to run variations on fire behavior based on changes in crown base height, as well as the various fuel models listed above. Table 3-9 shows the fire behavior in reference to either a surface fire (no aerial fuels involved), torching (usually single tree or small groups of trees), or crowning (fire, supported by surface fire, with continuous aerial fuels involved in the combustion process). Opening up the canopy (overstory), and thinning from below increases the crown base height and lowers the over all canopy bulk density of a stand, reducing the potential for an aerial or crown fire event to occur. Once a fire is initiated into the crowns and begins to sustain itself in the aerial fuel stratum, most fire suppression strategies become indirect. Spotting potential increases, and the opportunity to contain an established fire or protect resources is lessened. Figures 3-2 and 3-3 show grand fir encroachment around the bases of ponderosa pines, and the ladder fuels that would lead to an increased potential of a crown fire event.

Manual calculations for the “probability of ignition” was completed based on an air temperature of 88 ^{o}F with fine fuel moisture of 3 percent, and were determined to be 90 percent using the Fire Behavior Field Guide, Probability of Ignition table. This means 9 out of every 10 embers thrown outside the fire perimeter could produce a spot fire provided it landed in a receptive fuel bed. Based on fire spread rates, flame lengths, and spotting potential the planning area is a very high fire hazard that could easily produce fire behavior that would exceed local control capabilities.

Current fire hazard within the planning area is mostly due to understory brush and stand structure; fuel loadings in the mixed conifer stands has increased due to root rot, stress, dwarf mistletoe infestations, and other factors, due in part to stand densities and minimal understory treatments in the past as well as aggressive suppression strategies. Numerous stands are overstocked and in decline, with smaller shade tolerant species in the understory. These stands would support a stand replacement fire currently and would continue to be a significant fire hazard in the future without appropriate treatment. Actions that would help to reduce the current risk of stand-replacing events include:

- Emphasize removal of trees 1-7" DBH. Open canopy to promote larger overstory structure and fire tolerant species, removing smaller less fire tolerant species. Retain enough trees for future stocking of desired fire tolerant species, and to maintain open canopy spacing.
- Design and locate treatment units to break up large, continuous blocks of highly susceptible fuels.
- Use commercial and pre-commercial thinning, whipfelling (cutting small diameter fuels) and fuels treatments to change hazard to low or moderate susceptibility.
- Ensure that adequate fuels treatments are prescribed and carried out after treatment.
- Use prescribed fire to reduce natural and/or activity created fuels in treatment.
- Use hand and/or mechanical equipment to reduce accumulated fuels, either thru mastication or piling and burning the piled vegetation.
- Provide long-term road access to areas of moderate or high hazard to improve wildfire suppression capabilities.
- Provide opportunities for future maintenance burning in areas that were historically low intensity/high frequency (low) fire regime.

Environmental Effects

Effective treatments to reduce fire hazard include treatments that lower existing fuel concentrations, lower future fuel concentrations, or decrease the ladder fuels (brush and small trees) which provide vertical connectivity into the crowns of the overstory trees (increase crown base height). Commercial thinning, underburning, mowing, whipfelling, handpiling, and pre-commercial thinning may be effective in reducing fire hazard.

Fire Risk would stay approximately the same in all the alternatives except for the possibility of an operations fire from the harvest and post treatment activities in the proposed action, unless recreation or other public use increases during fire prone months.

The proposed action would allow for a breaking up of continuous blocks of high fire hazard areas. This breaking up of the high hazard areas would have an effect on a fire moving through the area, as well as providing a safer area for suppression resources to either suppress new starts or take actions on emerging large events. The intensity of the fire would be less, which in turn may alleviate some of the environmental damage, allowing for a higher success of suppression operations or alternatives in suppression options (such as a confine and contain strategy versus a control strategy). By opening the canopy there is a slight increase in wind, but overall rate of spread (ROS) is minimized due to the lowered fuel loadings and flame lengths would likely be reduced, allowing direct attack suppression strategies if needed. A targeted fuel model 9 or TU1 fire behavior in the areas dominated by ponderosa pine is ideal and in the short needle conifers, a fuel model 8 or TU1 would be appropriate (as long as the surface fuels have been treated). Duff in the mixed conifer is a high component of the fuel loading, and the treatments of the surface fuels would not likely affect this component of the stand; these ground fuels relate to smoldering and potential soil issues but do not contribute directly to ROS and FL, except as an element to pre-heating.

For measurement purposes, a proposal of 7-15 tons per acre of surface fuels (activity and residual) in the 1-hour, 10-hour, and 100-hour, (0 to 3 inch material) fuel moisture classes would generally meet the fire behavior reduction needed. Large woody material is needed to meet Forest Plan (1990), Standards & Guidelines for down woody debris, and in general does not contribute significantly to ROS, although there can be localized effects from soil heating. Greater flame lengths may contribute to aerial fuel ignitions (torching) on a localized area.

Hand piling, burning and underburning would reduce fuel loadings, fuel bed depth, and understory vegetation (ladder fuels) within the project boundary. Mowing would reduce fuel bed depths and understory vegetation but would not decrease overall fuel loadings. Underburning after the mowing would reduce the fuel loading (consuming fuels) and maintain manageable fuel conditions.

No Action Alternative – Direct, Indirect, and Cumulative Effects

The no action alternative proposes no projects and fire suppression would continue to occur. In the short term, (one to five years) the fire hazard would remain constant, at a high risk. In the future, dead or dying trees would fall down increasing the fire hazard. Natural fuels (pine needles and other dead vegetation) would continue to accumulate. Natural processes of decay are not likely to remove the down and dead woody debris before the next fire cycle, as the east slope of the Cascade Mountain range is typically drier (less average rain fall). As the available fuel increases, so would the potential for a large, stand-replacing wildfire event.

The risk of injury to the public and firefighters would increase as the fuel loadings and fire hazards increase. Larger, fast moving, higher intensity fires would put the public and firefighters at an increased risk to injury or death. The 2007 Ball Point fire used smoke jumpers for initial attack, and these resources were unsuccessful due to weather and heavy fuel loadings in the Badger Creek Wilderness, requiring a type 2 incident management team to be called to manage the suppression effort. Suppression costs would increase due to larger fires and the increased need for personnel, mechanized equipment, and aircraft. Resource damage caused by fire suppression efforts would also increase (fire lines dozer and hand, vehicle travel, chemical suppression use, etc), as well as an increased threat of damage to the Camp Baldwin Boy Scout camp (also, potential evacuation issues during the summer months when the camp is in use), and other private landholders in or adjacent to the planning area.

When large amounts of dead and down debris increase and there is an increase in ladder fuels, a fire would burn very hot and exhibit extreme fire behavior. Such fire behavior could result in loss of productivity and biodiversity in the stands, surface soils could be severely damaged, and could take many years to restore the ecosystem, as well as increasing the impact on the riparian areas of Eight Mile and Ramsey Creeks. Soil erosion could occur in some of the planning area following an intense post-fire precipitation event. Increased fire intensity also means loss of snags and downed logs important for habitat.

Proposed Action – Direct, Indirect, and Cumulative Effects

Proposes to underburn 630 acres after mechanical/hand treatment (thinning/mowing/piling/pile burning – includes unit acres that may or may not be underburned after mechanical/hand treatment based on stand conditions), underburn 277 acres with no mechanical treatment (maintenance underburning), and no underburning on 366 acres in areas not suitable for underburning due to aspect, fire regime, stand condition, etc. of the 1396 acres in the project.

Commercial vegetation removal and piling would occur on 808 acres to reduce canopy closure, remove understory encroachment (ladders), and increase crown base height of remaining stand, non-commercial vegetation removal on 191 acres (second growth stands, older plantations, etc), hand thinning and piling on 36 acres, and pruning (mastication) and possible piling of 97 acres in plantations/younger stands, and 277 of maintenance underburning (primarily east of Camp Baldwin).

These treatments (mechanical, hand, and prescribe fire) would reduce overall fuel loadings, thereby decreasing the Flame Length (FL) and Rate of Spread (ROS), lowering surface fuel height, and thus reducing the potential for crown fire initiation in those areas, allowing for the second entry of fire (underburning) into those areas to reduce the fuel loadings (tons/acre) and reduce the fire hazard to a moderate/low category, reducing the fire hazard and risk to private land and homes. In the event of a fire start in these areas, suppression resources would be able to contain and control a fire in the area of the Billy Bob Snow-park and Camp Baldwin in a safer and more effective manner. Unit acres proposed for treatment are approximate, as unit acres were mapped using GIS. The final acres of each unit could change by small amounts once the units are GPS after layout (primarily the maintenance underburning units – would follow original unit layout to minimize fireline construction impact).

Prescribe burning would have a two to four day impact on local airshed/air quality, during and after ignition. This would include underburning and burning of mechanical and hand piles. Units would be burned under conditions that minimize impacts to protected and sensitive areas, and would move smoke away from populated areas in the least amount of time (see air quality section).

Camp Baldwin has treated the area south of the 44 road with a commercial thin, which has left the residual stand at approximately 60 percent canopy cover and piled the activity fuels, which have been consumed over the past three years. Various sections of the area of Camp Baldwin have been similarly treated north of the 44 Road, primarily west of the Camp Baldwin resulting in a residual stand at approximately 50 to 60 percent canopy cover, and piling residual and activity fuels. Other land owners have treated the private lands to the east, southeast, and northeast of Camp Baldwin either thru commercial thinning or shelterwood type treatment. Most of these activities have removed the overstory to a certain extent and then piled the activity fuels which were then burned. The area southeast of Unit 21 is the most recent area where harvesting activities has occurred. There is no immediate, cumulative effect from a fuels standpoint, either through air quality or an increase in fire potential since the harvesting activities have been completed. There is always the potential for future harvesting activities on any of these private lands, which could increase the fire potential. (See the Vegetation Resource section in this chapter for the actual harvest treatment and acres on the private land.)

Also, the proposed action would reduce fire hazard by breaking up the continuity of the surface and ladder fuels, thus reducing the risk of a crown fire. From a fire hazard/fire suppression stand point, the proposed action meets the purpose and need for action. There are no cumulative effects associated with implementing the proposed action alternative.

Air Quality / Smoke Management

Existing Conditions

Air quality is of particular concern on the Mt. Hood National Forest Airsheds. Airshed is defined as a geographical area that, because of topography, meteorology, and climate, share the same air (Boutcher 94; MHFP, Glossary-1). Portions of the Mt. Hood Wilderness are federally designated as a Class I Airshed (MHFP, FW-046, and FW-047). The Mt. Hood Wilderness is six miles west of Billy Bob Hazardous Fuels Reduction Project planning area. The Badger Creek Wilderness, a Class II Airshed is three miles south Billy Bob Hazardous Fuels Reduction Project planning area. Management activities shall comply with all applicable air quality laws and regulations, including the Clean Air Act and the Oregon State Implementation Plan (MHFP, FW-040). Also, in compliance with the Clean Air Act, the Forest Service is operating under the Oregon Administrative Rule OAR 629-43-043. The Forest Service is complying and would continue to comply with the requirements of the Oregon Smoke Management Plan or OSMP, which is administered by the Oregon Department of Forestry. Smoke management is defined as: "the management of fuel treatments from forest activities so that there is no or reduced effect to local areas surrounding the project". This primarily deals with impacts to people or air quality.

The effects of smoke management from activity created fuels on the surrounding area are described below and the procedures and guidelines followed when utilizing prescribed fire as a management tool. All Forest Wide Standards and Guidelines for Air Quality FW-039 thru FW-053 (LRMP-MTF, 4:51-52) would be followed to minimize problems of Forest Service burns affecting air quality in local communities. All prescribed burning activities would comply with Forest Service Manual direction (FSM 5100, Chapter 5140)

Currently and in the future, all planned ignitions are and will be conducted according to the Operational Guidance for the Oregon Smoke Management Program (OSMP). The Operational Guidance contains the direction for meeting the terms of the OSMP. The Environmental Protection Agency has approved the OSMP as meeting the requirements of the Clean Air Act, as amended. The OSMP, which is administered by the Oregon State Forester, regulates the amount of forestry related burning that can be done at any one time. The amount of burning that can occur on any one day depends upon the specific type of burning, the tons of material to be burned, and the atmospheric conditions available to promote mixing and transportation of smoke away from sensitive areas. For each activity requiring prescribed fire, the Forest Service requires a written, site-specific prescribed burning plan approved by the appropriate Line Officer. The purpose of the plan is to ensure that resource management objectives are clearly defined and that the site, environment, or human health is not harmed. The plan contains a risk assessment to quantify the chance of fire escaping and develops a contingency plan for actions taken to prevent escape and if it does, quickly contain the escape. The plan would be implemented to minimize the possibility of any prescribed burn affecting Class I or other "smoke sensitive" areas in accordance with the OSMP.

The size class distribution for wood smoke particles is such that 82 percent of the particles range between 0.01 and 0.099 microns, 10 percent range between 1.0 and 4.99 microns, and 8 percent range between 5.0 and 15.0 microns. The most efficient particle size for scattering light (and thus reducing visibility) ranges between 0.3 and 0.7 microns. The majority (82 percent) of particulate emissions from wood combustion are in the size range that reduces visibility.

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

Smoke sensitive areas near Billy Bob Hazardous Fuels Reduction Project planning area include: the communities of the Dufur, The Dalles, Hood River Valley, and areas within the Columbia River Gorge National Scenic Area. Burning of treated material (piles, or underburning) would only be conducted when actual and predicted atmospheric conditions would minimize the possibility of smoke affecting these areas. The general public can obtain information about any proposed burns in the immediate area from local ranger districts, advertisements in local newspapers, radio, or television, and avoid areas approved by the State of Oregon. Use of mitigation measures and compliance with OSMP, there should be no long-term effects from prescribed burning or smoke from the proposed activities. Provisions for public safety would be taken prior to any burning activities. Some provisions include: issuing public notice before implementing burning activities, avoiding/minimizing smoke intrusions into populated areas, public roads, highways and class I airsheds.

Tables 3-10, 3-11 and 3-12 show the estimated amounts of particulate matter (PM) that would be created by the smoke from the burning prescribed for the alternatives. The acres and piles of burning below are for the treatment of natural fuels and created fuels. The particulate matter that is quantified below includes PM 10 and PM 2.5. Smoke is made up of suspended particulate matter and gases. Particulate matter is made up of soot, tars, condensed organic substances, and water droplets. Particulate matter less than 10 microns (PM10) is respirable into human lungs and considered a health hazard. One micron is equal to 1/1,000,000 of a meter.

Tables 3-10, 3-11 and 3-12 display an estimate of the amount of wildfire acres, underburning, and piles to be burned by the different treatments, and the estimated amounts of PM 10 and PM 2.5 to be released into the atmosphere from burning. Maintenance underburning is part of the proposed action and as such would not occur unless the proposed action is selected, so there is no air quality impact from this treatment in the no action alternative. Under no action, there are no treatments performed, including maintenance underburning.

