Chapter 3 - Environmental Effects

This section summarizes the physical, biological, social, and economic environments of the affected project area and the potential changes to those environments due to implementation of the alternatives.

Cumulative Effects Discussion

In this environmental analysis, three types of effects are considered: direct[1], indirect[2], and cumulative[3] environmental effects. Direct and indirect effects are described for the various topics below. Cumulative effects are also described for affected resources, but because cumulative effects involve the additive effect of project actions on the effects from past, present, and foreseeable future actions, an overview of the cumulative effects analysis process is included here.

On June 24, 2005, the CEQ[4] (Council on Environmental Quality) provided guidance on the extent to which agencies are required to analyze the effects of past actions (Connaughton, 2005). This CEQ letter is incorporated into the Vulcan Project by reference. CEQ interprets the National Environmental Policy Act (NEPA) and CEQ NEPA regulations on cumulative effects as requiring analysis and a concise description of the identifiable present effects of past actions to the extent that they are relevant and useful in analyzing whether the reasonably foreseeable effects of the project actions may have a continuing additive and significant relationship to those effects.

CEQ states that agencies are not required to list or analyze the effects of individual past actions unless such information is necessary to describe the cumulative effect of all past actions combined. Generally, agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions.

For the Vulcan Project, past activities were examined in order to understand the aggregate effects of past actions. A list of past actions and resulting effects that formed the current conditions was compiled for Forest Service various activities in the vicinity of the Vulcan Project. This compilation included the following:

[1] **Direct effects** are caused by the action and occur at the same time and place.

[2] **Indirect effects** are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable.

[3] A **cumulative impact** is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

[4] The **CEQ (Council on Environmental Quality)** was created by the National Environmental Policy Act of 1969. The CEQ provided regulations under 40 CFR (Code of Federal Regulations) 1500 that tell federal agencies what they must do to comply with the procedures and achieve the goals of the National Environmental Policy Act.

PAST ACTIONS--TIMBER HARVEST

Past Management

The United States portion of the Kettle River Watershed, north of the Kettle River, between Midway and Danville, contains just over 50,000 acres. About 56% (28,000 acres) of the area is forested and the remainder is grass or rock lands. About 31% (8,700 acres) of the forested area is administered by the US Forest Service. That leaves approximately 25% (12,500 acres) of the watershed as forested land in private, other Federal ownership, or (mainly) state land. About a third of the non-Forest Service timbered land (4,100 acres) has been harvested within the last 20 years and is in early structure. The remaining two thirds of the watershed (about 8,000 acres) are mainly in riparian zones in steep canyons and will not be treated. This leaves the greatest opportunity for forest restoration on National Forest System lands.

Past harvest occurred on Forest Service lands prior to the 1940s. Harvest resulted in returning the stand to early structure as in a regeneration harvest[5] or it selectively removed only scattered trees resulting in a multistoried structure. Regeneration cutting has occurred in the Vulcan area since the 60s. Prior to the 1960s and after the 1980s, treatments were mainly thinning, species selection (taking only a particular species), and uneven-aged management[6]. Regeneration harvests were generally planted to 400 trees (generally Douglas-fir or larch) per acre. Natural seedlings would also establish, creating dense carpets of seedlings in the new stands. Uneven-age management created conditions where shade intolerant larch and pine could not establish due to dense overstory.

Table 3-1. Timber Harvest per Decade on Forest Service Lands in the Vulcan Analysis Area*

Time of Harvest	# Acres
Prior to 1970	2,469
1970-1980	3,131
1980-1990	1,172
1990-2000	400
2000 -	356

*From Forest Service Records

Table 3-2. Timber Harvest per Decade on Non-Forest Service Lands in the Vulcan Analysis Area

Time of Harvest	# Acres
Prior to 1970	unknown
1970-1980	27
1980-1990	2,867
1990-2000	267
2000 -	1,210

[5] **Regeneration harvest**: Timber harvest conducted with the partial retention objective of opening a forest stand to the point where tree species of essentially the same age are established to form the new stand.

[6] **Uneven-aged management**: Treatments that remove single trees or small groups in order to create or maintain stands with multiple tree layers.

Past management including harvest and wildfire suppression over the last 100 years, has caused a departure from historic, pre-settlement conditions. Dense blankets of shade tolerant subalpine and Douglas-fir have established in the understory. This condition has led to increasing ground and aerial fuels and decreasing grass and shrubs. It has reduced stand vigor and resilience and has increased the potential for stand-replacing wildfire or insect and disease problems.
The introduction of bulldozers after World War II made road building and subsequent timber harvesting, much easier. During this time mostly large diameter trees were removed in the lower and flatter areas that were easy to access. The understory that had begun to advance due to fire suppression was left to create a new stand. The situation changed in the early sixties to regeneration cutting and burning of stands. This went on for about twenty years. This situation left large blocks (100 plus acres) of old growth intact but interspersed with heavily logged units (even-aged) and roads running through for access. With some stands that were partially logged represented as well.

PAST ACTIONS--FOREST VEGETATION AND FIRE

The current vegetation on Vulcan Mountain provides clues to the vegetation conditions of the past. Large overstory trees are the old residual survivors of the past, and the current timber stands reveal that Vulcan Mountain was dominated by large widely-spaced western larch or Ponderosa pine creating, which some refer to as a park-like condition because of its similarity to the spacing of overstory trees and open understory conditions in many urban parks. We know this because western larch and Ponderosa pine are fire tolerant species that require open sunny conditions and bare mineral soil in which to propagate, and cannot reproduce well in the shaded conditions found in the dense timber stands that now exist on much of Vulcan Mountain. The frequent occurrence of low-intensity wildfires ignited by lighting before human settlement served to clean the surface of the ground of accumulated fuels and thin shrubs, seedlings, and saplings. The well-intentioned introduction of systematic fire suppression beginning in the 1920s and 30s has had the indirect effect of gradually changing the vegetation structure and species composition on Vulcan Mountain. The understory composition now includes greater density of shade tolerant species, which have increased ground and ladder fuels and decreased the fire-adapted native grasses and shrubs.

Following World War II, timber harvesting often focused on removing large diameter trees from the overstory. Understory trees were allowed by fire suppression to grow into the new stand. Beginning in the 1960s and through the 1980s, timber management went through a phase where the economics of clear-cut harvesting was emphasized. Logging slash in clear-cut units was removed by broadcast burning. These varying management styles have formed the current vegetation pattern on Vulcan Mountain.

The combined influences of past wildfires, aggressive fire suppression, and management activities such as timber harvest, prescribed burning, pre-commercial thinning, and grazing have all contributed in creating the current fuels/vegetative condition in the Vulcan planning area. Changes in the structure and make-up of the forests have occurred. Species of trees that would ordinarily have been eliminated from forests by periodic, low-intensity fires have become a dominant part of the forest canopy. The timber stands have become overcrowded

with trees in all size classes. These overcrowded trees have become susceptible to insects and disease. The resulting conditions can promote high severity wildfires.

PAST ACTIONS--LIVESTOCK GRAZING

The earliest record of permitted livestock use on National Forest System lands in the Vulcan area is the Vulcan Allotment, which began in 1930. Both cattle and horses were run on the allotment until 1945 when the allotment changed to cattle. Numbers of cattle have ranged from 277 to 432 cow/calf pairs. A three pasture rotation system was implemented in 1981 with completion of pasture fence construction. Numbers of livestock and grazing systems will likely continue in the project area in a manner similar to what they are today (432 cow/calf pairs).

PAST ACTIONS--RECREATION

There are no developed recreation sites or system trails within the planning area. Approximately 10 undeveloped campsites are established along Forest Service Road 2114, with a few more scattered elsewhere in the planning area. Under Forest Plan direction, the area would continue to be used for dispersed recreation opportunities that involve use of motorized vehicles.

PAST ACTIONS--HERITAGE

Cumulative effects from past timber harvesting and road building on cultural resources cannot be accurately determined because field inventories for historic properties did not begin until the early 1980s.

PAST ACTIONS--VISUAL QUALITY

The dominant human actions that have affected the visual quality of the landscape are suppression of fire, road building, and natural resource based industries (agriculture, timber harvesting, and mining). These actions have altered the vegetative structure of the landscape by modifying species diversity and stocking levels.

PAST ACTIONS--CONCLUSION

As demonstrated above, the Vulcan Project would take place where historical logging, grazing, recreation, and fire suppression activities have taken place. Some of those past activities caused the need for the Vulcan Project. While an effort was made to catalogue individual actions, individual accountability for 100% of such past, present, and future activities is virtually impossible. Given CEQ's direction that suggests that it is not necessary to list and account for past actions on an individual basis, recognition of the general extent and magnitude, over time and the resulting current conditions, is sufficient to understand the additive effects of the Vulcan Project actions for the various resources.

Cumulative effects discussions are included for each affected resource. See below the "Cumulative Effects" sections for Timber, Fuels, Water, Transportation, Wildlife, Soils, Noxious Weeds, Air, Range, Recreation, and Visual Quality.

Environmental Effects by Resource

The main silvicultural objectives for this environmental assessment are to reduce stand susceptibility to damage by wildfire and forest pathogens, meet Forest Plan standards including moving toward historic range of variability, and increase tree vigor and resistance. This is best achieved by vegetative and prescribed fire treatments that reduce stand densities, forest fuels, and incidence of insects and disease on the at-risk stands of trees.

TIMBER VEGETATION

Information provided in this Environmental Assessment about the timber resource is excerpted from the *Vulcan Vegetation Management Project Silviculture Report* by Mary Rourke, September 12, 2006. The full text of this report is incorporated by reference. The Silviculture Report describes the current and desired conditions with regards to timber abundance of stand structures across the landscape, tree stocking levels within stands, and insect and disease conditions. It also describes and compares the environmental effects associated with the various alternatives (Alternative A--No Action, Alternative B--Proposed Action, and Alternative C). Measures intended to mitigate adverse environmental effects are also included.

Existing Conditions

The analysis area is composed primarily of mixed species, multi-layered stands of trees. Tree species include Douglas-fir, western larch, lodgepole pine, ponderosa pine, spruce, subalpine fir and some western red cedar. Plant associations run from ponderosa pine and Douglas-fir to the wetter subalpine fir associations. Some cedar plant associations occur on north aspects and in draws in very small amounts. Ponderosa pine mainly occurs on southern slopes in the south portion of the analysis area, but the area generally lacks the large continuums of dry ponderosa pine stands found in the south part of the District. Douglas-fir/ninebark and Douglas-fir/ninebark/twinflower and huckleberry plant associations are the most abundant. These plant associations indicate soils prone to summer drought, often with high rock content. Endemic forest pests include dwarf mistletoes, root and butt rot, and bark beetles.

In general, aspect determines timber type with south and western aspects covered in the drier plant associations, and north and eastern slopes with wetter vegetation. However, because of steep and droughty soils, the extreme northern part of the analysis area has dry plant associations even though it is a north aspect. The center and eastern portion of the area is composed of wetter plant associations and has many small ponds and wet areas. The south aspects of the southern portion of the analysis area are non-forested grass land with stringers of trees that follow the intermittent creeks. The west aspects are mostly dry Douglas-fir, with the exception of Tenas Mary creek.

Large 300-500 year old western larch are found throughout the area, especially in the dry to moderately wet areas. The composition of these stands indicates that the Vulcan area was dominated by park-like stands of large western larch prior to fire exclusion. The open stands were resistant to stand-replacing wildfires that burned frequently. The wetter areas, mainly in the central portion of Vulcan, contain the small diameter mixed conifers heavy with lodgepole pine that results from stand-replacing wildfire.

BIOPHYSICAL ENVIRONMENT (BE)

The current condition of the vegetation can be described by considering the biophysical environments that are found in the Vulcan analysis area. A biophysical environment is a grouping of plant associations on the landscape scale that have similar patterns of natural disturbance (e.g. fire, insects); disturbance magnitudes and frequencies; and type of vegetation (plant associations) found in a typical old growth forest.

Douglas-fir Biophysical Environments

The Vulcan area is composed of several biophysical environments. Approximately 39% of the area is in the warm dry Douglas-fir shrub or cool mesic Douglas-fir shrub BE.

Warm Dry Douglas-fir Shrub (WDDS)

Under historic conditions, the warm dry Douglas-fir shrub BE was characterized by small to moderate outbreaks of insect and disease and frequent low intensity wildfires (ground-fires) with occasional moderate intensity wildfires. High intensity, stand replacement fires were rare and small in size (usually the result of ground fires "crowning out" in a patch of denser trees). Old growth stands were dominated by ponderosa pine, western larch, and Douglas-fir. Plant associations include Douglas-fir/ninebark and ninebark/twinflower, Douglas-fir/pine grass, and Douglas-fir/snowberry. The majority of this BE is found at lower elevations on the perimeter of the analysis area, especially on the south (face) side. It is also found along the 2113 road and in the north. A century of fire suppression in this BE has generally created a condition of excessively dense[7] disease infested stands that are more prone to stand-replacing fires.

During the Togo Fire of 2003, (approximately 10 miles east of the Vulcan Project area), ground-fire occurred over some of the Douglas-fir BEs. In some places, fire behavior was more severe than was found historically, and large patches of stand-replacing fire occurred. This was due to the build-up of insect-caused mortality, dwarf mistletoe brooms, dense ingrowth, and heavy fuels, as well as fire specific conditions. In the underburned stands, many trees of fire intolerant species (subalpine fir, lodgepole pine, small Douglas-fir) were girdled by fire, often leaving a well-established overstory of the thick barked Douglas-fir and western larch. Other stands resembled the product of a successful prescribed fire. In severely burnt patches where crown fire occurred, greater than 80% of the overstory was killed.

[7] The terms "**densely spaced**", "**overly dense**" and "**overcrowded**", etc., refer to a condition where so many trees are present on a site that tree growth and vigor slows or stops, allowing pathogens and inter-tree competition to successfully cause tree mortality. An overcrowded or overstocked condition occurs in a stand of trees when the "growing space" or resources needed for plant growth, (light, water, and nutrients) becomes limited. Once a site becomes fully occupied, individual trees begin competing with their neighbors. As a result, the stronger trees continue to grow (though often at a slow rate), and the weaker trees stop growing or die. Slow tree growth and tree mortality reduce a stand's ability to meet various objectives set forth in the Forest Plan.

Most of the harvest units discussed in the EA as overcrowded are early or middle structure stands that have reached a level of site occupancy where individual trees are dying or are at risk of dying, either directly from lack of resources or indirectly from forest pathogens. This can be seen by tree ring analysis during formal or informal stand examinations. It can also be approximated by comparing the number of trees per acre, the average tree diameter, and the basal area to stocking guides and growth models. In the simplest terms, if tree crowns are overlapping, competition for sunlight is probably limiting tree growth; in dryer areas, if crowns are open, but growth has slowed, competition for moisture is likely.

Many of the severely burnt areas were old growth stands that had heavy dwarf mistletoe infections prior to the wildfire (Togo Salvage EA, 2003).

Cool Mesic Douglas-fir Shrub (CMDFS)
A small amount (less than 1%) of the analysis area is in the cool mesic Douglas-fir shrub BE. It mixes readily with and is often hard to separate from the warm dry Douglas-fir shrub BE in the Vulcan area. This biophysical environment is characterized by high severity disturbance from insects and disease, with low to moderate intensity wildfires with a frequency of 30-80 years. Ladder fuel situations develop quickly, and fires occurring toward the end of the range (60-80 years) result in large patches being returned to the early structural stage. Stands quickly reestablish to lodgepole pine and western larch following stand replacement fires. Old growth vegetation is dominated by Douglas-fir. Plant associations include Douglas-fir/big huckleberry and Douglas-fir/dwarf huckleberry. Because of the similarity in historic range and the way the two biophysical environments intermix in this planning area, warm dry Douglas-fir shrub and cool mesic Douglas-fir shrub have been grouped together for historic range of variability purposes.

Cool Dry Douglas-fir Subalpine Fir (CDDA) and Cold dry Subalpine Fir/Shrub (CDA) BEs
Approximately 22% of the area is in the cool dry Douglas-fir subalpine fir and cold dry subalpine fir/shrub BE. These two BEs were grouped because they are relatively similar in composition and response to disturbance. These stands are typified by cool to cold dry sites and can be found on all aspects. Fire intervals range from 30-60 years and these stands seem to be especially prevalent where lightening strikes occur. Fire intensity is generally moderate. Early seral species such as ponderosa pine, western larch, and large Douglas-fir are able to tolerate ground fires and remain in middle stages (as in no climax species, not related to size) for hundreds of years. Park-like stands are present, though at much lower frequencies than the drier BEs. Plant associations include subalpine fir/big huckleberry, subalpine fir/dwarf huckleberry, and subalpine fir/pine grass. Higher intensity fires may result in sites dominated by lodgepole pine.

Old stands are dominated by ponderosa pine, western larch, and Douglas-fir. Ecologically, these stands rarely attain true “old growth” because spruce and alpine fir are the climax old growth species and they rarely grow to form the overstory (153-154, Oliver and Larson, 1990). However, spruce and subalpine fir are frequently found in the understory. The majority of this BE is found at mid elevations. Fire suppression in this BE has generally created a condition of excessively dense understory that is more prone to stand-replacing fires. Vulcan Mountain has the highest percentage of this BE on the District. These associations are relatively rare and keeping old growth stands from this BE on the landscape (especially stands with the very large larch) is highly desirable.

Subalpine Fir/Spruce BEs
Approximately 39% of the analysis area is composed of plant associations that make up the cold mesic or very moist spruce biophysical environments. These BEs are found in the higher elevations and wet cool depressions in the central part of the analysis area. These stands may

have a partially open canopy when mature or they may be composed of early structural stands of dense lodgepole pine and western larch that burns before ever reaching maturity. The majority of the high intensity stand-replacing fire in Togo occurred in these BEs. High intensity fires found in this BE tend to regenerate to lodgepole pine and western larch.

Cold Mesic Subalpine Fir, Forb, and Shrub (CMA)
Twenty-two percent of the analysis area is in the cold mesic subalpine fir, forb, and shrub BE. This biophysical environment is characterized by low to high intensity outbreaks of insect and disease, and relatively infrequent moderate to high intensity wildfires. Fires tend to create a mosaic pattern as they burn with varying intensity depending on fuels accumulation and stand structure. Plant associations include subalpine fir/twinflower, with subalpine fir/dogwood on wetter sites and subalpine fir/dwarf huckleberry. Old growth vegetation is dominated by spruce, subalpine fir, and Douglas-fir.

The Very Moist Spruce -- Subalpine Fir Bottoms (VMSB)
This biophysical environment is characterized by small to high intensity outbreaks of insect and disease and moderate to very intensive wildfires. Old growth vegetation is dominated by spruce, subalpine fir, and Douglas-fir. Plant associations include spruce/equisetum and subalpine fir/bunchberry dogwood. This biophysical environment is found almost exclusively in the riparian and very wet areas. Very moist spruce -- subalpine fir bottoms comprises 17% of the analysis area (this includes a small portion of cedar BE). Wildfires that enter into these stands from adjacent drier stands often burn very hot, essentially wiping out the stand and may impair hydrologic function.

CURRENT STRUCTURAL PATTERNS

Forest structure is the term given to the physical and temporal distribution of trees in a stand. The distribution can be grouped based upon the size of trees, number of canopy strata, tree age or cohort, canopy closure, and overall structural diversity (USFS R-6, 1995). The percent of land in each stage varies over time. Current forest structure is a result of past disturbance in the planning area. Disturbances in this area have included wildfire, fire suppression, endemic and epidemic insect and disease activity, windthrow, snow damage, climate change, and human activities such as timber harvest and land clearing (see future explanation in section below). Without disturbance, stands succeed toward an old growth condition. However, disturbance is a necessary part of a landscape. Disturbances move stands backward in succession to the early stages and create the mosaic patterns found on a healthy landscape. Structural stages are not necessarily associated with stand age or seral development. The following definitions were used to define structure:

Early -- Structural Stage 1 and 2 - Stand initiation through stem exclusion.
These stages occur following a stand-replacing disturbance such as a fire or timber harvest. Seedlings reoccupy the stand and start growing toward fully utilizing the growing space. Trees are generally the same age class, but there may be a few older trees present. Tree size may range from seedlings to small pole size. Understory may contain forbs, grasses and shrubs.

Early -- Structural Stage 3 - Stand initiation through stem exclusion. This stage occurs when the young trees have fully utilized the site. There is not enough light or moisture present for new trees to begin growing in the understory. Trees may be small to large pole sized. These stands may be large enough to economically harvest in a commercial thinning operation

Middle -- Structural Stage 5 (SS5) - Understory reinitiation, multi-stratum without large trees. As single trees die (due to forest pathogens, small spot fires, etc.) openings fill in with a second cohort of trees that become established under the older, typically early seral (trees that grow best in open conditions, e.g. larch, pine) overstory. The overstory canopy is discontinuous and two or more canopy layers are present. The stand may have a mix of sizes; however, large trees are uncommon. For the Colville National Forest, "large" is defined as trees that are at least 21 inches in diameter at breast height. "Common" is defined as eight trees per acre for all biophysical environments other than the subalpine fir/grouse huckleberry biophysical environment (10 trees per acre).

Late Multi-Story --Structural Stage 6 (SS6) - Multi-storied with large trees. This stage characterizes stands that contain two or more cohorts of trees in two or more canopy strata. Medium and large trees dominate the overstory, though all sizes may be present.

Late Single-Story – Structural Stage 7 (SS7) - Single stratum with large trees. A single layer of medium or large early seral trees is present. The understory is absent or sparse in clumps of seedlings and saplings. The “park-like” conditions found in some ponderosa pine, Douglas-fir, or western larch stands may exist. Less than one half of a percent of the analysis area has timber in late single-story structure and these were grouped in with the rock/untimbered areas.

Structural stages were identified based on a watershed scale. Percentages are a rough estimate of the analysis area and are not intended to be used on a stand level scale without field verification.

For the purpose of this analysis, structure was quantified using the Historical Range of Variability (HRV) Analysis. The HRV Analysis is required by the Decision Notice for the Continuation of Interim Management Direction Establishing Riparian, Ecosystem and Wildlife standards for Timber Sales (USFS R-6, 1994) as amended in 1995 (USFS R-6, 1995). (This direction is commonly referred to as the ecosystem screens.) The decision notice amended the Colville National Forest Plan (USDA, 1988) in May of 1994.

The HRV groups structure by size and spatial patterns, and divides the area into biophysical environments based on plant association groupings (see previous section). HRV compares the percentage of forested stands in early, middle, and late structural stages within each biophysical environment with the estimated range of structures that was in each biophysical environment historically. Historical structural stage percentages reflect a time when the predominant disturbance was fire. In biophysical environments that have historical percentages in the single storied SS7, frequent low severity fires would underburn stands reducing the understory population and keeping insect and disease problems in check. In the biophysical environments that did not have SS7 historically, stands were shaped by higher severity stand-replacing fires.

In more recent times, timber harvest and to a lesser extent, insect and disease, has replaced fire as the primary disturbance mechanism. The HRV was analyzed for lands managed by the Forest Service. Table 3-3 provides the results of the analysis.

Table 3-3. HRV Analysis -- A Comparison of Current Percentages and Historical Ranges of Forest Structure by Biophysical Environment. Note: Calculated for the Forest Service Portion of Land Within the Analysis Area.

Biophysical Environment	Structural Stage***			
	Early	Middle	Late 6**	Late 7**
Cold Mesic Subalpine fir (CMA)				
Current	34%	26%	39%	NA
Historic Range of Variability	10-30%	25-65%	30-60%	NA
Warm Dry Douglas-fir (WDDF)and Co Douglas-fir/shrub (CMDFS)				
Current	11%	36%	53%	0%
Historic Range of Variability	10-25%	10-25%	5-20%	30-75%
Very Moist Spruce Bottoms (VMSB)				
Current	22%	22%	56%	NA
Historic Range of Variability	10-35%	20-75%	15-80%	NA
Cool Dry Douglas-fir (CDDA)				
Current	20%	24%	56%	0%
Historical Range of Variability	15-45%*	35-75%*	10-30%*	2-5%*

*The historical range for CDAS is likely underestimated due to inclusion of the cool dry Douglas-fir forb-shrub BE in this group and abundant evidence of recent open park-like larch stands in the Vulcan area. This area is likely a statistical outlier. In fact the original Colville-Okanogan-Wenatchee screens were changed to include single story old growth based on these Vulcan stands. Also, the middle percentages are somewhat misleading because these stands have large early seral species trees, while the species usually thought of as occurring as "old growth" in the fir series often do not show until fire exclusion has occurred.
** Late structure is identified by estimating the number of 21-inch diameter at breast height trees. There must be 8 trees per acre to be considered.
***percentages may not add up to 100% due to rounding.

While most of the current structure falls within or above the historic range, single storied old growth (late7) is lacking in the dry Douglas-fir and cool dry Douglas-fir BEs. In addition, both biophysical environments have percentages of multi-storied old growth well above historic levels. This is due to years of fire exclusion. The multi-story old growth has ladder fuels and crown arrangements and bulk densities that greatly increase the risk of unacceptable wildfire behavior (like a running crown fire). In this situation, screening direction encourages moving stands toward the single story old growth. The fastest way to achieve screening direction is by converting multi-story old growth to single story old growth.

Although the percentage of multi-storied old growth has remained within or above historic range of variability for much of the area, past timber harvests or disease and insect disturbance has removed the largest trees in places. This caused small openings in the canopy usually less than an acre in size. Gaps filled in with densely spaced Douglas-fir. In the past, fire would have thinned out the dense understory; however, past management has discouraged the historical underburns. This has created a condition of stands with overly dense multi-story stands; fewer

disturbances (pathogens and fire), resistant early seral tree species (western larch and ponderosa pine), and moderate to high levels of forest pathogens (dwarf mistletoe, bark beetles).

Early structural stands have generally resulted from even-aged timber harvest and are lacking the snags and downed wood required to maintain site productivity and provide wildlife habitat. Most of these stands were planted, and since Vulcan is a productive area, many natural seedlings quickly filled in where planted trees were unsuccessful. These stands are now overstocked beyond what would have occurred historically. Overstocked middle and early stands in the dry biophysical environments are causing an overall condition of low vigor and predisposition to wildfire and insect/disease damage.

INSECTS AND DISEASE

Current Condition: The current condition of the vegetation related to insect and disease problems was determined by aerial insect and disease flights, field surveys by Jim Hadfield, Area Pathologist (2004), stand exams (2003, 1992), and walk through exams, 2004-2005. Insects and diseases are a natural part of the ecosystem. They exist on the stressed trees within the stand. When stands are in good condition, there is adequate moisture, sunlight, and nutrients, and insect and disease populations are low (endemic). However, when growing resources become scarce as when overstocking or drought limit moisture, forest pests respond by increasing populations and attacks. In severe cases, populations may become epidemic. As discussed in the last section, the Douglas-fir biophysical environments are outside the historical range due largely to fire suppression. Current conditions of excess trees and continuous multi-story stands create excellent conditions for forests pests.

Acres in the early structural stages are generally free of the insects and diseases that favor dense multi-canopy late structure forests. However, as stands grow they become overly dense, especially without frequent underburning or precommercial thinning. Overstocking puts enormous stress on individual trees and entire stands by exceeding the carrying capacity of the site. At a certain point, overstocked stands are said to reach a zone of imminent mortality where trees begin to die. Forest pathogens may move in just prior to this point, speeding mortality.

Brooming Diseases: Currently, the biggest forest pathogen problem is dwarf mistletoe infection of Douglas-fir, western larch, and lodgepole pine. Dwarf mistletoe reduces the growth and vigor of infected trees and eventually results in mortality. When infected, the tree responds by forming “brooms” where the infection stimulates growth. These brooms tend to fall off and can cause large build-ups of ground fuels especially in Douglas-fir where the brooms may also become ladder fuels. In addition, the brooms increase crown bulk density and provide a good means for spreading of crown fires. In the past it is likely that dwarf mistletoe was kept in check by fire burning up through the brooms. Currently mistletoe is so widespread that such fire action could burn large areas in a running crown fire. The stands at high risk to dwarf mistletoe are those currently containing the host and associated species of mistletoe in the overstory with the same species in the understory (basically middle to old stands with abundant ladder fuels). Approximately 51 % of the Vulcan area is in this condition.

Douglas-fir Bark Beetle: Douglas-fir beetle outbreaks occur when an event such as a large wildfire or windstorm coupled with favorable weather and the presence of elevated endemic populations create conditions favorable for beetles (trees with thick phloem tissues for feeding

but reduced resistance mechanisms). Outbreaks may occur over large areas, killing vast amounts of timber and creating fuel for uncontrolled wildfires. Stands at the highest risk of beetle attack have an average diameter at breast height of greater than 14 inches, a species mix of greater than 50% Douglas-fir, and stand basal area exceeding 150 square feet per acre (Flanagan, 1998). Prior to attack, stands are usually in Structural Stage 5 or 6 (multi-storied middle or old growth). Following attack, the stand may lose 60-80% of the largest trees returning the stand to a middle or early structural stage. An outbreak of Douglas-fir bark beetle went through the Vulcan area several years ago. The beetle caused widespread mortality. Several formerly old growth stands regressed to earlier structural stages due to the beetle.

Most of the active beetle populations in the Vulcan area have died off. However, Douglas-fir beetle is still active in areas where trees have become stressed by a pathogen such as Armillaria root rot, fire damage, or due to close proximately to fresh large down material successfully colonized by beetles. In this case, high localized beetle populations continually attack neighboring trees and eventually the tree dies. Timber stand exams and aerial surveys have indicated the presence of high endemic levels of beetle populations in the area throughout the last decade. The 2005 Aerial survey identified 600 acres scattered in 30 patches throughout the analysis area as having current infestations. Approximately 32% of the planning area is at risk to future Douglas-fir beetle infestation (based on historic range of variability).

Other Bark Beetles: Mountain pine bark beetle often moves into early structural stands of dense lodgepole and ponderosa pine. High densities stress the trees, encouraging successful bark beetle attacks. Bark beetles may kill the attacked tree within a year and move on to the next tree. Attacks usually start out in small patches and may move on to cover many acres. Mountain pine beetle has been active in the central part of the analysis area where acres of dense lodgepole pine and western larch seeded-in following fires. The aerial survey observed 465 acres of mountain pine beetle.

Western pine beetle attacks and kills larger diameter ponderosa pine. The insect attacks trees that are stressed, often by drought in over-dense stands. Mortality greatly increases fuel loads and may allow the area to burn hot, bringing the stand back to the earliest structural stage. The 2005 aerial survey located 218 acres of western pine beetle caused mortality.

Spruce beetle and western balsam beetle on spruce and subalpine fir are found in increasing amounts in the analysis area (see below, section on climate change).

CLIMATE CHANGE

Global climate change is expected to impact the Vulcan planning area in the following ways: Warmer drier summers are expected to stress tree species at the lower ends of their range causing insect outbreaks, subsequent mortality, and a change in the plant associations. A good example of this can be seen on the transition zone on the western side of Catherine Creek where subalpine fir starts growing. In these areas, lower elevation subalpine fir is dying due to a western balsam bark beetle outbreak. The 2005 Aerial survey identifies 250 acres of western balsam beetle mortality, mainly in the middle part of the analysis area. In this area beetle caused mortality is expected to remove subalpine fir from the lower parts of its range where climate change is causing drying, replacing the live trees with snags. Subalpine fir is not expected to regenerate in these areas. Tree gaps will probably fill-in with Douglas-fir. Limited spruce beetle populations

are also found in the area and are expected to behave in a similar manner over the next few decades narrowing the range of the moist spruce associations.

Warmer spring seasons may increase the growing season length allowing more growth in trees and other vegetation. This is expected to be especially noticeable in natural meadows, which will tend to be colonized by tree and woody brush species. But it will also occur in the drier forest types where growing space is available. Although this ingrowth is commonly attributed to fire suppression there is a growing opinion that it is partially due to climate change. While the increase in season is likely to increase height growth, diameter growth is likely to be reduced since diameter growth starts later in the season than height growth and tends to terminate with adverse conditions such as drought.

Climate change directly influences the timing and likelihood of severe weather occurrences, especially wildfire. Climate change is expected to exacerbate the instability of the Vulcan area by increasing vegetation ingrowth and densities, changing vegetation types and species survival in the lower parts of their range, increasing insect outbreaks resulting in subsequent snags, and increasing the likelihood of lightening strikes and wildfire.

SUMMARY OF EXISTING CONDITIONS

- Fire has played an intensive role in shaping the Vulcan landscape.
- Fire exclusion has caused over half of the analysis area to be outside historic range of variability.
- Much of the vegetation in the analysis area is in a stressed and overstocked condition.
- Much of the area is prone to insect and disease attacks and undesirable fire behavior due to excessive fuel loads.
- Insect and disease problems exists in the area in moderate levels, however the potential for an increase in occurrence is high.
- Some of the worst disease problems are in the dry and moist Douglas-fir biophysical environments, especially in multi-storied old growth.
- Global climate change is expected to increase problems in the future.
- There is a high risk of future fire in these areas whether they are treated or not, but restoration can limit the ecological damage caused by uncharacteristic fires (crown fires vs. the historic ground fires).

Direct and Indirect Effects of the Alternatives

ALTERNATIVE A (NO ACTION)

No active management would take place under the No Action Alternative. This alternative would not reduce tree stocking nor begin to convert multi-storied acres to single storied stands in accordance with historic range of variability. There would be no reduction in hazardous fuels to improve the fire resilience of the stand. Stand susceptibility to insect and disease attacks would be unchanged and would worsen over time. Tree and stand vigor would continue to decline. There would be no precommercial and small pole thinning to release stands for quickly achieving old growth. There would be no thinning of previously planted units in Lynx Analysis Units to release spruce and firs. Wildlife habitat would be unchanged in the short term and would not be protected by treating the area around the habitat. Private land would not be protected by treating the surrounding wildland-urban interface.

Stands with mistletoe, beetles, and other forest pathogens would continue to move toward multi-storied structure as tree gaps caused by mortality fill in with shade tolerant seedlings. This alternative would not remove diseased or insect infested trees nor modify conditions that are favorable to the spread of pathogens. In general, increased multi-storied conditions and excessive densities would reduce stand vigor, encourage stagnation, and weaken trees making them more susceptible to pathogen colonization. As pathogen levels increase, mortality of the infected trees would occur and add to the dead wood or fuel component of stands. The old growth ponderosa pine and western larch would continue to die due to beetles or severe wildfire and would rarely be replaced by new seedlings. The understory will continue to fill in with shade tolerant Douglas-fir, subalpine fir, and spruce. Pathogens that have existed as endemic pests would verge on the epidemic. Larger subalpine fir would continue to drop out due to climate change. As mortality of the overstory occurs, regeneration of Douglas-fir, a species prone to forest pathogens and fire damage, would establish in openings increasing the amount of multi-storied stands and increasing ladder fuels.