Table 3-10: Acres of wildfire versus activities proposed

Fuels Treatment	No Action	Proposed Action
Burn Hand Piles	0	1080 piles*
Burn Machine Piles	0	11,995 **
Burn Landing Piles	0	50 ***
Underburn Acres	0	1298 acres
Wildfire ****	**200 acres**	**<20 acres**

* Hand piles = 30 piles/acre.
** Machine Piles = 10-15/acre
*** Landing piles = 1 pile/20 acres.
**** Based on historical fire sizes from 1900 to present, roughly every 10 to 20 years

Table 3-11: Comparison of particulate matter (10) release from wildfire versus activities proposed

Tons PM 10*	No Action	Proposed Action
Burn Hand Piles	0	2.85 tons
Burn Machine Piles	0	80.62 tons
Burn Landing Piles	0	19.77 tons
Underburn Acres	0	143.16 tons
Wildfire (including Aerial fuels)	130.5 tons	5.08 tons
Total tons PM10	**130.5 tons**	**248.63**

* Figures in Tons PM 10 includes PM 2.5

Table 3-12: Comparison of particulate matter (2.5) release from wildfire versus activities proposed

Tons PM 10*	No Action	Proposed Action
Burn Hand Piles	0	2.48 tons
Burn Machine Piles	0	70.22 tons
Burn Landing Piles	0	17.22 tons
Underburn Acres	0	132.71 tons
Wildfire (including Aerial fuels)	110.5 tons	4.3 tons
Total tons PM2.5	**110.5 tons**	**226.93 tons**

The values in Tables 3-10, 3-11 and 3-12 are only estimates for comparison purposes. The values are calculated from the FASTRACS (Fuels Analysis, Smoke Tracking, and Report Computer System) computer program. The actual amount of particulate matter released is dependent on many variables (e.g., weather, fuel moisture, firing method). Information for the wildfire particulate matter determined using FOFEM5 (First Order Fire Effects Module, version 5), based on projected smoke emissions per acre for a very dry, summer event. Wildfires with less or more acres would have a corresponding change in the amount of particulates generated by the event.

While the amount from a moderate wildfire is less than the overall for the fuels treatments with a smaller wildfire, the amount of particulate matter that is produced can be dispersed over a longer time period with less direct effect than a wildfire event. All numbers for the treatments assumed all acres/piles were treated in one burn period day of 12 hours, which is generally not possible due to limitations such as weather, terrain, personnel, and equipment. Most of the smoke producing treatments would occur over a two to four year time span, thus limiting the amount of particulates produced by the treatment method. The effects of the aerial component of the canopy being involved for a wildfire, was analyzed using a 75 percent crown burn for analysis thru the FOFEM5 program for smoke emissions. As a comparison, a 20 acre fire occurring in an untreated stand produces about 2.5 times the emissions than a similar fire in a treated stand. The proposed action does not include aerial fuel ignition, as the purpose and goal of the project is to limit/minimize any aerial fuel involvement by increasing crown base height, increased canopy spacing, and removing accumulated surface fuels. Overall, daily comparison shows that if the wildfire and the treatments all happened in one burn period, the treatments have a higher emission in tons per acre. Once spread out over time (time for underburning and pile treatments based on 20 years of prescribed fire experience – days could be a bit shorter, but would most likely take even longer to accomplish – spanning the 3-4 year time span), the Wildfire produces approximately 11 times the daily amount of particulates an emissions compared to areas treated.

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

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

Environmental Effects

No Action Alternative – Direct, Indirect and Cumulative Effects
By selection this alternative, the project area around Camp Baldwin would be left in its current condition. Air quality would remain unaffected, until a large fire event occurred. The Dalles and/or Hood River Valley would be impacted by such an event, with very high particulate matter imparted into the local air sheds, with potential health effects.

In the event of a large fire, Cumulative effects of smoke from adjoining private, state and national forest lands could mix with smoke from the planning area and impact populated areas such as The Dalles, Mosier, Mt. Hood, Hood River, Dufur, Tygh Valley/Wamic, and Maupin, depending on current weather and transport winds. Smoke would be monitored from viewpoints and/or aircraft to determine the probability of smoke intrusions into public areas.

Proposed Action Alternative – Direct, Indirect and Cumulative Effects
The selection of this alternative meets the purpose and need of the project for Billy Bob Hazardous Fuels Reduction Project. Burning of piled residual and activity fuels, as well as

underburning would occur. Units exceeding 10 or 15 tons per acre (depending on location and stand type) would be treated as per Forest Plan Standards & Guidelines FW-033 thru FW-038. Primary impact from pile burning (machine or hand) is limited and temporary, and would most likely impact hunters in the area. Typically, machine pile burning occurs in the fall and during periods of inclement weather (wet season).

Underburning could occur in the spring or fall depending on available windows of opportunity to meet desired outcomes (parameters for successfully meeting objectives). Underburning can produce more smoke than pile burning, which may have a greater impact on local air quality. All burning would be scheduled in conjunction with the State of Oregon to comply with the Oregon Smoke Implementation Plan to minimize the adverse effects to air quality. Underburning would be conducted when smoke dispersion conditions are favorable to minimize the potential for adverse effects.

Health risks are considered greater for those individuals in close proximity to the burning site, due to overexposure to particulate matter. Few health effects from smoke should occur to Forest users due to their limited exposure. Due to the distance involved and the season in which pile burning or underburning would occur, there would be negligible effects to individuals. Camp Baldwin will be notified prior to any burning activities.

Cumulative effects of smoke from adjoining private, state and national forest lands could mix with smoke from the planning area and impact populated areas such as The Dalles, Mosier, Mt. Hood, Hood River, Dufur, Tygh Valley/Wamic, and Maupin, depending on current weather and transport winds. Smoke would be monitored from viewpoints and/or aircraft to lessen the probability of smoke intrusions into public areas.

Vegetation Resources

A more detailed vegetation resource/silviculture report is located in the project record, located at the Barlow Ranger District. The analysis and conclusions of the report are summarized below. Reference material is contained in the full specialists report.

Existing Conditions

Information on the vegetative conditions of the larger landscape within which Billy Bob Hazardous Fuels Reduction Project lies is provided largely by an analysis conducted in the recent past by the Mt. Hood National Forest: Mile Creeks Watershed Assessment.

The Mile Creeks Watershed Assessment characterizes resource conditions at their respective scales, identifies issues, discusses trends and changes in conditions over time, defines desired conditions, and identifies possible management opportunities to be pursued at the project planning level. Only the elements from these analyses most pertinent to the fuel reduction proposal are discussed in this EA. For the complete analysis of vegetation conditions and ecological processes at the landscape scale, the reader should refer to the Mile Creeks Watershed Assessment, on file at the Barlow Ranger District office. The previous watershed level analysis provides the landscape context for the analysis of vegetation at the Billy Bob Hazardous Fuels Reduction Project level.

The analysis area boundary for disclosing effects at this more site-specific level is the 13,500 acre subwatershed area, which included all stands that were evaluated for possible treatment actions. Information sources included stand records and field surveys conducted in the 1980s and 1990s, as well as field reviews conducted in the year 2007.

Landscape Scale
The Mile Creeks Watershed Analysis describes the landscape of the east slope of Mt. Hood. Three climate zones are included in the watershed. Open, grass covered slopes and forests of ponderosa pine and Oregon white oak dominate the lower elevations and drier sites. Grand fir and Douglas-fir are major components on cooler, moister northerly aspects and mid-elevation sites. Grand fir, lodgepole pine and white pine are predominant at the higher elevations in the drainage.

Typically, across this landscape the true fir and Douglas-fir dominated forests are dense single or multi-storied stands. The drier sites where ponderosa pine is more common are becoming overstocked from encroachment by Douglas-fir, and are typically in a multi-storied condition. Douglas-fir is often a major component in the mid and lower canopies except on the driest sites, where ponderosa pine is prevalent, along with Oregon white oak. The lodgepole pine stands at mid to upper elevations in this landscape are often mixed with other species (Douglas-fir, grand fir) and most commonly form dense, single-storied canopies.

The analyses completed at the larger landscape scale noted that there have been some definite changes in the nature and condition of the vegetation across the landscape from historical conditions (the period prior to Euro-American occupation). Most of these changes reflect the consequences of 100 or so years of fire exclusion and suppression in combination with European settling of the area and timber harvest beginning in the earliest years of the 20th century. The first substantiated contact of Euro-Americans with Native groups that occupied the Columbia River valley occurred during the Lewis and Clark Expedition in 1805. Settlement of the valley by non-Indians really took off in the mid 1800s, primarily because of the discovery of gold. By the end of the 1800’s, timber was being cut from public lands at what was perceived as an alarming rate. This led to the establishment in 1893 of the Cascade Forest Reserve as part of a regional plan to preserve the forests of the Western United States. The Mt. Hood National Forest contains the northern portion of the original reserve.

Some level of increase in the amount of Douglas-fir forest type has occurred, with a correlating decrease in ponderosa pine and western larch dominated forest. However, the more notable changes have occurred in the structure classes and patterns of vegetation across this landscape. Increased tree densities, higher proportion of multistoried stands, reduction in amount of young, seedling/sapling forest (especially in the ponderosa pine and Douglas-fir types), and a more continuous coverage of forest canopies across the landscape are the major elements that have changed. In many areas, the forest conditions are outside the historical ranges, influencing the normal functioning of ecological processes across the landscape (MacCleery 1998). The nature and effect of these changes are discussed more thoroughly in the assessment referenced above and under the section on “Influence of major ecological processes and disturbances” later in this section.

The lower slopes of the Cascade Range (where the project lies) have a relatively high natural level of forest fragmentation. This inherent level of fragmentation is the result of a diverse topography and dissected slopes, with abrupt changes from one site and vegetation type to another. In historical times, fires would burn in this diverse topography in a variety of sizes, frequencies, and intensities. Fires in the forests of the dry southerly aspects would tend to be more frequent and often burn over onto the north aspects. There they would either die out quickly, due to moister fuel conditions, or they might burn at a low to moderate intensity. Under certain conditions, the fire might move into tree crowns and be carried quickly along due to the dense canopy on these northerly slopes, resulting in a stand-replacing fire.

Under this natural disturbance regime, a fairly fine-grained landscape mosaic of different forest patches would be created, and a predictable and repeated pattern of vegetation tended to develop in the foothills of Mt. Hood. Semi-open ponderosa pine forests dominated the warm, dry southerly aspects, with somewhat more dense single or multi-storied ponderosa pine/Douglas-fir forests (sometimes mixed with lodgepole pine) on the cooler, moister northerly aspects. Older overstory trees of ponderosa pine and Douglas-fir would often exist in both of these areas.

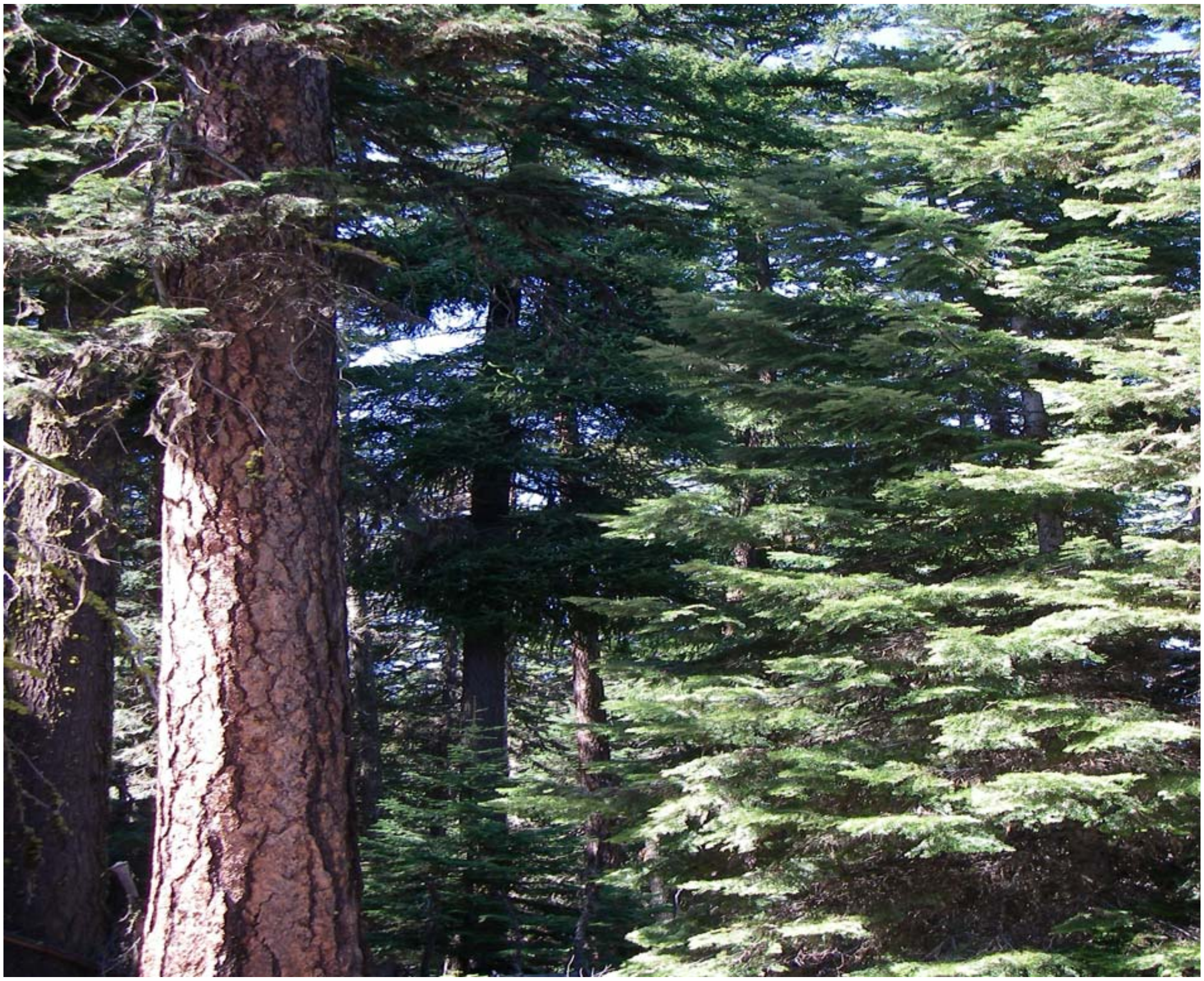

Figure 3-4: Continuous fuel ladder near Camp Baldwin.

Currently, because of fire suppression, past logging, and the natural succession of the forest, the landscape exhibits a different pattern of forest cover and structure types than it has historically. The average patch size has decreased while the number of patches has increased. Crown closure has increased. Stands once differentiated by stocking levels, canopy levels, and crown closure have become structurally more similar and continuous across the landscape. The forest is composed of more shade tolerant species. See Figure 3-4. These changes have affected the normal functioning of ecological processes, such as fire, insects, and disease.

Site Specific (Project Area) Scale

Proposed treatments in the fuel reduction project occur within the Eightmile, Ramsey and Hesslan Creek sub watersheds, a 15,997 acre area. Forest types were assigned within the National Forest boundary. East of the forest boundary is pine oak steppe habitat moving down to grassland and farmland. Douglas-fir dominated forests growing on warm, dry grand fir habitats cover most of the area influenced by the proposal. These areas have experienced a marked change in condition over the past 100 years from fire exclusion and selective harvest. Large remnant ponderosa pine and western larch provide clues to stand origin and fire frequency. There is an estimated 43 percent of the total acres of dry grand fir forest type, and a much smaller proportion of warm dry Douglas-fir and grand fir, with hot-dry pine-oak and Douglas fir in the southeast corner of the project analysis area. See Table 3-13.