No prescribed burns or mechanical fuels treatment would occur. By not treating the understories, the already high stand densities would increase. Ladder fuels would not be cut and the base to crown height (important as a measure of how high flame length can be in ground fire without elevation to the overstory) would remain as is or decrease. No treatment of overstory trees would cause crown bulk densities to increase especially where dwarf mistletoe infection of Douglas-fir is present. Additionally, there would be no treatments to break up canopy continuity. The stands of large western larch would be increasingly at risk to uncontrolled wildfire events.

As discussed in Betcha et al. (2001) stands at the highest risk to uncharacteristic wildfire are those in biophysical environments that had low to moderate severity fire historically. That describes approximately 60% of the analysis area (the dry Douglas-fir and Douglas-fir-subalpine fir biophysical environments). District lightning records show the risk of fire-starts is high in those areas. Without vegetation management, wildfires can be expected to occur and to be increasingly severe, even in biophysical environments that historically had moderate to high severity wildfires.

Increased ladder fuels, crown density and continuity, and additional dead wood would add to the fuel component of the stand, causing increased risk of uncharacteristic fire damage. If a wildfire started, it would be increasingly difficult to put out and intensities would be much greater than were found historically, causing crown fires and soil sterilization in areas. Fires would increasingly spread from the drier areas to the wetter plant association due to severe fire behavior. This would endanger the valuable old growth trees, wildlife habitat, and fire-fighters, as well as private property if fires were to spread off-Forest.

Assuming no wildfire or pathogen outbreak occurs (an unlikely assumption); the planning area would eventually reach an equivalent of multistory old growth acres above the historical range. The single story old growth stands, currently found in isolated grassland patches, would continue to decline as fire suppression and encroachment by Douglas-fir continues. In some cases, old growth multi-storied stands currently infected with bark beetles would revert (some already have reverted) to middle or early structure. The future structures would be well out of the historic range of variability. Because the largest most vigorous trees, often the better genotypes, are

more likely to be attacked by pathogens, the genetic base of the stand may decrease with mortality.

In this alternative no potentially negative consequences of active management would occur. For example, there would be no mechanical or prescribed burn-caused scarring of the residual stand, no loss of site productivity due to soil compaction, and no loss of organic matter due to vegetation and fuels treatments. No mortality of large trees due to prescribed fire or secondary agents following fire would occur.

The No Action Alternative may result in the irreversible effect of loss of old growth structure and habitat if lack of management results in conditions that cause stand-replacing fires in old growth. While trees will continue to regenerate and grow, the timeline to achieve the large old trees make losses irreversible in the foreseeable future.

ALTERNATIVES B AND C

The difference between the two alternatives is small, mainly the amount of acres being treated. Alternative C treats slightly more acres in the dry Douglas-fir biophysical environment. But it also treats less of the overly dense subalpine fir biophysical environments. Alternative B restores slightly more acres of early structural stage stands, but slightly less old growth stands.

The following discussion applies to both action alternatives.

Timber Harvest

Precommercial, commercial, and small pole thinning are the main vegetation treatments included in the action alternatives. These treatments are designed to increase tree vigor and growth, reduce the probability of severe wildfire (crown fires), and restore balance to historic range of variability. In general, the objectives are achieved by mechanical vegetation treatments and prescription fire. Treatments would reduce stand density, which would reduce conditions favorable to forest pests, reduce crown bulk density (vol-wt/sq ft), canopy continuity, and ladder fuels. Treatments would bring the landscape closer to historical mosaics as measured in the historic range of variability analysis by targeting stands in the biophysical environments that historically have single story old growth for a target structural stage (Structural Stage 7 or SS7).

Areas designated for wildlife habitat would move toward compliance with Forest Plan standards in a more rapid manner than would naturally occur. Openings left by harvest or pathogen caused mortality (mainly dwarf mistletoe, root rot, and bark beetles) would be prepared and planted with western larch (subject to a post harvest survey) especially in areas where this species is lacking due to past management (Units 8, 23, 171, 172). This will add species diversity and disease and fire resistance to the stands. Site specific prescriptions will be written for each unit. Prescriptions will be in compliance with this environmental assessment, the Forest Plan, INFISH, and other rules and standards governing the analysis area. As most of the Vulcan area is designated for wildlife habitat of some type (lynx, pileated woodpecker, pine marten, mule deer, etc.), harvests will be designed in a manner that improves or protects habitat.

Hazard Fuels Reduction

Prescribed burning for natural hazard fuels reduction is recommended in both action alternatives. In general, prescribed burning coupled with mechanical vegetation treatments compliment the silvicultural objectives of the activity proposals (to move structure toward a mix represented by historic range of variability, reduce the potential for damaging forest pests and uncharacteristic wildfire damage). The appropriate use of fire in the stands where it has traditionally been present would provide beneficial effects, such as help with nutrient release, balance soil microfauna, and restore other ecological processes. However, prescribed burning has the potential to trigger some undesirable effects also, such as to exacerbate forest pathogen problems and damage desirable trees.

Since burning is an indiscriminant process with a degree of unpredictability, a certain amount of damage is expected. Immediate fire effects, called first order effects, can affect vegetation by creating additional stress on the stand. Burns that are too intense may burn tree tissue, causing mortality or encourage insect attacks. Anchor roots may be burned causing trees to fall over. Longer-term fire effects, called second order effects, may develop. Fire-weakened trees become more susceptible to secondary pathogens like turpentine and Douglas-fir beetles. Soil organic matter is volatilized and site productivity may be reduced if burning becomes too hot. Because fire has been absent from the project area for several rotations, some damage to the residual stand is expected as fire burns off layers of accumulated needle duff, seedlings, saplings, and mistletoe brooms

On the other hand a fire may burn too lightly, have little effect on the stand, and not achieve the treatment objectives.

The effects of prescribed fire occur within ranges of intensity and extent and cannot be expected to appear on the landscape with exact uniformity. Burns often exhibit a degree of patchiness determined by the natural random arrangement of fuels across the landscape. Jackpot burning is less intense and typically burns 30 to 70 percent of a burn area while underburning may cover 50 to 90 percent of a burn area depending upon available surface fuels. The localized variability found in individual fuel concentrations across the landscape accounts for localized variability in fire intensity and its variations in first order and secondary order effects. These ranges of effects typically result in a mosaic of effects that contribute to a healthy biological diversity across the burn area.

Overall, the unpredictable effects of prescribed fire can be minimized by burning within the conditions of a burn prescription. Burning within prescription will minimize damage and mortality to desired residual vegetation and is not likely to reduce soil organic matter to below recommended nutrient levels. Vegetation Management Mitigation Measures 1 and 2 would also minimize detrimental effects due to prescribed fire activities.

Units scheduled for vegetation treatments that encourage Structural Stage 7 will be underburned following harvest. This will reduce competition from unmerchantable seedlings and some saplings, as well as reduce ground fuels caused by harvest. Reducing understory competition is expected to help increase the vigor of the residual overstory through time. Some mortality of trees that are heavily infected with dwarf mistletoe and/or surrounded by thickets of understory trees is expected. Continued periodic (10-20 year intervals) underburns could help maintain stands in Structural Stage 7.

ALTERNATIVE B

Timber Harvest Treatments
In the wildland-urban interface (WUI) (see map, Chapter 1, page 2), reducing fuels and changing expected fire behavior is the most important objective. Outside of WUI, treatments that restored historic range of variability are the primary objectives. Proposed treatments in Alternative B would restore the Douglas-fir and dry subalpine fir biophysical environments to structures, vigor, and densities that were found historically in both the WUI and non-WUI. In addition, commercial or precommercial thinning would reduce stocking and increase vigor and reduce fuels in subalpine fir units. Treatments to restore the historic range of variability are compatible with fuels reduction and insect/disease objectives in all but a few of the units. Most of the units occur on the perimeter of the analysis area which coincides with the WUI boundary. Linking the burn only treatments with the harvest-burn treatments would provide corridors of reduced fuels in the WUI.

This alternative uses active management in the form of small pole, precommercial, and commercial thinning harvests, mechanical fuels treatments, and prescribed burns to modify species composition and stand structure and density with the intent of achieving the purpose and need of reducing risks of wildfire in the WUI and improving forest health.

This alternative would treat 3,156 acres of vegetation by mechanical or hand methods, plus another 1,328 acres in whipfalling and burn units. Harvest would include a total of 2,216 acres of commercial thinning plus 45 acres of combination commercial/small pole thinning to reduce density, treat fuels and insect/disease problems. Approximately 1,523 acres of this total is within the wildland urban interface zone (WUI). Another 431 acres will be in small pole thinning units, including 361 acres that occur in the WUI. In addition, there are 464 acres of precommercial thinning treatments, 380 acres of which are proposed to reduce susceptibility to wildfire in the WUI. Approximately 100 acres would be spot planted with disease resistant western larch. Harvest is proposed in an old growth habitat management requirement unit (MRU) and in small portions of two other old growth MRUs to help reduce the potential for unacceptable fire affects and help improve future wildlife habitat.

Units Located in Pileated Woodpecker or Pine Marten Areas (Part of Units 7, 9, and 36): Treatment in these units would improve the ability to attain and speed development of desired habitat as required by the Forest Plan, and would also reduce fuels. The primary component lacking in these areas is large live and dead standing trees. Large trees would more readily grow after releasing the overstory by a basal area thinning from below. Thinning would increase the growth rate of the overstory and create canopy layers. This would be accomplished by uneven-aged selection which targets intermediate, suppressed, and pathogen infested trees. Standing deadwood greater than 12 inches in diameter at breast height would be protected as health and safety permits. Target crown closure would be 50% or greater. (This will vary according to site specific conditions.)

Units That Have Acres in Early Structural Stage: Approximately 1,250 acres of proposed thinning is located in stands in the early structural stage. Of that, 464 acres are proposed for precommercial thinning; 431 acres for small pole thinning, and 310 acres are proposed for commercial thinning. The treatment of these stands would reduce overstocking, encourage tree growth, and reduce insect and disease. Precommercial thinning would space trees 14-20 feet

apart, depending on species; drier stands would have wider spacing. Precommercial thinning would occur in trees smaller than 7 inches in diameter at breast height, removing the least desirable trees based on incidence of forest pathogens, vigor, and species mix. Commercial and small pole thinning would average 20-30 foot spacing depending on species composition and inclusion in the WUI or not, although more attention may be given to selecting disease free trees or leaving tree islands or small (1/4 to 1/2 acre) openings. If available, large snags will be protected by surrounding them with retention trees.

Table 3-4. Acres Treated by Structural Stage
(* indicates units with patches of both types of structure)

	Early	Middle	Middle/Late*
Commercial Thin	310	1,360	546
Small pole	431		
Combination *thin/pole	45		
Precommercial thin	464		
Total acres treated	1,250	1,360	546

* included in total commercial acres in above discussion

Units Located in the Lynx Analysis Units: (1,005 acres) Treatment in these units would thin previously-planted overstory of western larch and Douglas-fir trees, and would restore vigor to Douglas-fir stands enabling them to attain suitable denning habitat. Treatment would also lessen the probability of undesirable fire behavior. This would be accomplished by thinning areas, leaving approximately 10% of the area in clumps of trees, ½ to 1 acre in size and opening up small patches in areas of denning habitat. Down trees would be left, although they may be piled and partially burned in order to lessen the danger of damage by wildfire.

Management Area (MA) 6 and 8 (Winter Range): Acres in MA 6 and 8 are proposed for thinning in this alternative. Treatment in these units would thin the small understory and low vigor trees and release the vigorous larger trees so the overall canopy closure is greater than 60% with 40% or more coming from trees greater than 12 inches in diameter at breast height. The stands are currently plagued by beetles and mistletoe in areas and have high potential for crown fire. Treatments would produce a multi-story stand, which would allow attainment of a required percentage of cover for big game, but would eliminate most of the ladder fuels and excessive canopy layers within the WUI. Ten percent of the area would remain untreated so as to retain existing cover for wildlife.

Single Story Old Growth: Structural Stage 7, single story old growth in warm dry Douglas-fir biophysical environments (BEs) is overwhelmingly lacking in the Vulcan analysis area. Alternative B would treat approximately 42% of land in Douglas-fir BEs with commercial harvest or precommercial thinning. Another 28% of land in Douglas-fir BEs would be whipfelled and burned. These treatments would begin the process of restoring up to 60% of single story old growth.

Table 3-5. Acres Treated by Biophysical Environment
(* another 135 acres of mixed biophysical environments were not counted.)

	WDDF	CDDA	CDA	CMA
Commercial Thin	1,609	182	39	251
Small pole	342	19		70
Combination thin/pole	45			
Precommercial thin	256			208
Total acres treated*	2,252	201	39	529

Biophysical Environments:
Warm Dry Douglas-fir Shrub = WDDF
Cool Dry Douglas-fir Subalpine fir = CDDA
Cold dry Subalpine fir/shrub = CDA
Cold Mesic Subalpine Fir = CMA

Other Units: This alternative would encourage attainment of either single story old growth (for the Douglas-fir plant associations) or multi-story old growth (for subalpine fir plant associations). Firewood removal by the public would be allowed in areas with access and landing space. Removal of firewood would reduce smoke emissions during prescribed burning and provide fuel for the public.

Supplemental reforestation would occur in the following units: 8, 9, 23, 171, and 172. Planting in small openings would restock stands and provide a more favorable species mix for fire resistance. Units planned for planting will be reforested with western larch and/or ponderosa pine seedlings following harvest. Prescribed burning would help to prepare the seed bed and reduce competing vegetation. Units will be reviewed following harvest to determine the continued need for and requirements of post harvest treatments.

Hazard Fuels Reduction

Prescribed Burning: Commercial thinning coupled with prescribed burning would better achieve fuels objectives in stands with closed or nearly closed canopies by breaking up canopy continuity and reducing crown bulk density as well as reducing ladder and ground fuels (Omi and Martinson, 2002; Graham et al., 2004). Commercial or small pole thinning treatments are scheduled in areas that have potential for commercial harvest. Both treatments used in conjunction help to meet project objectives by reducing densities and the highly flammable dwarf mistletoe brooms, and moving stands closer to historic range of variability. Alternative B proposes 1,426 acres of commercial thinning followed by under burn treatments.

Most of the proposed burning without mechanical treatment is proposed in sites that are in rocky, non-timbered land or single storied dry biophysical environments. Pollet and Omi (2004) found that prescribed burning only treatments were likely to be effective in stands with low tree densities, few ladder fuels and poor access. Burning without other vegetation treatments is expected to limit the ability of a wildfire to spread in the short term by burning the ground vegetation, killing seedlings and small saplings. This treatment would help decrease the number of trees encroaching on meadows and move timbered stringers toward the single story condition. Alternative B proposes 2,858 acres of burn only treatment.

With prescribed burning only, the treatments would eliminate smaller ladder fuels and increase the base to crown ratio, but there is usually not much effect to the larger understory or crown (Fule et al., 2002; Graham et al., 2004). Burn only treatments are most effective when used in single story middle, single story old growth, or where meadows are being encroached upon by trees. The result is to eliminate seedlings and saplings. Mechanical work in the form of whipfalling can greatly enhance the chance of achieving burn objectives. Whipfalling helps eliminate competition and stress on the overstory by reducing densities and moving the stands toward achievement of single story old growth. Alternative B proposes 1,328 acres of whipfall, followed by burn treatments.

The east side of Burn-unit P goes into young subalpine fir/lodgepole stands that will not withstand much fire. While some creep of prescribed fire into the plantations is acceptable, damaging fire intensity will be minimized by ignition avoidance or control measures. (Mitigation 4). Burn treatments in Unit L are adjacent to a dense plantation on private land. Care will be taken to insure fire stays contained within the planned unit boundaries through standard preplanned containment strategies. Portions of Units K and G are located in dense stands of old growth that are in the process of reverting to earlier structural stages from years of Douglas-fir beetle and western pine beetle infestation. The old growth trees are not targeted for ignition, but low-intensity fire will be allowed to creep or smolder in surface fuels to reduce fuel loadings. These stands are expected to either burn poorly because of shaded conditions, or possibly cause excess damage in areas of heavy fuel concentrations. Adverse effects can be mitigated by doing pullback[8] or predetermined containment preparations

ALTERNATIVE C

This alternative is similar to Alternative B with the following exceptions:

- **Unit 1:** This unit was added to Alternative C. This unit would help achieve the silvicultural objects of reducing the susceptibility to forest pathogens and the probability of uncharacteristic wildfire damage.
- **Unit 19:** This unit was dropped. Although ecological function could be improved if this stand was thinned and overstory removed, the cost and impact of building a road into the area was not considered worth the benefit.
- **Unit 18:** This unit was dropped. Without construction of the road to Unit 19, the western, non-WUI part of this unit would drop out. The entire unit was removed because of the need to pursue an easement for harvest. If an easement were obtained, the portion of Unit 18 located in the WUI would be treatable.
- **Units 27, 29, 54:** Dropped Units 27, 29, and 54 because these units were in wetter plant associations and are not close to houses in the WUI.
- **Unit 30:** Dropped 37 acres from this unit because these acres were in wetter plant associations and are not close to houses in the WUI.
- **Units 53 and 35:** Dropped 18 acres from Unit 53 and 10 acres from Unit 35 because these acres were in wetter subalpine fir plant associations. The wetter portions of the

[8] **Pullback**: Manual labor focused toward removing accumulations of surface fuels from around the bases of large trees to help protect them from excessive heat during prescribed burning.

units that were dropped are adjacent to state land. Wet alpine fir lands are lower priority for silvicultural objectives.

This alternative would commercially harvest 2,107 acres. Precommercial thinning would be the same as Alternative B (464 acres).

Units Located in Pileated Woodpecker or Pine Marten Areas (Part of Units 1, 7, 9, and 36): The effects in these units would be similar to Alternative B. The only difference is the inclusion of Unit 1 located in the southwest pine marten stand. Treatment of this stand will increase acres treated to restore dry Douglas-fir biophysical environments. In addition, vegetation treatment called for in this alternative would reduce damage to the residual stand caused by underburning.

Units That Have Acres in Early Structural Stage: Effects for these units would be the same as in Alternative B.

Table 3-6. Acres Treated by Structural Stage, Alt C
(* indicates units with patches of both types of structure)

	Early	Middle	Middle/Late*
Commercial Thin	251	1,245	566
Small pole	422		
Combination **thin/pole	45		
Precommercial thin	464		
Total acres treated	1,174	1,245	566

** included in total commercial acres in above discussion

Units Located in the Lynx LAU: Effects in these units are similar to Alternative B.

Units in MA 6 and 8: The effects in these units are similar to Alternative B.

Units with Single Story Old Growth: The effects in these units are similar to Alternative B.

Table 3-7. Acres Treated by Biophysical Environment, Alt. C
(* another 135 acres of mixed biophysical environments were not counted.)

	WDDF	CDDA	CDA	CMA
Commercial Thin	1,645	182	39	61
Small pole	342	19		61
Combination thin/pole	45			
Precommercial thin	256			208
Total acres treated*	2,288	201	39	330

Cool Dry Douglas-fir Subalpine fir = CDDA
Warm Dry Douglas-fir Shrub = WDDF
Cold Mesic Abla = CMA
Cold dry Subalpine fir/shrub = CDAs

Hazard Fuels Reduction
Effects are the same as in Alternative B.

Cumulative Effects

Fire exclusion and past harvests have caused the Vulcan area to lose resistance and resiliency to wildfires and forest pathogens. While percentages of acres in early and middle structure are within historical levels, tree densities have reached unsustainable maximums over much of the area. Fuel build-up has far exceeded what was found historically. Most of the dry Douglas-fir middle and old growth in the area is located on National Forest System lands (greater than 90%). For the most part it is very heavily stocked with abundant fuels and conditions that favor forest pathogen outbreaks.

Attainment of structures in biophysical environments more in balance with historic range of variability depends upon restoration of stands within the Federal ownership. Successful treatments in either action alternative can begin the process of restoring up to 60% in single story old growth on Federal Lands. Reducing stand densities and removing weakened trees will greatly help the planning area achieve a more sustainable balance across all ownerships by reducing the stress on the stands, increasing vigor, decreasing the potential for insect and disease outbreaks, and increasing the resilience to wildfire. Additionally, treatments in the early to middle subalpine fir biophysical environments would reduce incidence of insect and disease, especially bark beetles by reducing stand densities and removing weakened and infested individuals.

The East-side Screening Direction prohibits harvest of green trees with a diameter at breast height of 21 inches or greater. Many large western larch and some Douglas-fir are infected with dwarf mistletoe. Leaving large infected trees in units will result in continued infection of susceptible species in the understory.

FOREST FUELS

Information provided in this environmental assessment about forest fuels is excerpted from the *Vulcan Vegetation Management Project Fuels Report* by Lisa Green, June 19, 2006. The full text of this report is incorporated by reference. The Fuels Report describes the current and desired conditions with regards to forest fuels and wildfire potential. It also describes and compares the environmental effects associated with the various alternatives (Alternative A—No Action, Alternative B—Proposed Action, and Alternative C). Measures intended to mitigate adverse effects are also included.

Existing Conditions

VULCAN FIRE CONDITION AND VEGETATION

The forests on Vulcan Mountain today do not exhibit the fire resilience of their predecessors. Well-intended fire exclusion efforts and timber harvesting activities have had the unintentional consequence of allowing an accumulation of woody debris and timber litter, overstocking of trees, and thickets of crowded understory vegetation. Before the era of aggressive fire suppression, naturally occurring wildfires effectively kept the trees in the forest widely spaced,

pruned of low-hanging branches, and consumed excess surface fuels on the ground. Since these forests had adaptations that allowed them to tolerate certain levels of fire, the forest could respond to disturbance with resilience. Fire suppression has interrupted those processes resulting in a currently unstable fuels condition.

The current vegetation within the Vulcan analysis area exhibits fuel conditions that are generally out of balance with the area's fire regime. The various species of trees and the structure of the stands themselves testify to a history where natural fires were relatively frequent and of low intensity over much of the area. After the institution of systematic fire suppression by land management agencies and local landowners, the natural cycles of fire were interrupted. Fire exclusion, timber management activities, and grazing have had a large impact on the vegetation in this area.

The following table shows the occurrence of plant associations and the overstory trees within them.

Table 3-8. Plant Association in the Vulcan Project Area.

Plant Association	Number of Plots	percentage of Total Plots	Overstory Tree Species
Douglas-fir/ninebark-twinflower	116	46%	Douglas-fir **western larch**
Douglas-fir/ninebark	28	11%	Douglas-fir **ponderosa pine**
Subalpine fir/big huckleberry	23	9%	**western larch** lodgepole pine
Subalpine fir/queencup beadlily	18	7%	subalpine fir Engelmann spruce **western larch** lodgepole pine Douglas-fir
Douglas-fir/common snowberry	14	6%	**ponderosa pine** Douglas-fir **western larch**

**Bold species are fire resistant, shade intolerant.*

The fire resistant, shade intolerant species of ponderosa pine and western larch only occur in dominant or co-dominant positions in Vulcan Project area stands, and do not occur as understory species in any of these plant associations, indicating their poor ability to compete in the absence of disturbances that create openings and bare soil. The presence of shade-tolerant[9], fire intolerant species surrounding and overtaking the fire resistant, shade-intolerant[10] species

[9] **Shade-tolerant** refers to species of plants that can develop and grow in the shade of other plants. Generally these are fire-intolerant species (i.e., species of plants that do not grow well or die from the effects of too much fire).

[10] **Shade-intolerant** refers to species of plants that do not grow well in or die from the effects of too much shade. Generally

indicate that the fire resistant species of trees are slowly being replaced. Without the disturbance regimes that maintained them, fire being the most widespread, ponderosa pine and western larch will gradually disappear from the landscape.

Furthermore, in the absence of natural fires, many areas within the Vulcan planning area have become overgrown with smaller diameter (sapling and pole sized regeneration) trees creating stocking levels that put the stand at risk of damaging wildfires. These small trees can provide a "fire ladder" allowing fire to gain access to the crowns of the dominant over-story trees. As ladder fuels increase over time, so does the potential for high intensity crown fires. When fire danger is high, wildfires burning in such fuel conditions may easily destroy the stand, incur high fire suppression costs, and threaten life and property values on neighboring private land. These kinds of fires have become increasingly dangerous and expensive to fight.

Stand Structure and Fuel Condition Class

Fuel Condition Classes are a function of the degree of departure from historical fire regimes resulting in alterations of key ecosystem components such as species composition, structural stage, stand age, and canopy closure. One or more of the following activities may have caused this departure: fire exclusion, timber harvesting, grazing, introduction and establishment of exotic plant species, insects or disease (introduced or native), or other past management practices.

Condition Class 2 or 3 categories describe stands where fire regimes have been interrupted; and as a result, vegetation becomes more susceptible to damage from fire, insects, and disease. Fuels condition class is inappropriate for its fire regime in many locations within the Vulcan Project area.

these are fire-tolerant species (i.e., species of plants that can withstand a certain frequency and intensity of fire).

The following examples show some current problem forest fuel conditions common throughout the Vulcan Project area.

Figure 3-1. Examples of Current Fuel Conditions

Surface Fuels Downed woody debris (logs, branches, needles) tend to accumulate over time without mechanical treatment or the natural occurrence of fire, creating the fuel conditions that cause hot fires that easily damage overstory trees and are hard to control.	 Westside of Little Vulcan Mountain
Ladder Fuels Overstocking of small trees and brush creates a ladder of fuel from the ground into the treetops by which fire can "climb" into the crowns of overstory trees.	 Westside of Little Vulcan Mountain
Overstocking The physical spacing between trees is so close that branches are intertwined, creating a continuous network of fuels that are elevated above the ground. When conditions are right, a surface fire can become a crown fire, where the fire is sustained by fuels above the ground. Such crown fires are very difficult to control and spread quickly.	 Westside of Little Vulcan Mountain

Crown Fire Potential
The increase in fuel condition class caused by the interruptions in the fire return intervals means the forest can develop increased potential for crown fires[11]. Fire suppression efforts are generally limited in effectiveness in slowing the progress of crown fires once they develop. They are dangerous events, both to firefighters and the public. In most cases, a crown fire stops when one of the factors in the fire environment changes; either weather, topography, or the fuel itself.

Fuel Loading
Fuel loading describes the amount or weight of forest fuels in a dry state and is measured in tons per acre. Fuels can be found at three levels; ground, surface, and aerial. Dead and down ground fuels, not attached to a living plant, are typically considered ground and surface fuels. Brush, small trees, and the lower limbs of larger trees are considered aerial or ladder fuels. Ladder fuels are more widespread than surface fuels in the Vulcan planning area. In general, surface fuel loadings are within acceptable parameters given the species composition, aspect and elevation.

However, overall the current fuel strata appear to exceed what one would expect if natural fire regimes were intact. Past management has reduced surface fuels where broadcast burning has occurred, but other areas are accumulating a large amount of surface, ladder, and canopy fuels.

Direct and Indirect Effects of the Alternatives

ALTERNATIVE A (NO ACTION)

The dry Douglas-fir ecosystem (vegetation, wildlife, soils, water, air) has adapted to frequent fire return intervals. Lightning patterns and wildfire occurrence will continue at historic rates. Increased fire severity in an environment that has not adapted to higher severity wildfire would increase fire effects to live vegetation (forbs, grasses, shrubs, and trees) and would increase consumption of dead organic matter (duff, roots, twigs, needles, branches, rotten logs, and other woody materials). These fire effects could include changes in the vegetative composition of the forest environment, and hotter and longer duration surface fires could consume duff, damage soils, and increase the spread of noxious weeds. Loss of vegetation and soil productivity would result in decreased water quality. Other fire effects would include increased risk of severe wildfire resulting in resource and property damage in the wildland urban interface and decreased public and firefighter safety. These increases have the potential for producing wildfires with higher particulate matter emissions that compromise air quality.

Under the No Action Alternative, actions proposed under the Vulcan Environmental Assessment would not be implemented. Restoring fire as an ecological process in fire-adapted ecosystems and managing vegetation and fuels in areas where fire has been excluded would not occur. The

[11] A **crown fire** is a fire that is sustained in the tree canopy. It requires a canopy that has enough density to provide a continous load of fuel above the ground. Trees that are crowded together with interlocking branches are particularly susceptible to crown fire. A crown fire generally requires wind and may travel quickly once the fire enters the tree tops where winds are stronger. A crown fire exhibits long flamelengths and showers of embers that contribute to spot fires ahead of the main fire. It is beyond the ability of firefighters to make effective direct suppression efforts. Attack with aerial retardants are generally not effective because retardant cannot penetrate the heavy tree canopy. The fire continues underneath the canopy as a surface fire until the canopy ignites again.

risk of severe, large wildfires, where the risk of losing key ecosystem components is high, would increase.

Direct effects of the No Action Alternative would not be immediately apparent.

The fire hazards would remain elevated, and both wildland-urban interface improvements and natural resource values would remain susceptible to destructive fires. Overstocked stand conditions would continue to foster insect and disease problems, which accelerate dead fuel accumulations. Critical habitat for old growth dependent species would remain at high risk. Grazing opportunities would continue to decrease. Encroachment by small trees and brush would continue on the rangelands and noxious weed infestation would continue to expand at its present rate. Fire adapted native species would not receive the low intensity surface fires needed to maintain their populations and help them compete.

During wildfire events, air quality and visibility would be reduced. Smoke produced from a wildfire would be greater and for a longer duration than smoke produced from low intensity prescribed burns.

Irretrievable effects may be experienced if a stand-replacing fire occurs in areas where dominant fire resistant trees such as ponderosa pine and western larch are surrounded by dense thickets of Douglas-fir. Loss of ponderosa pine and western larch seed sources would be likely under these circumstances.

ALTERNATIVES B AND C

Implementation of either action alternative would result in an overall reduction of forest fuels and decreased risk for severe wildfire effects. Forest resources, including air, water, soils, wildlife habitat, native vegetation, range improvements, and heritage sites would benefit from a reduced potential for severe wildfire.

Tree canopies would be thinned to reduce crown fire potential.

Seedlings and saplings would be reduced in number so that dense thickets would be less likely to provide ladder fuels and reduce grazing opportunities.

Dead and downed fuel accumulations would be reduced, lowering fire intensity.

Fire suppression in the WUI could be attempted with greater success by ground forces due to lower flame lengths. Air resources can more easily suppress fires where timbered canopies have been opened up to allow aerial retardants and water to penetrate to the ground.

State and private natural resources and property adjacent to National Forest System lands would face reduced threat from severe wildfire effects. Wildfire moving off of adjacent lands and on to national forest and vice versa could be more easily controlled.

Proposed natural fuels units are the same for both Alternative B and Alternative C.

DIFFERENCES BETWEEN ALTERNATIVES B AND C

The primary difference, from a hazardous fuels standpoint, between Alternative B and Alternative C is that approximately 200 fewer acres are treated in the subalpine fir plant association groups under Alternative C. However, treatments in subalpine fir plant associations will not have dramatic effects on reducing wildfire potential. These areas are typically defined by a Fire Regime that has longer fire return intervals. Wildfires in these areas are typically stand-replacing and dependent on drought conditions. Thinning in these wetter plant associations opens the canopy, which can increase fire behavior by lowering the moisture content of dead surface fuels and increasing the surface wind speed. Nevertheless, creating space between tree crowns in the subalpine fir plant associations could produce positive effects of reducing torching and crown fire potential. Any reduction in the potential for torching and crown fire would in turn reduce the chance of long range spot fires.

Cumulative Effects

Past forest management, including logging and fire suppression, has resulted in the build up of forest fuels and dense forests that favor stand-replacing wildfires. Fuels reduction treatments would have a positive cumulative effect by improving the ability of fire resistant species to compete and survive and provide positive cumulative effects in the areas of fuel continuity, slowing wildfire spread, and species diversity. Because vegetation tends to fill back in over time, no adverse cumulative effects are anticipated.

AIR QUALITY

Information provided in this Environmental Assessment about air quality is excerpted from the *Vulcan Vegetation Management Project Fuels Report* by Lisa Green, June 19, 2006. The full text of this report is incorporated by reference. The Fuels Report describes the current and desired conditions with regards to air quality in relation to prescribed burning for the purposes of reducing forest fuels and wildfire potential. It also describes and compares the environmental effects associated with the various alternatives (Alternative A—No Action, Alternative B—Proposed Action, and Alternative C). Measures intended to mitigate adverse effects are also included.

The Federal Clean Air Act, revised in 1991, is a legal mandate designed to protect human health, visibility, and welfare from air pollution. There are two subjects that need to be considered under the Federal Clean Air Act. One of these areas is called a “non-attainment area”. Pollution sources in these areas are subject to tighter restrictions. Spokane is the nearest non-attainment areas and would not be affected by prescribed burning in the Vulcan Project area.

The Clean Air Act also contains a provision called the Prevention of Significant Deterioration. This provision was designed to prevent areas from being exposed to the maximum amount of pollution. Three air quality classes (I, II, and III) were established. Class I airsheds are subject to the tightest restrictions.

The nearest Class I airshed is the Pasayten Wilderness in the Okanogan National Forest, approximately 60 air miles to the west of the project area. Visibility Protection Guidelines for Washington's Class I areas place restrictions on prescribed burning during weekends from July 1

through Labor Day. Specific prescribed burning restrictions during this period of time are based on distance from the Class I area. No restrictions are placed on prescribed burning occurring more than 60 air miles from a Class I airshed. Since the Vulcan proposed prescribed burning projects are 60 miles distance from the Pasayten Wilderness and prevailing winds move smoke away from the Pasayten, Prevention of Significant Deterioration will not be analyzed in this environmental assessment.

Existing Conditions

Managing smoke from controlled burning involves timing and cooperation with weather to minimize the impacts of smoke. The Republic Ranger District's burning program takes place when fuels and weather conditions meet predetermined prescription parameters. The burning of either logging slash or natural fuels is conducted primarily in the dry periods of the spring and fall. In any year, the burning program may involve ignitions on an average of 12 to 20 days. Not all of these ignitions would be in the Vulcan Project area. Burn days are chosen when winds will move the smoke out of the project area and dissipate it. Ignition typically ceases by late afternoon so the burn will consume most of the fuels before downslope wind patterns develop in the evening. Any residual smoke from burning that lingers overnight generally shows in a "mid-elevation" inversion layer within the valleys. Inversions generally break up mid-morning and the smoke dissipates upward. Smoke settling into the valley bottoms is rarely seen. This applies to the Kettle River Valley, which includes the towns of Curlew, WA, Grand Forks, B.C., and Midway, B.C.