Table 3-13: Vegetation types in Billy Bob Project Area*

Vegetation Type	Acres
Dry grand fir	5960
Warm, Dry Douglas-Fir and grand fir	3908
Cool, Dry Lower Subalpine	1261
Hot, Dry Pine-Oak and Douglas-Fir	1209
Moist grand fir	1159
Total	**13497**

*Excluding private land east of the Forest boundary.

Tree density within the Douglas-fir stands is relatively high compared to what most commonly existed historically on these sites (refer also to discussion under "Fire and Fuels" later in this chapter). It is important to understand that this dense Douglas-fir forest type is not in itself a condition that was never experienced in the past. Certainly there were pockets of forest on similar sites across the historical landscape that by chance escaped one or more fires, and very likely could have developed the dense canopy and/or multi-storied conditions that we see in the Billy Bob project area.

Due to fire suppression and exclusion across the entire Mt. Hood Forest over the last century (particularly the lower and moderate intensity "thinning" types of fire), these dense Douglas-fir dominated forests have developed over far more area than historically occurred. This has resulted in increased fuels and risk of larger scale, high severity fire, with the associated threat to resource and human values.

Accentuating the effects of fire suppression has been the logging that occurred in the late 1800s in much of the Douglas-fir forest type in these subwatersheds. Prior to this, there appears to have been numerous mature, overstory ponderosa pine and western larch in these stands, as well as overstory Douglas-fir. From evidence of the stumps that remain, it is estimated that from 30 to perhaps 60 trees per acre of these mature and older trees existed on these sites. By the early 1900s, most of these trees were removed. The understory seedling and sapling Douglas-fir and grand fir that occupied the site at that time, along with new regeneration that occurred after logging, has grown into the dense, mature stands of fir that exist on the sites today. See Figure 3-5.

Figure 3-5: Dense multi-storied stand in the Eightmile drainage.

Past Harvest: Available harvest data on National Forest System lands from the last 50 years or so is summarized in Table 3-14. Field observations indicate that virtually every mature stand in the Billy Bob/Camp Baldwin area had been entered and selectively logged at some time in the last 100 years. Interpretation of aerial photography of the project area indicates that approximately 1200 acres of forest has been thinned to some level on private lands in and around Camp Baldwin.

Table 3-14: Acres of Harvest on National Forest System lands in analysis area by decade.

Decade	Regeneration Harvest	Overstory removal	Thin	Selection/Stand Improvement	Salvage	Total harvest by decade
1951-1960				3		3
1961-1970	16					16
1971-1980	22 Shelterwood 398 Clearcut					420
1981-1990	134 Shelterwood 577 Clearcut	238	283	37		1269
1991-2000	1 Clearcut 93 Clearcut w/Reserves		123	500	41	758
2001-2006			57		73	130
Totals	1241	238	463	540	114	**2596 acres**

Table 3-15: Existing Site and Vegetative Condition of Treatment Stands within the Billy Bob Hazardous Fuels Reduction Project Area.

Treatment in Proposed Action	Acres	Forest Type: Vegetation Composition	Forest Structure; Density, Size & Age Classes	Vegetation Condition	Other
Mature Stands		GF, DF, WH, ES, WL, WRC LP, PP, Undergrowth low shrubs and grass (ninebark, mtn maple, chinkapin).	Dense single and two storied forest, from 300-500+ tpa overall, with main canopy composed mostly of DF trees in 9-16" dbh range. These trees are typically 70-110 yrs old. Remnant groups and scattered individual old overstory DF & PP (+-200 yrs, up to 28" dbh, normally < 5 tpa but some areas at higher density). Many snags; moderate to high amount downed wood. shrubs suppressed and decadent. Seedling or sapling trees in gaps created by root disease.	Dwarf mistletoe in DF, WL, PP. Heaviest infection in older trees. Younger age classes (<100 yrs) mostly in good condition, though some stressed due to overstocking in clumps. DF, WL, PP understory infected with dwarf mistletoe by overstory. Root rot pockets common, infecting grand fir and Douglas-fir. Poor health and form in this group.	Stands with evidence of partial cutting many decades ago (over 60 yrs), removing much of the overstory PP and DF, leaving inferior trees.
Thin	8				
Thin and Prune	366				
Thin, Prune and Underburn	429				
Thin and Underburn	5				
Sapling Stands			Few to no snags and light amount of downed wood.		
Hand thin	36	Riparian vegetation: DF, GF, ES . Underhill archeological site: PP, DF .	Riparian: same as Mature above. Underhill: Sapling to immature (early seral) stands from regeneration harvest 15-30 years ago. 300-500 tpa. Tree diameters up to 9" dbh.	Ladder fuels in riparian areas leave them vulnerable to crown fire.	
Mechanically Thin	70	GF, DF, ES, PP	20 to 30 year old plantations. Diameters from 0-9". 300-500 tpa.	Stocking levels and ladder fuels in sapling stands make them vulnerable to	Thinning can improve species diversity and favoring of fire
Mechanically Thin and Prune	22				

Treatment in Proposed Action	Acres	Forest Type: Vegetation Composition	Forest Structure; Density, Size & Age Classes	Vegetation Condition	Other
Mechanically Thin and Underburn	98	DF, PP, WL, GF		mortality from fire. Pruning to reduce whole tree torching, and thinning to increase spacing, will make young stands more resistant to fire.	resistant species.
Prune	97	PP plantation.	Stocking of 200-400 tpa, or less.		
Burn	277	Individual PP/DF/OWO. Pinegrass	Moderate retention overstory of PP & DF over seed/sap	Mistletoe infection in remnant overstory DF and PP. Brush providing competition in some stands.	

Abbreviations: PP = ponderosa pine; DF = Douglas-fir; LP = lodgepole pine; GF = grand fir; WL = western larch; WH = western hemlock; OWO = Oregon white oak; ES = Engelmann spruce; WRC= western red cedar
dbh = diameter breast height; tpa = trees per acre
*Acreages are derived from Geographic Information System data and are not exact.

Influence of major ecological processes and disturbances
Ecological processes and disturbances directly affect the diversity of plant and animal communities within an area over space and time. The better this interrelationship is understood, the easier it is to assess the integrity and sustainability of ecosystems and plan actions to maintain healthy, properly functioning ecosystems into the future. Ecological processes and disturbances include nutrient and biomass cycling, forest succession (the change in vegetation over time), weather events (i.e. windstorms), insects, pathogens, fire, and human influences (i.e. timber harvest).

Over the last century, there have been broad changes in vegetative conditions in the Cascade Range, as summarized in the landscape analyses referenced earlier. The primary or most obvious disturbances or factors of change, influencing vegetation in the fuel break project area include fire (i.e., lack of), insects, diseases and timber harvest. A brief discussion of insects, diseases, and timber harvesting follows below. A discussion of Fire and Fuels occurs in a previous section of this chapter.

Insects and diseases are natural elements of the ecosystem that can exert equal, if not greater, influence on forest development and conditions as fire. Most of these organisms have co-evolved with their host species over thousands of years. The balance between forests and their major pathogens is dynamic and fluctuates through time. In the past, with frequent fire disturbance, they probably existed most commonly at endemic levels (i.e. present in an area but causing low or moderate levels of mortality). However, population fluctuations were normal with epidemic conditions of some insects or diseases developing periodically and causing high levels of tree mortality over short periods.

The pathogen currently causing the most obvious effect on the forests in the Billy Bob/Camp Baldwin area is dwarf mistletoe on Douglas-fir. It is also found in many of the western larch and ponderosa pine. Dwarf mistletoes are small, leafless, parasitic plants that extract water and nutrients from live conifer trees. Douglas-fir dwarf mistletoe is host specific, larch and ponderosa pine dwarf mistletoes are not. Dwarf mistletoes cause decreased tree height and diameter growth, reduction in seed and cone crops, and direct tree mortality or predisposition to other pathogens or insects. Few trees infected as saplings become large-diameter old growth trees. Once the dwarf mistletoe has spread throughout the crown, it usually takes ten or more years for tree mortality to occur. Dwarf mistletoe has created an abundance of snags on the landscape.

There is increasing evidence that important interactions exist between dwarf mistletoes and animals (Hawksworth and Wiens 1996). Birds, porcupines, squirrels, and other animals eat seeds, shoots, and other parts of the plants. The dense branch masses (“witches brooms”) caused by dwarf mistletoe provide cover and nesting sites for some birds and mammals.

Historically, wildfires have been the most important single factor governing the distribution and abundance of dwarf mistletoes (Alexander and Hawksworth 1975 *in* Hawksworth and Wiens 1996). Fires are frequently effective in limiting dwarf mistletoe populations because trees usually return to burned sites much faster than the parasite does. In addition, more heavily infested trees have highly flammable witches’ brooms and lower live crowns, which may increase intensity of fire and tree (and associated mistletoe) mortality. In some situations, fire can increase rather than decrease the abundance and distribution of dwarf mistletoe populations. Spotty low and mixed severity fires may leave live infected trees on site that infest new tree regeneration.

The absence of fire, in addition to partial cutting in the early 1900s in the project area has contributed to Douglas-fir dominated, dense, and often multi-canopied stand conditions, which are particularly favorable to dwarf mistletoe. Dwarf mistletoe spread rate is fastest in the multi-storied stands where mistletoe seeds from infected overstory trees "rain down" on susceptible understory trees. Seedlings and saplings growing under a heavily infected overstory would be killed at an accelerated rate. They would often die before reaching maturity, or cone-bearing age.

In the project area, the severity of dwarf mistletoe infection is very high in older age classes of Douglas-fir, as well as in western larch and ponderosa pine. Many of the older (150+ year) Douglas-fir in the stands within the project area are infected with dwarf mistletoe, most with 100 percent of the crown affected, creating huge witches' brooms. Many western larch and Douglas-fir are already dead. The level of mistletoe infection in the younger Douglas-fir trees (<120 years) varies across the project area, from very low levels in some stands to very high levels in others. Generally, where a heavily infected Douglas-fir overstory exists, the infection level in the adjacent and understory trees is also high, and would be expected to continue to increase as long as the source of infection exists.

The dense, multi-canopied Douglas-fir and grand fir dominated forests in the area are also desired habitat for root diseases. Most of the stands on the eastside of Mt. Hood have some level of root disease present. All these organisms can cause increased stress, severe reduction in tree growth, and direct or indirect mortality to trees. Though the organisms themselves are a natural and integral part of the ecosystem, the condition of the vegetation across the landscape and within individual stands is in many cases not "natural". Selective logging, fire exclusion and mortality caused by white pine blister rust (a non-native pathogen) have resulted in stands of less tolerant species. These factors have altered species composition and forest structure. Insects, diseases and parasitic organisms now have far more of their favored habitat available to them – dense, multi-canopied Douglas-fir and grand fir forest – and therefore may cause more severe effects to the forests than has typically occurred in the past. In fact, several studies have found that the intensity and duration of budworm outbreaks and in some cases their frequency, have increased substantially over the past 50 to 100 years (USDA 1985).

Additionally, large populations of mountain pine beetles have been active in the upper Eightmile subwatershed and have caused high levels of mortality in lodgepole and ponderosa pine (USDA 2005). Mountain pine beetle can affect young ponderosa pine stands that are overstocked. Aerial survey data indicates that this is occurring on the eastside and will continue to occur. Overall density of a stand can reduce the resiliency of large ponderosa pine to western pine beetle when the large trees become drought stressed.

Species such as grand fir in overstocked stands are highly susceptible to fir engraver. Mortality has been occurring from fir engraver on the eastside and in the project area over the last decade.

Timber harvesting has been a major contributor to the change in vegetative conditions that have occurred across the project area. This impact has been more significant in some forest types, particularly the lower elevation ponderosa pine and drier Douglas-fir. Removal of the ponderosa pine and western larch in many of these forests, in combination with fire exclusion, has accelerated their development towards a multi-aged and multi-storied Douglas-fir condition. This, as described in other sections, has altered the normal functioning of ecosystem processes.

In the project area, records show about 19 percent of the area proposed for fuel treatment has previously been treated, during the period from 1960 to 1999 (refer to project record), although ground-truthing indicates that some amount of tree extraction has occurred across virtually every acre around Camp Baldwin. Timber harvest generally creates patch sizes that are substantially smaller than those created by wildfire, even in a mosaic type burn. Photo interpretation from historical aerial photography reveals stand-replacement patches were often several hundred acres in size.

Environmental Effects

The baseline condition against which changes to the vegetation will be measured is the current condition. Criteria used to determine effects on vegetation include: (1) total acres treated and acres treated within each affected forest type (particularly the dense Douglas-fir dominated forests); (2) changes in forest structure and composition; (3) how our actions compare to what conditions might have been historically (i.e. under a more natural disturbance regime, as discussed under fire/fuels section in this Chapter); (4) effects on residual trees; and (5) effects on insect and disease processes and forest vulnerability to these elements.

No Action Alternative – Direct and Indirect Effects

No acres are treated under this alternative, and thus there are no direct or indirect effects to the vegetation. Existing conditions as described above under "Affected Environment" would be maintained. In the short-term, there would be no measurable direct or indirect change in the current condition of the area relative to insect and disease levels or in the vulnerability of the stands to infestations. The warm Douglas-fir sites, currently occupied by densely stocked Douglas-fir and grand fir stands, would experience the continuing spread of root disease and resultant mortality over the long-term, as well as continued and spreading infestation and mortality from dwarf mistletoe. Fuel levels would remain high until a natural cleansing event occurs. If that event is fire, fire severity would be determined by the interaction of forest structure, physical setting and weather (Jain & Graham 2004).

Proposed Action Alternative – Direct and Indirect Effects

<u>Effects on forest types within the Project Area</u>

This alternative treats a total of 1396 acres, 808 with mechanical thinning, 191 acres of thinning in sapling stands, 36 acres with hand thinning, 97 acres of pruning only, and 277 acres with prescribed burning only. This equates to about ten percent of the 13,497 acre vegetation analysis area (3 subwatersheds) in which the treatment area lies. Of the area to be mechanically thinned, about 366 acres would also be pruned, about 429 acres would be pruned and underburned, and five acres would just be underburned following thinning of fuels. In addition, residual dwarf mistletoe trees would be girdled. See Table 2-2 in Chapter 2.

Most of the fuel reduction treatments proposed under the proposed action occurs within the Douglas-fir dominated forests of concern, located on the warm, dry grand fir habitat associations. This alternative changes about 370 acres of this type from what is currently dense, mostly closed canopy forest to a semi-open condition. This represents six percent of the total acres of this forest type within the vegetation analysis area for this project.

Units 60 through 67 in this alternative are low intensity underburns, and may affect stand structure slightly differently depending on forest type. See Table 3-16.

Table 3-16. Forest type of stands proposed for underburning only.