When dispersed properly, smoke does not threaten human health. However, high concentrations found on the fire line can expose firefighters to the toxic compounds found in smoke. Smoke from controlled burning occurs infrequently during a few weeks in a year. The actual exposure time during which a person is substantially exposed to harmful smoke concentrations is very short.

Direct and Indirect Effects of the Alternatives

ALTERNATIVE A (NO ACTION)

No smoke will be produced as a result of prescribed burning if the project is not implemented.

ALTERNATIVES B AND C

When evaluating air quality effects of prescribed fire, air quality effects of wildfire must also be considered. Prescribed fire can be ignited when weather and fuel conditions allow for and produce minimized smoke impacts. This is not the case with wildfires. Wildfires that produce negative air quality impacts typically burn when weather and fuel conditions are at levels that result in maximum consumption of forest fuels (ground, surface, and ladder fuels). Fire researchers are finding that prescribed burning to reduce forest fuels and subsequent wildfire severity can improve overall air quality.

Direct effects from prescribed burning will be seen as smoke from controlled underburning in both natural fuels and commercial thinning units. Most of the smoke is generated during the first few hours of the controlled burn, tapering off as the fuels consume. Ignition is generally stopped before evening so smoke has a chance to dissipate. Smoke from residual burning may settle into the valleys during the night.

The prescribed fire activities proposed in the Vulcan Project area are not expected to have any irretrievable or irreversible effects to the local air quality.

Cumulative Effects

Smoke from prescribed fire has the potential to combine with smoke from other burn areas on the District, and with smoke from burning being conducted on adjacent Forest Service Districts, other agency lands, and/or private lands. Smoke can also mix with residual smoke from the previous day's burning adding to the total production of smoke. In general, smoke emissions from controlled burns are occasional short-term events.

TRANSPORTATION

The following is excerpted from the *Vulcan Vegetation Management Project Transportation Report* by Ginger Gilmore, September 15, 2006. The full text of this report is incorporated by reference. The transportation report describes the existing condition with regards to roads and transportation. It also describes and compares the actions associated with the various alternatives (Alternative A – No Action, Alternative B—Proposed Action, and Alternative C).

Existing Conditions

Most of the transportation system in the Vulcan area was established during the 1960s and 1970s. Some additional roads were constructed in the 1980s to accommodate management activities during that period.

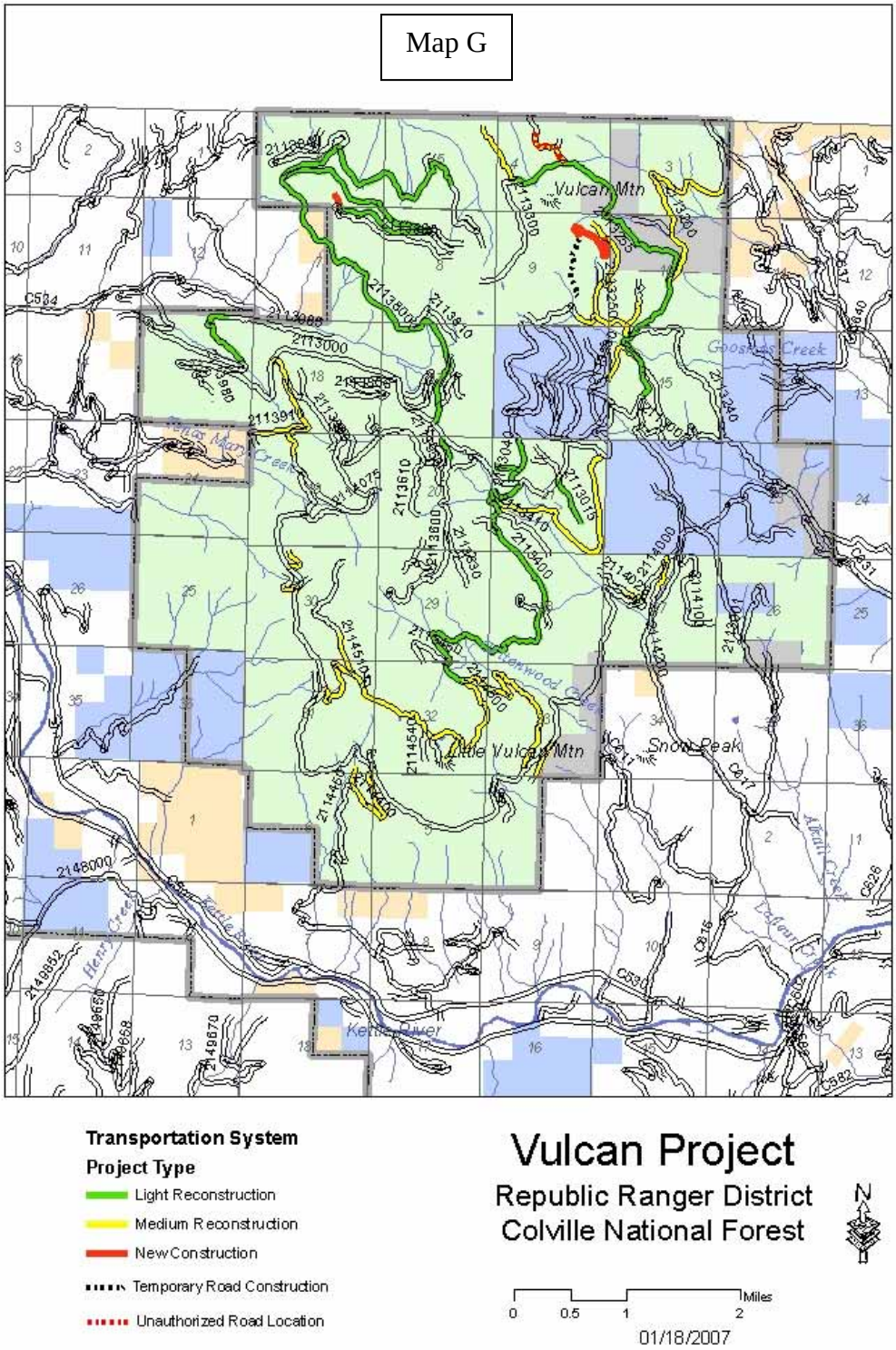
A road maintenance level is assigned to each system road that defines the level of service and maintenance required for that type of road. The criteria that helps to determine what maintenance level a road is assigned may include: 1) requirements for the protection of adjacent resources, 2) smoothness required for the desired operating speed, 3) user comfort or convenience, 4) season of use, and 5) volumes and types of traffic. In the Vulcan analysis area there is a mixture of different maintenance levels ranging from maintenance level 1 to 3. The table below shows the total road miles in the analysis area and the maintenance level they are currently listed as.

Table 3-9. Number of Miles for Each Maintenance Level

Operational Maintenance Level	Miles	% of Total
Level 3 (passenger cars)	8.9	9%
Level 2 (high clearance)	36.9	38%
Level 1 (closed)	38.8	39%
Private or Un-authorized roads	14.1	14%
Total Miles	**98.7**	**100%**

Most of the roads in the Vulcan area have road use restrictions on them to provide seclusion for winter range. The closure period for this area is generally December 1 – March 31. Any winter

logging activities need to consider this closure period and the amount of snow removal that would need to take place to get to the units.



Direct and Indirect Effects of the Alternatives

ALTERNATIVE A (NO ACTION)

Implementing the No Action Alternative would result in the Forest Service maintaining its transportation system on an annual operation and maintenance basis only.

ALTERNATIVES B AND C

Road Reconstruction

Roads in the Vulcan area have had heavy public and administrative use in the past. Some of the uses include logging, range activities, firewood collection, and hunting. Road reconstruction needs for both alternatives are described as light and medium and would only be considered on roads used for commercial haul. Specific work items for road reconstruction will be determined during the presale phase of implementation of this project.

Reconstruction types[12]

Light – This work includes construction of drainage structures such as culverts, drain dips and outslope drains. It would also include the associated surface blading and brushing. These drainage structures assist in the reduction of long-term sedimentation and include rocking of drain dips and riparian habitat conservation areas and their contributing areas, and rocking of roadbed for sediment control and subgrade strength. Roads shown on the previous map as light reconstruction will not have work items accomplished on their entire length.

Medium – This work may temporarily change the traffic service level, expand the capacity, or change the original design function of the road (i.e. change the critical vehicle from log truck (12 foot road width) to yarder (14 foot road width). Medium reconstruction would include "light reconstruction" plus occasional clearing of vegetation, including trees 6 inches and greater; excavation of the cut bank and roadbed for width, as well as construction of embankments; and culvert replacement and installation. Roads shown on the previous map as medium reconstruction will probably have work items accomplished on their entire length.

Heavy – This work would include light and medium reconstruction work items and would include road re-alignment, especially in curves less than 50 foot radius. These types of activities require heavier earthwork and clearing. No roads have been identified as needing heavy reconstruction work in this analysis area. If, during implementation, some roads are found to require heavy reconstruction, the Interdisciplinary Team will be consulted and the change will be documented.

New Road Construction

There will be approximately 0.8 miles of new road construction needed under Alternative B and 0.2 miles of new road construction under Alternative C. The proposed new road construction would be designed as low-standard single use roads and have all the appropriate Best

[12] **Reconstruction types** are labels used by Engineering on the Colville National Forest for consistency in describing road reconstruction impacts.

Management Practices for the protection of water quality designed into them. These roads would be located on flatter ground or benches where possible, to minimize excavation and embankment with a road width of approximately 12 – 14 feet. The design of these roads is generally free-flowing with rolling grades; emphasis placed on minimizing erosion and sedimentation. All newly constructed roads will be closed to vehicular traffic after post-sale activities and firewood gathering.

Table 3-10. New Road Construction Alternative Comparison

Alt. B Construction				
Road Number	**Maint Level**	**Const. Miles**	**Costs per mile**	**Total Road Costs**
Into Unit 18	2/1	0.6	$26,000	$15,600
Into Unit 37	2/1	0.2	$26,000	$5,200
Totals		0.8		$20,800
Alt. C Construction				
Road Number	**Maint Level**	**Const. Miles**	**Costs per mile**	**Total Road Costs**
Into Unit 37	2/1	0.2	$26,000	$5,200
Totals		0.2		$5,200

The effects of implementing Alternative B would require we pursue the acquisition of a legal right-of-way across private property into Units 18 and 19. This will be at a cost to the government but is undetermined at this time. It would also require the new construction of .8 miles of system road. The construction of new system roads will increase total system road miles and over all maintenance responsibilities. This Alternative also requires the construction of a temporary road in a place where the existing ground conditions may make it very difficult to scarify and adequately re-vegetation the disturbed area.

The effects of implementing Alternative C would be at an overall reduced cost to the government because it would eliminate the need for acquiring right-of-way across private land. It would only require the new construction of .2 miles of system road. The construction of new system roads will increase our total system road miles and over all maintenance responsibilities, but at a severely reduced amount compared to Alternative B. Alternative C would also eliminate the need for the temporary road to be constructed. If temporary roads can not be adequately scarified and closed it adds opportunity for uncontrolled access.

Reconstruction of existing unauthorized roads

Roads on National Forest System lands that are not managed as part of the Forest's transportation system are defined as unauthorized roads. Roads in this category were unplanned. They may have been acquired through a land exchange or they are user created roads. Some of these roads are open and drivable, while others are closed. In Alternative B, the Forest Service

will be reconstructing an unauthorized road to access Unit 61 and will bring it up to standards. A system road number will be assigned to this road during implementation and it will be added to the Forest Service Transportation System. This action will allow the Forest Service to track, maintain, or decommission this road just like all the other roads on the system. A gate will be installed at the approach of this road during reconstruction, and the road will be assigned closed road status after completion of the harvest activities.

Temporary road construction

Under Alternative B, one temporary road approximately 0.5 miles long would be constructed in Unit 19. Alternative C would not require any temporary roads. The term "temporary" is a Forest Service timber sale contract term used to define those roads planned to be constructed by the timber sale purchaser for the sole purpose of harvest of a specific unit. At a minimum, these roads are properly drained, scarified and seeded, and the entrances blocked upon completion of the harvest activities.

The roads that are considered for temporary road construction meet the following standards (Forest Service Manual 2400 Colville Supplement 2400-96-1, 2432.35b):

- Short term, single purpose road needed for one project or resource activity.
- Road will not be used in the next twenty years.
- Length is under ½ mile.
- Difficulty of construction is low with an acceptable level of resource impact.
    - The road has little or no rock blasting, is located on flatter slopes, and has no need for tight control of construction or location. No special design standards are needed for construction such as special sediment reduction methods, low boy access, rock surfacing, large culverts or bridges.

Table 3-11. Number of Miles and Cost of Temporary Road Development.

Alt. B Temporary Roads			
Unit	**Miles**	**Cost/Mile**	**Total Cost**
Unit 19	0.5	$5,000	$5,000

System road construction

See Table 3-10 above for new system roads in the Vulcan Project area. Future use was used as a main criterion for determining whether proposed roads would be constructed as temporary or system. If a road had a future use and/or needed to be extended in future entries, then it would have been identified and constructed as a system road and maintained in the Infrastructure Travel Routes database.

The table below lists the total miles of reconstruction and construction (including temporary roads) needed to implement either of the action alternatives in the analysis.

Table 3-12. Number of Miles and Cost of Road Development.

Alternative	Const. of Temp. Roads	Reconst. Miles	Const. Miles	Total Cost
Alternative A	0	0	0	0
Alternative B	0.5	33	0.8	$231,700
Alternative C	0	32.2	0.2	$204,020

Implementing either action alternative within the Vulcan analysis area will overall improve the road conditions of the transportation system and reduce the deferred maintenance needs. It will also help protect water quality by implementing Best Management Practices to the portions of the road system that we reconstruct. This will all be done according to applicable laws, regulations, standards and guidelines.

Cumulative Effects

Implementing an action alternative within the Vulcan analysis area will improve the road conditions of the transportation system and reduce the deferred maintenance needs. It will also help protect water quality by implementing Best Management Practices to the portions of the road system used.

WATER

Information provided in this environmental assessment about hydrologic resources is excerpted from the *Vulcan Vegetation Management Project Hydrology Report* by Joe Coates, June 1, 2006. The full text of this report is incorporated by reference. It compares and describes the environmental effects associated with the various alternatives (Alternative A—No Action, Alternative B—Proposed Action, and Alternative C). Measures intended to mitigate for adverse effects are also included.

Existing Conditions

MANAGEMENT FRAMEWORK

The following management direction applies to water resources on National Forest System lands within the Vulcan Project area:

- Comply with *Inland Native Fish Strategy (INFISH)* riparian goals and objectives. *(Inland Native fish Strategy, 1995)* INFISH provides regional interim management direction to maintain inland native fish populations and reduce potential negative impacts to aquatic habitat. INFISH amended Regional Guides and Forest Plans (including the *Colville National Forest Land and Resource Management Plan*). The interim direction is in the form of riparian management objectives, standards and guidelines, and monitoring requirements.

- Comply with State requirements in accordance with the Clean Water Act for protection of waters of the State of Washington (*Washington Administrative Code, Chapters 173-201 and 202*) through planning, application, and monitoring of Best Management Practices (BMPs) in conformance with the *Clean Water Act*, regulations, and federal guidance issued thereto. *(Colville National Forest Land and Resource Management Plan, 1988, pp 4-51)*

- In watersheds where project scoping identifies an issue or concern regarding the cumulative effects of activities on water quality or stream channels, a cumulative effects assessment will be made. This will include land in all ownerships in the watershed. Activities on National Forest System lands in these watersheds should be dispersed in time and space to the extent practicable, and at least to the extent necessary to meet management requirements. On intermingled ownerships, coordinate scheduling efforts to the extent practicable. *(Colville National Forest Land and Resource Management Plan, 1988, pp 4-52)*

- Revegetate, cut and fill slopes and other large areas of disturbed soil as quickly as possible with vegetation suitable for the management goals of the area. *(Colville National Forest Land and Resource Management Plan, 1988, pp 4-52)*

- Emphasize protection and improvement of soil, water, vegetation, fish, and wildlife resources while managing the riparian areas under the principles of multiple use and sustained yield. Give preferential consideration to riparian dependent resources when conflicts among land use activities occur... *(Colville National Forest Land and Resource Management Plan, 1988, pp 4-53)*

- Road construction in riparian areas will be limited to stream crossings unless determined otherwise by site-specific analysis. Numbers of stream crossings will be minimized and they will be constructed to minimize sedimentation and to allow fish passage where appropriate. *(Colville National Forest Land and Resource Management Plan, 1988, pp 4-54)*

- Meet the requirements of *Executive Orders: 11988* (Floodplain Management), and *11990* (Protection of Wetlands).

HYDROLIC CONDITIONS

The existing hydrologic condition of the Vulcan Project area is the result of historic logging, mining, and livestock grazing activities. Since 1960, approximately 7,500 acres of timber has been harvested on National Forest System lands within the project area. Most of this logging (74%) occurred between 1960 and 1980. Currently, 432 head of cattle graze the Vulcan allotment between June 6th and October 15th. A Forest Service road system has been constructed across much of the project area in support of these activities. Several county roads connect with the Forest Service road system to provide public access to federal, state, and private lands within the project area.

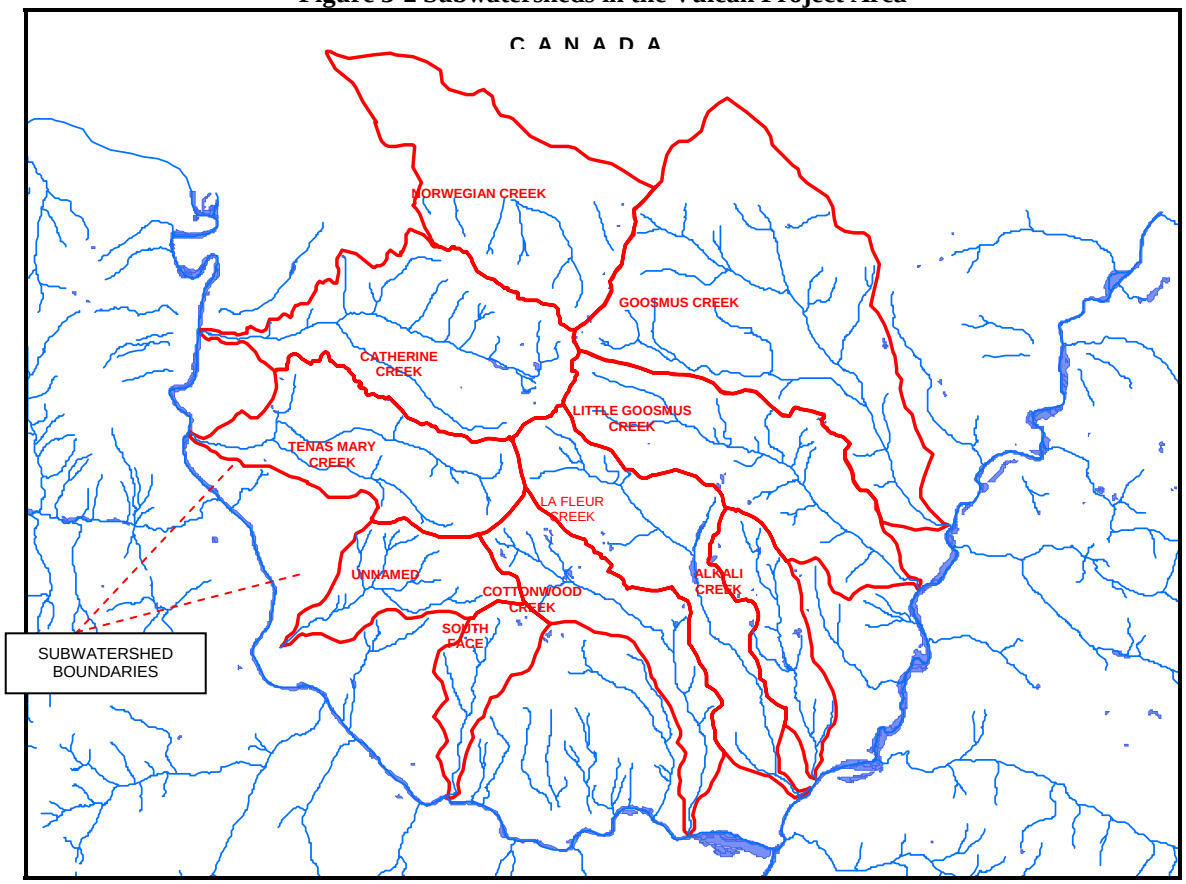
Streams in the project area have steep to very steep channel gradients and are moderately to deeply entrenched with low width/depth ratios. Most streams occupy narrow valleys and have

riffle or step/pool configurations and the stream density appears to be low in most subwatersheds. These streams have a high sediment transport potential and a relatively low in-channel sediment storage capacity.

Cattle and roads are currently impacting streams and wetlands through reduced levels of riparian vegetation and increased delivery of sediment and fecal coliform bacteria. These impacts are occurring primarily at road/stream crossings and along stream reaches where riparian vegetation has previously been affected by timber harvest. Most streams inventoried in 1995 were in a properly functioning condition, or if functioning at risk, had a slow upward trend toward recovery.

Two project area streams are on the 1995 Colville National Forest Total Maximum Daily Load (TMDL) Submittal Report. Cottonwood Creek is listed for fecal coliform bacteria and LaFleur Creek for water temperature exceedence. Both streams will continue to be monitored by the Forest Service for these parameters. The Washington Department of Ecology recently published the Detailed Implementation Plan for the Forest TMDL which will outline mitigation measures that will be implemented to correct these problems.

Figure 3-2 Subwatersheds in the Vulcan Project Area



The streams in the Vulcan Project area (Figure 3-2 above) drain into the Kettle River which is a tributary of the Columbia River (Lake Roosevelt). The Kettle River watershed in Washington State covers about 640,000 acres, while the total Kettle River basin (in Canada and the United States) covers about 2.7 million acres. The Kettle River watershed in Washington State represents about 24% of the total Kettle River basin. The Vulcan Project area represents about 3.2% of the Kettle River watershed in the United States and about 0.7% of the total Kettle River basin area.

SUBWATERSHED DESCRIPTIONS

The following subwatershed descriptions are based upon riparian surveys conducted in 1995. Subsequent spot checks of representative stream reaches in 2005 indicated that there has been little change since the original surveys were conducted.

Norwegian Creek

This stream flows into Canada from the north face of White Mountain. On Colville National Forest, less than 5% of this drainage is occupied by natural openings, such as meadows. This subwatershed has low accessibility to cattle due primarily to steep terrain. The mid-slopes of this basin below 4,500 feet are closed cedar/spruce or hardwood in old clearcuts. The channel gradients of Norwegian Creek are very steep (greater than 18%). Very steep, narrow riparian zones link the channels to upland slopes of 30 to 120%. Riparian species are cedar/devil's club to Sitka alder/lady fern. No appreciable areas of cattle impacts were noted in this basin.

Catherine Creek
Approximately 60% of this watershed is located on National Forest System lands. Catherine Creek appears to go subsurface during the summer below the forest boundary and only has surface connections with the Kettle River during spring runoff. Approximately 45% of this drainage is occupied by natural openings on the national forest.

The channel and mostly narrow riparian zones are constrained by upland slopes of about 30%. About 1,500 feet above the forest boundary the stream flows through a trough-shaped inner valley up to 55 feet deep and 250 feet wide. Approximately 0.15 miles of channel and/or riparian zones are in a degraded condition on National Forest System lands.

On the South Fork, approximately 0.75 miles of channel are in a degraded condition within the forest boundary. These channels have degraded upper banks and are carrying sediment that is finer than that represented in the upland. Along the degraded reaches, the riparian vegetation is more open and dominant species are less abundant than on undisturbed reaches. These degraded reaches are associated with roads and riparian harvest. In addition, a log culvert has failed at a road crossing and some down-cutting has occurred. The South Fork of Catherine Creek is rated "functional-at-risk" with no apparent trend.

Undisturbed riparian vegetation on both forks of Catherine Creek is spruce/lady fern to bunch berry and spruce snowberry. Three unmapped slope failures were observed; two predate the establishment of the national forest. Trampling damage from cattle is occurring at 3 developed water sources (springs). The most common instream problem is transport and accumulation of fine organic rich sediment from cattle impacts. The south-southwest aspects are predominantly grassland and forb-shrub meadows. Some meadow soils are unstable and forage appears under-utilized.

Tenas Mary Creek
Approximately 55% of the Tenas Mary subwatershed is located on National Forest System lands. Like Catherine Creek, Tenas Mary also goes subsurface prior to reaching the Kettle River and has less than 1% flood flow reaching the mainstem of the Kettle River. No surface connections with the Kettle River were observed during the spring of 2006. Conditions on this stream are very similar to those of the South Fork of Catherine Creek. Approximately 35% of this drainage is occupied by natural openings on the national forest.

Both forks of Tenas Mary Creek have stable channels and dominantly stable, undercut banks over 70% of their length. The remaining channels (30%) have degraded upper banks and are carrying sediment that is finer than that represented in the upland. Along the degraded reaches the riparian vegetation is more open and dominant species less abundant than on undisturbed reaches. These degraded reaches are associated with roads and riparian harvest. Old harvest units were increasing access and sediment from bank trampling. There is an overall lack of course material in the channels. One of the reaches was rated as "functional-at-risk" with a slow upward trend. The second reach was rated in a properly functioning condition.

Unnamed Creek
This unnamed subwatershed was not delineated during the 1995 inventories. No known field data was collected. This subwatershed drains southwest into the Kettle River, and about 2/3 of the basin appears to be in natural openings. About 65% of the basin is within the national forest

boundary. No surface connections with the Kettle River were observed during the spring of 2006.

South Face (Cummings Creek)
Approximately 70% of the South Face subwatershed is located within the national forest. Cummings Creek appears to have perennial flow most years to the Kettle River, but no surface connections with the Kettle River were observed during the spring of 2006. Approximately 0.8 miles are in a degraded condition on National Forest System lands. This basin is dominated by very steep ephemeral streams and is characterized by poorly developed channels with stable vegetated beds and banks. The channel character remains stable due to confinement by 45% to 80% valley side slopes despite heavy bank degradation in sand and boulder outwash material for ½ miles above the forest boundary. The riparian habitat type on the undisturbed banks ranges from cottonwood-red osier to spruce-red osier. The disturbed bank has low vigor Douglas-fir/ninebark and ponderosa pine/bunch grass vegetation. An estimated 65% of this drainage is occupied by natural openings on the national forest.

Cottonwood Creek
Approximately 60% of this basin is on National Forest System lands and about 0.5 miles of stream are in a degraded condition. Riparian vegetation on the lower surface is alder-oak fern and the upper is maple to spruce-queen cup. Stock access is mostly limited by dense vegetation and steep valley walls. Cattle impacts are concentrated in the harvested area below Forest Road #2114 and where Forest Road #2113.400 crosses near the pasture unit fence. Like most of the other streams in the analysis area, Cottonwood Creek is intermittent below the forest boundary and goes subsurface prior to entering the Kettle River except during spring runoff. Less than 10% of this drainage is occupied by natural openings on the national forest. The lower watershed, below the forest boundary is almost the reverse with about 90% in natural openings. Approximately 0.58 miles of stream in this subwatershed were rated as in a properly functioning condition. However, the interdisciplinary team noted several slides and slumps.

LaFleur Creek
An estimated 65% of the LaFleur Creek subwatershed is located inside the national forest boundary. Like Cottonwood Creek, the lower reaches of LaFleur Creek have intermittent flow except during spring runoff. The West Fork of LaFleur Creek occupies a narrow trough at the bottom of a steep “V” valley that is an inner valley to a gentle “V” shaped upper drainage. Stable undercuts are common to dominant in banks that are heavily vegetated and stabilized by rocks and coarse debris. The predominant riparian vegetation types are spruce/alder and spruce/maple. Approximately 1.2 miles are in a degraded condition and less than 5% of this drainage is occupied by natural openings on the national forest.

Riparian harvest on one reach of the West Fork of LaFleur Creek has allowed stock and wildlife to degrade the channel and move fine material into the stream. Recent, historic, and prehistoric debris flows and deep seated landslides have contributed fine material to the West Fork.

The East Fork of LaFleur Creek has a gradient of less than 2% over outwash terraces and through abandoned beaver ponds. These short channel reaches are in alder/lady fern habitat. Fine gravel aggradation at the forest boundary indicates that the reach is vulnerable to lowering base level flow on downstream private lands. The East Fork is the only stream on the grazing allotment with gradient and flow regimes suitable for beaver. There are stable dams on this

stream reach. Approximately 0.3 miles of LaFleur Creek below the 200 Road is rated as "functional-at-risk" with a downward trend due to lack of vegetative root mass, erosion, down-cutting, and an unusual amount of new channels.

Alkali Creek

Approximately 20% the Alkali Creek subwatershed is on National Forest System lands. No field information was collected on this subwatershed during the 1995 inventories. Informal surveys in 2005 indicated that most cattle impacts are concentrated along Forest Road 2113 and the water development between Forest Road 2113 and Forest Road 2113.001. Upland areas have little forage value and receive little use by cattle. Approximately 15-20% of this drainage is occupied by natural openings on the national forest. No surface connections with the Kettle River were observed during the spring of 2006.

Little Goosmus Creek

The Little Goosmus Creek subwatershed is approximately 75% within the national forest boundary; however a significant amount of non-federal land is located within the forest administrative boundary. The stream originates on moraines and flows over glacial outwash. The riparian habitats are dominated by spruce-oak fern, mountain alder-lady fern, and Rocky Mountain maple. The riparian vegetation is mostly dense and vigorous with cattle accessing streams primarily at road crossings. The condition of the riparian vegetation and the abundant woody debris maintain the steep, straight channel in balance with the prevailing slope and dominantly fine material in the watershed. Much of the upper watershed has been affected by logging and road development. The stream is transporting fine sediments efficiently and is subject to suspended sediment turbidity following thunder showers. Cattle have been a minor influence on stream conditions. Approximately 0.15 miles of stream are in a degraded condition on National Forest System lands. Little Goosmus Creek appears to have perennial flow into the Kettle River. Less than 5% of this drainage is occupied by natural openings on the national forest; however about 50% of the drainage below the forest boundary appears to be in natural openings. No properly functioning condition ratings have been conducted in this subwatershed.

Goosmus Creek

The West Branch of Goosmus Creek has mostly steep channels with streambed material that is predominantly gravel and small cobbles with one short boulder reach in a canyon near the forest boundary. One reach above Forest Road 2113.240 crossing has a similar landform to the lowest reach of LaFleur Creek and is likewise vulnerable to lowering of base level flows on downstream private lands. Riparian habitats range from cedar/devil's club to spruce/snowberry with wide variations in density. Only about 350 feet of stream is highly accessible to cattle and subsequently degraded. Abundant forage and water above 4,200 feet elevation reduces cattle impacts on the lower parts of the allotment. Less than 5% of this drainage is occupied by natural openings on the national forest. The lower reaches of Goosmus Creek appear to have perennial surface flow connections with the Kettle River.

Only the headwaters of the North Fork of Goosmus Creek are included in the national forest grazing allotment. Channels are steep, straight, and small. Soils are similar in character, but much thinner than other drainages in the project area. Riparian areas are dense and vigorous and the uplands contain a heavy cover of young conifer reproduction and logging slash. Approximately 1,800 feet of channel has been influenced by an active prehistoric slide near the

south 1/16 corner of Section 3, Township 40 North, and Range 33 East. Two recent fill slope failures were observed in 2005 on Forest Road 21113.200 in Sections 3 and 10.

Three properly functioning condition evaluations were conducted on Goosmus Creek in 1995 totaling 0.89 miles of stream. All three segments were rated in a properly functioning condition. Goosmus Creek appears to have perennial flow into the Kettle River.

Direct and Indirect Effects of the Alternatives

ALTERNATIVE A (NO ACTION)

Under the No Action Alternative, current Forest Service plans would continue to guide management of the project area. On-going activities such as fire prevention and suppression, livestock grazing, dispersed recreation, mining, road maintenance, noxious weed treatments, and established special use permits would continue. No new activities would be initiated to accomplish proposed project goals. Management activities on non-federal lands are assumed to continue at or near current levels.

Two possible scenarios are possible under the No Action Alternative. The first assumes that no large, uncontrollable wildland fires will occur within the project area in the foreseeable future. The second assumes that some type of high intensity, stand replacement fire would occur. Accurately predicting the size and location of such a fire event is beyond the scope of this analysis. It is reasonable to assume that severe impacts to water resources would follow if a large, uncontrollable fire did occur. For more detail see the Hydrology Report.

ALTERNATIVES B AND C

The potential impacts to water resources that are common to these action alternatives have similar effects, but differ in terms of scale and magnitude based on the amount of treatment area proposed for each activity.

Water Quality

The average annual sediment outputs in the project area are higher than natural baseline levels due to the influence of roads, cattle, and historic riparian logging. These glacial soils naturally contain a large component of sands and gravels; however channel substrates likely have higher than normal small-sized particle distributions due to management related sources. Much of this sediment is coming from existing riparian roads that constrict channels and floodplains along the lower stream reaches in these watersheds.

Proposed road construction, reconstruction, maintenance, and increased traffic levels under both action alternatives will increase sediment levels. There should be little to no discernable effect to sediment levels from timber harvest since no harvest activities are proposed within riparian habitat conservation areas. Sediment will be delivered to streams mainly at road crossings and where contributing road segments are located within the zone of riparian influence. Neither action alternative will construct any new stream crossings. Sediment levels will decrease several years after project completion to a new baseline after operations are complete. This new sediment baseline may be lower than the current sediment levels after road improvements are implemented. Mitigation measures and Best Management Practices will effectively compensate for some of the road impacts.

None of the project area rock sources will have any direct, indirect, or cumulative effect on water quality. Non-commercial treatments have a low potential to impact water resources and are not located in riparian habitat conservation areas.

Fecal coliform bacteria and stream temperatures are not expected to change over current levels as a result of proposed actions. Water quality is expected to continue to meet state criteria on federal lands for all alternatives. The Kettle River will continue to violate water quality standards for reasons unrelated to this project.

Water Yield and Channel Morphology
Equivalent Clearcut Areas (ECA)[13] will vary in subwatersheds for both action alternatives due to timber harvest and road construction. No changes to flow regimes[14] are anticipated to result in damage to stream channels from either action alternative. Most proposed harvest and prescribed burn units are located in the snow dominated precipitation zone. This reduces the risk of flooding due to rain-on-snow events. Channel conditions in most of the project area are stable. All subwatersheds (except Little Goosmus Creek) will remain below the Forest threshold of concern (25%) in all alternatives. The ECA modeled in Little Goosmus Creek will increase from 25% to about 33% in both action alternatives over the next 15 years. The ECA model assumes that all proposed activities will occur in the same year. It is more reasonable to assume that harvest activities will occur over a period of 3 to 5 years and this will result in a flatter hydrologic recovery curve and a lower ECA value. Stream channels and riparian vegetation are stable and intact throughout much of the basin and therefore capable of handling any increased flows that may result from vegetation treatments. The proposed increases in created openings in Little Goosmus Creek are not anticipated to result in detectable changes to flow regimes and/or channel morphology under either action alternative.

Wetlands, Floodplains, and Groundwater
Short-term sedimentation and turbidity levels are expected to increase by a minor amount during road construction, reconstruction, maintenance, and timber haul. Some of this material will be deposited in downstream floodplains and connected wetlands. No changes to groundwater function are anticipated from either action alternative.

Cumulative Effects

WATER QUALITY

Sediment
Much of the projected sediment increase under both action alternatives will be directly related to log haul and road construction/reconstruction. The most visible increase will be small particles carried in suspension. These are particles that will remain in suspension during high and moderate flow velocities and will not settle out downstream until reaching slack water in low gradient reaches or behind large woody debris. These particles can contribute to increased downstream turbidity levels. Increased turbidities typically occur during snowmelt runoff in the

13 The **ECA** is the area of a watershed in a 'clearcut' condition at a specific point in time. Past vegetation manipulation treatments and natural disturbance events that have the potential to affect the water yield of a watershed are converted to an equivalent clearcut area, added to alternative proposed treatments, and expressed as a % of the total watershed area.
14 **Flow regime** referrs to seasonal pattern of stream flow over the year (Gordon et al. 1992).

spring or during large storm events even under natural conditions. Road construction, reconstruction, and maintenance during timber sale operations will also contribute coarser sediments in the range of sand and medium-sized gravel. Some of these larger particles would add to the existing levels of bedload transport and decrease downstream storage capacities. The amount of increased short term turbidity from proposed management related sources will be negligible by the time it reaches the Kettle River. Bedload sediments will be trapped behind large in-stream woody debris and deposited along bars on lower gradient stream reaches of the tributaries. Most bedload movement will occur during spring runoff and large storm events.

Off-site cumulative effects of sedimentation are not anticipated to occur from proposed road reconstruction point sources due to their small size and scattered locations. Most road crossings will not be reconstructed simultaneously with other sites in the same watershed. Normally any elevated downstream turbidity levels from one site will have cleared before work begins at another site in the same subwatershed.

Existing management-related sediments will continue to move through the analysis area and into Kettle River, eventually reaching the Columbia River. Downstream effects outside the project area are likely to remain within the existing range of variation and/or be masked by other activities occurring at lower elevations on state and private lands. The downstream and cumulative effects of proposed federal actions within the project area will be mitigated by Best Management Practices so that water quality standards are effectively met. Stream turbidities are expected to meet state water quality turbidity standards under both action alternatives.

The effects of timber harvest are expected to be slight (virtually undetectable downstream) since riparian harvest and fire treatments are not scheduled within INFISH riparian habitat conservation areas in either action alternative. Prescribed burning and the use of fire for natural fuels reduction and wildlife habitat improvement in the past have not created appreciable ground disturbance nor caused increased erosion except in small, localized areas of concentrated fuels. Continued use of fire for this purpose is not anticipated to increase sediment delivery to streams in the project area. Any surface erosion from these areas will be adequately buffered by vegetation in undisturbed riparian habitat conservation areas prior to reaching the streams and no downstream cumulative effects are anticipated from proposed vegetative treatments in either action alternative.

Sediment impacts from proposed Forest Service road, vegetation, and fire treatments, when added to past and future activities within the analysis area, will be virtually undetectable.

Temperature

No downstream cumulative effects to stream temperatures are anticipated to occur under either action alternative since INFISH riparian habitat conservation areas will remain intact and undisturbed. Neither alternative will construct any new stream crossings. Downstream cumulative effects to temperature will be minimal and undetectable using standard monitoring techniques. Stream temperatures along the Kettle River will likely continue to violate state water quality standards due to conditions not associated with this project.

Stream temperature impacts from proposed Forest Service road, vegetation, and fire treatments, when added to past and future activities within the analysis area, will be virtually undetectable.

Bacteria
No downstream cumulative effects to fecal coliform bacteria are anticipated to occur under either action alternative since no new stream crossings are planned and since INFISH riparian habitat conservation areas will remain intact and continue to limit cattle access to streams and wetlands. Streams on federal lands are anticipated to continue to meet state water quality standards for fecal coliform bacteria. The exception may be in Cottonwood Creek. This is a pre-existing condition which is being regulated and monitored under the Colville National Forest Total Maximum Daily Load and will not be affected by the proposed Vulcan Project.

Bacteria impacts from proposed Forest Service road, vegetation, and fire treatments, when added to past and future activities within the analysis area, will be virtually undetectable.

HYDROLOGY AND WATER YIELD

The results of the ECA model are almost identical for both alternatives because the area proposed for treatment is very similar.

Under both Alternatives B and C, timber harvest, road construction, and non-commercial treatments will increase created openings across the project area. The probability of peak flows causing stream channel damage increases as the harvested area of a watershed exceeds 25% in an open condition. (Colville National Forest Plan FEIS, p. IV-17)

All subwatersheds in the analysis area will remain below the 25% threshold of concern over the next 15 years with the exception of Little Goosmus Creek. The ECA for Little Goosmus Creek is currently about 25%. With the implementation of the Vulcan Project (along with continued timber harvest on non-federal land) the ECA values will increase to almost 33% over the next 15 years. The ECA recovery curve begins to flatten at this point, and this is probably the maximum value that will occur before the values begin to decrease as hydrologic recovery occurs. It is unlikely that increased ECA values in this subwatershed will result in detrimental channel-forming flows for the following reasons:

- It is unlikely that future harvest levels are sustainable as modeled on non-federal lands within this watershed. The model therefore presents a worst-case scenario.
- Other comparable streams on the forest with similar elevated ECA values show no evidence of channel damage from elevated flows. There appears to be a considerable safety factor built into the 25% forest threshold of concern.
- “The riparian vegetation [on Forest Service land] is mostly dense and vigorous...the condition of the riparian vegetation and the abundant woody debris maintain the steep, straight channel in balance with the prevailing slope and dominantly fine material in the watershed.” (Swartz, 1995)
- It is likely that deep, permeable, glacial soils in these moderately sloping basins of the analysis area are adequately buffering the effects of increased created openings.

Hydrologic recovery is expected to continue in the headwaters of the analysis area and no increased channel-forming flows from federal lands are expected to cumulatively degrade

channel conditions in any part of the analysis area, which includes 1st, 2nd, and 3rd order watersheds.

The most sensitive areas that could be affected by increased equivalent clearcut areas (ECA) are along the lower reaches of Little Goosmus Creek. Bank erosion and downstream deposition in the low gradient reaches and in storage behind large woody debris are the most likely impacts should such flows occur. Based on the ECA model, Vulcan riparian surveys, and field observations of watersheds displaying similar ECA values, any increase in the average duration of near bankfull flows is not likely to result in detrimental channel conditions resulting from this project. Streambanks are well vegetated and stable in most areas of the watershed and channels are capable of handling increased flows.

Potential increases in high magnitude peak flows due to rapid snowmelt caused by snowpack exposure to rain or warm winds is somewhat more likely to occur under both alternatives since a reduction of stand densities will result in increased snow depths and increased solar radiation. Most of the activities proposed in both alternatives, however, are located in the snow-dominated zone of these watersheds. The risk of increased rain-on-snow events in these alternatives is small due to the limited area of proposed harvest within the rain-on-snow zone.

Floodplains, Wetlands, and Groundwater

Small amounts of sediment from proposed activities will cumulatively be stored along low gradient floodplains and wetlands. This will occur primarily along the Kettle River since most of the streams in the analysis area have high gradients. These sediments will originate at various locations in the headwaters of these watersheds and be transported during spring runoff and large storm events. Most of the management generated sediment will come from the influence of existing riparian roads and increased traffic levels from timber haul.
The management generated sediment levels are expected to drop to a new baseline within several years after the project is completed due to decreased levels of traffic and increased vegetation at disturbed sites. Cumulative effects are therefore; expected to be minimal in downstream areas of these watersheds from proposed management activities.

It is likely that the effects of sediment generated as a result of these proposed activities on federal lands will be masked by the sediment supplied from timber and grazing activities occurring on non-federal lands and from county/private road systems. The impacts from the proposed activities should be undetectable using current monitoring techniques and within the existing range of variation in this watershed. Proposed improvements to existing roads at stream crossings (i.e. surface aggregate) are expected to reduce long-term sediment delivery to wetlands and floodplains over existing levels.

Detectable levels of groundwater function are not expected to change within the project area because of the short-term, localized nature of the proposed activities.

Summary

All of the alternatives are expected to meet Forest Plan Standards and Guidelines. The use of project design features and INFISH standards and guidelines exceed the requirements of the State Forest Practices Act. Monitoring will be conducted to ensure that Best Management Practices and mitigation measures are effective in reducing non-point source pollutants.

All proposed culvert installations during road construction are covered within a memorandum of understanding between the State of Washington, Department of Fish and Wildlife and the U.S. Forest Service.

WILDLIFE

Information provided in this Environmental Assessment about wildlife is excerpted from the *Vulcan Vegetation Management Project Wildlife Species Reports* by Chris Loggers, September 20, 2006. The full text of these reports is incorporated by reference. The Wildlife Reports describe the current and desired conditions with regards to Management Indicator Species; waterfowl; migratory birds; and 10 Threatened, Endangered, or Sensitive species. The reports also describe and compare the environmental effects associated with the various alternatives (Alternative A—No Action, Alternative B—Proposed Action, and Alternative C). Measures intended to mitigate adverse effects are also included.

Of the 14 Management Indicator Species (MIS) listed in the Colville National Forest Land and Resource Management Plan (Forest Plan), 13 may be found within the Vulcan planning area.

Several threatened, endangered, or sensitive species that might occur on the Colville National Forest do not occur in the project area. There will be no impact to the species listed below from the implementation of this project, and these species will not be further addressed in this document.

- Northern leopard frogs have been documented on the Colville National Forest only from one location in the Pend Oreille Valley and amphibian surveys from 2000 to 2004 on the District did not encounter them;
- Common loons, Clark's grebes and eared grebes nest on large bodies of water, which do not occur in the area;
- Ferruginous hawks and sandhill cranes do not nest in the area;
- The area does not contain large lakes that pygmy whitefish occupy;
- The area does not contain habitat for woodland caribou;
- The streams flowing from the project area are not considered fish-bearing therefore, bull trout, westslope cutthroat trout, and redband trout do not occur.

In addition, because great blue herons have not been documented in the planning area and the area does not contain suitable heron habitat, this more common species will also not be addressed further in this document.

Big Game

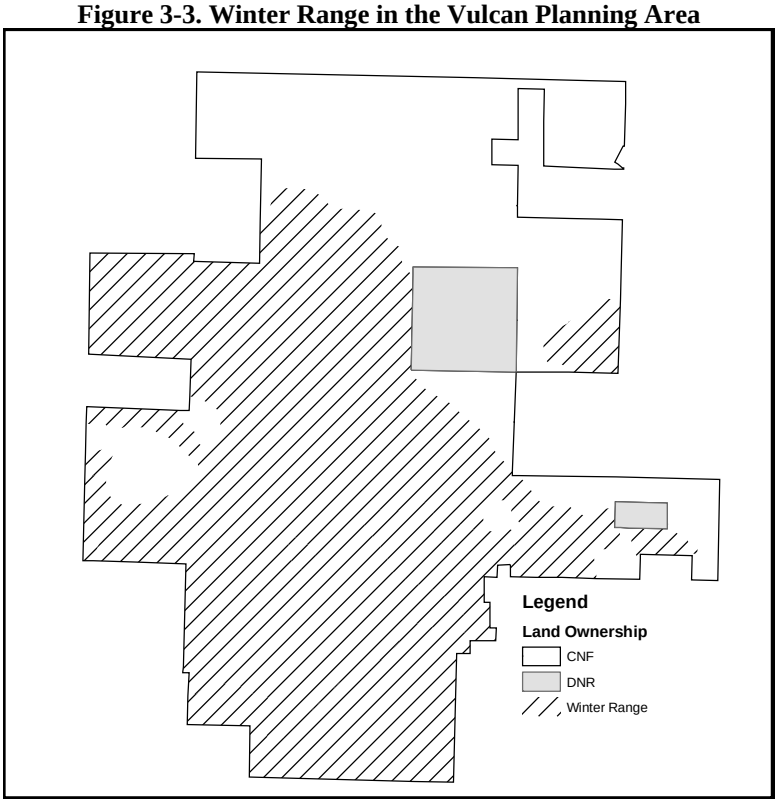
EXISTING CONDITIONS

The Vulcan Project area provides year-round habitat for mule deer, white-tailed deer, and some elk and moose (Figure 3-3). Within this area, mule deer have historically been and are currently the major ungulate species, with lesser numbers of white-tailed deer, and very few elk or moose. Under the Forest Plan, management within winter range areas (MA-6 and MA-8) emphasizes elk east of the Pend Oreille River, deer west of that river, and mule deer west of the Columbia River.

Management emphasis within the Vulcan planning area is appropriately on mule deer. About 67% of National Forest System lands in the project area (11,000 acres of MA6 and MA8) were designated as big game winter range during development of the Forest Plan (Figure 4). The project area contains winter range in other Management Areas, on private land, and on land managed by the Washington Department of Natural Resources and U. S. Department of Interior Bureau of Land Management, especially on more open slopes with southerly or westerly aspects.

In the 1960s and 1970s mule deer were extremely abundant on Vulcan. Washington Department of Fish and Wildlife recently concluded a 5-year program to study mule deer in northeast Washington, including some on Vulcan Mountain. The animal distribution data indicate that mule deer use more open habitats within the winter range, more open than currently exists over much of the area. The data on spring condition of does indicate that the does emerge from winter in very poor condition, an indication of the stress of winter and also of the relatively poor physiological condition in which they enter winter. The condition in which they enter winter generally depends on the condition of the habitat that they use during the summer and early autumn. It appears that the current forage conditions of summer and autumn habitat on Vulcan could improve.

Figure 3-3. Winter Range in the Vulcan Planning Area



The relative amounts and distribution of forage and cover areas is a key factor in determining the usefulness of winter range (MA-6 and MA-8) to deer and other ungulates. Under the Forest Plan, management activities within these areas should work toward creating forage:cover ratios approaching 50:50, dispersed to provide for maximum utilization of forage. However, these conditions favor white-tailed deer, which use habitat much differently than mule deer, which

select for more open habitats. About 4,400 acres, or 41%, of the winter range provides overhead cover (which does not meet the 50% directed by the Forest Plan, pp. 4-98, 106). Most of the stands will not grow into cover because they are too dry to support dense forested habitats. Few of the stands meet cover objectives because they have been harvested. Many of the stands that do support trees contain a good overstory but have become very overgrown and dense. Fire has not visited these stands in decades, and therefore, has not regenerated the brush and killed the smaller trees.

Habitat security within winter range areas is managed primarily by regulation of open road densities during winter months. During winter, many of the open roads are closed and the road density meets the Forest Plan requirements for winter range in Ferry County (0.4 mi/mi^2, LRMP, pp. 4-108). Additionally, in winter, all of the National Forest System roads remain effectively closed because the Forest Service does not plow them.

DIRECT AND INDIRECT EFFECTS OF THE ALTERNATIVES

Alternative A (No Action)

Under Alternative A, the existing forage:cover ratio within winter range areas would not change. Habitat would not improve, and conditions on summer and winter range for mule deer would continue to decline as understory trees encroached into open stands and continue to reduce forage. Without adequate forage, this area would not provide suitable ungulate habitat and would not contribute toward meeting the Forest Plan objective for mule deer and population levels. Alternative A would not affect existing open road densities or habitat security. The area would remain within existing Forest Plan direction.

Alternatives B and C

Alternatives B and C differ in their effects to winter range by only 5%, a negligible amount. Both action alternatives propose commercial treatments within winter range areas to open the stands, reduce competition from young trees, retain older and larger trees on the landscape, and promote forage. The treatments are not designed to remove the larger overstory trees that create good cover in winter and which help intercept snow and keep the areas around the boles snow-free; so neither of the alternatives will change the amount of cover. Both will, however, result in more available forage due to the opening of stands. Alternative B, treating slightly more acres than Alternative C, will have a slightly greater positive benefit, though the difference is negligible.

Table 3-13. Winter Range Acres Treated by Alternative.

	Alt B	Alt C
Commercial Thin	1,113	1,045
Small pole	324	315
Combination thin/pole	45	45
Commercial subtotal	1,481	1,405
Precommercial thin	229	229
Total acres treated	**1,710**	**1,634**

Both action alternatives also propose about 4,400 acres of prescribed fire on winter range, which will open the understory and regenerate forage species. It will also begin to manage the area towards more historic conditions, which suited mule deer better than current conditions.

No road construction will occur in winter range in either action alternative.

CUMULATIVE EFFECTS

The quantity and quality of ungulate winter range in the Colville National Forest area has varied considerably over time and has been dramatically reduced from historic levels. Much of what was historically winter range is now in private or other ownerships and may or may not be managed with consideration for wintering ungulate needs. Many of these lower elevation areas have been converted to agricultural uses and may provide suitable winter forage, depending on land use, distance to suitable cover, and landowner tolerance. Large fires that occasionally burned across this landscape also altered forage and cover availability. Settlement and the advent of various land management activities resulted in roads that affect habitat security as well as the introduction of several noxious weed species that affect forage availability. Fire suppression over this same time period has contributed to adverse changes in the amount and distribution of both forage and cover. Much of what is currently managed on the Colville National Forest as winter range is a remnant of historical winter range and/or lands that served as secondary winter range areas prior to settlement and land conversions.

Since the Forest Plan became effective in 1988, management projects on Forest Service administered lands within these areas have been designed to incorporate wild ungulate winter range requirements, including a goal of improving the ratio of cover and forage. Timber sales and other projects (including this one) have been designed and analyzed according to Forest Plan direction. The cumulative, long-range result will progress toward the desired 50:50 forage:cover ratio across the landscape, although treatments to reduce effects of insects/disease and weather may decrease cover availability in specific areas over the short-term. Timber management and prescribed fire projects have also been conducted, which increase forage quantity in many areas. The action alternatives proposed for the Vulcan Project continue this trend and will result in improved forage conditions within this portion of the landscape and add cumulatively to the progress already made in other portions of the Forest. The No Action Alternative does not contribute to this trend and places this area at greater risk for large scale disturbances (insects or disease problems and/or stand-replacing wildfire) that could adversely affect wintering ungulate habitat for many years.

Because this project does not propose to create new roads in winter range, it will not contribute to cumulative effects of roads.

Ground disturbing activities, including timber harvest, road construction and reconstruction, and prescribed fire, can spread or increase noxious weed populations that can displace wild ungulate forage. Cattle grazing and motorized vehicles also help spread noxious weeds. Standardized practices on the Colville National Forest, as well as specific mitigation measures prescribed for the action alternatives in the Vulcan Project, have been designed to contain or reduce this impact, and should not contribute cumulatively to this existing problem. The No Action Alternative has no new ground disturbing activities, and therefore has no cumulative effects to noxious weeds.

Barred Owl, Pileated Woodpecker, Pine Marten, and Northern Three-toed Woodpecker

EXISTING CONDITIONS

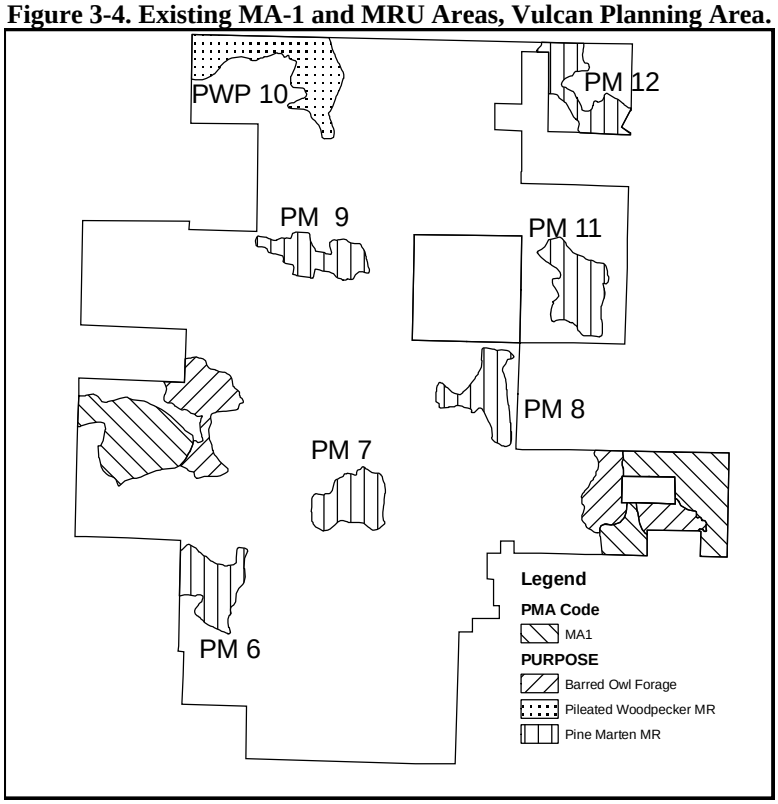
Existing MA-1 Areas

The Vulcan Project area contains two MA-1 areas (old-growth dependent species habitat). Both of these MA-1 areas meet the minimum Forest Plan core size requirement (300 contiguous acres or more). Both areas contain large trees that barred owls use for nesting, either in cavities or nests built by other large birds. However, both MA-1 areas lie mostly in warm, dry habitat and provide mediocre barred owl habitat. When the Forest Plan was written, barred owls were uncommon. Since then, they have continued to expand their range westward (to the coast) and are now rather common in a wide variety of lower-to-mid elevation habitats.

Existing Pileated Woodpecker Management Requirement Unit (MRU)

The Vulcan planning area contains one pileated woodpecker MRU area that abuts Canada on the northwest side of the planning area. Nearly the entire MRU contains suitable habitat, and pileated woodpecker sign was noted and a northern three-toed woodpecker was seen during field surveys.

Figure 3-4. Existing MA-1 and MRU Areas, Vulcan Planning Area.



Existing Pine Marten/Northern Three-toed Woodpecker MRUs

The Vulcan planning area contains six pine marten/northern three-toed woodpecker MRUs. All of these MRUs were mapped as dedicated units rather than as rotations because suitable habitat in much of the drier, southern two-thirds of the project area does not exist. Only PM9 contains sufficient habitat to support marten. About 30% of PM11 and PM12 contain suitable habitat, and little or no suitable marten habitat exists in PM6, PM7, or PM8. (See Figure 3-4 above.) Sufficiently large trees do exist, but the habitat is warm, dry Douglas-fir plant associations that are not marten habitat. Pileated woodpecker sign was noted in all PM areas but no northern three-toed woodpeckers were sighted.

DIRECT AND INDIRECT EFFECTS OF THE ALTERNATIVES

Alternative A (No Action)

The No Action Alternative would not change current ecological trends in barred owls, pileated woodpeckers, pine marten, and northern three-toed woodpeckers habitat conditions.

Alternative B and C

Effects of proposed actions on barred owls, pileated woodpeckers, pine marten, and northern three-toed woodpeckers are assessed primarily by addressing the effects of proposed actions on the habitat conditions within MA-1 areas and MRU areas. Although it is recognized that these species may occur in suitable habitat outside the designated MA-1 and MRU areas, the establishment and maintenance of desired conditions within MA-1 and MRU areas was considered sufficient to provide for these species across the Colville National Forest and the established standards and guidelines for managing these areas provides an effective baseline for

evaluation of the existing conditions and expected effects of alternatives on these species across a broad landscape.

MA-1 Areas
The Vulcan Project proposes to conduct underburns in portions of both MA-1 areas to begin to manage these areas to support more open-grown, large trees on appropriate sites. Although prescribed fire will not enhance the area for pine marten, the area does not contain marten habitat because marten do not occupy warm, dry habitats. The prescribed fire will maintain the area as habitat for pileated woodpeckers. No commercial harvest or other activity other than prescribed fire will occur in either MA-1 area.

Pileated Woodpecker MRUs
No harvest, prescribed fire or other activities will occur in the pileated woodpecker MRU, so the area will not change from current conditions.

Pine Marten/Northern Three-toed Woodpecker MRUs
No management-related activities will occur in PM7, PM9, or PM11. Unit 9 in both action alternatives proposes to commercially thin the understory of a part of a small portion of PM12 to reduce competition among the remaining larger trees. The harvest will occur in drier, middle-structural stage stands that do not provide pine marten habitat. The harvest will improve habitat for both northern three-toed and pileated woodpeckers. Unit 1 lies completely within PM6 and proposes commercial thinning for the same reason as Unit 9. This area will be underburned when harvest is completed, and nearly the entire PM6 is proposed for prescribed fire. The Forest Service would not propose to conduct prescribe fire in good marten habitat because it would incinerate the stand and destroy all marten habitat. The reason to allow prescribed fire in this PM area is because it does not support pine marten habitat due to dry conditions. PM6 does support pileated woodpecker habitat, and the proposed harvest and prescribed fire will enhance that habitat by reducing competition for resources by smaller trees. The entire PM8 is proposed for commercial harvest in Unit 7, followed by an underburn. Some of this area does support marten habitat, although the amount is too small to support a marten. Commercial thinning followed by underburning will improve the habitat for pileated and northern three-toed woodpeckers.

Habitat Connectivity
The Forest Service identified and mapped potential corridors between MRUs, MA-1 areas, and late structure habitat during project planning. Although some commercial thinning units will narrow an identified corridor, sufficient cover remains on the north sides of slopes and in riparian areas to allow pine martens to move through the habitat within Vulcan.

CUMULATIVE EFFECTS

Timber harvest prescriptions and identified connectivity corridors under the action alternatives have been designed to protect or enhance existing barred owl, pileated woodpecker, pine marten, and northern three-toed woodpecker management areas, and promote healthier, more resilient timber stand conditions that will continue to provide for these species in the future. Cumulatively, these actions contribute favorably to actions occurring on other parts of the Forest and contribute toward meeting Forest Plan direction across the landscape.

The No Action Alternative (Alternative A) contributes toward meeting Forest Plan direction over the short term by avoiding any vegetative treatments that may impact existing barred owl, pileated woodpecker, pine marten, and northern three-toed woodpecker habitat. Over the long term, by increasing the risk of insect infestations, disease, or wildfire, it does not contribute toward development or maintenance of healthy, diverse forest conditions that will continue to support these species across the landscape. The No Action Alternative does contribute to meeting Forest Plan objectives for these species.

Beaver

No adverse effects to beavers or beaver habitat are expected to be associated with or result from either action alternative. Beaver are not known to currently occupy habitat within or near any of the proposed activity sites, and activities would not occur within aquatic or riparian habitats.

Blue Grouse

EXISTING CONDITIONS

Summer Nesting Habitat
Much of the mid elevations of the project area supported more open, park-like stands than currently exist. Lack of fires and subsequent succession resulted in shrubs and trees encroaching on these park-like stands, thus reducing their extent and quality. Most of the project area could have supported blue grouse habitat, and the area was well-known for blue grouse hunting. Much of this now consists of relatively closed stands and provides fairly poor habitat. The area's blue grouse population has, along with those throughout the area, declined in the past two decades.

Winter Roosting Habitat
Using aerial photos, topographical maps, and field surveys, the Forest Service identified about 8,300 acres of potential blue grouse winter habitat. Approximately 45% of those acres still contain the larger trees that blue grouse use in winter. Another 23% will be growing into blue grouse roosting habitat within the next 40 years or might contain small patches of roosting habitat.

DIRECT AND INDIRECT EFFECTS OF THE ALTERNATIVES

Alternative A (No Action)
Alternative A will not affect blue grouse habitat either positively or negatively.

Alternatives B and C

Summer Nesting Habitat
The partial harvest of trees on more open, dry sites that occur in both action alternatives will have a beneficial effect to blue grouse nesting and brood habitat by opening the overstory and understory. The difference between the action alternatives is inconsequential; both will benefit blue grouse because the harvest prescriptions for all units are some form of commercial

thinning that will remove smaller trees and retain the larger overstory trees. No units will harvest in or near wetlands.

Noxious weed spread into unaffected habitat probably constitutes the greatest long-term threat to blue grouse. Alternative C, which proposes the least amount of new road construction (0.2 miles vs. 0.8 miles in Alternative B) and causes the least ground disturbance from harvest activities (fewer by about 160 acres compared to Alternative B) will contribute least to the spread of noxious weeds; thus will have the least negative effects to blue grouse habitat. Both action alternatives propose construction of new road: Alternative B proposes 0.8 miles of new road and Alternative C proposes 0.2 miles.

Areas that will be burned to reduce fuel loading will improve blue grouse habitat by opening stands and stimulating forage. Spring fires usually are conducted before onset of nesting. Those that are not would temporarily reduce blue grouse numbers: nesting females would escape the flames but the clutch could be lost. This loss would not dramatically affect the blue grouse population (compensatory rather than additive mortality). Prescribed fire can also set the stage for the spread of noxious weeds. The extent and potential spread of weeds after prescribed fires has not been well documented on the Colville National Forest. Both action alternatives propose the same prescribed fire in wildland-urban interface areas and similar small pole treatments, and therefore, will have virtually the same effects. The effects of harvest to nesting habitat are beneficial; however the effects of noxious weed encroachment is detrimental.

Winter Roosting Habitat

Portions of sixteen units in Alternative B and seventeen units in Alternative C could affect winter roost habitat because the stands contain larger trees. None of the proposed prescriptions will remove larger trees because all call for commercial thinning to remove understory and competing trees. Therefore, neither action alternative will negatively affect roost trees. Removing the understory and smaller trees that compete with the larger, older ones for nutrient, space and light will decrease stress on the older trees and probably result in a longer-lived stand. Concomitant with harvest, most of the stands will be underburned after harvest, which will also improve conditions by further opening the stands. The difference between the two action alternatives, one stand and portions of two others totaling about 35 acres, is inconsequential. Precommercial thinning will not affect roost trees. Prescribed fire could negatively affect some roost trees, but the intent of the prescribed fire is to underburn, not ignite a stand-replacing event.

CUMULATIVE EFFECTS

The area considered for cumulative effects analysis consists of the entire District. Planned and completed projects will have minimal effect on blue grouse habitat because roost trees will be retained and wetlands will be buffered. Past regeneration harvest in all watersheds severely reduced blue grouse habitat by removing large ponderosa pine or Douglas-fir, especially mistletoe-infested Douglas-fir, on open, dry, south-facing slopes. The extent of this loss and the impact to blue grouse are not known. Fire suppression also resulted in a loss of habitat by allowing more open habitats preferred by blue grouse to grow closed and thus are little used by blue grouse.

Roads built into blue grouse habitat will increase the amount of noxious weeds and will decrease forage for blue grouse.

Prescribed fires will enhance blue grouse habitat but has the potential to spread noxious weeds.

Alternative A does not affect blue grouse habitat. Both action alternatives positively affect blue grouse habitat. All units will open the understory and will enhance the existing stands for blue grouse. Harvest will not remove trees larger than 21 inches in diameter at breast height; so larger roost and forage trees will not be affected. Alternatives A, B, and C will not cause an area-wide decrease to blue grouse habitat.

Franklin's Grouse

EXISTING CONDITIONS

Large blocks of young lodgepole pine do not exist in the project area, and lodgepole pine-dominated stands are infrequent. Lodgepole pine is a common component of many stands, especially those on the northern half of the planning area. Lodgepole pine grows in most of the stands that had been harvested in the 1970s, 1980s, and 1990s but is not the dominant species in any. About 3,160 acres (15% of the planning area) of young stands on National Forest System land could provide some good Franklin's grouse habitat. Another 3,270 acres (16%) could provide more habitat. However, because of the lack of young lodgepole pine-dominated stands, most current habitat is marginal.

DIRECT AND INDIRECT EFFECTS OF THE ALTERNATIVES

Alternative A (No Action)

Alternative A would not impact Franklin's grouse habitat conditions.

Alternatives B and C

The prescriptions in both action alternatives would not lead to regeneration of lodgepole pine. Therefore commercial harvest in either alternative will neither improve nor reduce the quality of Franklin's grouse habitat.

The precommercial thinning proposed on about 495 acres in Franklin's grouse habitat in both action alternatives will negatively affect Franklin's grouse habitat by removing the dense thicket habitat. The Forest Service will prevent complete loss of this habitat by retaining unharvested portions (10% of acres, consisting of 0.5 to 1 acre of unthinned plots) in these units. The result will still not improve Franklin's grouse habitat, but will not result in a decrease at the population level.

Commercial thinning in early structural stage stands probably would not greatly affect Franklin's grouse either positively or negatively because the intent is to thin overstory trees and not disturb the understory. Conducting prescribed fire in these stands would reduce the amount of habitat for Franklin's grouse.

Prescribed fire is proposed for about 5,800 acres. Few of these areas currently provide Franklin's grouse habitat. Most of these open stands provide habitat for blue grouse rather than

Franklin's grouse. Thus, the fires would have a minor negative effect on Franklin's grouse habitat. The amount of proposed fire is the same in each alternative and comprises a small amount of Franklin's grouse habitat. Therefore, the negative effects will be minimal and will not affect the population of Franklin's grouse.

Habitat reduced by noxious weeds remains a concern. The Forest Service uses the amount of construction as an index of soil disturbance and potential for spread of noxious weeds. Alternative B proposes 0.8 miles of new road construction, and Alternative C proposes 0.2 mile. The difference is insignificant relative to the amount of Franklin's grouse habitat, and small enough that neither alternative would negatively affect the population of Franklin's grouse.