Forest Type	Underburn only acres	Total area treated in forest type
dry grand fir	104	1200
hot, dry pine-oak and Douglas -fir	30	35
warm dry Douglas fir and grand fir	142	176

The treatments would result in little change in the current structure or species composition on the hot dry pine-oak sites. Mortality to encroaching (and some mature) grand fir would be expected due to the thin bark of that species in the dry grand fir and warm dry Douglas fir forest types. These stands proposed for prescribed burning only have been previously underburned within the last 20 years. The trees that could be killed would mostly be seedlings and saplings of any of the species present. By applying prescribed fire in a less than uniform manner, patches of regeneration can be retained to provide structure and the future overstory. For the most part, an open forest with grass undergrowth would still remain after treatment.

<u>Effects on forest structure and composition</u>

Low intensity prescribed burn treatments (Units 60-67). About 277 acres of land would be burned with a low intensity underburn under the proposed action. There would be a relatively minor change to the vegetation with this treatment. This burn would perpetuate the current condition of widely spaced ponderosa pine and Douglas-fir trees of all sizes and ages. Most of these trees would survive the burn, though some of the smaller seedlings and saplings may be killed. The underburn would remove some of the needle and litter layer that has accumulated over many decades and stimulate growth of the grasses and forbs. The lower limbs of some trees may require pruning prior to burning to prevent torching and subsequent mortality.

Thinning treatments. This alternative would mechanically thin about 808 acres of mature forest. The focus would be on leaving the most vigorous, usually larger diameter trees, and favoring ponderosa pine and western larch over Douglas-fir, and a component of trees in all size classes would be retained for future stand structure. A number of trees of all sizes down to saplings (i.e. 3” or less in diameter) would be retained, including snags (about four per acre). Understory patches would break up the line of sight and provide wildlife cover. This treatment would be followed by piling to reduce the amount of fine fuels and slash concentrations left after treatment. Another 191 acres of sapling sized stands would be thinned to increase spacing between trees and move stand composition toward fire tolerant species.

The most notable direct change to vegetation in these areas would be a substantial reduction in tree densities. Density would be reduced from the current 250 to 600+ trees per acre down to about 40 to 100 trees per acre on about 715 acres. The canopy cover would remain slightly higher on about 96 acres after mechanical thinning. Currently dense, closed canopy stands would change to a semi-open condition (see Table 3-17 and Figure 3-6), where most trees would be spaced such that their crowns would not be touching (boles about 30 feet apart). This would reduce competition among trees for moisture and light, improving growth and vigor in residual trees. Substantially more sunlight would reach the forest floor, stimulating growth of understory grass, forb and shrub species. Future underburning would stimulate the growth of these grasses and shrubs even further. Thinning and prescribed fires can modify understory microclimate that was previously buffered by overstory vegetation (USDA 2004).

Table 3-17: Target canopy cover in fuel reduction units*

Canopy Cover	Acres
60 percent	292
50 percent	172
40 percent	574

*Underburning and pruning units are not included.

Higher levels of canopy cover left for fisheries, northern spotted owl habitat, or recreation aesthetics are usually less effective for fuel reduction per unit area. If canopy cover is to be maintained over 40 percent, surface fuel reduction and understory vegetation clearing should be more intensive over wider expanses (Agee et al. undated). The U.S. Fish & Wildlife Service has allowed for 300 acres of northern spotted owl habitat to be altered to less than 60 percent canopy for this project; this fuel reduction project would treat approximately 272 acres of suitable habitat to a resulting canopy cover of less than 60 percent.

Figure 3-6: Target canopy cover in project area

Species composition would essentially remain unchanged, though ponderosa pine may increase slightly in proportion within those units where it currently exists. This is because ponderosa pine would be chosen over Douglas-fir as a leave tree whenever possible. However, because Douglas-fir and grand fir are currently so overwhelmingly dominant in most stands, this increase in proportion of ponderosa pine would be quite small. Small openings created in root rot pockets may be large enough to allow western larch to germinate and grow; larch need full sunlight to become established and thrive. Openings will be planted with western larch, ponderosa pine, white pine, and where appropriate, western red cedar.

Stand structures that were originally single storied and essentially even aged, composed of 80 to 110 year old Douglas-fir, would remain so, only far more open-canopied. Few to no old overstory trees would exist, because there were none in the present stand. Stands currently with a more multi-storied structure, and a wide range in ages of trees, would also be more open after treatment, but still in the multi-age/multi-canopied structure. These areas would appear park-like after treatment, with widely spaced trees and a relatively clean, green forest floor. Where canopy cover previously excluded herbaceous vegetation, herb production would increase with the reduction in canopy and may present a challenge for management.

Pruning: Removal of the lower branches of sapling trees on about 120 acres would not affect overall structure or composition, but would remove fuel ladders and make the trees less likely to torch out in a low severity fire. Fuel treatments are most effective if both ladder and surface fuels are treated (Raymond & Peterson 2005).

Comparison to historical conditions

The character of the existing stands within the subwatersheds is heavily influenced in a detrimental way by past fire suppression and logging activity, as described earlier under “Affected Environment”. The treatments proposed largely counteract this influence, reducing tree densities and altering forest conditions to be closer to an estimated historical condition.

Thinning maintains the overwhelmingly Douglas-fir dominated forest, though density and structure are altered to a more desirable, sustainable condition. Some improvement of conditions would occur for ponderosa pine and western larch regeneration, survival, and growth by creating small openings, releasing of existing pine, and applying periodic underburning. Over time, it is hoped that ponderosa pine and western larch may find some sites to regenerate within these treatment units. Reducing understory ladder fuels and downed woody debris would lower risk of crown fires. Periodic underburning would restore more natural processes to the site and the landscape, reintroducing fire with all its known and unknown benefits to these plant communities.

The prescribed burn treatments in the proposed action are an attempt to functionally replace wildland fire with prescribed fire. The forests in the project area are adapted to fire, of variable intensities and sizes (as described more thoroughly under the section on “Fire and Fuels”). The prescribed burns would result in effects similar to that of a “natural” wildland fire. The treatments recognize the important role fire has historically played in these ecosystems for recycling of nutrients and organic biomass, and regeneration or stimulation of the vegetation. However, we also recognize that the effect of a prescribed fire does not in all cases equate to that of a wildland fire. Prescribed fire is likely to be at lower intensity than a wildland fire on that site, primarily to reduce the risk of fire escape. Higher intensity fires may burn much of the duff and debris layer on the forest floor. Fires of different intensities favor different complements of plant species, because of the variability in a plants tolerance and resistance to fire. These tradeoffs are sometimes necessary to ensure that the prescribed fire can remain under control, or to ensure that other management objectives are met (such as avoiding excessive loss of live trees during burning operations).

<u>Effects on residual trees in thinned areas</u>
In the thinned units there is an increased risk of blowdown, bending and breakage of the residual trees from snow loading. Trees that have grown for many decades in densely stocked conditions and are relatively small in diameter as a result (i.e. <9” diameter at breast height) are often more vulnerable to these effects if a thinning occurs and the surrounding “supporting” trees are removed. However, it is not expected that these effects would be significant in this area. Tree diameters would vary, but many, if not most, trees would be of large enough diameter and strength to withstand the effects of winds and snow. In addition, snow loads on these lower elevation sites are not excessive in most years.

Mechanized equipment would be used to fell and remove the trees in the commercially thinned units. There is some risk of damage to residual trees from these activities. However, residual tree spacing would be quite wide, allowing machinery to have adequate room to maneuver and therefore should be able to avoid any appreciable damage to residual trees. Although the residual forest structure should reduce fire spread and fire behavior, it is not possible in many stands to leave the fire resistant species due to forest health issues. In units that are thinned and underburned, mortality can be expected to any residual grand fir due to its thin bark.

<u>Insect and disease processes and forest vulnerability</u>
A minor direct reduction in dwarf mistletoe populations would occur with treatments proposed under this alternative. This would occur mostly because many of the dwarf mistletoe infected trees would be removed from the site in the fuel reduction treatment. There would still be many dwarf mistletoe infected trees left throughout the area, because in some areas there would be no choice but to leave these trees in order to meet structure retention objectives. The rate of dwarf mistletoe spread through the stand would likely be decreased from present conditions under this alternative because of the wide spacing created between the trees. The range of mistletoe seed spread is limited. Understory burning has been shown to reduce stand infection (Conklin and Armstrong 2005). Girdling of the residual infected overstory trees will reduce the spread of dwarf mistletoe to regenerating understory as well as create numerous high quality snags across the treatment area.

Root disease and dwarf mistletoe infections limit the ability to leave all the most fire resistant species, which are ponderosa pine, western larch, and Douglas-fir. Thinning in areas with root disease would also increase the rate of mortality in susceptible retained trees, due to the increased amount of inoculum in the stumps of cut trees. (USDA 1991). More snags from trees killed by root disease can be expected to appear in many of the treated stands over the next decade or so.

Some reduction in vulnerability of the stands to future infestations of insects such as spruce budworm and tussock moth would occur under this alternative. This is because a widely spaced forest, with lightly stocked understory tree layers, would be created by treatment and maintained through time by understory burning. Though the host species Douglas-fir would remain the dominant stand component, this change in stand structure would create conditions much less favorable for these insects (Fellin and Dewey 1986). Decreasing stand density would also improve the resilience of larger diameter pine against attack by western pine beetles

Proposed Action – Cumulative Effects

Discussions of the cumulative effects are limited to those past, present and reasonably foreseeable activities that have been determined to have a cumulative effect on the vegetative resource. Refer to Appendix B in the Silvicultural Report (project record) for evaluation of all possible activities that were originally considered in this cumulative effects analysis for vegetative conditions.

<u>Landscape Scale – Cumulative Effects of Alternatives</u>

The total acreage treated by thinning or prescribed burning in the proposed action alternative is 1396 acres. This is a fairly inconsequential amount of vegetative change when considered at the landscape scale, specifically the 13,500 acre analysis area as described earlier. The proposed action treats a portion of the dense Douglas-fir stands of concern in the analysis are and moves overall landscape vegetation towards a structure that likely would have occurred under a natural disturbance regime. The project meets many other important land management objectives, such as reducing fire risk, protecting private lands, and improving wildlife habitat.

<u>Cumulative Effects for the No Action Alternative</u>

This alternative perpetuates the current condition of the vegetation in Billy Bob project area, which has been heavily influenced by the past fire suppression and logging activities as described earlier. There is higher probability and increasing risk of mixed and uncharacteristically lethal fire (stand-replacing) in this area under this alternative (see effects discussion under the section on “Fire and Fuels”). A future fire of this sort would result in dramatic changes to the vegetation condition, uncharacteristic of what the area historically experienced. Crown fires were more difficult to sustain in western white pine and western larch dominated stands than in stands dominated by other species (Graham et al. 1999).

<u>Cumulative Effects for the Proposed Action</u>

Treatments under this alternative would improve the ability of fire suppression forces to contain fires by altering fire behavior and lower the overall risk of stand-replacing fire in the future in the project area. As described under “Fire and Fuels” section, future fires in the treated area are likely to be low intensity and non-lethal, easier and safer to control. Eventually, fire behavior would be more within what the site historically experienced on most similar sites, which would help ensure that key ecosystem elements and processes are sustained. The potential for severe and undesirable impacts to the forest and site from a future high intensity fire would be reduced. This does not take into consideration the somewhat uncertain effects of climate change on this forest ecosystem.

Treatments on private lands around Camp Baldwin to reduce fuel loading and fire risk have occurred in the last few years (see Figure 3-7 for a map and estimated acres of Vegetation Treatments on Private lands). These treatments are adjacent to units on NFS lands and share similar treatment methods as the proposed units in this project. Forest conditions were similar (dense Douglas-fir) and conditions after treatment would be the same (semi-open forest with about 50 trees per acre). Stands on private land may have been healthier due to a lower incidence of the historical practice of selectively logging the biggest and straightest trees from a stand, leaving more options from which to choose when thinning today.

Cumulatively, this project would increase the amount of the Douglas-fir forest type treated across this area, converting dense stands to a more desirable semi-open condition, with resulting landscape and site specific effects as described under earlier sections in this section. These additional vegetation treatments also have associated effects on fire risk, wildlife, and other resources, as described under the respective sections in this Chapter.

Stands in the fuel reduction area contain high levels of root disease. This factor, combined with topography and previous harvest, is expected to make residual trees more susceptible to windthrow. It is not possible to predict the full extent of windthrow that may occur.

It is recognized that trees girdled because of dwarf mistletoe infection may eventually become hazard trees. The structural benefit they provide in the potential long-term overrides the future maintenance cost for their felling or removing.

Transportation Systems

Existing Conditions

The road system consists of 32.68 miles of system classified Forest Development Roads. There are 21.43 miles of open system roads within the project area. This equates to approximately 9.74 square mile with an open road density of approximately 2.20 miles per square mile.

Attached are two tables (Table 3-18 and Table 3-19) that show the roads that are inside the boundary for the Billy Bob Hazardous Fuels Reduction Project.

Table 3-18: System of classified Forest Development Roads that provide partial access to the National Forest System Lands inside the project area.

Road Number	OBJ_MAINT	Surface	Length	Comments
4400000	4	AC	4.79	
4400014	2	NAT	0.30	
4400140	2	AGG	0.20	
4400170	2	NAT	0.70	
4400180	2	AGG	0.25	
4421000	2	AGG/NAT	5.73	
4421016	1	NAT	0.30	
4421150	2	Agg/Nat	1.10	
4421160	2	AGG	0.50	
4421170	2	Agg	0.40	
4421180	1	Nat	1.20	
4430000	3	AC	0.34	
4430000	2	AC	0.76	
4430120	2	AGG	0.56	
4430150	4	BST	0.82	Eightmile Campground
4440000	2	AGG	1.42	
4440120	2	AGG	0.20	
4440130	1	AGG/NAT?	1.50	
4440140	2	AGG	1.10	
4450000	2	AC	1.32	
4460000	2	AGG/NAT	4.45	
4460120	1	AGG	1.60	
4460140	1	AGG	2.60	
4460141	1	AGG	0.54	
TOTAL MILES			**32.68**	

Abbreviations: Objective Maintenance Level = OBJ_MAINT; Asphalt Concrete = AC; Native Material = NAT; Crushed Aggregate = AGG; Bituminous Surface Treatment = BST; Boy Scouts of America = BSA

Table 3-19: Private roads that are inside the boundary for the Billy Bob Hazardous Fuels Reduction Project and have been used in the past to access Forest Service projects. The legal description is: T2.S, R11.E.; SW¼ of SW¼ of Sec. 10. The 4400160 road is a private road and provides primary access for Camp Baldwin.

Road Number	OBJ_MAINT	Surface	Length	Comments
4400160	BSA	AGG	0.50	Boy Scouts of America (BSA)
4400161 spur	BSA	NAT	0.20	BSA used by Forest Service to access Lake Salvage sale in early 1990's.
TOTAL MILES			**0.70**	

Roads are asphalt, gravel, and native surface. Road drainage consists of ditch to culverts or insloped or outsloped surface to draindips or berms. Roads in the Planning Area provide access for administrative, public, and commercial users. Some of the roads are used during winter for winter recreation, primarily snowmobile trails.