CUMULATIVE EFFECTS

Franklin's grouse habitat is likely to decrease due to the recent trend towards reduced levels of regeneration harvesting in lodgepole stands. Precommercial thinning continues in several watersheds on the District. Although unthinned patches are left in thinning units, precommercial thinning in lodgepole pine decreases habitat quality for Franklin's grouse. Prescribed fire will continue to favor blue grouse habitat to the detriment of Franklin's grouse habitat, but the extent of the affected areas are limited. Several hundreds of thousands of acres of dense Franklin's grouse habitat remain on the Forest. The Vulcan Project area affects a small fraction of it (less than 5%), and the area's population of Franklin's grouse will not dramatically increase or decrease.

CONCLUSION

Treatments in either action alternative were not designed to specifically regenerate lodgepole pine, and will not create stands that consist primarily of lodgepole pine. Prescribed fire will have a negative effect on Franklin's grouse because it will create open stands that provide habitat for blue grouse rather than Franklin's grouse. However, most of the proposed fires will occur on warmer, drier sites that normally provide poor Franklin's grouse habitat, so the negative effects will be minimal or nonexistent. Precommercial thinning will decrease habitat quality for Franklin's grouse, but the retention of 10% of the units in an unthinned condition will somewhat mitigate that loss. No key issues or issues raised during public scoping involve analysis elements used to determine effects to Franklin's grouse. Habitat reduced by noxious weeds is measured using new road construction as an index: Alternative B proposes 0.8 miles of new construction and Alternative C proposes 0.2 mile.

Other Woodpeckers

EXISTING CONDITIONS

The effects of management activities on most woodpeckers are directly related to management-induced changes in the density and distribution of snags. Within the entire Vulcan planning area, timber harvest has occurred on approximately 40% of the National Forest System land since the 1960s. Detailed snag surveys have not been conducted within all these harvest areas; so specific snag numbers are not available for this analysis. However, based on past observations, it is reasonable to expect that few of these areas meet the current snag retention standards. The balance of treatment acres (both earlier Forest Service harvests and those on

other ownerships) are not expected to contain enough snags to meet current Forest Plan standards.

This assumption is supported by the use of DecAid (Mellen et al., 2003), a database released by the Forest Service in 2003 that contains information about snags and wildlife. Data compiled from existing, unharvested stands in northeastern Washington indicates that in the mixed conifer forest, large snags are not common: nearly 90% of the plots surveyed contained 4 or fewer snags larger than 20 inches in diameter per acre. Snags between 10 inches and 20 inches in diameter are more common, although 60% of the unharvested plots contained fewer than 6 snags per acre. Harris (1999) found a similar situation when he compiled data from Forest Service vegetation plots in Region 1, which includes most of the Northern Rocky Mountains.

General observations indicate that overall snag and downed wood levels on National Forest System lands in the planning area are similar to levels found in other areas: sufficient small snags and downed wood and infrequent large snags and downed wood. Most mixed conifer stands affected by fire in the 1920s and 1930s follow a similar pattern: few or no snags greater than 20 inches in diameter but adequate numbers of smaller snags.

In the past several years, large-scale mortality from Douglas-fir bark beetle, blow down from wind events, and to a lesser extent, root rot have increased the number of large snags and downed wood. No large fires have occurred in the project area in the past 50 years, so aside from the above-mentioned pockets, no concentration of snags exists.

Figure 3-5. Distribution of the unharvested area of the EMC_NCR_S Vegetation Condition among snag density classes (#/acre) for snags > 20" dbh, based on 406 unharvested inventory plots. Graph based on data in DecAid, which expresses values as snags/ha.

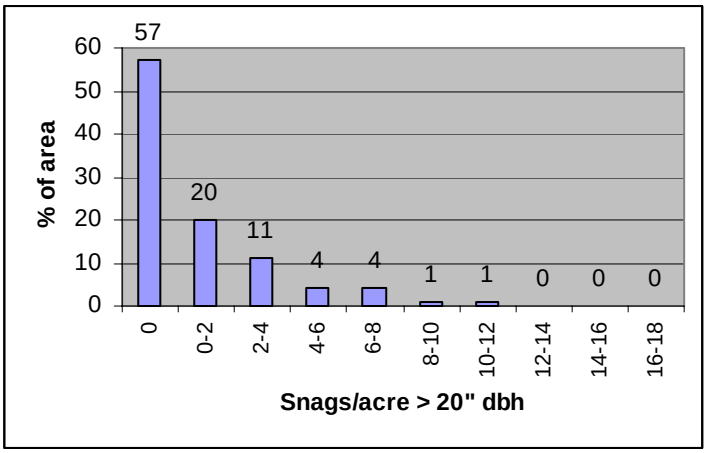
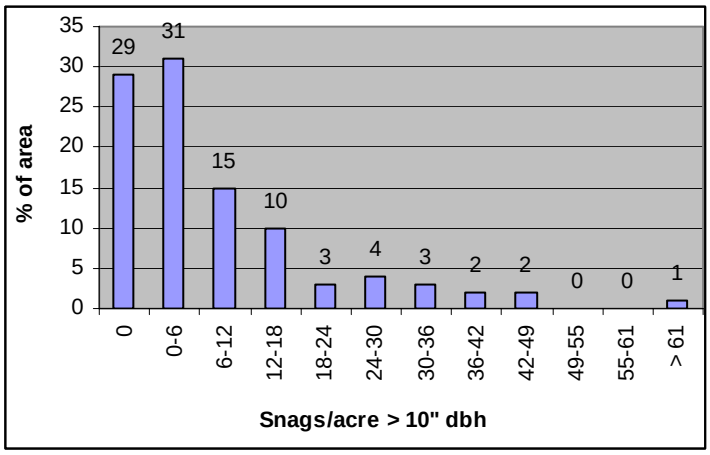


Figure 3-6. Distribution of the unharvested area of the EMC_NCR_S Vegetation Condition among snag density classes (#/acre) for snags > 10" dbh, based on 406 unharvested inventory plots. Graph based on data in DecAid, which expresses values snags/ha.



The Vulcan planning area currently does not have any Forest Service acreage mapped as the Structural Stage 7 (single stratum) ponderosa pine habitat favored by white-headed woodpecker. However, several Structural Stage 6 stands, especially on the southern end of the planning area, on the dry southern aspects, are close to meeting the requirements for that classification. The Forest Service did not conduct specific surveys for white-headed woodpeckers within the project area but there are reports of this species near the project area.

DIRECT AND INDIRECT EFFECTS OF THE ALTERNATIVES

Alternative A (No Action)

Alternative A does not propose any timber harvests and would not result in the immediate loss of existing snags. However, the smaller trees that shade snags keep the moisture content of snags higher and result in faster decomposition of snags, which will result in faster loss of snags over the longer term. Additionally, the increased risk of insect, disease and/or wildfire problems presented by this alternative could result in an increase in all-sized snag numbers across the project area.

Alternatives B and C

Both action alternatives propose only one form of harvest prescription in all units: commercial thinning. In the two alternatives, the amount of precommercial thinning, commercial thinning, small pole removal or a combination differs by about 160 acres, which out of the total of about 3,000-3,160 acres amounts to about 5% and is a negligible difference.

Harvest in the Structural Stage 6 stands, if loss of snags can be minimized, will enhance habitat for those species that require more open-grown, large trees. The proposed harvest will also improve the longevity of existing snags because smaller trees will be cleared from around the large snags. The smaller trees shade the snags, keeping the snags cooler and retaining moisture. The cooler, moister conditions cause the snag to decay more rapidly than if it were exposed to drying, and the snag falls more rapidly in these denser stands. Because the loss of some snags is inevitable during harvest operations, the number of large snags throughout the harvest units will decrease in the short-term, under either action alternative. This decrease will

be consistent with the landscape numbers obtained from unharvested plots throughout the area; scattered large snags, but no or few concentrations of large snags.

The proposed harvest activities under both action alternatives are designed to meet Screening Direction for riparian, ecosystem, and wildlife standards for timber sales. Remaining snag levels are expected to usually be consistent with the Forest Plan requirements in most units unless sufficient existing trees and snags do not currently meet the requirements or if safety standards require removal. As mitigation, the Forest Service requires the creation of snags in any unit that falls below Forest Plan standard required snag levels when suitable trees are present.

Maintaining large downed wood on site is less of a problem than retaining snags. Contracts for this project will not allow removal of large non-sawtimber, thus the amount of downed wood, both large and small, will increase. Proposed underburns in the units and on the larger landscape will result in the consumption of smaller fuels. These stands will be underburned when the risk of a stand-replacing fire is very low, so the intensity of the prescribed fire will be low. These lower-intensity fires will reduce the amount of small downed wood but rarely result in the complete consumption of large downed wood. Additionally, the low intensity of the underburns will not case-harden much of the larger downed wood, thus retaining the quality of the downed wood as habitat for ants, primary prey of several woodpeckers.

CUMULATIVE EFFECTS

The area considered for cumulative effects analysis consists of the Republic Ranger District. Existing snags throughout the cumulative effects area were created primarily through fire and post-fire mortality, and most recently through insects and disease and windstorms. On the other hand, timber harvest has reduced snags. Many of the forested stands at mid and higher elevations were initiated during fires in the 1920s and 1930s. In areas of very densely stocked trees, snag numbers might be high but standing snags of large diameter are rare or absent. At high elevations, four large fires have occurred since 1985 and all have created expansive areas of dense snag habitat. At lower elevations, many of the areas have been partially harvested, no fires have occurred, and snag levels probably are lower than they were historically.

Throughout the area, snags have developed and continue to develop primarily through root rot diseases, insect outbreaks, and fire and post-fire mortality. The tree damage created during the winter storms of 1996/1997 created a great number of standing, broken, live trees. These trees will become extremely valuable as time passes because they will begin to decay and to attract insects, yet will remain standing. Additionally, because they are not considered snags under Occupational Safety and Health Administration guidelines, many more of these can remain in a stand during salvage logging activities. In the past decade, outbreaks of Douglas-fir bark beetle have created patches of snags in Douglas-fir habitats, especially on the east side of the District.

In contrast, planned and completed projects have reduced or will reduce standing snag densities. Past harvest has eliminated or reduced snags, especially large snags. Past road building and the firewood policy of allowing snags to be harvested within 200 feet of open roads eliminated or continue to suppress snag levels. However, the proposed project will add little to the cumulative negative effects of reduced snag levels because non-sawtimber will remain on site, new roads will be closed after harvest activities, green trees will remain on site

to develop into snags in the future, and the Forest Service will create snags in units that fall below standards in the Forest Plan.

Large Raptors

EXISTING CONDITIONS

All of the project area could be considered raptor habitat, but not every acre is currently considered suitable nesting habitat, especially for nesting accipiters. Although closely related, each accipiter species tends to prefer specific stand types. Goshawks most often nest in mature tree stands, whereas Cooper's and sharp-shinned hawks prefer to nest in overstocked sapling, pole and small tree stands. Most, but not all, goshawk nests are also found below 4,000 feet in elevation. More than 13,840 acres (approximately 67%) of National Forest System lands within the Vulcan Project area are considered capable of producing trees, and therefore could be considered potential nesting habitat for accipiters. Timber stands currently classified as early structural stage (3,160 acres or 20%) probably do not provide suitable nesting habitat at this time due to their small tree sizes and/or open stocking densities.

One goshawk nest has been documented within the project area since 1993. This nest is located in a mid-structural stage stand. It has not been active recently. No other accipiter nests have been found within the planning area, although individuals have been sighted elsewhere. Golden eagles have successfully nested southwest of the planning area boundary.

DIRECT AND INDIRECT EFFECTS OF THE ALTERNATIVES

Alternative A (No Action)

Alternative A does not propose any vegetative treatments; therefore it will have no immediate or short term impact on any known raptor nest. Over the long-term, natural forest successional processes will continue to increase stem densities in many stands, potentially increasing nesting habitat availability for accipiters over current conditions. However, this alternative also creates an increased risk for insect, disease and/or wildfire that could adversely affect large areas of this project area for many years and reduce available accipiter nesting habitat well below current levels.

Alternatives B and C

In both action alternatives, commercial thinning harvest is proposed in the unit that contains the historical goshawk nest. Monitoring of the nest site will continue and appropriate buffers will be established if the nest again becomes active.

Harvest in both alternatives calls only for commercial thinning, which will not result in the loss of many nest trees. In the Structural Stage 6 stands, the more open understory and canopy probably will improve habitat somewhat for goshawk. Commercial thinning in the earlier structure stands will not improve the habitat in these stands for either Cooper’s or sharp-shinned hawks, although sufficient habitat remains in the planning area to support both these species.

Neither precommercial thinning units, nor prescribed fire units will affect accipiter habitat.

CUMULATIVE EFFECTS

Attempts have been made to locate and protect known raptor nests within the Vulcan Project area. Timber harvest prescriptions under the action alternatives have been designed to promote healthier, more resilient timber stand conditions that will continue to provide raptor nesting opportunities. Cumulatively, these actions contribute favorably to actions occurring on other parts of the Forest and contribute toward meeting Forest Plan direction.

The No Action Alternative (Alternative A) contributes toward meeting Forest Plan direction over the short term by avoiding any vegetative treatments that may impact existing raptor habitat. Over the long term, by increasing the risk of insect infestations, disease, or wildfire, it does not contribute toward development or maintenance of healthy diverse forest conditions that will continue to support raptors across the landscape. The two action alternatives differ by about 160 acres, an inconsequential amount. Both will contribute to cumulative improvements in goshawk habitat and will contribute to a slight decrease in dense, mid-structural stage stands that Cooper's and sharp-shinned hawks inhabit. However, this dense habitat covers a good portion of the cumulative effects analysis area.

Waterfowl

EXISTING CONDITIONS

Waterfowl are not a Management Indicator Species under the Forest Plan; however, Forest Plan Standards and Guidelines provide management direction to insure their habitat needs are considered in project planning. Waterfowl generally do not use the Vulcan planning area because so little open water exists, except for steep-gradient streams. Optimal brood habitat for all cavity-nesting ducks is within ½ mile of shallow wetlands and no such habitat exists in the Vulcan planning area.

DIRECT AND INDIRECT EFFECTS OF THE ALTERNATIVES

Because the area provides extremely poor habitat for waterfowl, and because National Forest System lands are more than ½ mile from the Kettle River, neither action alternative will affect waterfowl, either positively or negatively.

CUMULATIVE EFFECTS

Because neither alternative will affect waterfowl habitat, none of the alternatives would contribute to cumulative positive or negative effects to waterfowl.

Migratory Birds

EXISTING CONDITIONS

Migratory birds utilize a variety of habitats, including upland coniferous forests (in all stages of development), openings, and riparian zones. Of greatest concern from a management perspective are those habitats that, when compared to the rest of the Forest, contain unique characteristics, are naturally limited in abundance or distribution, or have experienced the greatest declines or changes over time. In general, bird species requiring these habitats have undergone greater population declines over time than other species that primarily use general coniferous forest habitats. Within the Vulcan Project area, these areas of concern would

include riparian areas and areas with deciduous trees. Within coniferous forest habitats, areas classified as Structural Stage 7 are also important because this condition is more limited than other coniferous forest habitats.

The Vulcan planning area does not support any wetland areas that exceed about an acre in size, and most are much smaller. It also does not include large areas of deciduous trees. Small stands of aspen or cottonwood are located along more moist habitats and stringers on the south end of the planning area. The area does not contain any Structural Stage 7 habitat, although it supports about 830 acres of Structural Stage 6, much of which could, with management, move towards Structural Stage 7 classification.

DIRECT AND INDIRECT EFFECTS OF THE ALTERNATIVES

Alternative A (No Action)

Alternative A does not result in any management induced changes to migratory land bird habitat conditions. Over time, and in the absence of other disturbances, some existing openings, riparian areas, and deciduous habitats would be expected to succumb to forest succession, and the local population levels of birds requiring these habitats would decline. Opportunities to develop large tree, single stratum (Structural Stage 7) habitat in this area would not be realized.

Alternatives B and C

The difference in acres treated between Alternative B and C amount to about 160 acres of commercial thinning and is inconsequential. Both action alternatives propose to commercially thin Structural Stage 6 stands to move some towards Structural Stage 7 conditions. The concomitant underburning would enhance the movement of these stands towards Structural Stage 7.

Both alternatives propose the same amount of prescribed fire which, aside from a few nests that might be destroyed during the spring underburning, would improve habitat conditions for those species that occupy more open sites. Again, this habitat type is not uncommon in and near the Vulcan area.

Precommercial thinning is proposed on the same number of acres in both action alternatives. Within treatment units, habitat for those species that prefer dense, younger stands will decrease, although suitable and sufficient habitat remains on the landscape so that these species will not exhibit a population decline.

Riparian habitats are probably the most sensitive source habitats for migratory birds. They are also the most scarce habitat type. No harvest units in either alternative will affect riparian habitat in the Vulcan Project area.

CUMULATIVE EFFECTS

Within the Vulcan planning area, migratory land bird habitat conditions have been affected by a wide variety of management activities. Because the majority of the forested area is public land, the areas have not been converted to pasture. Most pasture on private lands near the Kettle River is naturally open because of dry conditions. Fire suppression has reduced much of the habitat diversity that occurred across this project area when fires actively burned, especially

on the southern two-thirds of the planning area. Livestock grazing occurs on both private and public lands. Except for private lands in the valley bottoms, most of the forested riparian conditions remain fairly good.

The cumulative effects of these activities have been proportionally greater in those habitats that historically have been transitory in nature and/or in limited supply such as openings, shrub fields, riparian habitats, early successional forests, and single stratum forest types rather than in the general coniferous forest environment. Current and future management activities that maintain or improve these types of habitats contribute cumulatively to the perpetuation of bird species that require these conditions, and also contribute to the maintenance of the area's bird species diversity. Activities that do not maintain or improve these habitats do not contribute cumulatively to maintenance of existing habitat and species diversity.

For the alternatives under consideration in this project, Alternative A (No Action) does not contribute to the long-term maintenance of diverse land bird habitats. Because the action alternatives differ by only a small number of acres treated, they provide equally positive opportunities to restore under-represented habitat (especially Structural Stage 7) via commercial thinning, maintaining openings and shrub fields via prescribed fire, and promoting healthier, more resilient forest conditions across the project area.

Gray Wolf (Endangered Species)

EXISTING CONDITIONS

Records of wolf sightings on the Colville National Forest date from 1914 (Hansen, 1986), and confirmed and unconfirmed sightings have occurred since then. No confirmed sightings have come from in or near the project area. Wolf packs have not been sited on the Republic Ranger District, but single animals might move through the project area.

Ungulate Prey Base

National Forest System lands in the project area and cumulatively all lands within the project area contain fawning areas and summer and winter range for big game, thus provide prey for wolves the entire year. Much of the summer and winter range exists in moderate to poor condition due to noxious weeds and because the flush of woody browse caused by earlier disturbances (mainly fire) has grown out of reach of big game. In addition, dense coniferous stands limit light reaching the ground and thus herb productivity.

Mule deer are more common than white-tailed deer. A recently concluded study on mule deer completed in the area concluded that they are not in good condition in early spring, an indication that they probably are not entering winter in prime condition, which reflects the relatively poor condition of summer range (W. Meyers, pers. comm.).

Denning and Rendezvous Sites

Because recent information suggests that sensitivity to human disturbance may be less than previously thought, the Forest Service did not detail potential habitat for denning sites. Screening criteria restricts harvest near most bodies of water, so the Forest Service did not attempt to identify potential rendezvous sites. The Forest Service did not find any denning or rendezvous sites during field reconnaissance.

Minimal Exposure to Humans
Road building from past harvest activities has reduced the amount of core area habitat in the project area. The Forest Service did not have sufficient information to conduct analysis on private lands, but considering the amount of harvest activity, little seclusion habitat probably remains on those areas.

Approximately 4.6 square miles of National Forest System lands have a road density of less than 1 mile/square mile and are considered core area habitat, which constitutes about 18% of the National Forest System lands in the project area. Secluded habitat remains mostly in the more open country that can not support timber large enough to harvest, thus remained without roads to access timber.

DIRECT AND INDIRECT EFFECTS OF THE ALTERNATIVES

Alternative A
Alternative A will not affect wolves either positively or negatively.

Alternatives B and C
Neither action alternative will negatively affect corridors. Commercial timber harvest, prescribed fire, and precommercial thinning will improve habitat conditions for big game, the primary prey of wolves, under both Alternatives B and C. Alternative C proposes slightly more commercial harvest in winter range than Alternative B, but the difference is not significant. Alternative B proposes 0.6 miles more of new road construction than Alternative C, which proposes 0.2 miles, and therefore presents a slightly greater risk of noxious weed influx. Neither alternative will affect denning or rendezvous sites.

Conclusions
Alternative A will have no effect on wolves. The action alternatives will have low risk and low consequences. Alternatives B and C may affect but are not likely to adversely affect gray wolves or gray wolf habitat.

Grizzly Bear (Threatened Species)

EXISTING CONDITIONS
The Grizzly Bear Recovery Plan (USDI FWS, 1993a) identifies "grizzly bear ecosystems" which contain specific recovery areas. The recovery plan classifies areas by "Management Situations" based on the needs of the bears and the capabilities of the areas to supply those needs. The Vulcan Project area lies within a Management Situation #5 which is not managed primarily as grizzly bear habitat.

Transient grizzly bears have not been recorded from the project area. The Natural Heritage Program Database lists no verified grizzly sightings in or near the project area.

Travel Corridors and Hiding Cover
The Vulcan planning area juts southward from Canada and slopes dramatically downward to the Kettle River. For bears and other large carnivores, it probably does not provide a great link between forested areas to the north and south. However, a large section of forested habitat lies

south of the planning area and fingers of cover snake down the steep slopes to the Kettle River, so the area cannot be dismissed from providing potential corridors.

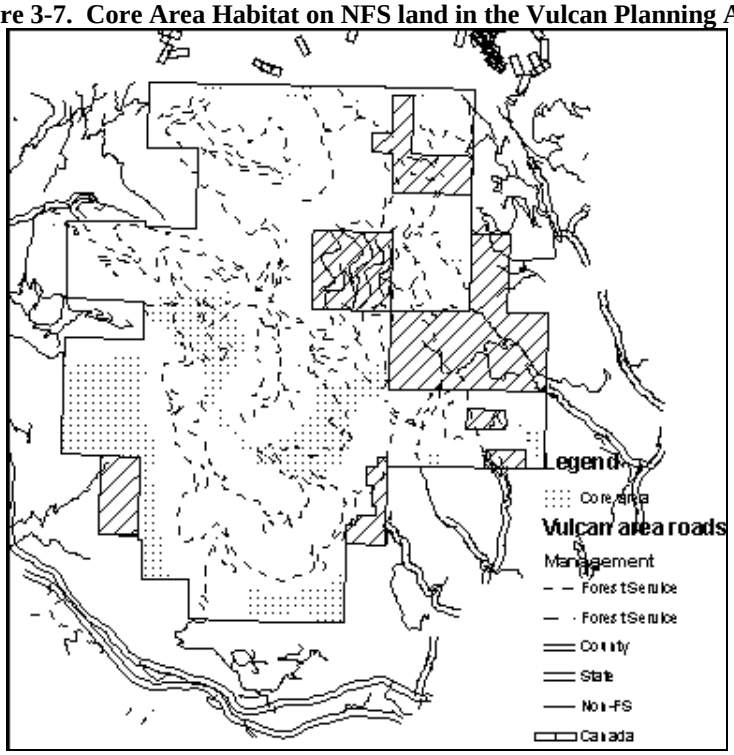
About 22% of the Vulcan planning area is too open to provide hiding cover because it is too dry to support dense tree or shrub growth. About 4% of the Vulcan area is too open to provide hiding cover because past harvest units eliminated cover. These stands will, within the next 15 years, again support hiding cover. Sufficient forested habitat lies on most ridge tops or riparian areas to allow for bears to move through the area relatively undetected. The lower-elevation lands adjacent to the Kettle River, which borders the project area on the west, south, and east, consist of pasture, agricultural land, and residential houses. This does not prevent bears from moving through the area, but probably discourages them.

Core Area/Secluded Habitat

Road building from past harvest activities has reduced the amount of secluded habitat in the project area. To determine the amount of secluded habitat on National Forest System land, the Forest Service used all open and unrestricted roads in the project area because most remain passable by off-highway vehicles or motorcycles. The Forest Service did not have sufficient information to conduct analysis on private lands, but considering the extensive harvest activity on private land, probably little if any secluded habitat remains.

On National Forest System land about 4.6 square miles of land have a road density of less than 1 mile/square mile and are considered core area habitat, which constitutes about 18% of the National Forest System land in the project area. Not surprisingly, an arc of secluded habitat exists along the western and southern boundary, which corresponds with grassland or lightly forested areas that provide little if any cover. The areas of low-density open roads in the center part of the planning area contain a network of closed roads. Many roads in the project area receive little use during most of the year and several closed roads probably receive no traffic at any time, so the amount of core area habitat is greater than that represented by Figure 3-7 below.

Figure 3-7. Core Area Habitat on NFS land in the Vulcan Planning Area.



Forage

No past management targeted the creation of shrub fields to produce berry crops, although this happened inadvertently during harvest and subsequent prescribed fire. Past fires created dispersed patches of huckleberries (*Vaccinium* species) and past timber harvest at mid and higher elevations also enhanced or extended some patches.

Forest roads segment the project area but few if any deer are killed by vehicles on these roads. The area is well-known for, at one time, supporting a very large mule deer herd. That herd size has dwindled and a Washington Department of Fish and Wildlife study conducted on the condition of does in early spring indicates that they are in relatively poor condition. The project area also does not contain any avalanche chutes that could provide ungulate carrion in the spring for scavenging bears.

DIRECT AND INDIRECT EFFECTS OF THE ALTERNATIVES

Summary

Alternative A will not affect grizzly bears either positively or negatively. Alternatives B and C do not differ in their effects and neither alternative will result in habitat conditions that will hamper bear movement.

Alternatives B and C have low likelihood of adverse effects because bears rarely use the project area. Because of planned modifications, both action alternatives will have low consequences. Alternative A will have no effect on grizzly bears. Alternatives B and C may affect but are not likely to adversely affect grizzly bears.

Bald Eagle (Threatened Species)

EXISTING CONDITIONS

Nest Sites
The nearest bald eagle nest lies about 13 miles south of the planning area, on Curlew Lake (WDFW, 2006). The Kettle River is the only fish-bearing water body near the Vulcan planning area. Several sites on non-National Forest System land along the river provide good nesting habitat for bald eagles. A small portion of the Vulcan planning area lies within 2,000 feet of the Kettle River, but almost none of this habitat contains trees, and therefore does not provide nesting habitat.

Roost Sites
In winter, bald eagles congregate along the Columbia River east of the project area. No concentrations of birds occur along the Kettle River, although individual bald eagles may roost near the river. A small portion of the planning area contains potential roost sites.

DIRECT AND INDIRECT EFFECTS OF THE ALTERNATIVES

Nest and Roost Sites
No alternative proposes harvest near the small amount of nesting or roosting habitat that occurs in the planning area. Several prescribe fire units are located in potential habitat, but the prescription is to conduct underburns rather than kill the larger trees, so the proposed fire units will not affect potential nesting or roosting habitat. Proposed precommercial thinning or road closures would not affect potential nesting or roosting habitat.

CUMULATIVE EFFECTS
The area considered for cumulative effects analysis consists of the entire District. Because this project will not affect bald eagles, it will not contribute to cumulative effects for this species.

CONCLUSION
All alternatives will have no effect on bald eagles or bald eagle habitat because only prescribed fire units may affect potential nesting or roosting habitat, and the prescriptions call for underburns, which are not intended to kill large trees.

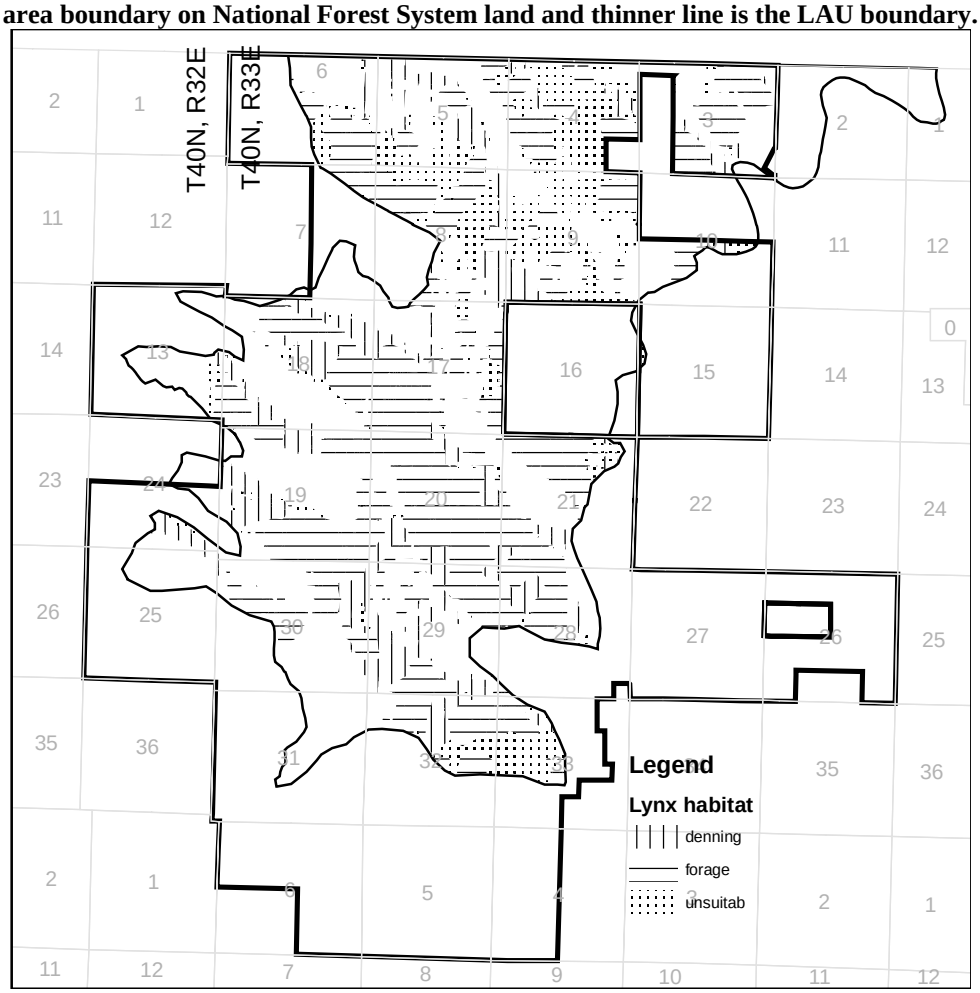
North American Lynx (Threatened Species)

EXISTING CONDITIONS

Habitat Distribution
The Vulcan Lynx Analysis Unit (LAU) does not contact other LAUs. The nearest LAU lies east of it, in the Kettle Range, separated by approximately 7 miles of low elevation range and agricultural land. All lynx habitat adjacent the Vulcan LAU lies to the north, in Canada. The Forest Service used a combination of intense survey plots, general walkthroughs or aerial photos to determine conditions. Of the approximately 8,760 acres within the LAU on National Forest System land, the Forest Service determined that about 5,425 acres supported lynx habitat (Figure 3-8).

The Forest Service attempted to analyze effects on an area about the size of the average home range of a female lynx, combining more than one LAU. Because the Vulcan LAU does not abut others, this was not possible. Habitat components are well-distributed within the LAU, though habitat is fractured by drier sites that do not support lynx habitat, especially on south-facing slopes.

Figure 3-8. Lynx habitat with the Vulcan LAU. The thick line is the planning area boundary on National Forest System land and thinner line is the LAU boundary.



The Forest Service has no historic records for lynx in this area, but a lynx trapper who caught many lynx on the Kettle Crest also trapped this area for lynx, which is how he happened to catch a wolverine. Recent nearby sightings came from the Kettle Crest, about 7 miles east, and in Canada.

Connectivity Areas (Corridor Routes)

No travel corridors in the lynx analysis unit have been eliminated due to past harvest. Ridges dissect the area in several places, and the tops of several ridges do not support lynx habitat although the north sides of the ridges might. Sufficient cover remains on the ridges, or on the north sides, and in riparian areas to allow lynx to move through the LAU and potentially on to the Kettle Crest.

Unsuitable Habitat (Created by Harvest)
About 1,075 acres (19%) of the lynx habitat within the LAU do not contain cover suitable for lynx because of past harvest, primarily in the 1980s. The harvested areas should grow into good foraging habitat in the next 5 to 15 years.

Foraging Habitat
Most of the forage consists of mature forests with somewhat dense ground cover and downed wood that provides habitat for hares (at lower densities than in young stands) and red squirrels. These habitats vary less over time than younger stands and sustain a more stable, though much lower population of prey than younger forests. About 3,175 acres (59%) of lynx habitat fit this description.

In the project area, no large fires occurred within the past 30 years to regenerate lodgepole pine stands, thus expanses of young, high-quality forage do not exist. Except for some past regeneration harvest units, almost no part of the LAU contains dense, young even-aged forests.

Denning Habitat
About 21% (1,175 acres) of the LAU contains an overstory of the type that lynx denned in on the Okanogan National Forest (Koehler, 1990) and in Montana (J. Squires, pers. comm.). A few small areas of wind-throw were noted during field reconnaissance, and some of this downed wood will contribute to denning habitat.

Roads and Winter Snowmobile Trails
Current information suggests that lynx do not directly avoid, nor are displaced by low-use forest roads (Ch. 12 in Ruggiero et al., 1999; LCAS/Ruediger et al., 2000), although roads can still negatively affect lynx. Roads can negatively affect lynx by allowing human disturbance in denning habitat and increasing access for incidental or illegal hunting or trapping. Plowing or packing snow on roads or snowmobile trails in winter might allow competing carnivores to access lynx habitat thus increase competition for prey.

About 17.3 miles of open road wind through lynx habitat, of which 0.2 miles are private or county road. The existing open road system does not negatively affect lynx denning.

No areas serve as designated snowmobile routes, and snowmobile use of the area is low.

DIRECT AND INDIRECT EFFECTS OF THE ALTERNATIVES

Alternative A will not affect lynx habitat. Alternative B proposes to harvest more acres than Alternative C (Units 18, 19, 27, 29, 54, and part of 30). None of the prescribed fire units will occur in lynx habitat. Some precommercial thinning will occur in lynx habitat to remove tree species that do not contribute to foraging habitat (see section on effects to foraging habitat).

Figures 3-9 and 3-10 display and Table 3-13 lists the effects of harvest units to lynx habitat.

Figure 3-9. Effects of Units in Alternative B.

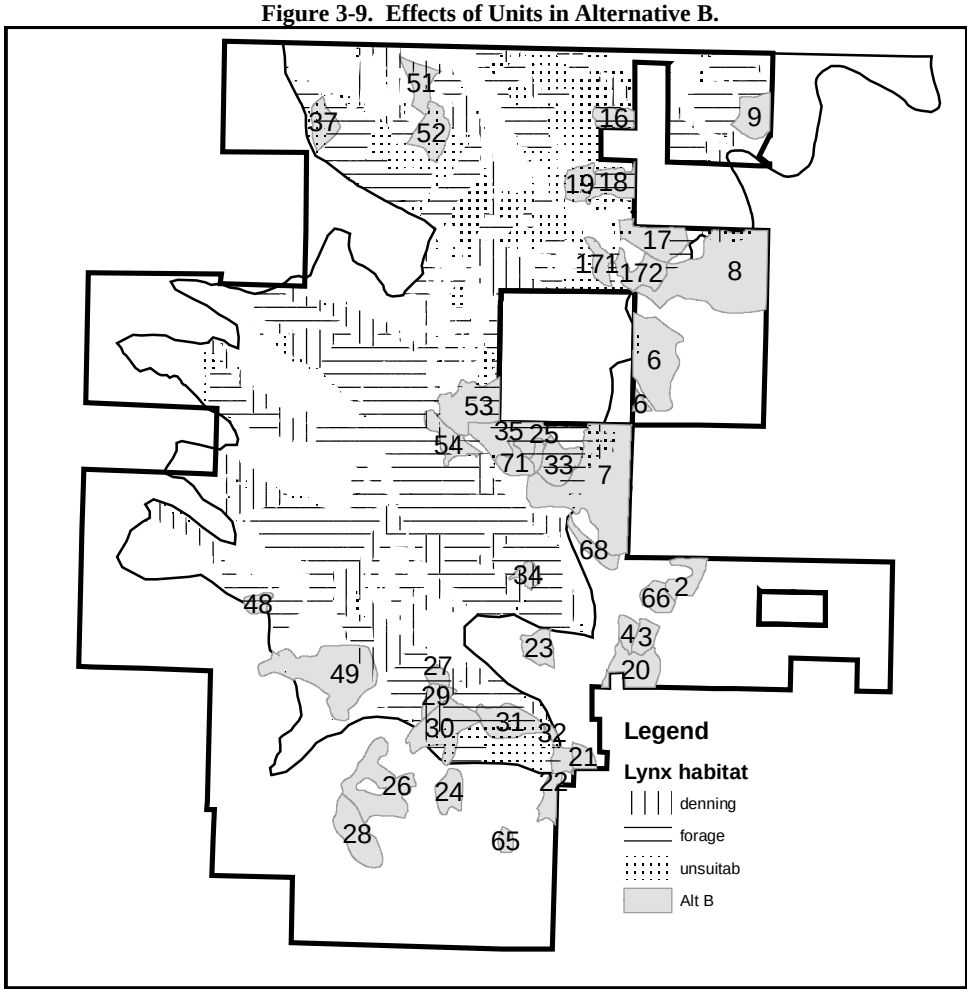


Figure 3-10. Effects of Units in Alternative C.

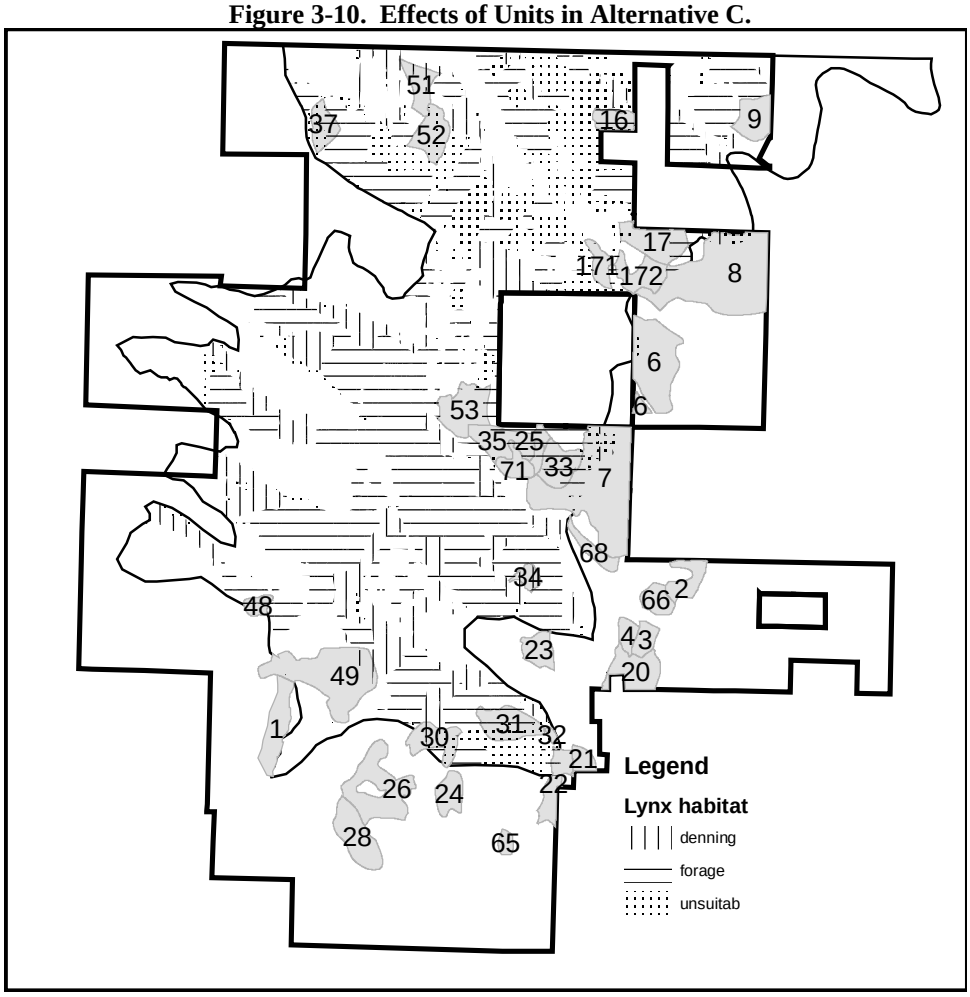


Table 3-14. Effects of Alternatives to Lynx Habitat Types.

Habitat type	Existing	Alt B	Alt C
Denning	22%	22%	22%
Forage	59%	52%	53%
Unsuitable	20%	26%	25%
Total	100%	100%	100%

Unsuitable Habitat

The amount of unsuitable habitat will not exceed the 30% suggested as maximum in the Lynx Conservation and Assessment Strategy in either alternative. All commercial harvest treatments are some form of commercial thinning, and will therefore eliminate little cover or forage that exists within the units to be harvested. Both action alternatives create nearly the same amount of unsuitable habitat.

Connectivity Cover (Corridor Routes)
Sufficient forested habitat remains on slopes near or on the ridge tops to maintain corridors. No harvest will occur in riparian buffers, so riparian corridors will remain virtually intact.

Foraging Habitat
Commercial harvest will not affect the dense stands of young subalpine fir, spruce, or lodgepole pine created by past harvest; so these high-quality patches of snowshoe hare habitat will remain. The Forest Service has proposed precommercial thinning in some stands that contain some foraging habitat (precommercial thinning Units 11, 12, 13, 14 and 15). The stands were harvested in the NorCan timber sale and subsequently replanted to a variety of species, most of which do not provide good foraging habitat. The proposed precommercial thinning will thin those trees that do not contribute to foraging habitat, leaving the lodgepole pine, subalpine fir, and spruce, thereby improving the foraging habitat for snowshoe hares.

The forage stands that will become unsuitable habitat due to harvest are those that currently provide low-quality forage habitat. These stands are within the wildland-urban interface zone and will be thinned to prevent stand-replacing wildfire.

No small-pole, precommercial thinning units, or prescribed fire areas occur in lynx habitat, and therefore, will not affect current forage habitat created by past harvest. All alternatives retain the dearth of good foraging cover that existed before harvest.

High-quality foraging habitat is created by stand-level disturbance via fire or harvest. Immediately after the disturbance, the habitat is considered unsuitable. The newly established stand takes about 15-20 years to grow into high-quality forage habitat. Both action alternatives have nearly the same positive affect to future high-quality forage habitat. However, none of the treatments will open the stands to the degree necessary to regenerate lodgepole pine, and therefore, will not begin to supply the dense, higher-quality forage that is necessary to support high densities of snowshoe hares.

Denning Habitat
Harvest in potential denning habitat will not reduce the amount below the minimum suggested in the Lynx Conservation and Assessment Strategy. Harvest within potential denning habitat will not remove downed wood and will remove smaller-diameter trees in the understory. This will allow the area to retain most of the resources necessary for denning habitat. These units will provide future forage habitat, thus benefit lynx in the long term.

Roads and Winter Snowmobile Trails and Seclusion Habitat
Two segments of road of 0.6 miles (to access Units 18 and 19) are proposed in Alternative B, and 0.2 miles (to access Unit 37) are proposed for both Alternative B and C. Both road segments lie at the periphery of the LAU and both will be closed at the end of project activities. Neither road would preclude lynx from using the Vulcan LAU.

None of the alternatives will increase or decrease snowmobile use in lynx habitat because the current level of use remains low.

Provisions in timber sale contracts would protect any denning sites that may be discovered during harvest and protect against any accidental "taking" (as defined in FSM 2670.5) of a lynx during harvest-related activities.

CUMULATIVE EFFECTS

Though the Vulcan LAU does not connect with those on the Kettle Crest, the Forest Service used those on the Kettle Crest as the area on which the Forest Service analyzed cumulative effects due to its proximity to the Vulcan LAU.

Future Harvest

In addition to this project, the Forest Service has planned and sold timber in several LAUs within the cumulative effects analysis area. All future harvest activities would be planned using the Lynx Conservation and Assessment Strategy as the best available science, thus would not negatively affect lynx. Additionally, nearly 30% of the area has been designated as off-limits to timber harvest under the current Forest Plan.

Unsuitable Habitat

The amount of unsuitable habitat should decrease, which should have a minor positive effect on lynx in the short-term but could be detrimental to lynx in the long term. In those parts of the District where habitat falls below historical conditions for late and old structure, regeneration harvests will be limited and little unsuitable habitat will be created. Current unsuitable habitat will decrease because many regeneration harvest units cut in the 1980s and early 1990s will grow into at least poor forage habitat. Large fires within the past 20 years have created patches of unsuitable habitat.

Foraging Habitat

Within the next 10 to 15 years, large patches created by past fires will grow into high-quality forage habitat. However, cattle graze within these stands and reduce forage available to snowshoe hare, and thus reduce the quality of the foraging habitat. Precommercial thinning will not occur in these stands, allowing them to retain their quality as foraging habitat.

Denning Habitat

Denning habitat will continue to increase as the trees burned by the fires start to fall. Currently, downed wood from the White Mountain Fire in 1988 has created thousands of acres of denning habitat structure, and the regenerating lodgepole pine is starting to provide sufficient canopy.

Travel Corridors

Current and future projects will retain existing corridor widths at least 400 feet wide, thereby retaining their utility to lynx. Again, most of the higher-elevation corridors will remain unharvested.

Road Density

Nearly all current sales temporarily increase road density, although in the past few projects, the Forest Service has proposed to construct fewer roads and that trend probably will continue outside WUI areas. New roads probably will not negatively affect lynx movements during the period in which they are open, about 3 to 6 years (Ruggiero et al., 1999). They may negatively affect lynx because noxious weeds will follow the soil along the road corridors and cause loss of snowshoe hare habitat. Most of the noxious weed species that currently infest the area do

not grow well in the cooler, moister habitats that lynx occupy. Although the loss of habitat due to noxious weeds will occur, the extent of the effects on snowshoe hare, thus lynx, is not known.

CONCLUSION

Alternative A will have no effect on lynx.

Alternatives B and C may affect but are not likely to adversely affect lynx. The likelihood of adverse effects is "low" because both alternatives used the best available science to eliminate potential negative effects. No prescribed fire units occur in lynx habitat. Some precommercial thinning is proposed, but will not remove those plant species that snowshoe hare use for browse. Alternative B proposes to build an additional segment of road to harvest a dense stand that is surrounded by unsuitable habitat. Therefore, Alternative B is slightly less desirable than Alternative C.

Both action alternatives propose to harvest the same amount of denning habitat, create nearly the same amount of unsuitable habitat and have nearly the same effect to future good forage habitat.

The consequence of adverse effects for all action alternatives is moderate because lynx from Canada may use some of the lynx habitat in the planning area.

Peregrine Falcon

EXISTING CONDITIONS

Nesting Sites

The cliffs near Tonata Creek are the only tall cliffs in the area, and these lie across the Kettle River to the south of the Vulcan Project area. No historical records list peregrine falcon as having nested on or near the Colville National Forest.

Foraging Habitat

The agricultural areas along the Kettle River Valley surrounding the project area provide open foraging habitat. Open foraging habitat also exists on National Forest System land.

DIRECT AND INDIRECT EFFECTS OF THE ALTERNATIVES

Timber harvest will not affect peregrine falcons because the harvest units do not affect either nesting or foraging habitat. The prescribed fire treatments will open habitat, but will not affect populations of birds on which peregrine falcon prey.

CUMULATIVE EFFECTS

The area considered for cumulative effects analysis consists of the Republic Ranger District. No records indicate that peregrine falcons nested on or near the District, although people see several in northeast Washington each year, usually during migration and usually east of the Kettle Crest. The Forest Service surveyed potential nest sites identified by Pagel (1993) during nesting seasons in the early and mid 1990s and did not sight any peregrine falcons. From 2002

to 2006 the Forest Service, along with Washington Department of Fish and Wildlife, reinitiated nesting surveys and found no nesting peregrine falcons.

Because this project does not affect peregrine falcons, it does not contribute to cumulative effects for this species.

Conclusion

All alternatives will have no impact to peregrine falcons or their habitat.

California Wolverine

EXISTING CONDITIONS

A wolverine sighting occurred in 2005 just east of the planning area, along the Kettle River. This sighting was verified by a DNA sample of hair recovered from the location.

Successional Stages

The Vulcan planning area contains a diversity of tree sizes and ages. It did not experience the extensive fires of the late 1920s that burned through many higher elevation areas, although fires did burn parts of the area. Subsequent timber harvest has eliminated larger trees from several parts of the planning area.

Corridors

Many wildlife species travel along corridors on ridges and saddles or riparian areas, using cover in these areas to provide security. The Forest Service delineated corridors for the planning area according to guidelines in the Forest Plan (5 June, 1995, amendment). See discussion under the grizzly bear section in the Biological Evaluation.

Past harvest has affected some potential corridors, but large openings that would prevent wolverine from moving through the area do not exist and riparian corridors remain intact.

Prey

Wolverines are primarily carnivores rather than omnivores, so big game carrion provides a large portion of their diet. See the discussion under the gray wolf section in the Biological Evaluation for existing conditions of big game summer and winter range.

Core Area/Seclusion Habitat

Wolverines seem to respond to human disturbance in a manner similar to grizzly bears, and the Forest Service modeled seclusion habitat using the same criteria. See discussion of *Seclusion Habitat* within the grizzly bear section in the Biological Evaluation.

Denning Areas

The project area does not contain high mountain cirques or talus slopes that wolverine use for denning.

DIRECT AND INDIRECT EFFECTS OF THE ALTERNATIVES

Successional Stages
Alternative A, the No Action Alternative, will not change conditions of successional stages. Under the action alternatives, most proposed harvest activities were designed to allow trees in some stands to more quickly grow to larger sizes, thus moving blocks of habitat more closely in line with historical conditions. The other prescriptions were to thin the understory in stands that contain a good overstory, thus reduce competition for light and moisture. This should benefit wolverine by providing a variety of habitat types and amounts of habitat similar to historical conditions.
Alternative B proposes to harvest slightly more acres than Alternative C, and therefore begins to move more area towards historical conditions. Overall, this difference in acreage is negligible.

Corridors
Alternative B proposes 0.8 miles of new road, while Alternative C proposes 0.2 miles of new road. Proposed new roads would not preclude wolverines from using areas, and the Forest Service will mitigate the effects of new roads by pulling slash and debris over them when they are closed. Therefore, the new roads will not negatively affect potential corridors. Harvesting in either action alternative will not restrict riparian corridors to less than 400 feet wide, and therefore, will not prevent wolverines from using these areas.

Prey
The existing cover:forage ratio within designated winter range (MA-6 and MA-8) does not currently meet Forest Plan expectations because substantial acreage on the southern part of the planning area is too dry to support trees, much less dense cover. Both action alternatives propose harvesting in areas containing cover. However, these commercial thinning prescriptions will improve cover in the long-term by reducing competition among remaining overstory trees and allowing the crowns to thicken and widen.

Alternative A does not begin to move cover in winter range to more desirable conditions. It also keeps the project area at greater risk for large scale disturbances (insects, disease, or wildfire) that could negatively affect game by eliminating cover availability for many years.

Prescribed burning activities under both action alternatives are expected to improve existing forage quality and quantity within treatment areas.

Core Area/Seclusion Habitat
Both harvest units and roads can negatively affect secluded habitat. Commercial thinning Units 7, 23, 27, 29, 31, 34, 46, 67 and 68, and precommercial thinning Units 46 and 67 will affect core areas. These units will be accessed by opening existing closed roads that contribute to current core area. New roads will not be constructed in core areas. Therefore, as mentioned above, the negative effects to core areas would occur only during harvest activities and could last less than a few months; although negative effects probably will last as long as the roads remain open. Roads usually remain open for a few years until the end of harvest activities. During the time that the roads are open, the area will provide less seclusion habitat than it currently does. The reduction in seclusion habitat for this period will not prevent wolverine from using the Vulcan area.

After harvest and post-harvest activities, the Forest Service will close all new roads and roads currently closed that were opened and reconstructed for the project. The Forest Service recognizes that road closures are not 100% effective. Roads will be closed after post-harvest activities have been completed, within 6 years of the beginning of project activities.

Loss of habitat due to noxious weed invasions can be decreased by pre-harvest techniques such as controlling noxious weeds on existing haul roads in the project area starting a few years before harvest activities, and re-seeding roads with species that will aggressively compete with noxious weeds when the roads are constructed (D. Fagerlie, pers. comm. and INWMP).

Denning Areas
No denning habitat exists in the project area.

CUMULATIVE EFFECTS

The area considered for cumulative effects analysis consists of the Vulcan planning area and the Kettle Crest, east of Vulcan. Several projects have occurred in this area in the past two decades, most of which have included timber harvest. Four large fires have swept through some of the higher elevation areas since 1988. Additionally, other ownerships within the Forest boundary have planned and implemented projects. Activities have modified habitat (timber harvest, prescribed fire) and increased both road densities and human presence. Recreational access/use also potentially affect wolverine habitat. The Forest Service has winter and other season use-trails throughout the eastern (Colville) portion of the District. However, given the amount of human manipulation of habitat at low and moderate elevations, wolverines still seem to use the area.

Successional Stages
The Forest Service planned all recent sales using the concept of managing towards historical ranges of variability for different structural stages, which should maintain successional patterns and processes similar to those with which wolverine evolved. Continued management under this scenario should benefit wolverine.

Travel Corridors
The Forest Service adopted guidelines to maintain corridors to connect late and old structural stage stands. All current and future projects will retain these corridors. The Forest Service does not have guidelines to maintain cover on major ridges and saddles. Harvest on major ridges and saddles will restrict travel corridors, but sufficient cover remains in riparian areas and on the more dense slopes to provide cover for wolverine.

Prey Summer and Winter Range
All recently planned projects contain elements that will improve conditions for big game, thus wolverine. This trend will continue. Much of big game winter range lies within the wildland-urban interface, and fuels reduction projects that include prescribed fire and opening the canopy will improve forage conditions for big game, thus wolverine. The first phase of the Malo-East Lake project is being discussed, which will treat portions of the wildland-urban interface between Sherman and Boulder-Deer Creek highways. Other planned prescribed fire and harvest treatments in winter range will improve conditions for big game. Action alternatives will improve the cover:forage ratio and propose underburning that will improve forage. These projects will benefit big game, thus wolverine.

Noxious weeds have severely impacted big game habitat throughout the West, which decreases and in many cases offsets the improved forage conditions that result from opening the canopy. The level of forage reduction and consequent reduction in big game populations is not known. Along road corridors, the Forest Service will spray and use Integrated Pest Management for noxious weeds.

Core Area/Seclusion Habitat
Many projects have reduced seclusion habitat, thus decreased habitat quality for wolverine. Current and future projects that construct, reconstruct, or reopen roads will reduce seclusion habitat for the time that the project remains active. The Forest Plan requires that new roads be closed at the end of harvest activities, thus the most severe negative effects should be limited to the time during which the roads remain open to vehicle traffic. This varies among sales, but often a road remains open for about 6 years (the time of construction through treatment, plus a year of post-treatment firewood collection). Closed roads reduce disturbance from humans and improve seclusion habitat, but road closures are not completely effective. Roads built into seclusion habitat will influence human access until the road prism becomes too difficult to navigate. Other areas throughout the cumulative effects analysis area still provide seclusion, especially the large Management Areas 10 and 11 along the Kettle Crest.

Denning Areas
Few potential natal denning areas occur, and those that do lie in MA-11 on the Kettle Crest, which does not allow motorized vehicle traffic. One of these areas, Sherman Peak, receives considerable use by back-country skiers during the spring. No cumulative effects are expected to potential denning areas from this project.

CONCLUSION

Structural stage distribution will change most with Alternative B, which begins to move more habitat towards late and older structure than Alternative C, but the difference at the landscape level is negligible. Both action alternatives have the same effect to the core area habitat that remains and will only affect it during the time of timber harvest. Wolverines will not be negatively affected by Alternatives B or C. For prey habitat, both action alternatives have approximately the same effect and will slightly improve conditions. None of the alternatives will affect denning areas because that habitat does not exist in the project area.

Alternative A will have no effect on wolverine. Alternatives B and C may affect individual wolverine, but “will not lead in a trend towards federal listing or loss of viability.”

Pacific Western Big-eared Bat

EXISTING CONDITIONS

Although many miners constructed prospecting pits throughout the Vulcan area, only one mine exists. This mine lies on an open grassland, south-facing slope below the face road. The Forest Service did not survey this mine.

DIRECT AND INDIRECT EFFECTS OF THE ALTERNATIVES

No proposed harvest or precommercial thinning units will occur close to the mine. Harvest will open stands and presumably improve foraging conditions for Townsend's big-eared bats. Prescribed fire will be timed to avoid roosting or hibernating bats.

CUMULATIVE EFFECTS

The area considered for cumulative effects analysis consists of the Republic Ranger District. Planned projects and treatments on other ownerships within the Forest boundary could contribute to cumulative effects due to the fact that private landowners are not required to manage for these bats.

Forest Service timber treatments in this and other projects probably will not negatively contribute to cumulative effects to either hibernacula or maternity sites because the Forest Service buffers mines known to be occupied, no prescribed fire and few timber projects occur during winter, and the Forest Service does not destroy old structures because of their historical value. Recreational and commercial use of mines and illegal use of historical structures that support Townsend's big-eared bats potentially will cause disturbance of summer roost sites, maternity sites, and hibernacula during late autumn, but few recreationists or miners explore mines during winter.

CONCLUSION

The No Action Alternative is expected to have "no impact" to Townsend's big-eared bats. These bats have not been documented within the planning area but may occur. Alternatives B and C may impact individual Townsend's big-eared bats, but are "not likely to result in a trend toward Federal listing or loss of viability".

The consequences of adverse effects are moderate because of the limited number of bats in the project area. The likelihood of adverse effects is low because few Townsend's big-eared bats are likely to occupy the planning area.

Pacific Fisher

EXISTING CONDITIONS

Areas meeting the broad description of fisher habitat are present in the Vulcan planning area, but only one sighting was documented in the south of the Vulcan area in 1989. Specific surveys were not conducted for this project analysis.

Fisher prey on small mammals and spend most of their time in mature and older forests. They require denning sites sheltered from harsh weather conditions and safe from predators with an adequate prey base nearby. The Vulcan Project area does not currently provide much high quality habitat for fisher. Existing habitat conditions were predominately shaped by the series of fires, timber harvest, and fire suppression which occurred over much of the area in the past. These fires and management actions resulted in the current over-abundance of densely stocked timber stands and smaller diameter trees that are not developing into the larger tree, multi-stratum habitat preferred by fisher.

DIRECT AND INDIRECT EFFECTS OF THE ALTERNATIVES

Alternative A will not alter any existing habitat conditions for fisher. Stands (including densely stocked small diameter ones) will not be thinned and roads will not be constructed. The density of overhead cover and the occurrence of older stands will also not be altered. Over the short term, Alternative A will have the least negative impact because no additional fragmentation or change to canopy will occur. Over the long term, this alternative presents a greater risk from wildfire because many stands are overstocked, and the habitat is not capable of maintaining these conditions over a long period of time.

All commercial harvest prescriptions in Alternatives B and C call for some form of commercial thinning, which favors retaining larger trees and snags, removing smaller competing trees, and should produce better fisher habitat. Riparian and other corridors are minimally affected by harvest and would allow for fishers to move about on the landscape. The connection of MA-1 areas and pine marten and pileated woodpecker MRU areas will not be harvested. Prescribed fire will move some stands towards historical conditions, which will improve fisher habitat. Thus, over time, the project area should provide better fisher habitat conditions than currently exist.

CUMULATIVE EFFECTS

Timber harvest prescriptions and identified connectivity corridors under the action alternatives will protect or enhance existing fisher habitat conditions, and promote healthier, more resilient timber stand conditions that will continue to provide for this species in the future. Cumulatively, these actions contribute favorably to actions occurring on other parts of the Forest.

The No Action Alternative (Alternative A) contributes toward maintaining potential fisher use over the short term by avoiding any vegetative treatments that may impact any existing fisher habitat. Over the long term, by increasing the risk of insect infestations, disease, or wildfire, it does not contribute cumulatively toward the development or maintenance of healthy, diverse fisher habitat conditions across the landscape.

CONCLUSION

Both action alternatives equally protect or maintain existing conditions because the amount by which they differ is inconsequential at the landscape level. Furthermore, commercial timber harvest will not occur within MA-1 boundaries, pileated woodpecker MRUs, or pine marten MRUs. Travel corridors retain sufficient cover to allow fisher to move throughout the planning area. All harvest prescriptions call for some form of commercial thinning and are designed to move the stands towards late structural stage more rapidly than if harvest did not occur. Thus, over time, the project area should provide better fisher habitat conditions than currently exist.

The No Action Alternative, Alternative A, is expected to have no direct impact. Alternatives B and C may impact individual fisher or habitat, but are “not likely to result in a trend toward Federal listing or loss of viability for the population or species".

Great Gray Owl

EXISTING CONDITIONS

The Vulcan Project area contains potential great gray owl habitat. There are numerous natural openings on the east, south and west flanks of Vulcan Mountain that could provide foraging habitat. Some of these areas have small groves of aspen and/or cottonwood trees that may also provide nesting opportunities.

No known nests have been documented in the Vulcan planning area, nor are there any sightings. Specific surveys for great gray owls were not conducted. However, during general wildlife surveys which were conducted within the Vulcan analysis area, great gray owls were not observed or heard.

DIRECT AND INDIRECT EFFECTS OF THE ALTERNATIVES

The No Action Alternative, Alternative A, will not directly affect potential nest sites or other great gray owl habitat components over the short term. Over the long term, this alternative presents a greater risk from wildfire because many stands are overstocked and the habitat is not capable of maintaining these conditions over a long period of time. This could result in a loss of any existing great gray owl habitat and a reduction in potential habitat for many years.

Maintaining great gray owl habitat can be compatible with forest management. Natural meadow systems and other openings can be maintained and restored through fire management. Great gray owls will nest in small patches of mature forest if suitable nesting structures exist. Younger forest stands with residual older forest components can also provide nesting habitat. Retention of large trees with suitable nesting platforms is important for maintaining nesting habitat.

Both action alternatives have the potential to negatively affect great gray owl habitat by altering nest site availability and/or affecting unknown nests. However there are numerous elements within both action alternatives that insure that potential great gray owl habitat will persist in this area. These elements include:

- Harvest will not remove the large trees on which great gray owls nest, nor will harvest affect aspen or cottonwood areas;
- Prescribed fire will enhance habitat for small mammals, thus for great gray owls;
- There will be no impact to potential nesting habitat in Structural Stage 6 stands because, although harvest will occur in them, it will remove smaller trees in the understory;
- Structural Stage 5 stands that occur within MA-1 areas, pileated woodpecker MRUs or pine marten MRUs (“A” rotation blocks) will either remain unharvested or if treated will remain as Structural Stage 5 or become more open, even-aged Structural Stage 4 stands that great gray owls would use as foraging habitat;
- Some studies indicated that great gray owl foraging may also occur in stands with low canopy cover. Some of the proposed harvest may enhance forage opportunities by opening up dense stands;
- Forest management that maintains a mix of successional stages and maintains well-distributed mature and older forest stands having platforms for nests and dense canopy

cover and escape perches for young should be compatible with management for this species.

CUMULATIVE EFFECTS

Within the Vulcan planning area, some potential great gray owl nesting habitat has been reduced or eliminated by past harvest. Most of the open areas are open because of harsh environmental conditions rather than human activity. Exotic plant and animal species have successfully invaded this area as a result of some human activities potentially altering foraging habitat and prey species availability. Numerous timber management projects have occurred in this project area over the last 30 years and others are expected to occur in the future. Recreational activities may disturb individual nests and will likely continue in the future. Finally, numerous small projects (for example, opening stands to benefit bighorn sheep) have maintained or enhanced great gray owl habitat.

Potential foraging habitat is not transitory, as it is on the eastern, wetter side of the Colville National Forest, so the cumulative effects of these activities have been greater in nesting habitat than in potential foraging habitat. Current and future management activities that maintain or improve nesting habitat contribute cumulatively to the perpetuation of any species that require these conditions.

Alternative A (No Action) does not contribute to the long-term maintenance of potential great gray owl habitat, because it creates a greater risk from uncontrolled wildfire. Severe wildfires could result in a loss of any existing great gray owl habitat and a reduction in potential habitat for many years.

Alternatives B and C provide opportunities to maintain and improve existing habitat conditions and restore under-represented habitat such as large trees, late and old stand structures, as well as promote healthier, more resilient forest conditions across the project area.

Both action alternatives proposed in this analysis contain measures that are expected to perpetuate the type of habitat conditions reported as suitable for great gray owl foraging and nesting over the long term. Neither action alternative is expected to have any cumulative negative effects to great gray owls.

CONCLUSION

The Vulcan Project area contains potential great gray owl habitat, but there are no known nests or sightings.

The No Action Alternative does not alter any potential habitat over the short term and is expected to have no impact on any existing great gray owls or their habitat in this area.

Alternatives B and C propose harvest in great gray owl habitat but will still provide for the retention of suitable habitat characteristics over the short term. In the absence of any documented great gray owl activity in this area, the action alternatives may impact individual great gray owls or their habitat, but are “not likely to result in a trend toward Federal listing or loss of viability".

SOILS

Information provided in this Environmental Assessment about soils is excerpted from the *Vulcan Vegetation Management Project Soils Report* by Nancy Glines, November 14, 2006. The full text of this report is incorporated by reference. The Soils Report describes the current conditions with regards to soils in the Vulcan Project area. It also describes and compares the environmental effects associated with the various alternatives (Alternative A—No Action, Alternative B—Proposed Action, and Alternative C). Measures intended to mitigate adverse effects are also included.

Existing Conditions

MANAGEMENT FRAMEWORK

The regulatory framework for maintaining soil productivity is provided by the Multiple-Use Sustained Yield Act of 1960, which directs the Forest Service to achieve and maintain outputs of various renewable resources in perpetuity without permanent impairment of the land's productivity. The National Forest Management Act of 1976 (NFMA) requires the Forest Service to safeguard the land's productivity. The implementing regulations for Forest Planning that followed NFMA requires the Forest Service to measure effects of prescriptions, including "significant changes in land productivity" (Code of Federal Regulations 36, CFT Part 200, Section 1, 1987). To comply with NFMA, the Chief of the Forest Service has charged each Region with development of soil quality standards for detecting soil disturbances indicating a loss in long-term productivity potential. For Region 6 and the Colville National Forest, these soil quality standards are located in the Forest Service Manual at 2520, R6 Supplement 2500-98-1. These supplement the standards in the Colville Forest Plan (pg. 4-50). The Colville National Forest Land and Resource Management Plan (as amended) discusses the effects of timber harvest on soil productivity (pages IV-5 through IV-10).

Pacific Northwest Regional policy is to design and implement management practices that maintain or improve soil and water quality and to emphasize protection over restoration. When initiating new activities:

- Design new activities that do not exceed detrimental soil conditions on more than 20% of an activity area[15]. (This includes the permanent transportation system.)
- In areas where less than 20% detrimental soil conditions exist from prior activities, the cumulative detrimental effect of the current activity following project implementation and restoration must not exceed 20%.
- In areas where more than 20% detrimental soil conditions exist from prior activities, the cumulative detrimental effects from project implementation and restoration must, at a minimum, not exceed the conditions prior to the planned activity and should move toward a new improvement in soil quality.

(Forest Service Manual 2500—Watershed and Air Management, R6 Supplement 2500 – 98 – 1)

The Colville National Forest Land and Resource Management Plan provides additional soils management direction: "National Forest System lands will be managed under the principles of multiple use and sustained yield without permanent impairment of land productivity.

[15] Activity area is the total area of ground-impacting activity, and a feasible unit for sampling and evaluating (Forest Service Manual 2500—Watershed and Air Management, R6 Supplement 2500 – 98 – 1). Typically an activity area is a contract unit.

- The total acreage of all detrimental soil conditions should not exceed 20% of the total acreage within the activity area including landings and system roads. Consider restoration treatments if detrimental conditions are about 20% or more of the activity area. Detrimental soil conditions include compaction, puddling, displacement and severely burned soil.
- Skid trail requirements must be specified in timber sale contracts that require tractor yarding.
- Identify areas of high soil erosion or mass failure potential and evaluate probable impacts of resource development.
- Retain organic matter to maintain site productivity."