Limited road maintenance dollars have resulted in a backlog of road maintenance. This has resulted in roads brushing in, drainages becoming non-functional, and road surfaces needing repair. Lack of maintenance negatively affects safety for the users, increased potential for damage and loss of road structure, and higher levels of sedimentation. Roads brushing in reduce visibility for safe driving. Failed drainages increase the road damage and amount of sediment entering creeks. Damaged road surfaces such as pot holes, ruts, washboards, breached water bars and pavement cracking, can be obstacles to drivers, add sediment into creeks, and increase the rate of degradation of the road infrastructure.

The Forest Service identifies and removes leaning trees that are considered an imminent safety hazard though Danger Tree Identification. Trees that are removed are made available to the fire wood program and stream restoration or other resource enhancement projects.

Environmental Effects

Activities related to timber sales affecting the transportation system include: log haul, road construction, reconstruction, maintenance, road closures, access, and cutting danger trees that lean over the road. These relationships/effects will be discussed for the no action and proposed action alternatives.

Haul Route Analysis
A route analysis cost of haul, road maintenance and reconstruction to Dee, Oregon shows Forest Service Road (FSR) 4400000 from its junction with Oregon State Highway 35 at mile post 0.00 to the Forest boundary at mile post 14.57 to be the most economical route.

Roads were analyzed for three different seasons of haul: wet operation season, normal operating season and dry operating season. Given the existing conditions and life expectancy of roads, wet season haul would not protect the integrity of existing roads. A cost analysis to reconstruct main haul roads to withstand the wet operating season, or the normal operating season is economically prohibitive and beyond the financial capability of this project or any road maintenance or reconstruction funding source available. The roads were designed for hauling timber during the normal operating season, generally June through October (reference policy December 18, 1989 extended season haul policy). The proposed action alternative was analyzed for the normal operating season haul. Soil moisture in the subgrade must be below its plastic limit to meet this design parameter.

No Action Alternative – Direct and Indirect Effects
The no action alternative would not involve log hauling, road construction, road reconstruction, road closures, or timber sale related road maintenance. This alternative would not change the use pattern of roads, correct existing road erosion problems, or correct ineffective road closures. Individual Danger Trees would continue to be removed as they are identified. These trees would continue to be available for the fire wood program.

Proposed Action Alternative – Direct and Indirect Effects
Log Haul has the most critical effect on the transportation resource. The amount of moisture present in the subgrade or base course is a concern. Past commercial haul during wet conditions of the base and subgrade have weakened the structural capacity of aggregate surfaced as well as asphalt surfaced roads. Even with normal traffic, road damage is likely to occur. With heavy vehicles use on saturated base and subgrade, the damage would be accelerated.

Hauling during freeze/thaw conditions has damaged the surface and base materials. As frost penetrates the road prism, it pulls moisture up into the subgrade and base course material, saturating the subgrade. When the moisture in the subgrade and base course freezes, the ice expands, pushing soil and rock particles apart. This action reduces the compaction in the subgrade and base course, which in turn reduces the structural capacity of the road. During this freeze/thaw condition, moisture content normally reaches the saturated condition leaving the base and subgrade in a weakened condition. During this period, an 80,000 pound legal loaded truck would produce five times or more stress on the travel way than it would produce during optimum moisture conditions for the base and subgrade.

Plowing snow for winter haul eliminates insulation, which allows deeper frost penetration. Plowing also stores snow along the shoulders of the road. As the snow melts, the subgrade is saturated and prolongs the time it takes for the road to dry out in the spring. Snowplowing for use would accelerate damage caused from saturated soils and freeze/thaw. It would also set up a corridor for collecting and concentrating water during rain-on-snow events that could accelerate damage to the road and drainage structures.

Access to landings from roads should have a grade of 2 to 8 percent, plus or minus. The access should have an aggregate surface for a distance that prevents tracking native materials and soils onto the main road. Asphalt roads need protection to prevent edge breaking.

The proposed action would involve log haul (See Haul Route Analysis for details). Commercial haul would be prohibited when moisture is greater than the plastic limit in the subgrade and during freeze/thaw cycles, which would mitigate damage to road surfaces during the normal operating season.

Road maintenance would occur in the proposed action. Maintenance would protect the road infrastructure, improve safety of the road, decrease sedimentation, help to protect fish and fish habitat, and reduce the spread of noxious weeds. Brushing roads increases sight distance to improve visibility for safe driving. Blading, ditch and culvert cleaning, rocking, spot rocking, resurfacing as well as removing and replacing barriers and water bars corrects or improves water drainage. Repairing road surfaces by blading, rocking, spot rocking, resurfacing, removing and replacing barriers and water bars as well as pavement patching and deep patching would reduce obstacles, reduce maintenance costs, and protect the road infrastructure. Appropriate water sources would be selected for compacting and dust abatement that assure stream flow and fish protection measures are met. Maintenance activities could cause some short term delays or detours for road users while road work is being done.

Road maintenance and reconstruction are proposed for the proposed action. There would be no effects from maintenance or reconstruction, temporary roads or road closures as long as BMP are followed (General Water Quality Best Management Practices, USDA Pacific Northwest Region, November, 1988 R –1 through R – 23). There would be a temporary increase in access for all forest users until roads are closed at the end of the project.

Road density for the project area meets or exceeds the Forest Plan Standards and Guidelines. All Forest System roads used for the proposed action would remain in the same Maintenance Level as they are currently assigned.

Cumulative Effects for the Proposed Action Alternative

Factors considered for cumulative effects on the transportation system include log haul, road reconstruction, road closures, road density, road maintenance, and access. Planned and current active projects include 8 Mile Salvage, North Fork Mill Creek planning area, The Dalles Watershed Fuel Break and Billy Bob Hazardous Fuels Reduction. There are private timber lands that may affect the area located inside the project area.

Assumptions for this analysis include: Log haul would occur during the normal operating season. All the timber sales from the above planning efforts would be completed in 5 to 7 years. All the other timber sales would protect the roads to standard.

The Commensurate Share Policy is used to determine maintenance and reconstruction responsibilities for any project that has commercial haul. Under this policy all competing users would be assessed their commensurate share of responsibility for maintenance and reconstruction. This policy would reduce the cumulative effects of commercial haul over a similar time frame. Timber sales from the adjacent planting areas would continue independent of Billy Bob Hazardous Fuel Break project. With the current mitigation measures for the proposed action, there would be no unacceptable damage to Forest System Roads. Removing danger trees would increase safety for all users.

Soil Productivity

A more detailed soil productivity report is located in the project record, located at the Barlow Ranger District. The analysis and conclusions of the report are summarized below. Reference material is contained in the full specialists report.

Existing Conditions

Background and Introduction

The productivity and health of entire plant communities depend on the presence of healthy soils. Regional soil productivity protection standards were originally implemented in 1976, and have been revised several times since then (Pacific Northwest Region Monitoring and Evaluation Report, 2001), including incorporation into the Mt. Hood Land and Resource Management Plan (Forest Plan) as part of the soil productivity chapter. Soil distribution across this analysis area is relatively consistent. Each type of soil is given a soil map unit (number) to show where they occur on a soil map. Then, each soil type is assessed for many risks and hazards called management ratings (e.g. erosion risk, compaction hazard), which are located in the Mt. Hood National Forest Soil Resource Inventory (SRI) (Howes, 1979), and in the Mile Creeks Ecological Unit Inventory (EUI) (McArthur, 1999, unpublished survey). The scale at which the mapping was produced in the SRI is one inch to the mile, which makes it most useful as an initial broad-scale planning tool to identify and display maps of possible soil concerns or sensitive areas. The EUI was mapped at a scale of four inches to the mile, four times finer than the SRI. As a result, it is valuable for site-specific planning, such as this, and will be used to supplement the SRI in this analysis when possible. Unfortunately, one of the main drawbacks of the EUI is no management ratings, such as erosion potential or compaction hazard, were assessed to each soil type. There was an attempt to correlate the EUI mapping with soil mapping that was done in The Dalles Watershed and use the management ratings derived from that mapping effort. However, there was a consistent difference in how soils were described from one mapping effort to the other, generally due to the coarser textures identified in the field during EUI mapping.

Soil Types in the Billy Bob Planning Area

Soils across the planning area have been derived from volcanic ash deposits ranging in depth from less than seven inches to greater than 20 inches. Ash clouds from volcanic eruptions would be carried downwind from Mt. Hood and deposited across the area by prevailing wind patterns. Subsequent winds, precipitation events, and ancient landslides have altered, and continue to alter, the original depositional pattern by removing soil completely in some places exposing bedrock, and depositing it in others resulting in deep deposits. Despite the variability in soil depth, surface soil characteristics (such as texture) are very consistent across the proposed treatment areas. See Figure 3-8 for soil unit map.

For the purpose of this analysis, soils have been divided into two main categories and further subdivided into a total of three general types based on slope steepness. The two main categories are soils that formed under a more frequent fire return frequency (based on vegetation types and surface soil characteristics) versus those under a more infrequent fire return frequency. Soils developed under more frequent fire returns tend to have a more developed, darker topsoil that ‘stores and protects’ site organic matter from loss during fire. Soils developed over time where fire is less frequent tend to be lighter in color and store nutrients above ground in the duff and woody material. These two types are further divided into soils on less than 30 percent slope and those on greater than 30 percent slope. A summary of soil mapping units and their associated management interpretations is located in Table 3-20. Key observations from the table include:

- All potentially impacted soils have a low to moderate compaction hazard;
- Erosion risk for soils on less than a 30 percent slope run generally from slight to moderate for undisturbed, bare soil; and,
- Erosion risk for bare soils on greater than a 30 percent slope are all rated as moderate.

Table 3-20: Summary of soil types in the analysis area and associated management interpretations from Mt Hood Soil Resource Inventory.

SRI Soil Map Units	Compaction Hazard	Erosion Potential (bare soil)	Corresponding EUI Mapping Unit(s)*
Frequent Fire <30% slope			
156	Low-Moderate	Slight-Moderate	24C, 34C
160	Low	Moderate	30C
Frequent Fire >30% slope			
154	Low	Moderate	35D, 36D
Less-frequent Fire >30% slope			
157	Low-Moderate	Moderate	26D
162	Moderate	Moderate	26D

*Field validated with EUI field notes 38, 43, and 44: and soil profiles 22M, 23M, 25M, and 36M.

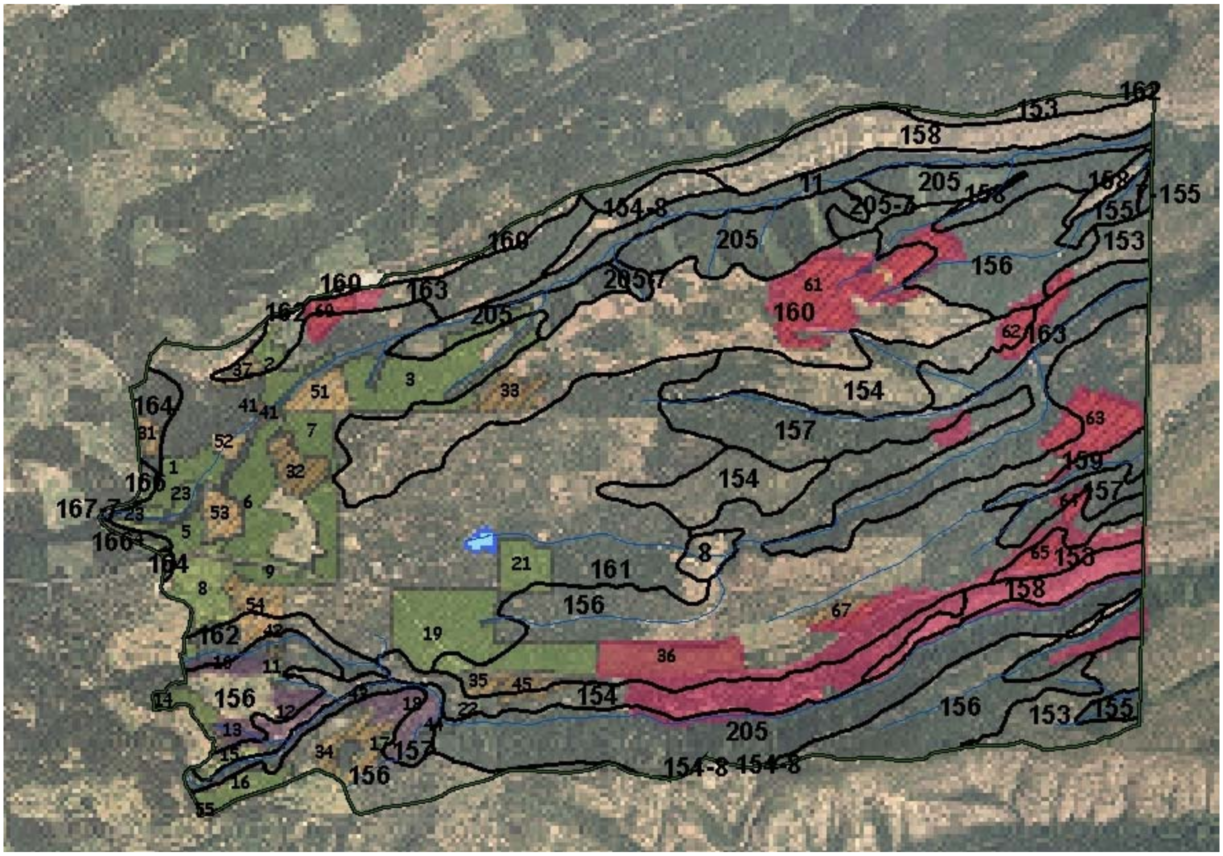

Figure 3-8: Soil map units (identified with the larger font number and delineated with thick black line) and proposed treatment areas (smaller font number and delineated using color) in relation to each other. Red color indicates underburn only; green is ground based treatment; purple is aerial based treatment; tan is hand treatments only.

Analysis Area, Applicable Standards and Guidelines, and Methodology

The analysis area for soil resources in this Environmental Assessment (EA) are the proposed treatment boundaries (see Figure 2-1). A comparison of alternatives will be conducted using applicable Forest Plan standards and guidelines as the method of measure (Table 3-21) to answer the following questions:

> *If the proposed action is implemented, what measurable changes occur to the soil, and of the changes, which do we use in the analysis to describe the effect? What are the consequences of taking no action?*

In other words, what are the risks to the soil and related/associated values from the proposed action? In addition, is it possible to reduce risks through mitigations or project design criteria? What would happen if no action is taken? For this analysis and project type, the following three measures would be used to assess impacts:

1. The risk of erosion and subsequent sedimentation of adjacent water bodies in the Eightmile and Ramsey Creek drainages.

   Erosion Hazard: The possible impact of concern stemming directly from soil erosion is runoff from bare areas carrying sediment that affect watercourses. This hazard rating is based upon a particular soils' texture, slope, etc. for bare soil. Surface soils across the entire area are very consistent, resulting in similar erosion hazard ratings.

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

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

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

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

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

Table 3-21: Summary of Forest Plan Soil Standards guiding the soils analysis. Full texts of these standards are on pages 4-49 and 4-50 of the Forest Plan.

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

Soil Erosion Hazard Class	Effective Groundcover
Slight to Moderate	60%
Severe	75%
Very Severe	85%

The methodology used to gather data needed for this effects analysis include field visits as well as previous field experience, including monitoring and soil surveys in the area. Personal observation and knowledge of how soils respond to the proposed types of management actions was used to predict impacts.

Assumptions and Design

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

If a proposal to implement winter logging is presented, the following would be considered by the District Ranger and Responsible Official if the ground is not frozen hard enough and/or insufficient snow depth to support the weight and movement of machinery in moist to wet soil conditions (these are based upon observations and monitoring of winter logging in Sportsman's Park):

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

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

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

D. Due to higher pounds per square inch than track mounted equipment, no rubber tired skidders would be used even on skid trails once soils become fully saturated (approach their liquid limit).

Environmental Effects

Current and Predicted Changed Conditions Caused by the Proposed Action

Soil erosion risk

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

Detrimental soil conditions

The results of soil quality field surveys performed over several years are shown in Table 3-22 below. The timber sales that were monitored for soil damage following ground disturbing activities are either within or adjacent to this planning area. They also occurred on soil types that exist within the planning area, or on soil types expected to respond in a similar fashion. There is a substantial drop in monitored soil damage from the early 1990’s to present. Reduced impacts may be attributed primarily to the following: major changes in practices, such as the elimination of machine (dozer) piling of logging slash; lower ground pressure machinery that reduce compactive forces; and an awareness that soil damage was exceeding acceptable levels with a conscious effort to reduce damage. The one major change in operations that led to the greatest decrease in soil damage was moving away from dozer piling to more grapple piling of slash.

Table 3-22: Summary of stands monitored with shovel probe transects.

Sale Name and Unit Number	Year Monitored	Silv Treatment	Logging System	Fuel Treatment	SRI Soil Type	% Monitored Detrimental Soil Impacts
Crow 10	1992	Clearcut	Ground	UN	168	14
Perry 10	1992	Clearcut	Ground	UN	168	11
Scout 3	1993	Thinning	Ground	MP*	156	41
Pebble 19	1993	Thinning	Ground	UN	164	10
Silver 1	1997	Thinning	Ground	UN	164	21
Tap 1	2005	Thinning	Ground	None	164	7
Tap 2	2005	Salvage	Ground	None	164	4
Tap 3 and 4	2006	Thin/Sal	Ground	None	165	5

*Machine piled (dozer). UN – records were not found that showed the method of slash treatment.

The conceptual layout of logging system patterns for the proposed treatment areas have been designed to ensure less than 15 percent of the area is impacted (ground disturbance) within each individual stand that uses ground-based equipment. Since ground disturbance does not equate with detrimental soil condition, and design already has impact area below 15 percent, it is not expected that any of the proposed treatment areas would exceed the Forest Plan standard, with the exception of Areas 19 and 21. Soils underlying skid trails nearest landings are most likely to incur detrimental damage because they receive the most trips with equipment. Further away from landings, soils are impacted less and less as fewer trips occur over them. The past several years of Forest Plan monitoring results indicate a clear trend in the reduction of detrimental impacts due to the increasing use of low ground impact machinery. Observations during monitoring indicate obvious detrimental impacts on main skid trails and landings that receive numerous trips with higher impact machinery (such as skidders), with much less impact on lateral trails and within the unit where harvester equipment typically works. As an example, a recently (July 2006) completed thinning unit in the West Fork Hood River watershed was yarded with a large log loader. Random shovel probes occurring right behind the machine as it moved through the unit showed virtually no damage at all.

Areas 19 and 21 are adjacent to Road 44 and/or surrounded by lands belonging to the Boy Scouts. It is likely these areas already exceed the 15 percent standard due to impacts such as vegetation management, installation of a buried irrigation pipeline parallel to Forest Road 4400, and extensive crisscrossing pathways caused by campers.

Organic matter levels

It is likely organic matter tonnage would be reduced to levels below Forest Plan standards, especially in the higher fire frequency areas. Since the overarching goal of the hazardous fuel reduction project is to reduce organic matter available to burn, it is a trade-off to meet the purpose and need. Fine organic matter levels should trend upward as the forest floor in higher fire frequency areas increase in shrubs, forbs, and grasses.

No Action Alternative – Direct and Indirect Effects

Soil Erosion Risk
The risk of erosion within the analysis area would remain unchanged because the amount of groundcover protecting the soil surface from erosional influences is widespread. The expected effect is the landscape would respond and change proportionate to the severity of natural events such as storms or wildfire. Uncharacteristically hot wildfire due to fuel build ups may occur, depending on many unpredictable factors such as field conditions during burning. These effects would likely be localized, but some areas may experience a decrease in site productivity. This is especially true in some of the densely forested riparian areas along Eightmile Creek where burn intensities would likely be high, with erosion and sedimentation risks commensurate with the burn intensity.

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

Organic Matter Levels
Soil organic matter and corresponding soil functions would continue to occur as they are in a general sense. Similar to erosion risk, the expected effect is that the soils at landscape and site scales would respond and change proportionate to the severity of natural events such as storms or wildfire. In addition, organic matter decomposition is influenced substantially by temperature, moisture, and fire, thus the rate of decay and cycling would continue accordingly.

Proposed Action – Direct and Indirect Effects

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

of erosion and subsequent sediment delivery caused by the proposed action is extremely small.

Detrimental Soil Conditions

Impacts caused by heavy equipment would increase the amount of detrimental soil damage within the treatment areas. This increase is not expected to exceed Forest Plan standards except in Areas 19 and 21. Therefore, there would be no accompanying measurable decrease in site productivity in the remainder of the units. In Areas 19 and 21, the amount and resulting effect from detrimental soil condition would be very similar in appearance to the vegetation treatments and burning that have already occurred east of this area adjacent to the north side of Forest Road 4400. The Changed Condition section above explains how logging systems are expected to impact the ground based treatment areas.

Organic Matter Levels

It is likely localized acreage would be lower than Forest Plan standards for organic matter, which is an intention of the proposed action for a hazardous fuel reduction project. When this occurs, it is not expected to be a substantial impact to nutrient cycling because these are not clearcuts followed by intense burning and extreme loss of current and future organic matter, and many of the soils impacted would retain substantial organic matter reserves in the mineral topsoil due the way in which they have developed.

Cumulative Effects

Analysis of soil impacts for this kind of project inherently incorporates cumulative effects on an activity area basis, since we are examining previous impacts plus expected. On a larger scale, there is unauthorized OHV use occurring in Ramsey Creek downstream of the project area, which has resulted in obvious localized erosion and subsequent sediment input directly into the stream. The amount of sediment has not been measured. Efforts are undertaken to discourage the OHV use when it is observed in the field (placing logs, limbs, rocks in the trail, etc).

Watershed Resources

A more detailed watershed resources report is located in the project record, located at the Barlow Ranger District. The analysis and conclusions of the report are summarized below. Reference material is contained in the full specialists report.

Existing Conditions

Project Area Description
The Billy Bob Hazardous Fuels Reduction Project is located primarily in the Upper Ramsey Creek and Upper Eightmile Creek Watersheds on the Mt. Hood National Forest in Wasco County. Vegetation includes mixed conifer forests, meadows, and open grassy slopes. Average annual precipitation ranges from 50 inches on the west side to 30 inches on the east side, occurring mostly during the winter months. Elevation in areas proposed for treatment ranges from 2,500 to approximately 4,000 feet. Primary aquatic features in the project area include Ramsey Creek and Eightmile Creek. This area is also the site of a portion of the Wolf Run Ditch which provides irrigation water for the upper Eightmile valley. Much of the ditch has been converted from surface flow to pipes.

The Billy Bob Hazardous Fuels Reduction Project is located primarily within portions of three 7th field watersheds (see map below), 15E (Eightmile Creek), 15G (Hesslan Creek), 15I (Ramsey Creek). A very small portion of the proposed treatments are located in one other 7th field (15F Rail Hollow), but the total acreage is so low (41 acres) that potential treatment effects are expected to be unmeasureable at the 7th field watershed scale. All of the above mentioned 7th field watersheds are located within the Upper Eightmile Creek and Headwaters Fifteenmile Creek 6th field watersheds (see Figure 3-9). The entire planning area is within the Fifteen Mile Tier I Key Watershed as identified in the Northwest Forest Plan. The Fifteen Mile Watershed is also the 5th field watershed that contains the Billy Bob Hazardous Fuels Reduction Project.

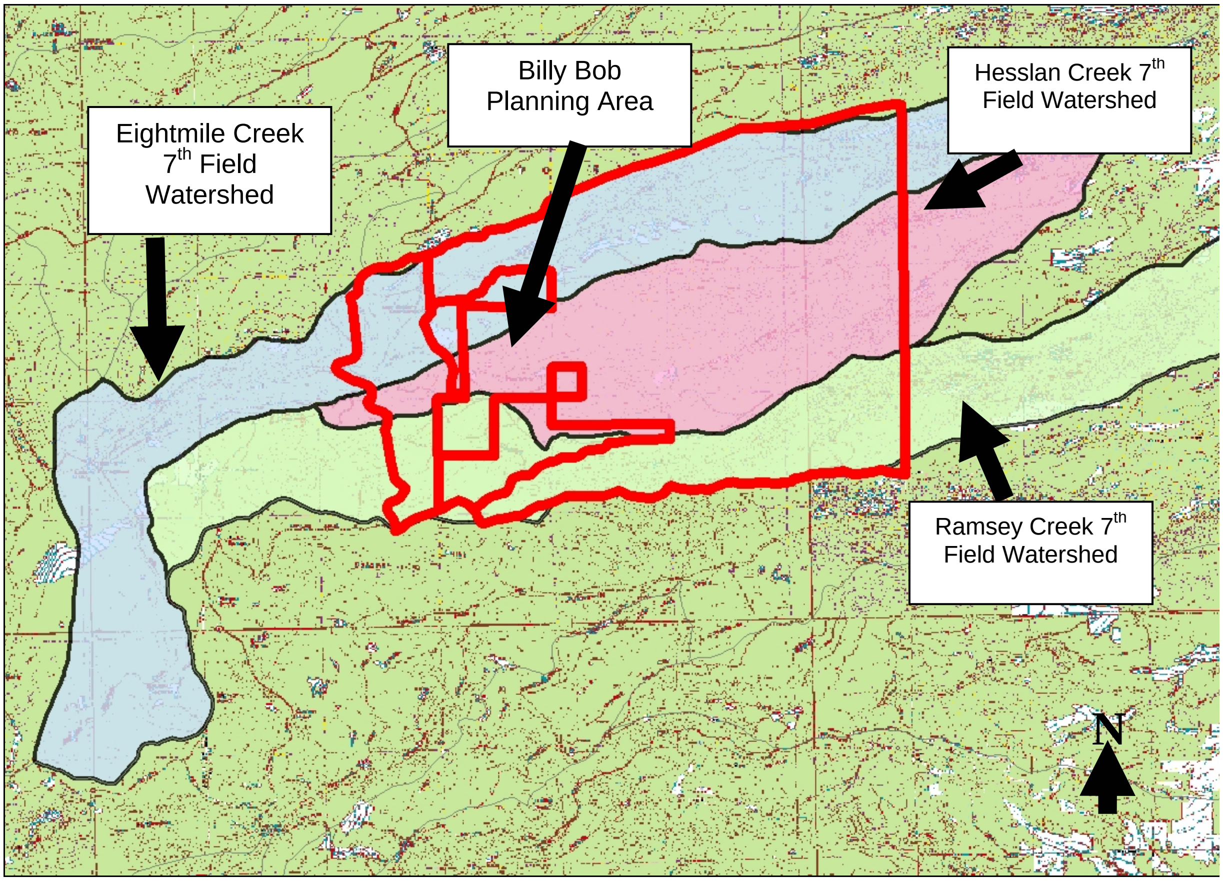

Figure 3-9: Map showing the location of the three 7th field watersheds that the Billy Bob Planning area lies within. The planning area is outlined in red and is in the central portion of the map.

There are many streams, springs and wetlands located within these sub-watersheds. As mentioned above, the primary streams include Eightmile Creek and Ramsey Creek. There are approximately 56.5 miles of stream in the National Forest portion of these 7th field watersheds in the following categories: 28.8 miles of perennial streams (flow year around) and 27.7 miles of intermittent streams (streams that dry up for part of the year and do not contain fish).

Water Quality

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

The CWA requires States to set water quality standards to support the beneficial uses of water. The Act also requires States to identify the status of all waters and prioritize water bodies whose water quality is limited or impaired. For Oregon, the Department of Environmental Quality (DEQ) develops water quality standards and lists water quality limited waters. In addition, Region 6 of the Forest Service has entered into a Memorandum of Agreement (MOA) with the

Oregon State DEQ to acknowledge the FS as the Designated Management Agency for implementation of the CWA on National Forest land. In an effort to support the CWA, the Forest and Scenic Area conduct a variety of monitoring and inventory programs to determine status of meeting state water quality standards as well as other regulatory and agency requirements. In an average year, approximately 75 sites are monitored for water temperature throughout the Forest. In addition, other water quality monitoring occurs at various locations throughout the Forest depending on the year. This could be turbidity monitoring, instream sediment sampling, water chemical sampling or surveys of physical stream conditions. Currently, approximately 25 miles of physical stream habitat is surveyed every year and to date approximately 1200 miles of stream have been surveyed. Information collected during these surveys includes the number of pools and riffles, the amount of large wood, riparian area condition and types and numbers of fish and other aquatic organisms to name a few of the parameters.

By direction of the CWA, where water quality is limited, DEQ develops Total Maximum Daily Load (TMDL) plans to improve water quality to support the beneficial uses of water. For water quality limited streams on National Forest System lands, the USDA Forest Service provides information, analysis, and site-specific planning efforts to support state processes to protect and restore water quality. Currently, the Miles Creek Basin is in the process of TMDL development. Once the TMDL plan is completed, streams would be removed from the 303(d) list and stream recovery would be achieved through an implementation plan.

Stream Temperature

Water temperature data has been collected by the Forest Service on the above mentioned stream systems for several years. Data has been collected on continuous temperature recording dataloggers in three locations that include Eightmile Creek and Ramsey Creek (see Figure 3-10). Grab samples were collected during stream surveys in Eightmile Creek (1999) and Ramsey Creek (1994 and 2004).