(Colville National Forest Land and Resource Management Plan, 1988, pp 4-50)

LANDFORMS

The upper parts of the slopes and ridges in the Vulcan Project area are characterized as a **glacial scour** landform. In these areas, continental glaciers scoured away many of the fine materials leaving bedrock at or near the surface. The soils typically formed on colluvium and residuum, are shallow or moderately deep to bedrock, and the rock content is high. Deep glacial deposits occur in low spots, in crevices, and along many streams.

A landform characterized by **glaciated mountain** slopes occurs in the lower elevations. This landform is dominated by glacial till deposits, but also includes rockland mixed with glacial till, and a small area of glacial outwash in the upper Goosmus Creek area. The soils are very deep to bedrock.

SOIL ON THE LANDSCAPE

The soils were divided into 4 general groups, described below.

Group 1: Soils formed in wetlands, along streams, and in depressions. This group is found in both landforms, but it is more common in the glaciated mountain slopes landform. These soils are typically wet at least part of the year. This group of soils covers about 397 acres in the planning area.

Management Concerns: These soils are not suitable for logging, and would require special practices for road construction (low soil strength and problems with drainage). While small areas of these wetland soils are mapped within some proposed timber removal units, they would be protected by the riparian habitat conservation areas. No wetland soils are found along proposed road construction.

Group 2: Soils on glacial material. This group occurs in both landforms, but is common in the glaciated mountain slopes landform. This group has been divided into two sub-groups based on the presence or absence of a distinct volcanic ash surface horizon.

Group 2a: Soils formed on glacial material with a distinct ash-cap. These are the most common soils in the planning area, and are widely distributed on the middle and lower slopes. These soils are suitable for timber management and road construction and cover about 9,371 acres in the planning area.

Management Concerns: Most of these soils compact easily when moist because of the ash-cap[16] and low rock content in the surface horizon. The underlying glacial material is sometimes coarse gravel and sand, which may make tall roadcuts difficult to vegetate.

Group 2b: Soils formed on glacial material, but do not have a distinct ash-cap. These soils are limited in extent and are suitable for timber management and road construction. This group of soils covers about 617 acres in the planning area.
Management Concerns: The underlying glacial material is coarse sand and gravel. Tall roadcuts may be difficult to vegetate. Without an ash-cap, these soils are more prone to surface erosion and ravel on steep slopes.

Group 3: Soils on residuum and colluvium. This group of soils is more common in the glaciated scour landform, and has been divided into two sub-groups based on the presence or absence of a distinct volcanic ash surface horizon.

Group 3a: Soils formed on residuum and colluvium with a distinct ash-cap at the surface. These soils are widely distributed in upper slopes and ridges and are suitable for timber management and road construction. This group of soils covers approximately 152 acres in the planning area.
Management Concerns: These soils have an ash-cap, but generally the ashy surface horizon has a high rock content. Compaction potential is variable.

Group 3b: Soils formed on residuum and colluvium without a distinct ash-cap. Rockland mapping units are the only areas that fall into this group (228 acres).

Group 4: Soils and soil mapping units that include both glacial and residuum parent materials. These soils are found in both landforms, but are more common in the glaciated scour landform. This group of soils covers about 5,993 acres in the planning area.

HOW PAST AND ON-GOING ACTIVITIES HAVE AFFECTED THE SOIL

Commercial timber harvest appears to have begun in this area about 1960. Large areas were partially cut with tractors, especially in the upper Goosmus and LeFleur Creek watersheds. Walk-through exams of several of these areas revealed some of the major skid trails and skid roads are still visible and show evidence of compaction (resistance to penetration). Two transects were completed and found detrimental soil conditions ranged from 0 to 5% (compaction on roads and skid trails).

Clearcutting began in this area in the late 1960's. The plantations observed have 100% soil cover. Duff is typically about 1 inch thick, and downed wood is generally low. The primary detrimental soil condition observed in the plantations is compaction on skid trails, landings, and roads. Transects indicate detrimental soil conditions range from about 8 to 12%.

Some evidence of firewood cutting was observed, but this area does not appear to receive intensive firewood activity. In most areas, the cutting was light and few skid trails, skid roads, or firewood access roads were observed (one firewood-user created road was observed in Unit 26). Detrimental soil conditions in these areas were typically less than 1-2%.

[16] Volcanic ash-cap soils typically have very low bulk density, and low soil strength.

This area receives a moderate level of dispersed camping. The campsites appear to be largely associated with hunting in the fall. All of the campsites are located on existing roads and landings. In addition, off-highway vehicles use several open roads, and some closed roads. Recreation use of areas that are already in a detrimental soil condition does not increase the extent of detrimental soil conditions in the planning area.

The entire planning area is located within the Vulcan grazing allotment. Well-used livestock trails, heading toward water sources occur throughout the planning area and in many proposed treatment areas. Concentrated use occurs near water.

The effects of fire exclusion on soil have not been studied extensively. According to Smith and Fischer (1997) fire exclusion has allowed fuels to accumulate on the forest floor; the duff is thicker and the amount of down wood is probably greater. On exposed south and west facing slopes the duff may be thicker than would occur under a natural fire regime. Fire exclusion has probably allowed rocky sites to become forested where they may have supported brush under a short fire-return interval fire regime. Comparison with the 1972 aerial photos shows areas where stand density has increased in the intervening 30 years. Harvey et al. (1999) suggests that fire exclusion has changed the location of nutrient pools moving nutrients from the soil and high canopy to the forest floor and low canopy trees. This shift in nutrient pool and organic matter load could make sites more vulnerable to nutrient losses from fire.

At a landscape scale, the existing detrimental soil conditions are very low. Most of the detrimental soil conditions that have occurred are limited in extent and intensity. Those sites with detrimental soil conditions are widely scattered and do not occupy a large percentage of the planning area.

Direct and Indirect Effects of the Alternatives

ALTERNATIVE A (NO ACTION)

Alternative A defers activities in this area at this time. Detrimental soil conditions due to road construction, the construction of landings, and ground-based timber harvest would not occur.

Continued fire exclusion would allow fuels to accumulate on the forest floor creating thick duff layers that have potential to affect soil microbiology, chemistry, and nutrient cycling. Site nutrients would continue to migrate from the soil and high canopy to the forest floor and low canopy trees (Harvey et al., 1999). This shift in nutrient pool and organic matter load could make sites more vulnerable to nutrient losses from an uncontrolled wildfire.

The location, size, and intensity of future wildfires are difficult to estimate, although some generalizations can be made. Generally uncontrolled wildfires occur during the driest time of the year and yield a more intense fire than would occur under prescribed fire conditions. The adverse effects of an intense fire (loss of forest floor material, increased erosion, changes in soil biota) would be more widespread in an uncontrolled wildfire than under a prescribed fire.

The primary impact of an intense fire on soil productivity is increased erosion. Increased erosion is due to increased exposure of mineral soils (litter and duff burned off), the development of water repellent conditions, and destruction of soil aggregates[17].

ALTERNATIVES B AND C

Both action alternatives impact the soil resources in the same ways. The number of acres impacted varies between the alternatives.

Table 3-15. Key Indicators for the Effects on Soil Productivity

	Alternatives	
	B	**C**
Key Indicator for changes in site productivity due to road and landing construction		
Acres of new road construction	5	1
Acres of temporary road construction	2	0
Acres of landings to be constructed	19	18
Total acres where productivity is severely reduced due to construction of roads, landings, and rock pits.	26	19
Key Indicators for the effects of logging		
Total acres to be yarded with a ground-based system.	2,493	2,371
Acres CT to be yarded in the winter.	303	292
Acres CT to be yarded in the summer.	1,759	1,657
Acres of small pole thinning	431	422
Key Indicators for the effects from burning		
Total acres to be treated with fire	7,209	7,046
Jackpot Burning and pile burning	1,376	1,191
Underburning in harvest areas	1,426	1,448
Underburning outside harvest areas	4,407	4,407

Effects of the Construction of Landings and Rock Pits

Ketcheson, Megahan, and King (1999) noted that "Numerous studies have shown that most sediment resulting from timber harvest activities is caused by erosion on forest roads associated with the harvest rather than by erosion on the areas disturbed by tree cutting and skidding." Erosion from roads and landings may move into the fluvial system, impacting water quality and stream functions.

Regardless of soil type and site conditions, detrimental soil compaction and displacement always occurs on landings and rock pits. The construction of landings and rock pits is considered an 'irreversible effect' on soil productivity as described in 40 CFR 1502.16.

[17] Organic matter is important in stable soil aggregates. High soil temperatures burn the organic matter in the soil matrix, leaving the soil in an 'ashed' condition. Ashed soil is a fine powder that has lost its natural cohesiveness and is highly erodible. This characteristic has been observed on the Leona Fire and Togo Fire, both on the Colville National Forest.

Landings: In order to construct landings, the soil is typically bladed to flatten the site, and highly compacted, significantly reducing site productivity for deep rooted plants. To the extent reasonable, both alternatives would use existing landings. But, both alternatives would develop new landings. The number of landings and the acreage of land impacted by these landings vary between the alternatives.

Rock pits: This project proposes to use the material stockpiled in the Vulcan pit. No additional areas would be impacted at this time.

Effects of Prescribed Fire (Underburning) as the Only Treatment

Both alternatives propose about 4,407 acres of prescribed fire in areas that are not being harvested (burn Units A through V). These areas are identical in both action alternatives. The effects of fire on soils are highly variable depending on the type and intensity of the fire and the amount of surface fuels consumed. Fire is a natural process in these forests and presumably soil processes are capable of handling many of the changes produced by fire. This planning area is a dominated high-frequency/low-intensity fire regime. Generally, no signs of past logging activity were noted in any of the prescribed burn areas. The prescribed fires would occur under conditions that yield a low to moderate intensity fire rather than extreme wildfire conditions.

Table 3-16. Prescribed Fire Units

Unit	Sensitivity to prescribed fire[18]	Unit	Sensitivity to prescribed fire
A	Medium to low	L	Medium
B	Medium	M	Medium to low
C	Medium	N	Medium to low
D	Medium to low	O	Medium
E	Medium to low	P	Medium
F	Mostly medium. 8 acres rated high.	Q	Medium
G	Mostly medium. 1 acre rated low. 3 acres rated high.	R	Medium
H	Medium	S	Medium
K	Medium	V	Medium Note: Forest Plan standards do not apply to BLM lands.

[18] Sensitivity to burning refers to "prescribed burning damage potential" The definitions are: Low - The potential for soil damage is insignificant. Medium - The potential for soil damage is significant, but the damage that may occur is not expected to last more than one year. High - The potential for soil damage is significant, and the damage that may occur can be long-term. Sensitivity to prescribed fire rating is from the *State Soil Survey Report for the Northeast Area"* by the WADNR (Washington State Dept of Natural Resources). Note that "significant" in the NEPA (National Environmental Policy Act) context is defined in 40 CFR 1508.27 and agency NEPA procedures. In the soil sensitivity context from the WADNR, "significant" is not defined, but it is not necessarily the same as under NEPA. Consequently, identifying an environmental impact as significant by the WADNR does not necessarily mean it is "significant" under NEPA.

Erosion

Erosion is a natural process. Prescribed fire at all intensity levels burns some of the forest floor material and the removal of this soil cover contributes to surface erosion. In general, low and medium intensity fires burn only part of the duff and litter, leaving soil cover over the majority of the site.

Some erosion is expected to occur as a result of prescribed fire. Most of the treatment areas are open grassy slopes, open-grown conifer stands with a grassy understory, hardwoods, and low to moderate density brush. The surface soil within the proposed burn units is typically loam, gravelly loam, or very stony loam. The fires prescribed in both Alternatives B and C are expected to burn off most of the grass, leaving the fine roots and root collars intact. In areas of denser conifers and brush, the fire would be expected to consume the duff and litter in discontinuous patches.

Even after a light burn, some erosion is expected. If erosion occurs, it typically occurs in the first year after the fire. In this area, erosion is likely to occur as the result of a high intensity summer thunder storm. The probability of erosion and the amount of erosion varies, based on the probability of individual storm events. The following table shows the probability of sediment delivery.

Table 3-17. Probability of Sediment Delivery from No Treatment and Prescribed Fire (WEPP model using a climate generated by for Vulcan Mountain using PRISM)

Treatment		50% slope, 20% rock cover	50% slope, 50% rock cover
No burn	Probability of sediment in the year following treatment.	7%	10%
	Sediment from a storm with a 6 year return interval	0.00 t/ac	0.00 t/ac
	Sediment from a storm with a 15 year return interval	0.02 t/ac	0.06 t/ac
	Sediment from a storm with a 30 year return interval	0.79 t/ac	0.81 t/ac
Light burn	Probability of sediment in the year following treatment.	10%	20%
	Sediment from a storm with a 6 year return interval	0.00 t/ac	0.06 t/ac
	Sediment from a storm with a 15 year return interval	0.39 t/ac	0.94 t/ac
	Sediment from a storm with a 30 year return interval	4.89 t/ac	4.25 t/ac

Note that the numbers are for **sediment delivery** (material eroded from the site that ends up in a body of water) not **erosion (**the wearing away of soil through wind, water, gravity, etc. but may or may not be deposited into a stream). The erosion figures are higher; the 30-year storm is 6 tons/acre instead of 4. But the soil that is not eroded off the site is redeposited. This makes the upper part of the slope poorer and the lower parts richer. Site productivity for these grassland and brushland sites is not likely to be greatly affected. These sites would lose about 4-6 tons of sediment in one year and then lose essentially no sediment for many years. In the year following the prescribed fire (the only year sediment is significantly elevated) a 15-year storm (6.6% chance) in the burned scenario would have sediment yields similar to a 30-year storm (3% chance) if the area were unburned. If the burned area experiences a 30-year storm (3% chance), sediment delivery would be 4 times the sediment yield of a 100-year storm in the unburned state.

Effects of Commercial Timber Harvest Using a Ground Based Yarding System

Compaction and Displacement

Compaction is an increase in soil bulk density. Detrimental compaction is defined by the Colville National Forest as an increase in bulk density of 15-20% over the undisturbed level and macropore space reduction of 50% or more (Forest Plan FEIS glossary pg. 11). The compaction potential of the areas proposed for ground-based yarding is generally 'high', but varies with rock content. A 'high' compaction potential means that these soils will reach a higher % increase in bulk density with less compactive effort (fewer passes, less weight). The main tractor and cut-to-length trails are likely to remain compacted for a long time and probably constitute an 'irreversible effect' on soil productivity as described in 40 CFR 1502.16. Areas of very light tractor skidding (single pass, over slash, dry conditions), or light cut-to-length use (1 to 3 passes, over very good slash bed) are expected to decompact over a period of 30-50 years.

Displacement is the movement of surface soil from one location to another. Detrimental displacement is defined as the removal of more than half of the A horizon from an area greater than 100 square feet, which is at least 5 feet in width. Overwhelmingly, displacement occurs in combination with compaction on roads, skid trails, and landings. While displacement may add to the overall detrimental conditions of these trails, it does not increase the extent of detrimental conditions.

Tractor yarding: With tractor yarding, the skid trails will experience detrimental compaction regardless of soil characteristics, unless ameliorating conditions exist such as snow or frozen ground. The project designates the minimum skid trail spacing. The number of skid trails is generally independent of the timber volume to be removed. The number of passes on each trail would increase as the volume removed increases. Maximum compaction typically occurs in the first 1-3 passes, so the amount of compaction would not generally increase as the volume removed increases. With 130-foot skid trail spacing, this project would detrimentally compact about 10% of the activity area. All heavy equipment is required to remain on the designated skid trails. By limiting the extent of these trails, the project would limit the extent of detrimental soil conditions.

Cut-to-length yarding (CTL): The compaction of CTL trails is strongly related to the amount of slash or snow buffering the trail, and the number of passes by the heavy forwarder. CTL systems with proper slash buffering do not create detrimental conditions on the entire skid trail. Soils with a moderate compaction potential would likely experience slightly lower levels of compaction on secondary trails. High volume removed may mean more trips on each trail by the forwarder which would increase compaction slightly. Mitigation is included to prevent the use of a CTL system unless the unit has sufficient slash or snow. With sufficient slash or snow, a CTL activity area would experience about 8-12% detrimental compaction.

Pole removal: Both alternatives propose about 420 acres of small pole thinning. If the pole-sized material is removed from the site, it would be accomplished with ground-based equipment, probably a small tractor or small CTL machine. The equipment would be held to the same spacing and slope standards as a commercial removal. The effects are expected to be the same as with a commercial removal.

Yarding over snow or frozen ground: Both alternatives include about 300 acres that would be yarded over snow or frozen ground conditions. Yarding over snow and frozen ground substantially reduces compaction to less than 5%.

Erosion

The Region 6 Soil Quality Standards define detrimental erosion as visual evidence of surface loss in areas greater than 100 square feet, rills or gullies and/or water quality degradation from sediment, or nutrient enrichment (FSM 2532). Reviews of past harvest units in this planning area did not find areas of erosion large enough or severe enough to meet the criteria for detrimental soil conditions.

Tractor yarding: Tractor skid trails are typically bare, because the tractor drags the logs on the trail[19]. The soil in these skid trails is also compacted and the soil structure destroyed. Because of the slope limitations for tractor logging (35%), soils with high surface erosion potential would not occur on tractor skid trails. The project includes measures to minimize erosion on skid trails such as water bars and seeding. Because erosion is limited to skid trails, erosion does not contribute to the extent of detrimental soil conditions. The erosion potential for most of the soils proposed for tractor yarding is 'low' or 'moderate' on slopes less than 35%. Several proposed units have small inclusions that are too steep for tractor or CTL yarding. The project is designed to exclude these steep areas from tractor operations.

Cut-to-length yarding: Cut-to-length machines that place a mat of slash before them do not bare the soil and subject it to erosion. Erosion is rarely observed on CTL trails.

Soil biology and nutrient cycling

Timber removal can change soil microbiology through changes in stand density, soil temperature, moisture, species composition, and composition of the forest floor. Both alternatives propose commercial thinning and precommercial thinning with pole-sized material removed. The trees to be removed are understory and co-dominant trees. Thinning would not likely reduce crown cover enough to appreciably influence temperature or water regimes (Hermann, 1978). Furthermore, neither alternative proposes to simplify composition. Logging and tree removal alone does not remove the organic material on the forest floor. All alternatives retain the larger trees, which eventually die, fall down, and provide the refugia needed, especially on drier sites.

Nutrient loss from the removal of the boles of trees is typically small and can be replaced through the course of a rotation (Spurr and Barnes, 1980; Grier et al., 1989). Much of the nutrients in a tree are located in the bark, limbs, and foliage (Grier, et al., 1989).

Summary

The primary detrimental soil condition would be from compaction. Overall detrimental soil conditions would be about 9-10%. Minor changes in soil biology may occur; however, these are consistent with the changes in stand conditions and are not detrimental soil conditions.

[19] Logging over snow does not bare the skid trail.

Effects of Commercial Timber Harvest Using a Cable or Skyline Logging System

The primary affect of commercial logging with a cable system is disturbance especially in the area just below the landing. Both alternatives include about 200 acres of commercial thinning using a cable or skyline yarding system.

Disturbance and erosion

Monitoring on the Colville National Forest has found detrimental soil conditions in skyline units is typically 0.5-3%.

Soil biology and nutrient cycling

The effects of timber removal on soil temperatures, moisture, and biology are discussed in the previous section. This treatment would result in a stand with a great deal of diversity and the forest floor would remain intact.

Summary

The primary detrimental soil conditions that occur on skyline units are bare soil and erosion. Detrimental soil conditions would be about 1-2%.

Effects of Mechanical Piling

The primary affect of mechanical piling is compaction. Both alternatives propose about 1,000 acres of machine piling. All units proposed for machine piling were also logged with a ground-based system.

Compaction

This equipment typically has low ground pressure and generally only passes over the ground once. These activities would not increase the amount of detrimental soil conditions in tractor yarded units. In CTL units, however, this additional piece of equipment has the potential to increase the amount of compaction on the CTL trails. Whether this occurs, and to what extent, depends on the amount of slash on the trail. CTL operations may experience a small increase in detrimental soil conditions due to mechanical fuel treatments.

Effects of Underburning, Jackpot Burning, and Pile Burning in Harvest Units

The primary impact of jackpot burning to these soils would be a minor increase in erosion from the removal of soil cover. Both alternatives propose about 1,200-1,400 acres of jackpot and pile burning.

Erosion

Concentrations of slash would be burned. Small areas may burn hot enough to remove most of the soil cover, but these areas are typically small (less than 100 ft^2) and dispersed across the unit. Material eroded from these ‘hot spots’ would not move off the site. It would be deposited onto adjacent unburned and lightly burned areas.

Biological changes

High intensity fires may volatilize soil nutrients such as nitrogen and sulfur. The fire intensity proposed in Alternatives B and C would not be high enough to volatilize an appreciable amount of these plant nutrients. Typically cation plant nutrients (e.g., potassium, calcium, etc.) do not volatilize at the temperatures expected in these treatments. They remain in the ash, where they may be leached into the soil (Downer and Harter, 1979). Because of the amount of organic

matter to be left on the site, appreciable leaching is not expected to occur under either alternative.

Effects of 'Lop and Scatter', Whipfelling, and Handpiling Slash

None of these activities involve heavy equipment. Detrimental soil conditions do not occur as a result of these activities.

Effects of Combined Treatments

Most of the treatment areas will experience more than one treatment. Typically commercial timber harvest includes both the harvest and some fuel treatment. Compaction/erosion/ displacement on skid trails are far and away the most common detrimental soil conditions associated with the proposed actions. Mechanical fuel treatments generally do not increase the amount of detrimental soil conditions because the equipment is limited to the existing skid trails. Burning after harvest often increases detrimental soil conditions slightly.

Table 3-18. Detrimental Soil Conditions of Combined Treatments for Commercial Thinning and Precommercial Thinning with Optional Pole Removal.

Yarding system	Fuel Treatments		
	No fuel treatment and hand pile / burn	Mechanical pile / burn	Underburn and Jackpot burn
T	8-10%	8-12%	8-12%
CTL	8-10%	8-12%	8-10%
C	1-3%		1-5%

EFFECTS UNIQUE TO ALTERNATIVE B

Timber Harvest Activities

Alternative B proposes about 2,700 acres of commercial timber harvest, including small pole thinning.

- About 2,200 acres (80%) would be yarded with a ground-based system in the summer[20].
- About 300 acres (11%) would be yarded with ground-based system in the winter.
- About 200 acres (9%) would be yarded with a cable system.

The majority of the units proposed for treatment occur in both alternatives. The primary difference between the alternatives is not the specific effects, but the number of acres to which they apply.

Five units, totaling about 150 acres, occur in Alternative B but not in Alternative C. In addition, 4 units are larger in Alternative B than in Alternative C (about 70 acres). No special or unique conditions occur in these areas which would yield effects that are different than described in the effects common to both alternatives.

[20] Depending on conditions, the purchaser may request to log in the winter. If conditions are good, this request is generally honored.

Roads and Landings

Impacts to soil productivity, compaction, removal of the surface horizons, and displacement occur when roads are initially constructed. Changes in road drainage, addition of surfacing, etc. do not change the basic road 'footprint' and do not impact soil productivity.

Alternative B proposes about 0.8 miles of new road construction, impacting productivity on about 5 acres, and about 0.5 miles of temporary road, impacting productivity on about 1.5 acres.

Alternative B would require about 134 landings. Based on an individual unit review, it is estimated that about 40% of the landings would utilize existing roads and landings. About 19 acres would be developed into landings for this alternative.

EFFECTS UNIQUE TO ALTERNATIVE C

Timber Harvest

Alternative C proposes about 2,529 acres of commercial timber harvest, including small pole thinning.

- About 2,100 acres (80%) would be yarded with a ground-based system in the summer.
- About 270 acres (10%) would be yarded with ground-based system in the winter.
- About 250 acres (10%) would be yarded with a cable system.

The majority of the units proposed for treatment occur in both alternatives. The primary difference between the alternatives is not the specific effects, but the number of acres to which they apply.

One unit (Unit 1) occurs in Alternative C, but not in Alternative B.

Roads and Landings

Alternative C would construct about 0.2 miles of new road, impacting productivity on about 1 acre. No temporary roads are proposed in this alternative.

Alternative C would require about 128 landings. Based on an individual unit review, it is estimated that about 40% of the landings would utilize existing roads and landings. About 18 acres would be developed into landings for this alternative.

Cumulative Effects

Each proposed treatment area was examined for existing detrimental soil conditions. Transects were completed in some units to estimate existing detrimental soil conditions. For details on individual units, see the Soil Report.

Across the landscape, the most common causes of existing detrimental soil conditions are past logging, recreation, and livestock grazing. Within the proposed treatment areas, past logging was the primary cause of detrimental soil conditions.

Table 3-19. Summary of Cumulative Effects Expected

Proposed Treatments	Existing DSC	Estimated Resulting DSC	Acres	
			Alt. B	Alt. C
Commercial timber harvest with a ground-based yarding system, followed by mechanical piling, jackpot burning, or underburning.	0-5%	9-12%	1,885	1,710
	5-10%	10-16%	172	236
	10-15%	See table below	367	356
	>20%		69	69
Commercial timber harvest with a cable system, followed by underburning	0-5%	0-5%	193	151
	5-10%	5-10%	0	0
	10-15%	See table below	12	12
Fuel treatment underburn areas	0-5%	2-5%	4,439	4,439

VEGETATION TREATMENT AREAS

The detrimental soil conditions found in these units are mostly from past logging including roads (both authorized and unauthorized), skid roads, skid trails, and landings. In many cases the remnant logging features are suitable for reuse. The higher the level of existing detrimental soil conditions, the more features are generally available to be reused. Where these are reused, total detrimental soil conditions would increase by something less than the 8-10% increase from the direct effects. Each proposed harvest area was reviewed to consider whether existing landings, roads, skid trails, etc. would be likely to be reused during this entry. The previous table displays a summary of this analysis.

Units where the existing detrimental soil conditions exceed 10% were reviewed on a case-by-case basis. Both alternatives propose vegetation treatments in 11 units that currently exceed 10% detrimental soil conditions. The following units occur in both alternatives.

Table 3-20. Summary of Treatment Areas with High Existing Detrimental Soil Conditions

Unit	Acres	Treatment	Conclusion
21	18	HTH, ground, winter, MP	Group 2a, compaction is potentially high. Existing DSC[21] 11%, due to old roads. The old roads could be used as the main skid trails, a landing would have to be constructed. Winter logging would increase DSC about 1-2%. If grapple machine remains on existing roads, final DSC would be about 12-13%. Grapple piling off the old roads would increase DSC by about 5% resulting in a final DSC of about 18-20%.
28	69	HTH, ground, winter, underburn	Group 2a, compaction is potentially high. Existing DSC about 29%, due to roads, skid trails, old landings. It would be difficult to use the impacted areas effectively this entry. Existing landings acceptable for reuse. Winter logging required to prevent additional impacts. Final DSC about the same.
31	60	HTH, ground, winter, MP	Group 2a, compaction is potentially high. Existing DSC about 11% due to FR 2113400 and landings. Reuse landings. Winter logging and grapple piling expected to result in DSC of about 16-18%.
33	51	HTH, ground, winter, underburn	Groups 2a & 4, compaction is potentially moderate to high. Existing DSC about 11% due to old roads and landings. Reuse most of the landings, and most of the skid trails. Final DSC expected to be about 11-13%.
35	77 (B) 66 (C)	HTH, ground, winter, MP	Group 2a, compaction is potentially high. Existing DSC about 11%, old roads, landings, skid trails. Reuse roads, landings, skid trails. Winter logging expected to increase DSC to about 12%. MP off trails would increase to about 17-19%.
39	40	SPT, ground, MP	Group 4, compaction is potentially moderate. Existing DSC about 12% due to skid trails. If equipment stays on existing trails, DSC to remain about 12%.
43	29	SPT, ground, MP	Group 4, compaction is potentially moderate to low. Existing DSC about 11%, skid trails. If equipment stays on existing trails, DSC to remain about 11%.
44	59	SPT, ground, MP	Group 4, compaction is potentially moderate to low. Existing DSC about 11%, skid trails. If equipment stays on existing trails, DSC to remain about 11%.
65	12	HTH, cable, underburn	Group 2a, compaction is potentially moderate to high. Existing DSC about 14%, FR 2114035 and landing. Would require 1 new landing. Final DSC expected to be about 16-18%.
69	5	SPT, ground, handpile	Group 2a, compaction is potentially moderate to high. Existing DSC about 15%, roads and livestock. Combine with adjacent unit 22 into a single activity area. When combined, final DSC expected to be about 10%.
71	28	HTH, ground, winter, MP	Group 2a, compaction is potentially moderate to high. Existing DSC about 11%, roads, skid trails, landings. Winter logging expected to increase DSC to about 12%. MP off trails would increase to about 17-19%.
P	287	Burn	Existing DSC about 2%. After treatment, DSC to be about 5%.

Summary

None of the units that occur only in either Alternative B or only in Alternative C have high levels of existing DSC. Furthermore, both action alternatives meet the Forest Plan standards for soil conditions.

[21] Detrimental soil conditions

NOXIOUS WEEDS

Information provided in this Environmental Assessment about noxious weeds is excerpted from the *Vulcan Vegetation Management Project Noxious Weed Report* by Kelvin Davis, October 30, 2006. The full text of this report is incorporated by reference. The Noxious Weeds Report describes the current and desired conditions with regards to noxious weeds in the Vulcan Project area. It also describes and compares the environmental effects associated with the various alternatives (Alternative A—No Action, Alternative B—Proposed Action, and Alternative C). Measures intended to mitigate adverse effects are also included.

Existing Conditions

As indicated in the table below, several weeds are present. Diffuse knapweed is found along roads and on open sites on the Vulcan Face. In some locations, the knapweeds are exceeding the damage threshold[22] for competing with desirable vegetation, including species desirable for wildlife and livestock forage.

Musk thistle is found primarily along the forest boundary on state lands and federal lands near Louie Springs.

[22] One of the measures used in determining management strategies for noxious weeds is the **damage threshold**. The damage threshold for a given noxious weed occurs at the point when the noxious weed is out-competing desirable vegetation on a given site. It is also the point when a large amount of wildlife and livestock forage is being lost.

Table 3-21. Noxious Weed Species, Abundance, and Class within the Project Area.

Common Name	Scientific Name	Status on NFS lands within Project Area	Acres	Noxious Weed list status
Musk thistle	***Carduus acanthoides***	Invader	0.4	B non-designate
Diffuse knapweed	***Centaurea diffusa***	Established on dry openings; Invader in new openings and disturbances	65.7	B non-designate
Canada thistle	***Cirsium arvense***	Invader	Present/unknown	C
Bull thistle	***Cirsium vulgare***	Invader on new disturbances	Present/unknown	C
Hounds tongue	***Cynoglossum officinale***	Invader	98.3	B non-designate
Hoary Alyssum	***Berteroa incana***	Invader	25.3	B non-designate
Orange hawkweed	***Hieracium aurantiacum***	Invader, becoming established along roads	120.8	B designate
Yellow hawkweed	***Hieracium pratense***	Invader	2.8	B designate
Goatweed (St. Johnswort)	***Hypericum perforatum***	Invader, becoming established in dry openings and rock outcrops	321	C
Dalmatian toadflax	***Linaria genistifolia***	Invader	Present/unknown	B non-designate
Tansy Ragwort	***Senecio jacobaea***	Invader	0.2	B designate
Common mullein	***Verbascum thapsus***	Invader on newly disturbed or poor condition sites	Present/unknown	C

One site of tansy ragwort is along Forest Road 2113-800. Surveys show no sign of tansy ragwort since treatment.

Yellow and orange hawkweed can be found for the most part along road shoulders. As hawkweeds infest road corridors, some locations may exceed the damage threshold for out-competing more desirable vegetation species that provide road shoulder stability and sediment trapping abilities. More monitoring is necessary to determine the effects of hawkweeds' invasion of forested plant communities along old roads and skid trails.

Houndstongue has invaded the project area since the 1980's and the Vulcan area is one of the first places this species was found.

Several Class C noxious weeds, including goatweed, Canada thistle, bull thistle, and common mullein can be found throughout the Vulcan Project area. Populations of goatweed tend to ebb

and flow with climatic conditions, which influence soil moisture conditions and sustainability of biological control agents, such as the goatweed beetle. Goatweed was found in many of the same dry, open sites as diffuse knapweed. Canada thistle and bull thistle are found in scattered locations, but primarily in the first years after ground disturbing activities. Common mullein, as individual plants or scattered populations, also occupies these same types of disturbed sites, as well as dry, poor condition sites throughout the project area. As these disturbed sites become stable or improve in productivity, these pioneering (colonizing) noxious weeds give way to other species of vegetation.

One of the greatest contributors to the spread of noxious weeds, if there are nearby seed sources, is the number of roads open to vehicular access. The analysis area currently has 45.8 miles of road open to motorized travel. The highest risk of weed spread is associated with roads that are accessible to all types of vehicles (cars, trucks, all-terrain vehicles, mountain bikes, motorcycles, etc.). Next highest risk is roads that are closed to vehicles greater than 40 inches in width but are open to all other vehicles. At the lower end of the spectrum (but still at risk) are trails that normally are closed to motorized use by regulation. Many of these trails are still used by off-highway vehicles and motorcycles, but are at lower risk due to the reduced level of traffic associated with them. The analysis area has 38.8 miles of level one or closed roads.

The existing dense forest canopy on undisturbed timbered sites provides a natural deterrent to noxious weed invasion. The noxious weeds identified above are not generally shade tolerant, although common houndstongue, spotted knapweed, and orange hawkweed can be found in shade. Where there is an existing understory, and especially where it receives little disruption, vigorous regrowth of forest vegetation will also deter noxious weed invasion. This is especially true of sites with greater than 25 % pine grass or with a dense, shrubby understory.

There is high economical and successful effectiveness of treating most noxious weeds with the use of herbicide under the existing treatment environmental assessment (*Preventing and Managing Invasive Plants Environmental Impact Statement and Record of Decision (October 11, 2005*). However, follow-up treatment is essential because of missed weeds, re-invasion, and viable seed sources in the soil. Mechanical treatments are most often successful in small populations, with weeds that won't sprout after pulling. Biological agents have been successful in dalmatian toadflax, goatweed, and musk thistle. While the biological agents reduce populations, eradication of weeds with biological agents will not occur. Timber sale provisions for cleaning equipment and collecting deposits for noxious weed treatment have been highly effective in reducing and treating noxious weeds.