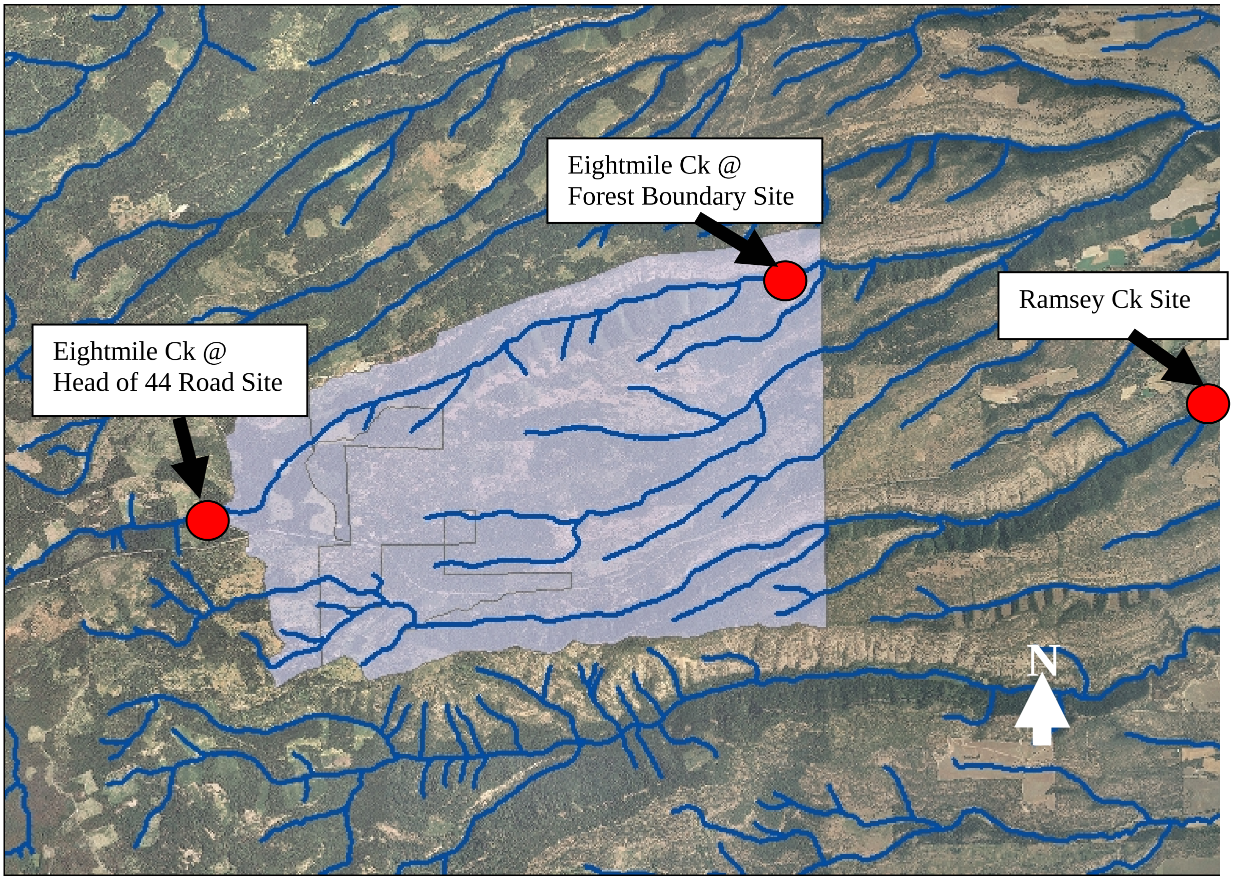

Figure 3-10: Water temperature monitoring sites in the Billy Bob Fuel Treatment Project area. Monitoring sites are shown as red circles on the map and the Billy Bob Project area is shown in blue.

The highest 7-day average maximum stream temperatures (in °C) for the years deployed ranged as follows in Table 3-23.

Table 3-23: Highest 7-day average maximum stream temperatures (in °C).

Stream	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Eightmile Creek at Forest Boundary	13.8	15.4	12.9	14.7	15.3	14.9	15.4	ND	ND	16.4
Eightmile Creek at Head of 44 Road	8.8	9.3	8.4	9.3	11.8	9.5	10.6	ND	ND	10.1
Ramsey Creek	20.4	22	20.6	21.3	ND	ND	21.5	ND	ND	19.7

ND = Equipment Not Deployed for that Year at that Site

The section of Eightmile Creek in the project area is listed on the 2004/2006 State of Oregon 303(d) list of impaired water bodies for salmon and steelhead spawning and core cold-water habitat water temperatures that exceed a 7-day average maximum of 13.0°C and 16.0°C respectively. As displayed in Table 3-23, the upper Eightmile Creek site, located just above the planning area, does meet these temperature criteria. The lower Eightmile Creek site, located just at the National Forest boundary, has met the 16.0°C core cold-water habitat standard every year except for 2006. Since the Forest Service equipment is typically deployed during the summer months (June through September), there is very little overlap of time to determine whether the lower site meets the 13.0°C standard since this standard is only applicable between January 1 and June 15. Equipment was deployed in May, five of the eight years that data was collected at this station. The highest 7-day average maximum stream temperatures for May ranged from 8.14°C to 12.23°C, with all but one of the years being in the 8°C range.

The section of Ramsey Creek in the project area is also listed on the 2004/2006 State of Oregon 303(d) list of impaired water bodies for salmon and steelhead spawning and core cold-water habitat water temperatures. As displayed in Table 3-23, the Ramsey Creek site has exceed the 16.0°C core cold-water habitat standard every year that equipment has been deployed. As was the case with Eightmile Creek, the Forest Service equipment is typically deployed during the summer months (June through September) with very little overlap of time to determine whether the site meets the 13.0°C standard. Equipment was deployed in May, four of the six years that data was collected at this station. The highest 7-day average maximum stream temperatures for May ranged from 10.93°C to 16.67°C, with all but one of the years being in the 15°C to 16°C range.

In summary, temperature standards were exceeded in both Eightmile and Ramsey Creeks. Ramsey Creek seems to have higher stream temperatures and has exceeded the 16.0°C core cold-water habitat standard regularly while Eightmile Creek has only exceeded it one year and it was at the lower site. The upper Eightmile Creek site is well within both the salmon and steelhead spawning and core cold-water habitat standards.

<u>Sediment and Stream Channel Condition</u>
Eightmile Creek and Ramsey Creek have high channel gradient headwaters and moderate gradient, confined middle sections. Both creeks are “A” Rosgen channel types in the extreme upper portions of the streams and grade into “B4” and “B” channel types throughout the rest of the planning area (Barlow stream surveys, 1997, 1999 and 2004). “A” channel types are high energy, steep gradient (4 to 10+ percent) channels that rapidly move water and sediment through the system while “B” channels are lower gradient (2 to 4 percent) that are still “transport” type reaches that move water and sediment through but have lower stream energy. These channels are generally stable and Rosgen (1996) identified this channel type as having a “low to moderate” sensitivity to human disturbance. He also identified riparian vegetation as having a “neglible to moderate” controlling influence on the stability of a A and B channels. Rosgen “B” type channels have an excellent recovery potential once the cause of instability is corrected.

Stream surveys conducted on 10.3 miles of Eightmile Creek and 13 miles of Ramsey Creek in 1997, 1999 and 2004 support the characterization of moderately stable stream banks and channel bed. The 1997 Ramsey Creek survey did note areas of eroding streambanks but by the 2004 survey, “These banks now appear to be stabilizing due to restoration work. Some of the banks are still bare but are no longer eroding at the bases”(2004, page 18). By 2004 the streambanks in the Ramsey Creek survey area were characterized as “relatively stable with only 1.4 percent identified as unstable" (2004, page 18). This relatively quick recovery is consistent with the excellent recovery potential described in the preceding paragraph. The Eightmile Creek survey noted that "Gravel was the dominant substrate...but substrate <6mm was common as well" indicating an excess of fine sediment similar to what was noted in the 1997 Ramsey Creek survey.

Both Eightmile Creek and Ramsey Creek are listed on the 2004/2006 State of Oregon 303(d) list of impaired water bodies for sedimentation. The listed segments extend from mouth to headwaters for both streams. A draft Water Quality Restoration Plan (WQRP) has been prepared for the headwaters of Fivemile Creek, Eightmile Creek, Fifteenmile Creek and Ramsey Creek by the USDA Forest Service. The purpose of the WQRP is to identify sources and causes of pollution, to make recommendations for Best Management Practices (BMP) and restoration activities to reduce levels of potential pollutants, to display any new monitoring that is pertinent to the 303(d) listing parameters, and to develop a proposed time-table for completing the restoration work. Information from the WQRP is often used by DEQ to develop their Total Maximum Daily Load (TMDL) plan.

The original 303(d) listing for these segments is based on information contained in the 1994 Mile Creeks Watershed Analysis (USDA Forest Service, 1994). The watershed analysis utilized sediment data collected during stream surveys and other monitoring efforts to conclude that fine sediment generated on National Forest System land exceeded a desired amount for salmonid embryo survival (1994, page F-21). All of the 13 sample sites cited in the analysis had fine sediment comprising more than 20 percent (the threshold from literature) of the total surface particle sizes. According to the watershed analysis, the source of this fine sediment included a variety of activities including "system and non-system roads, ditch lines, culverts, tractor harvest units, recreational trails, campgrounds, dispersed campsites, bank erosion, highly erosive soils, and low resiliency soils" (1994, page F22). The Mile Creeks Watershed Analysis identified local stream channel morphology problems such as bank erosion and lateral widening in the vicinity of Pebbleford, Underhill, Eightmile and Lower Eightmile Campgrounds as well as dispersed recreation sites and stream fords in both Ramsey and Eightmile Creek basins. These erosion sites tend to destabilize the channel, ultimately producing instream sediment and increased water temperature due to channel widening. As a result of these findings and project recommendations in the watershed analysis, effort was put into a number of restoration activities aimed at, among other things, a reduction in fine sediment input. According to the draft WQRP, fine sediment levels have been reduced in all sample sites in Eightmile Creek between 1994 and 2000. The WQRP attributes the reduction, at least in part, to the implementation of a number of restoration projects that occurred after 1994. The draft WQRP goes on to make several recommendations including continued restoration as funding allows, continued fine sediment monitoring, and implementation of BMP for Forest management activities.

A potential source of coarse and fine sediment mentioned above is roads. Sediment can wash off road surfaces into adjacent streams. Road density (miles of road per square mile of basin) can be used as a general indicator of potential problems associated with roads. Road densities within a sub-watershed that exceed 3.0 miles per square mile indicate areas that should be examined more closely for specific sediment related problems, although it is possible to have isolated areas of road instability even in areas of low road density. This value is based on professional judgement by local Forest Service hydrologists, fish biologists, and earth scientists. See Table 3-24

Table 3-24: Total specified road densities for 7th field watersheds within the planning area

Sub-watershed	Road Density (mi/mi^2)
Eightmile Creek-15E	2.16
Hesslan Creek-15G	2.15
Ramsey Creek-15I	2.05

All of the road densities are below 3 mi/mi^2 indicating road derived sediment is probably not a major source of pollution at this time in these sub-watersheds. This conclusion is reinforced by a field derived assessment made by the hydrologist during the summer of 2007. The survey looked at current road conditions and proposed treatments in the Billy Bob planning area relating to the potential to deliver sediment to streams. Some smaller site specific areas of surface erosion were noted on some roads, but no large scale erosion that was delivering sediment was identified. This conclusion is also supported by actual field data from stream surveys and additional monitoring from the WQRP that suggest a recovering trend in fine sediment input.

In addition to calculating road density at the 7th field scale, road density was calculated at the 6th field scale as well. Sixth field watersheds are larger that 7th fields. The results are displayed in Table 3-25.

Table 3-25: Total specified road densities for 6th field watersheds within the planning area

Watershed	Road Density (mi/mi^2)
Headwaters Fifteenmile Creek	1.58
Upper Eightmile Creek	1.61

In summary, the 1994 Mile Creeks Watershed Analysis indicated that fine sediment was a concern in Eightmile, Fifteenmile and Ramsey Creek drainages. As a result of this, these streams were added to the Oregon DEQ 303(d) list of impaired water quality due to increased fine sediment. These areas have become a focal point for watershed restoration efforts targeting among other things, a reduction in anthropogenic related fine sediment input. Recent monitoring and surveys indicate that this effort is paying off with a reduction in fine sediment and a recovery trend in these basins.

Riparian Area Condition

Native riparian vegetation plays a key role in forming aquatic habitat for fish and other aquatic species. Roots help stabilize stream banks, preventing accelerated bank erosion and providing for the formation of undercut banks, important cover for juvenile and adult fish. Riparian areas with native vegetation could supply downed trees (large wood) to streams. In turn, downed trees in streams influence channel morphology characteristics such as longitudinal profile; pool size, depth, and frequency; channel pattern; and channel geometry. Turbulence created by large wood increases dissolved oxygen in the water needed by fish, invertebrates and other biota. The extent of the hyporheic zone adjacent to and under the stream surface is increased by large wood in streams. Invasive plants could slow down or prevent the establishment of native trees, decreasing or delaying the future supply of large wood in stream channels.

Riparian forest canopy protects streams from solar radiation in summer, and could moderate minimum winter nighttime temperature, preventing the incidence of anchor ice or freeze-up in streams (Beschta, et al., 1987). Changes in water temperature regime could affect the survival and vigor of fish, and affect interspecies interactions (FEMAT, 1993).

Riparian areas are dynamic. Disturbances characteristic of uplands such as fire and windthrow, as well as disturbances associated with streams, such as channel migration, floods, sediment deposition by floods and debris flows, shape riparian areas (FEMAT, 1993). The most likely human caused modification in the project area is past timber harvest activity. Part of the 1990 and 2004 stream surveys included an assessment of the condition of riparian vegetation along the 23.3 miles that were surveyed. As described above, these surveys were in Eightmile Creek and Ramsey Creek, which constitute the major streams within the planning area. These surveys identifed that these streams were generally well shaded with timber harvest units present but most having a good buffer of in-tact riparian vegetation between the unit boundary and the stream. In addition to observations about timber harvest units, stream surveyors also collected data on stream shading utilizing a solar pathfinder. This instrument measures the amount of shade that is provided to a stream channel. These shade values are probably on the high end of natural variability since fire exclusion has removed this major riparian area disturbance factor from the landscape (see Table 3-26).

Table 3-26: Stream shade values.

Stream	Ave. Stream Shading (%)	Max and Min Stream Shading (%)
Eightmile Creek	29%	0 – 53%
Ramsey Creek	26%	0 – 61%

These values are comparable to other nearby drainages. Table 3-27 displays shading values. This area is within the City of The Dalles Municipal Watershed and has limited timber harvest and other anthropogenic disturbances in the riparian areas.

Table 3-27: Stream shade values for streams in the South Fork Mill Creek subwatershed

Stream	Ave. Stream Shading (%)	Max and Min Stream Shading (%)
S.Fk. Mill Creek-Reach 1	29%	0 – 97%
S.Fk. Mill Creek-Reach 2	11%	0 – 38%
Crow Creek	27%	0 – 54%
Alder Creek	23%	0 – 44%

According to the Mt. Hood National Forest Land Managment Plan, "…there will be little apparent change in Forestwide riparian areas…These areas will reflect relatively high vegetative and structural diversity most closely associated with mature and old growth stand conditions. Many individual areas, totaling roughly 10 to 15 percent …reflect errly seral stage vegetation associated primarily with past timber harvest activities. Riparian areas for intermittent streams, seeps, and springs increasingly show a shift toward early seral stage vegetation…”.

Environmental Effects

No Action Alternative – Direct and Indirect Effects

Water Quality

Stream Temperature

Stream temperatures would remain at current levels in the watershed due to no reduction in streamside shading. Primary shade zones (areas of riparian vegetation directly adjacent to streams) along perennial streams would continue to fill in with understory vegetation. Since these areas are already densely vegetated, it is not anticipated that this component would reduce stream temperatues any great degree within the project area.

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

Sediment

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

1985). An increased susceptibility to debris torrents was noted following the fire and was an important factor in causing incresed sediment yields.

While much of the sediment increase can occur within the first year after the fire (Agee 1993, Debano et. al. 1998), it may take many years for sediment levels to reach pre-fire levels depending on fire severity. DeBano et al. (1996) demonstrated that following a wildfire in ponderosa pine, sediment yields from a low severity fire recovered to normal levels after three years, but moderate and severely burned watersheds took 7 and 14 years, respectively. Robichaud and Brown (1999) reported first year erosion rates after a wildfire from 9 to 22 tons per acre decreasing by one to two orders of magnitude by the second year and to no sediment by the fourth in an unmanaged forest stand in eastern Oregon. Erosion rate reduction was due to recovery of natural vegetation. First year growing season shrubs, forbs and grasses accounted for 28 percent of the total ground cover whereas after the second growing season, total ground cover was 82 percent. In the event of a high severity burn, there could be severly impaired water quality due to high trubidity levels. It may take many years (5 – 10) for turbidity levels to decrease to background levels.

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

Proposed Action Alternative – Direct and Indirect Effects

Water Quality

<u>Stream Temperature</u>

This alternative proposes to thin vegetation within Riparian Reserves. Vegetation removal has the potential of increasing solar radiation to surface water which in turn may increase water temperature. The following analysis will utilize tools contained within the "Sufficiency Analysis for Stream Temperature" (2004) document to identify necessary shade so that stream temperatures within treatment areas would not increase as a result of the proposed vegetation treatments. The previously mentioned document is the result of work between the Forest Service, Bureau of Land Management (BLM) and State of Oregon Department of Environmental Quality (DEQ) and identifies how to maintain sufficient stream shading while providing the opportunity to treat Riparian Reserve vegetation to improve stand condition. Vegetation treatments in the Billy Bob Hazardous Fuels Reduction Project would have the benefit of minimizing negative effects that may result from a catastrophic wildfire.

The concept of the sufficiency analysis is to maintain a primary shade zone next to the stream and identify a secondary shade zone that can be treated to reach Riparian Reserve Objectives. In order to maintain sufficient shade next to the stream, the primary shade zone is untreated. The size of this zone is dependant on the current height of the trees and the hill slope. This relationship is shown in the Table 3-28.

Table 3-28: Shade Zones Next to Streams

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

As an example, if the height of trees in the riparian area are predominately <20-feet tall, the primary shade zone would be 14 feet wide for an area that had 30 percent to 60 percent hill slopes next to the stream. Based on field observations in proposed treatment units, most of the hill slopes are between 30 percent and 60 percent and existing tree heights range from <20-feet to 60-feet or more. The proposed prescription for riparian area treatments would thin vegetation that would be <60-feet tall, which translates into a maximum primary shade zone of 33-feet for the project area. Since the treatment would include removal of trees greater than 60-feet tall in some cases, the primary shade zone was set at 60-feet. This area would be left untreated next to perennial streams to maintain current stream shading and temperatures.

In addition, vegetation treatments within the secondary shade zone (60-feet to 100-feet), would leave a canopy closure of approximately 60 percent. This would result in a canopy closure reduction of <50 percent which would provide consistency with the Sufficiency Analysis. Due to project design that meets and exceeds the Sufficiency Analysis, there should be no increase in stream temperature resulting from implementation of this project.

<u>Sediment</u>
Some ground disturbing activites in this alternative have the potential to dislodge soil particles which in turn may increase erosion and sedimentation to surrounding surface water. These features include new temporary roads, landings, skid trails, yarding corridors, burn piles, underburning areas as well as areas of snowplowing, road maintenance and road repair. A detailed discussion of soil erosion and sedimentation is contained in the soils section of this document (see Soil Productivity Section). According to the soils analysis, amounts of erosion and sediment delivery are expected to be small due to maintaining protective groundcover along with implentation of BMP design criteria.

The ability of BMP to reduce erosion and sediment delivery is documented in a study referenced in the soil section (Rashin et. al. 2006). In this study, they looked at 21 harvest sites that had a variety of treatments ranging from no buffers to buffers up to 66 meters wide. They found that "Of 157 individual erosion features determined to deliver sediment to streams during either the first or second year following timber harvest, 94 percent were located within 10 m of the stream. Conversely, 74 percent of the 248 erosion features with no evidence of sediment delivery were greater than 10 m from streams. The sediment routing survey results indicate that when erosion is initiated by ground disturbing activities within 10 m (slope distance) of a stream, delivery of sediment was more likely than not."

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

Mitigation and design criteria that include use of erosion control (e.g. erosion control blankets, straw wattles, waterbars) where necessary, “no-touch” buffers of 60 feet along perennial streams and 30 feet along intermittent streams, and lower impact road maintenance techniques (leaving vegetated buffer strips in ditchlines near streams) would substantially reduce the amount of sediment reaching the streams from this work. Burroughs and King (1989) reported that measures such as erosion control blankets alone can reduce sediment production by 80 to 90 percent. This in conjunction with other measures such as minimizing the amount of ground disturbance and seeding these areas would further decrease the chance of short term direct and indirect sediment production. With the above mentioned mitigation and design criteria new temporary roads, landings, skid trails, yarding corridors, road maintenance, and road repair work are expected to have minimal effect on sedimentation.

Prescribed fire units are not expected to introduce additional sediment into surface water. A literature review by Beschta (1990) states that “Management practices that prevent the occurrence of hot slash burns and encourage rapid revegetation would help minimize potential increases in fire-related sedimentation from upslope source.” Relatively “cool” burns (such as the prescribed fire units in this project) “should have little impact on erosion and sedimentation, regardless of general watershed slope.”

Fuel treatment activities may increase surface erosion in the harvest units along temporary roads, landings, skid trails and yarding corridors. The amount of erosion is expected to be low and short lived due to mitigation measures such as ground based logging restrictions on ground over 30 percent side-slope, ripping and water barring disturbed areas, and seeding disturbed areas. It is unlikely that any material would reach the aquatic system due to buffering by the Riparian Reserves, associated “no touch” zones within the Riparian Reserves, and the other required mitigation measures such as ripping and water barring skidtrails.

Watershed Effects

Key Watershed

The NWFP states that “The amount of existing system and nonsystem roads within Key Watersheds should be reduced through decommissioning of roads” (NWFP B-19). Within the Mill Creek Tier 1 Key Watershed, 4 miles of roads have been decommissioned to date since the inception of the Northwest Forest Plan. The reduction of road miles from 61 miles to 57 miles would result in an overall reduction of road related sediment through time in the Key Watershed.

It is expected that 3 miles of temporary road would be constructed to facilitate access for this project. This would temporarily raise the miles of nonsystem road, but these roads would be decommissioned within 3 years of construction and total miles in this Key Watershed would return to 57. Road densities within 7th field watersheds will temporarily as shown in Table 3-29.

Table 3-29: Road densities within 7th field watersheds

7th Field Watershed	Existing Road Density (mi/mi^2)	Potential Road Density with Temporary Roads (mi/mi^2)
Eightmile Creek	2.16	2.27
Hesslan Creek	2.15	2.21
Ramsey Creek	2.05	2.12

Road densities are still below 3 mi/mi^2 when temporary roads are included. As stated in the Existing Conditions section above, "Road densities within a sub-watershed that exceed 3.0 miles per square mile indicate areas that should be examined more closely for specific sediment related problems, although it is possible to have isolated areas of road instability even in areas of low road density. This value is based on professional judgment by local Forest Service hydrologists, fish biologists, and earth scientists".

Special Emphasis Watersheds

Eightmile and Ramsey Creek watersheds are identified in the Mt. Hood National Forest Land and Resource Management Plan as Special Emphasis Watersheds. As Special Emphasis Watersheds, watershed impact areas or areas within a watershed which are being hydrologically disturbed by management activities "should not exceed the "thresholds of concern" (TOC) for watershed stability" of 25 percent of the total watershed area. This threshold is set to disperse activities in space and time to "minimize cumulative watershed effects." Currently, the watershed impact area for the two watersheds stands at 13.5 percent and 13.1 percent respectively, which is well below the TOC of 25 percent. Implementation of this alternative would result in a very minor increase in the impact area of approximately 0.8 percent which still is well below the LRMP Standard.

Cumulative Effects

Water Quality

Stream Temperature

No detrimental cumulative effects are expected as a result of increased water temperature due to mitigation measures designed to maintain existing vegetation adjacent to streams. As described in the direct and indirect effects section, this project would maintain existing water temperatures.

Sediment

No measurable detrimental cumulative effects are expected as a result of sediment introduction due to the small amount of sediment expected from this project. As described in the direct and indirect effects section, mitigation measures and project design criteria aimed at minimizing erosion and sedimentation reduce the potential of erosion and delivery of the material to adjacent surface water. There is a chance that some fine sediment from activities in and around Camp Baldwin and other Forest Service vegetation treatment projects would mix with fine sediment from road maintenance and snowplowing adjacent to Eightmile Creek creating a cumulative effect. The amount of sediment from all of these projects is expected to be very small and have a low risk of mixing together due to the distance between the activities.

Watershed Effects

Table 3-30 provides a qualitative summary of potential cumulative watershed effects. It shows existing and potential projects, effects from those projects that may result in cumulative effects with the Billy Bob Hazardous Fuels Treatment Project, whether these projects overlap in time and space and an assessment if a measurable cumulative effect is expected. Findings of this summary are supported by the analysis above which utilizes pertinent research, mitigation measures and design criteria and applicable management standards and guidelines.

Table 3-30: Qualitative summary of potential cumulative watershed effects

Project	Potential Effects	Overlap in Time	Overlap in Space	Measurable Cumulative Effect	Extent, Detectable
Existing Old Forest Service Timber Harvest Units	Suspended Sediment	No	Yes	No	Projects are completed. No remaining sediment, stream temperature and water quantity effects due to mitigation implementation on the original projects and natural recovery.
	Stream Temperature	No	Yes	No	
	Water Quantity	No	Yes	No	
Forest Service Timber Harvest Activities Planned or Underway (8mm, Tap, W. Fivemile)	Suspended Sediment	Yes	Yes	Not Measurable	There may be an overlap in timing of these projects with the project area; any minor suspended sediment would not be measurable due to implementation of mitigation measures and conformance with existing Forest Plan Standards & Guidelines on both the existing projects and Billy Bob Hazardous Fuels Reduction.
	Stream Temperature	Yes	Yes	No	The Billy Bob Hazardous Fuels Reduction Project would maintain the primary shade zone so there should be no cumulative increase in stream temperature.
	Water Quantity	Yes	Yes	No	No cumulative water quantity effects due to mitigation implementation, conformance with existing Forest Plan Standards & Guidelines and natural recovery on both the existing projects and Billy Bob Hazardous Fuels Reduction.
Camp Baldwin and other Private Land Activities	Suspended Sediment	Yes	Yes	Not Measurable	Some projects are completed so there are no remaining sediment effects due to natural recovery. Other ongoing projects at Camp Baldwin and other adjacent private land, such as road maintenance and vegetation manipulation, have a chance of some short term introduction of fine sediment that may mix with minor fine sediment from the Billy Bob Hazardous Fuels Reduction Project. Any minor suspended sediment would not be measurable due to implementation of mitigation measures and

Project	Potential Effects	Overlap in		Measurable Cumulative Effect	Extent, Detectable
		Time	Space		
Camp Baldwin and other Private Land Activities (continued)	Stream Temperature	Yes	Yes	No	conformance with existing Forest Plan Standards & Guidelines on the Billy Bob Hazardous Fuels Reduction Project. Some projects are completed so there are no remaining stream temperature effects due to natural recovery. The Billy Bob Hazardous Fuels Reduction Project would maintain the primary shade zone so there should be no cumulative increase in stream temperature.
	Water Quantity	Yes	Yes	No	No cumulative water quantity effects due to mitigation implementation, conformance with existing Forest Plan Standards & Guidelines on the Billy Bob Hazardous Fuels Reduction Project and natural recovery for some of the Camp Baldwin projects.
Miscellaneous Tree Salvage (Hazard Trees)	Suspended Sediment	Yes	Yes	Not Measurable	There may be an overlap in timing of this project with the Billy Bob Hazardous Fuels Reduction Project; any minor suspended sediment would not be measurable due to implementation of mitigation measures and conformance with existing Forest Plan Standards & Guidelines in both projects.
	Stream Temperature	Yes	Yes	No	This project and the Billy Bob Hazardous Fuels Reduction Project would maintain the primary shade zone so there should be no cumulative increase in stream temperature.
	Water Quantity	Yes	Yes	No	No cumulative water quantity effects due to mitigation implementation, conformance with existing Forest Plan Standards & Guidelines and natural recovery in both projects. .

Project	Potential Effects	Overlap in		Measurable Cumulative Effect	Extent, Detectable
Invasive Plant Treatment	Suspended Sediment	Yes	Yes	Not Measurable	There may be an overlap in timing of this project with the Billy Bob Hazardous Fuels Reduction Project; any minor suspended sediment would not be measurable due to implementation of mitigation measures and conformance with existing Forest Plan Standards & Guidelines in both projects. .
	Stream Temperature	Yes	Yes	No	The Billy Bob Hazardous Fuels Reduction Project would maintain the primary shade zone so there should be no cumulative increase in stream temperature.
Past Aquatic Restoration Projects	Suspended Sediment	Yes	Yes	Not Measurable	There may be an overlap in timing of these project effects with the Billy Bob Hazardous Fuels Reduction Project. Any minor suspended sediment may slightly slow the recovery resulting from restoration project implementation, but this would not be measurable due to implementation of mitigation measures and conformance with existing Forest Plan Standards & Guidelines in both projects..
	Stream Temperature	Yes	Yes	No	The Billy Bob Hazardous Fuels Reduction Project would maintain the primary shade zone so there should be no cumulative increase in stream temperature.
	Water Quantity	Yes	Yes	No	No cumulative water quantity effects due to mitigation implementation and conformance with existing Forest Plan Standards & Guidelines in both projects and natural recovery in the past restoration projects.
Future Aquatic Restoration Projects	Suspended Sediment	No	Yes	Not Measurable	There may be a spatial overlap of these project effects with the Billy Bob Hazardous Fuels Reduction Project. Any minor suspended sediment may slightly slow the recovery resulting from

Project	Potential Effects	Overlap in		Measurable Cumulative Effect	Extent, Detectable
Future Aquatic Restoration Projects (continued)					restoration project implementation but this would not be measurable due to implementation of mitigation measures and conformance with existing Standards and Guidelines in all projects on National Forest.
	Stream Temperature	Yes	Yes	No	The Billy Bob Hazardous Fuels Reduction Project would maintain the primary shade zone so there should be no cumulative increase in stream temperature.
	Water Quantity	Yes	Yes	No	No cumulative water quantity effects due to mitigation implementation and conformance with existing Forest Plan Standards & Guidelines in all projects on National Forest Land.