Direct and Indirect Effects of the Alternatives

ALTERNATIVE A (NO ACTION)

Orange and yellow hawkweeds have occupied sites on approximately 125 acres since 1998. This represents an average increase of approximately 14 acres per year. Given the same abilities and funding to treat these weeds, the future extent of these weeds could be as much as 140 acres or less than 1% of the planning area in the next 10 years. This is based upon likely unknown sites and existing sites that get missed during follow-up treatments and the ability of the weed to spread both by rhizomes and seed dispersal.

Diffuse knapweed infestations have occurred in the planning area since the 1980's. Since weed treatment began in 1992, population levels have remained somewhat stable. With treatment following project activities, knapweeds are not expected to increase beyond current levels of 66 acres or less than 1% of the planning area.

Houndstongue populations have increased at the rate of 2 acres per year in the planning area since the 1980's. Not all populations have been mapped with global positioning systems. Houndstongue would increase due to uncontrollable seed dispersal by a number of agents including humans, wildlife, and livestock. The population would be expected to double in the next ten years to 200 acres or 1% of the planning area.

Hoary alyssum is established on roads leading into the project area and has been treated since 2005. Based upon visual observation around the Curlew area, spread is rapid due to high quantity of seed production. There currently is 25 acres of infestation or 0.1% of the area.

There would be little additional increase in the extent of dalmatian toadflax, musk thistle, and goatweed because these weeds have effective biological agents and existing populations are manageable.

ALTERNATIVES B AND C

In the action alternatives, there would be road maintenance funds collected under the timber sale contract for noxious weed treatment along haul routes. There would also be contract provisions for cleaning equipment.

Creating more open stands would provide a more favorable environment for noxious weeds to become established. Although most weeds normally do not compete well with native vegetation in shaded environments, it is anticipated that the thinning treatments will not provide enough shade in most areas to deter noxious weed establishment. Therefore, the disturbed areas would be at moderate risk for infestation if seed sources for weeds, such as knapweed, hawkweed, houndstongue, and goatweed, are readily available. Timely implementation of mitigation measures would likely reduce this risk to acceptable levels.

Disturbed areas would create a seedbed readily susceptible to noxious weed invasion. In order to minimize the risk of noxious weeds becoming established on these areas it is critical that seeding of disturbed sites be accomplished as soon as possible after the activity is complete. For natural hazard-fuels[23] burning activities, the expectation is that exposure of mineral soil will be widely scattered, the areas of bare soil would be small in size, and that re-colonization by native plants will occur rapidly.

For the effects analysis on the action alternatives, the estimated maximum area of disturbance to mineral soil will be as follows:

[23] The term **natural hazard-fuels** refers to fuels that accumulate naturally, as opposed to fuels that accumulate as a result of logging or other activity (called **activity fuels**).

Table 3-22. Estimated Maximum Disturbance Chart[24]

Tractor Harvest	5% of activity area
Skyline Harvest and Helicopter	2% of activity area
Road Construction & Reconstruction	24 feet wide for length of road
Road Obliteration/Decommissioning/Abandonment	24 feet wide for length of road
Road Maintenance	15 feet wide for length of road
Prescribed burning	3% of activity area
Grazing*	3% of activity area
Mining (mines, gravel pits, borrow sites etc.)	100% of activity area

*Soil disturbance as a result of grazing activities is based upon soil effects analysis on range projects. Considering water developments, trails, salting areas, and corrals, disturbance ranged between 1% and 3%.

Table 3-23. Estimated Maximum Disturbance Chart for Alternative B

Disturbance Activity	Acres of disturbed soil
Tractor Harvest 2,442 Acres , Tractor/Cable 45 acres	124
Skyline Harvest 206 Acres and Helicopter 0 Acres	4
Road Construction 1 Miles/Reconstruction miles 33 Miles	99
Road Obliteration/decommission/abandonment (1 Miles)	3
Road Maintenance (10.2 miles re-opened roads)	18
Natural Fuels, controlled burning 4,936 Acres	148
Prescribed burning (Slash and Mechanical) 1,596 Acres	48
Borrow Pit (0 acres)	0
Total	444

There would be 444 acres of disturbed soil available for invasion by noxious weeds or an additional 3.1% of the planning area under Alternative B.

Table 3-24. Estimated Increase in Weeds Chart for Alternative B

Disturbance Action	Extent Acres
Road Construction/reconstruction	15
Harvesting	113
Burning	180 (109 acres same as harvest acres)
Total	308

[24] Source: *Method for Evaluating Soil Disturbance for Various Timber Harvest Alternatives*, by Duane Dipert, Soil Scientist, Colville National Forest, 1990.

Table 3-25. Estimated Maximum Disturbance Chart for Alternative C

Disturbance Activity	Acres of disturbed soil
Tractor Harvest 2,320 Acres , Tractor/Cable 45 acres	118
Skyline Harvest 163 Acres and Helicopter 0 Acres	3
Road Construction & Reconstruction miles 33 Miles	99
Road Obliteration/decommission/abandonment (1 miles)	3
Road Maintenance (9.9 miles re-opened roads)	18
Natural Fuels, controlled burning 4,936 Acres	148
Prescribed burning (Slash and Mechanical) 1,618 Acres	48
Borrow Pits (0 acres)	0
Total	437

There would be 437 acres of disturbed soil available for invasion by noxious weeds or an additional 3.1% of the planning area under Alternative C.

Table 3-26. Estimated Increase in Weeds Chart for Alternative C

Disturbance Action	Extent Acres
Road Construction/reconstruction	15
Harvesting	116
Burning	180 (109 acres same as harvest acres)
Total	311

EFFECTS COMMON TO ALTERNATIVES B AND C

In addition to the area in Alternative A, there would be 3 acres of hoary alyssum disturbed by road construction/re-construction, 6 acres disturbed by harvest and burning, and 8 acres disturbed by burning in natural fuels areas. The increase in extent would be dependent upon the timing of the disturbance. The extent of hoary alyssum would not increase if the plants were not in bloom. The extent of hoary alyssum would increase substantially if they were seeded out.

In addition to the area in Alternative A, there would be 7 acres of houndstongue disturbed by road construction/re-construction, 6 acres disturbed by harvest and burning, and 10 acres disturbed by burning in natural fuels areas. The increase in extent would be dependent upon the timing of the disturbance. The extent would not increase if they were not in bloom but would increase substantially if they were seeded out.

In addition to the area in Alternative A, there would be 1 acre of orange or yellow hawkweeds disturbed by road construction/re-construction, 2 acres by harvesting and burning, and 1 acres disturbed by burning in natural fuels areas. The increase in extent would be dependent upon the timing of the disturbance. The extent of hawkweeds would increase somewhat if hawkweeds were not in bloom. The extent of hawkweeds would increase substantially if hawkweeds were in bloom.

In addition to the area in Alternative A, there would be 3 acres of knapweeds disturbed by road construction/re-construction, 2 acres by harvesting and burning, and 13 acres

disturbed by burning in natural fuels areas. The increase in extent would be dependent upon the timing of the disturbance. The extent of knapweeds would increase 27% per year if knapweeds were in bloom and spread around by equipment, and/or if equipment disturbed seeds already stored in the soil. During the life of the project (5 years), this would represent 83 acres or 0.4% of the planning area including other populations.

Mitigation measures to conduct inspections of these areas prior to harvest activity, cleaning of felling and skidding equipment, supplemental grass seeding, and post sale noxious weed treatments would minimize the introduction and spread of noxious weeds and would reduce the increase in extent of these weeds.

The effects on the increase of dalmatian toadflax, musk thistle, and goatweed would be the same as under Alternative A.

Cumulative Effects

The boundary of the cumulative effects area is defined as the area bounded by the Kettle River. The road systems within the area were chosen because they are the primary vectors of noxious weed spread.

Table 3-27. Past, Present, and Foreseeable Estimated Maximum Disturbance Chart

Disturbance Activity	Acres of Disturbed Soil
Harvest (1,850 acres)	92
Road Maintenance (223 miles)	405
Road Construction/Reconstruction (0 miles)	0
Road Obliteration/decommission/abandonment (0 miles)	0
Burning (0 acres)	0
Grazing (47,128 acres)	1,414
Mining (68 acres)	68
Total	1,979

There have been and will continue to be in the foreseeable future: harvest activities, recreational use, livestock use, prescribed burning, wildfires, noxious weed treatment, road decommissioning, road maintenance, and mining.

Alternative B would add 444 acres of additional disturbance to 1,979 acres of existing and future disturbance or an increase of 22.4% and Alternative C would add 437 acres or an increase of 22.1%.

Alternative B is expected to add an additional 308 acres (Table 3-21) to 635 acres of noxious weeds or an increase of 48.5% and Alternative C would add 311 acres (Table 3-23) or an increase of 48.9%.

Noxious weeds would continue to increase with recreational use, including firewood gatherers, driving for pleasure, hunting, off-highway vehicle users, and berry pickers. Off-highway vehicle trails would likely increase in the area under new policies which would substantially increase the chance of noxious weed invasion.

Noxious weeds would increase in areas with current weed populations due to wildfires and subsequent suppression activities under all alternatives.

HERITAGE

Information provided in this Environmental Assessment about heritage resources is excerpted from the *Vulcan Vegetation Management Project Heritage Report* by Steve Kramer, December 14, 2006. The full text of this report is incorporated by reference. The Heritage Report describes the current and desired conditions with regards to heritage resources in the Vulcan Project area. It also describes and compares the environmental effects associated with the various alternatives (Alternative A—No Action, Alternative B—Proposed Action, and Alternative C). Measures intended to mitigate adverse effects are also included.

Existing Conditions

There are five identified historic properties within the proposed treatment area. Of these, four historic properties are located within or near identified planning units, and have the potential to be affected.

Past management practices have not identified any of these properties as evaluated for their eligibility to the National Register of Historic Places. Historic properties that are unevaluated are managed as if eligible, and mitigations for these properties will follow management prescriptions as specified.

Direct and Indirect Effects of the Alternatives

ALTERNATIVE A (NO ACTION)

There would be no change from the current condition. Historic properties would continue to gradually deteriorate over time, subject primarily to natural forces.

ALTERNATIVES B AND C

The following four heritage sites have the potential to be impacted under both Alternatives B and C:

06210400109 Management Class 2
06210400186 Management Class 2
06210400187 Management Class 2
06210400201 Management Class 2

Project activities have the potential to damage or destroy these four sites directly by heavy machinery, falling trees, road building, fuels treatments, etc., or indirectly as a result of discovery and increased access to each site.

Having a buffer left around each one of the sites will protect the Management Class 2 sites. The size of the buffer will vary based on site-specific circumstances dealing with yarding methods and site vulnerability. With the buffering, each site will be protected. This will

reduce the volume available in each unit by a small amount, and may influence how the logs are yarded adjacent to each site.

Cumulative Effects

Under the No Action Alternative (A), continued buildup of fuels from downed woody debris and from the density of trees could cause an adverse effect to historic properties. Unchecked fire within the planning area would destroy standing and downed historical structures, affecting National Register eligibility characteristics of these historic properties.

Under Alternatives B and C, historic properties within the planning area will experience minimal cumulative effects.

RANGE

Information provided in this Environmental Assessment about rangeland grazing is excerpted from *the Vulcan Vegetation Management Project Range Report* by Kelvin Davis, October 30, 2006. The full text of this report is incorporated by reference. The Range Report describes the current and desired conditions with regards to rangeland and domestic livestock grazing in the Vulcan Project area. It also describes and compares the environmental effects associated with the various alternatives (Alternative A—No Action, Alternative B—Proposed Action, and Alternative C). Measures intended to mitigate adverse effects are also included.

Existing Condition

The earliest record of permitted livestock use for the Vulcan Allotment is 1930. Both cattle and horses were run on the allotment until 1945 when the allotment changed to cattle only. Numbers of cattle have ranged from 277 to 432 cow/calf pairs. A three pasture rotation system was implemented in 1981 with completion of pasture fence construction.

There are known stock driveways within the analysis area, however, none have been mapped with the global positioning system. There are some Level 1 roads that are being used for stock driveways, some of which have been closed to vehicular traffic. There are 38 existing spring developments, and approximately 27 miles of interior and boundary fence maintained by the permittees within the analysis area. Primary range is considered to be the open grasslands and areas of ponderosa pine, Douglas-fir and bluebunch wheatgrass. The remaining suitable range is transitory range created by past harvest. The season of use is June 1 thru October 15 with a three pasture deferred rotation system. The stocking rate is 432 cow/calf pairs.

Direct and Indirect Effects of the Alternatives

ALTERNATIVE A (NO ACTION)

Over the short-term, selection of Alternative A will result in little or no change in the range resource as it exists today. There would be no increase in road and stream crossings which would provide access to riparian areas by livestock. There would be no effect on current natural barriers providing allotment and pasture boundaries.

The opportunity to improve the range resource (construction of improvements) through Sale Area Improvement funds would not be realized. The most evident effect of this alternative to

the range resource would be the loss of the opportunity to improve and expand the upland grazing areas available and accessible to livestock. There would be no effect on primary range and no increase or decrease in transitory range.

ALTERNATIVES B AND C

There would be no access to riparian areas created by new road construction under both Alternatives B and C. There would also be no new accessible riparian areas because of harvest or burning.

Approximately 0.8 miles of new road construction under Alternative B and 0.2 miles of new road construction under Alternative C are proposed in the Vulcan Project. Both alternatives propose decommissioning approximately 1.0 mile of road. There would be no effect on permittee operations due to the decommissioned road. Permittees would still be able to access their improvements and move livestock between units.

These alternatives would result in an improvement in grazing opportunities in transitory range. The creation of 2,262 acres (Alternative B) or 2,227 acres (Alternative C) of more-open stands available to cattle would improve forage availability for livestock. This would be expected to last for 10-15 years depending on when early structure stand tree canopies close and older structure stands regenerate understories.

All burning outside harvest units would take place on primary range. Non-forest lands are typically primary range, which is the first forage used by livestock. These rangelands are normally best utilized in the spring and early summer. The greatest impacts to use of primary range would be with spring burning (after May 1) and prior to October 15. Mitigation to eliminate burning during this period and burning less than 1/3 of the area per year in pastures 1 and 2 would reduce the impacts to permittees (Range Mitigations #1 and 2).

Burning in rangelands where older, decadent shrubs occur or where conifers are encroaching would improve rangelands over the long term.

There would be no impact to range improvements with mitigation to protect improvements during harvest and burning activities.

There would be no adverse effect on primary rangelands.

Cumulative Effects

The cumulative effects of past timber harvest, roading activity, and increased recreational use and development have all complicated the management of grazing within the analysis area.

In addition, between approximately 1975 and 1995 there has been a dramatic increase in the amount of roads and timber harvest units that provide access to riparian areas. In the past, many of these activities also prescribed the use of palatable forage species when seeding for erosion control. This created an environment that attracted cattle into riparian areas and provided desirable forage that kept them in these areas rather than moving on to natural upland range areas. However, past timber harvest activities have had a positive effect on grazing on these allotments. Timber harvest created openings in the forest which temporarily provided

additional forage for livestock. When this transitory range is available, it reduces grazing pressure on primary and secondary range. Greatly reduced timber harvest levels (as compared to ten years ago) plus the switch from regeneration harvesting (clearcut, seed tree, and shelterwood treatments) to intermediate harvests (thinning) has decreased the number of openings being created in the forest and the resulting available forage.

The No Action Alternative does nothing to reverse the condition of declining transitory range that is being lost as past timber harvest areas and natural meadows become occupied by trees. Declining transitory forage gradually leads to decreasing numbers of cattle, decreasing season of use, or to increasing pressure on primary range and/or lowland riparian areas. This declining forage availability will likely lead to increasingly complicated management, which could lead to or contribute to reduced grazing on public lands in the project area. This reduced grazing could lead to increased difficulty in the permittees continuing in the livestock business, and could contribute to a decline in the ranching lifestyle and its contribution to the local economy.

Alternatives B and C, on the other hand, should improve transitory range and make permit management less complicated. As a result, the action alternatives, in a small way, are expected to help the permittees stay in the livestock grazing business, which in turn should help maintain the grazing industry locally, and should help maintain the ranching lifestyle and the local economy.

RECREATION

Information provided in this Environmental Assessment about recreation is excerpted from the *Vulcan Vegetation Management Project Recreation Report* by Jann Bodie, July 25, 2006. The full text of this report is incorporated by reference. The Recreation Report describes the current conditions and Forest Plan direction with regards to recreational activities in the Vulcan Project area. It also describes and compares the environmental effects associated with the various alternatives (Alternative A—No Action, Alternative B—Proposed Action, and Alternative C). Measures intended to mitigate adverse effects are also included.

Existing Conditions

Recreation in the Vulcan Project area consists mostly of firewood cutting and spring/fall hunting activity which results in the utilization of dispersed camping sites. Vulcan is also known for an abundance of wildlife and provides multiple viewing and photography opportunities. Driving for pleasure to enjoy the scenic views of the Kettle River Valley is also a popular recreation activity for the local population. There are no developed recreation sites or system trails within the planning area. Approximately 10 undeveloped campsites are established along Forest Road 2114, with a few more scattered elsewhere in the planning area. They provide staging areas for those wishing to recreate including hunters, off-highway vehicle users, hikers, berry pickers, forest product gatherers, picnickers, wildlife viewers, and pleasure drivers.

Direct and Indirect Effects of Alternatives

ALTERNATIVE A (NO ACTION)

The No Action Alternative would not alter or affect current recreation activities.

ALTERNATIVES B AND C

Under either of the action alternatives, there are no foreseeable long term negative effects. Long term, there should be an increase in visual variety as there will be an increase in large trees, variation in tree size, and more visible shrubs and grass.

In the short term, a reduced quality of the recreation experience would result from noise, dust and smoke. The presence of harvesting equipment and log trucks should be expected to last through 3 to 5 seasons and is expected to result in displacement of visitors wishing to visit a quiet forest setting.

No new road closures are proposed, and therefore, no change in recreation use patterns are expected.

There would be no adverse effects to recreation by the activities proposed in the project area.

Effects Regarding Applicable Forest Plan Standards

All alternatives are consistent with the Forest Plan management area prescriptions for recreation and trails. Forest Plan standards would be met under all of the alternatives for recreation and trails. Activities adjacent to dispersed sites and roads will follow Forest Plan guidelines. The area will continue to provide a spectrum of recreation experiences compatible with the Roaded Natural and Roaded Modified ROS classes. Harvest activities and fuels treatments are mitigated to limit the exposure of the forest visitor and provide for an appropriate experience particularly during times of expected high use.

SENSITIVE PLANTS

Information provided in this Environmental Assessment about sensitive plants is excerpted from the *Vulcan Vegetation Management Project Sensitive Plant Species Report* by Kathy Ahlenslager, June 13, 2006. The full text of this report is incorporated by reference. The Sensitive Plants Report describes the existing conditions with regards to sensitive plants potentially found in the Vulcan Project area. It also describes and compares the environmental effects associated with the various alternatives (Alternative A—No Action, Alternative B—Proposed Action, and Alternative C). Measures intended to mitigate adverse effects are also included.

Existing Condition

No federally listed threatened or endangered plants or plants proposed for federal listing are known to occur in the analysis area. Fifty-four plant species listed on the Regional Forester's Sensitive Species List are documented or suspected for the Colville National Forest. Two of these, in three populations, were known from the project area: crenulate moonwort (*Botrychium crenulatum*) and small northern bog-orchid (*Planthera obtusata*). In addition, potential habitat

exists in the analysis area for another 38 suspected sensitive plant species (USDA, 2006; WNHP 2006; WNHP and USDI 2006). Sensitive plant surveys resulted in the documentation of one new site for kidney-leaved violet (*Viola renifolia*).

Direct and Indirect Effects of the Alternatives

ALTERNATIVE A (NO ACTION)

The no action alternative would continue with current management practices. For this alternative the likelihood of adverse effects is considered to be "Low" (1) and the consequence of adverse effects is "Low" (1). The resulting risk assessment value is 1--proceed with the project as planned.

ALTERNATIVES B AND C

Proposed treatment units for Alternatives B and C are similar regarding those that could negatively affect sensitive plants. Unit 31, proposed for commercial harvesting, overlaps a site with crenulate moonwort. Removal of trees within 100 feet of these plants will affect the canopy cover of the site and could negatively affect this plant population. A natural fuels unit (Unit C) is planned 250 feet northeast of this sensitive plant site.

Unit 39, proposed for small pole thinning, overlaps sites with crenulate moonwort and kidney-leaved violet. Removal of trees within 100 feet of these populations will affect the canopy cover of the sites and could negatively affect the two plant populations. A natural fuels unit (Unit N) is planned 23 feet northeast of this sensitive plant site. Unit 46 is proposed for small pole thinning and is within 196 feet of a small northern bog-orchid site.

No sensitive plants are known to occur in any of the other proposed timber harvest or fuel treatment units that were surveyed. Since all action alternatives will result in a net improvement to future single storied old-growth habitat conditions through restoration activities (timber harvest and prescribed burning), no long-term adverse affects of the timber harvest or fuel treatments on sensitive plant species are expected, except where there are known sensitive plants.

For the two action alternatives B and C, the likelihood of adverse effects is considered to be "Moderate" (5). The consequence of adverse effects is rated as "Moderate" (5), because of possible effects to populations of crenulate moonwort and kidney-leaved violet. The resulting risk assessment value is 25--modify the project if feasible to reduce risk.

By implementing the mitigation measures for Alternatives B and C, it is anticipated that the sensitive plant populations located within the project area will maintain at least present population levels and viability. The likelihood of adverse effects is decreased to "Low" (1). The consequence of adverse effects is "Moderate" (5) because of possible effects to the plants or habitat. The resulting risk assessment value is 5--proceed with the project as planned.

All alternatives may have an impact on individuals, but are not likely to cause a trend to federal listing or loss of viability because mitigation measures will be implemented.

Cumulative Effects

There should be no negative cumulative effects from activities proposed in any of the alternatives, as long as the mitigation measures are followed. Since sensitive plants in northeastern Washington have evolved with fire, there should be no negative long-term cumulative effects from fire treatments. There are no regulations to protect sensitive plants on private land. The Forest Service's determination that this project is "not likely to cause a trend toward federal listing or loss of viability" is based upon known occurrences on federal lands alone.

VISUAL QUALITY

Information provided in this Environmental Assessment about visual quality is excerpted from *Visual Effects Analysis, Vulcan Vegetation Management Project* by Larry Besemann, July 27, 2006. The full text of this report is incorporated by reference. The Visual Quality Report describes the current and desired conditions with regards to visual quality in the Vulcan Project area. It also describes and compares the environmental effects associated with the various alternatives (Alternative A—No Action, Alternative B—Proposed Action, and Alternative C). Measures intended to mitigate adverse effects are also included.

Existing Conditions

The Vulcan Project area is typical of the Okanogan Highlands character type[25]. Stands on north facing slopes tend to be dense with continuous canopy while south facing slopes tend to be more open with breaks in the canopy. The overall appearance of the project area is a mixture of natural-appearing and logged forestlands, including undisturbed areas that are considered a scenic feature of the landscape.

The dominant human processes that affect the visual quality of the landscape are road building, natural resource based industries (agriculture, timber harvesting, and mining) and fire suppression. Fire suppression has altered the vegetative structure of the landscape by modifying species diversity and stocking levels.

The designated Retention and Partial Retention Visual Quality Objective[26] areas generally meet the Natural Appearing designation and all other areas meet the "Altered" classification. This ranking does not include private lands.

The primary travel ways and use areas of visual concern are as follows:

[25] A **character type** is a large physiographic area of land that has common characteristics of landforms, rock formations, water forms, and vegetative patterns.

[26] **Visual Quality Objectives (VQO)** are categories of acceptable landscape alteration measured in degrees of deviation from the natural-appearing landscape. In **Retention** VQO, human activities are not evident to the casual Forest visitor. In **Partial Retention** VQO, human activity may be evident, but must remain subordinate to the characteristic landscape. In **Modification** VQO, human activity may dominate the characteristic landscape, but must, at the same time, follow naturally established for, line, color, and texture. It should appear as a natural occurrence when viewed in foreground or middleground. Under **Maximum Modification** VQO human activity may dominate the characteristic landscape, but should appear as a natural occurrence when viewed as background.

- Washington State Highway 21 and County Road 501 (Kettle River Road), 602 (Boulder/Deer Creek), and British Columbia 3 corridors are Concern Level 1 Primary Travel Ways. These travel routes are designated as Level 1 Primary Travel Ways due to regional importance and high public interest in the scenery. The National Forest System lands in the Vulcan Project area are seen at a middleground[27] and background[28] distances from these highways.

- Kettle Crest Trail is also a Concern Level 1 Primary Travel Way.

- County Road 502 (Toroda) is a Concern Level II Travel Way.

The following statements describe the visual situation relating to the specific management areas within the Vulcan Project area.

- Management Area 1 (old growth dependent species habitat emphasis) is 786 acres and represents 4% of the project area. Management Area 1 standard is "a range of visual quality objectives that are consistent with management objectives for the area." A small portion of the area can be seen from middle ground viewing. Almost all of the area can be seen from the back ground. All of Management Area 1 can be seen from any Concern Level 1 road. A small portion can be seen from a Concern Level 2 County Road 502 (Toroda).

- Management Area 5 (scenic/timber emphasis) is 2,802 acres and represents 14% of the project area. In Management Area 5, the visual quality objectives are Partial Retention (based on the Colville National Forest Visual Quality Objective GIS layer). A small portion of the area can be seen from a middle and background viewing distance from Concern Level I road, County Road 501 (Kettle River Road).

- Management Area 6 (scenic/winter range emphasis) is 2,196 acres and represents 11% of the project area with a visual quality objective of Retention or Partial Retention. Most of Management Area 6 can be seen from a middle and background viewing distance. Individuals on Concern Level 1 road, County Road 501, would see most of the area.

- Management Area 7 (wood/forage emphasis) is 2,630 acres and represents 13% of the project area with a Modification VQO (visual quality objective). Most of this management area can be seen from Concern Level 1 roads, County Roads 501 (Kettle River Road) and 602 (Boulder/Deer Road), and can barely be seen in the middle ground from Concern Level 2 areas.

- Management Area 8 (winter range emphasis) is 8,863 acres and represents 43% of the project area with a Modification VQO. Most of this area can be seen in the back ground. This management area can be seen from Concern Level 1 road, County Road 602 (Boulder/Deer Road), and cannot be seen in the middle ground from Concern Level 2 areas.

[27] **Middleground** viewing distance is from 1/4-1/2 to 3-5 miles from the viewer.
[28] **Background** viewing distance is from 3-5 miles to infinity.

Direct and Indirect Effects of the Alternatives

ALTERNATIVE A (NO ACTION)

In general, no immediate change would occur in the quality of the scenic resources. While no proposed activities would occur in the No Action Alternative and consequently no immediate change in landscape appearance, in the long-term, due to the high risk of stand-replacing wildfire, this appearance may not be sustainable.

ALTERNATIVES B AND C

Road Construction Activities

Unauthorized roads within the planning area would be opened and used as temporary roads. In Alternative B, the proposed 0.6 mile of road construction that would access Units 18 and 19 has the potential to be seen from County Road 602 in the background viewing distance. The visual quality objective (VQO) is Partial Retention. Therefore, construction of the road will occur along the topographic break to minimize any views of the road opening.

Alternatives B and C propose 0.2 mile of road construction to access Unit 37. The proposed road construction does not have the frequency of views or the topographic concerns that would negatively affect the natural appearance of the scenery.
All road reconstruction activities would meet Forest Plan standards for visual quality.

Timber Cutting

For the purposes of this analysis, the term “timber cutting” includes all commercial thinning, small pole thinning, and precommercial thinning. At all viewing zones except the immediate foreground, it is expected that these treatments would be seen as nothing more than a textural change in the forest canopy.

Skyline logging has the potential to introduce vertical lines through treated stands; the cable units would be potentially visible from any Concern Level 1 Travel Ways or use area. However, because of the long viewing distance involved, this treatment would be nearly impossible to detect.

Timber Cutting Visible from Concern Level 1 Areas:

Analysis indicates that the project area would not be visible at a foreground viewing distance from either State Highway 21, County Road 501, and 602 (Boulder/Deer).

Under Alternative B, areas visible from:

- State Highway 21: Commercial Thinning Units 2, 4, 6, 7, 8, 9, 17, 18, 19, 20, 21, 22, 23, 24, 29, 32, 33, 65, 68, 171, and 172; Small Pole Thinning Units 10 and 69; and Precommercial Thinning Unit: 67.

- County Road 501: Commercial Thinning Units 22, 24, 32, and 65; Small Pole Thinning Unit 69.

- County Road 502: Commercial Thinning Units 1 and 49; Small Pole Thinning Units 46 and 47; and Precommercial Thinning Units 50.

- County Road 602: a portion of Commercial Thinning Units 2, 3, 4, 6, 7, 8, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 27, 29, 30, 31, 32, 33, 34, 35, 49, 53, 54, 65, 66, 68, 71, 171, and 172; Small Pole Thinning Unit 69; and Precommercial Thinning Units 55, 67, and 72 would be potentially visible at the background viewing distance.

Under Alternative C, areas visible from:

- State Highway 21: Commercial Thinning Units 2, 4, 6, 7, 8, 9, 17, 20, 21, 22, 23, 24, 32, 33, 65, 68, 171 and 172; Small Pole Thinning Units 10 and 69; and Precommercial Thinning Unit 67.

- County Road 501: Commercial Thinning Units 22, 24, 32, and 65; Small Pole Thinning Unit 69.

- County Road 502: Commercial Thinning Units 1 and 49; Small Pole Thinning Units 46 and 47; and Precommercial Thinning Units 50.

- County Road 602: Commercial Thinning Units 2, 3, 4, 6, 7, 8, 16, 17, 20, 21, 22, 23, 24, 25, 30, 31, 32, 33, 34, 35, 49, 53, 65, 66, 68, 71, 171, and 172; Small Pole Thinning Unit 69; and Precommercial Units 55, 67 and 72 would be potentially visible at the background viewing distance.

Timber cutting visible from the Kettle Crest Trail (13):

- Under Alternative B, Kettle Crest Trail, Point 1 (Arcview analysis) a portion of units: 2, 3, 4, 5, 6, 7, 8, 9, 10, 17, 18, 19, 20, 21, 22, 23, 24, 25, 27, 28, 29, 30, 31, 32, 33, 34, 35, 53, 54, 55, 65, 66, 67, 68, 69, 71, 72, 171, and 172 would be visible from the background viewing distance. Viewing distance is from 12 to 17 miles.

- Under Alternative C, Kettle Crest Trail, Point 1 (Arcview analysis) a portion of units: 2, 3, 4, 5, 6, 7, 8, 9, 10, 17, 20, 21, 22, 23, 24, 25, 30, 31, 32, 33, 34, 35, 53, 55, 65, 66, 67, 68, 69, 71, 72, 171, and 172 would be visible from the background viewing distance. Viewing distance is from 12 to 17 miles.

- Because of the viewing distances (background and middle ground), and the type of treatments (thinning), all timber cutting treatments visible from Concern Level 1 roads and trails would meet at least Partial Retention VQO, and would therefore meet Forest Plan standards for visual quality.

Timber Cutting Visible from Concern Level 2 Areas:

- Under both Alternatives, analysis indicates that from County Road 502, Commercial Thinning Units 26 and 49 would be potentially visible at the background viewing distance.

- Because the timber treatment units would be logged under a thinning prescription with mitigation measures applied, it is expected that these units will meet Partial Retention VQO, and would therefore meet Forest Plan standards for visual quality.

Prescribed Burning Activities
The majority of the areas proposed for treatment in this project would have some form of prescribed burning.

Hand pile, machine pile, and landing pile burning have the potential to scorch nearby trees or tree limbs, and will leave a blackened area on the ground where the pile burned. Scattered orange foliage on conifer trees and spots of blackened ground would be visible. It is expected that the visual effect will only last for a few seasons until scorched needles fall and vegetation becomes re-established in burned spots.

Underburning has the potential to blacken tree trunks, low branches and the ground, and turn low-hanging tree foliage orange. The effect can be visually dramatic immediately following the burn, but the effect becomes less as scorched foliage drops and understory vegetation re-grows, usually within a few seasons after the burn. The visual effects of underburning are usually minimal to the casual observer in five years or less.

At the foreground viewing distance, the visual effects of prescribed burning is as described above, and are expected to meet the Partial Retention VQO (see example of Partial Retention – Underburn on page H-29 in *Landscape Aesthetics, a Handbook for Scenery Management*, USDA Forest Service Agriculture Handbook Number 701). As the viewing distance increases, the visual effects become less evident. At the middle ground viewing distance, one is likely to see only occasional black or orange tree crowns widely scattered through the green forest canopy; the result of trees that torched or became excessively heated/scorched during the burn. At the background viewing distance, little if any visual effect should be discernable.

Prescribed Burning visible from Concern Level 1 roads:

- GIS analysis indicates that the project area would not be visible at a foreground viewing distance.

- Under both alternatives, portions of Units A, B,C, D, E, F, G, H, K, L, M, P, Q, R and S viewed from State Highway 21, County Roads 501 and 602 would be jackpot burned and potentially visible at a middle ground viewing distance. Other prescribed burning areas would be potentially visible at the background viewing distance, but the effects of burning are not expected to be discernable.

- Because of the viewing distances (background and middle ground) all prescribed burning treatments visible from Concern Level 1 roads would meet at least Partial Retention VQO, and would therefore meet Forest Plan standards for visual quality.

Prescribed Burning visible from Concern Level 2 road:

- Under Alternative B, analysis indicates that a portion of Units 28, 47, 48, 49, 50, F, G, H, K, L, M, and P (underburned) would be potentially visible from the middle ground and background viewing distance of County Road 502 (Toroda).

Comparison of Alternatives
The No Action Alternative would not have short-term visual effects.

Alternative B has visible 2,703 total acres of harvest treatment. Alternative C has visible 2,550 total acres of harvest treatment. As a result, Alternative B would have more visual impact resulting from timber cutting.

Alternative B would treat the most acreage that is visible with prescribed fire (2,783 acres); underburning 1,425 acres, jackpot burning 304 acres, and pile burning 1,054 acres.

Alternative C would treat the least amount of visible acreage with prescribed fire (2,633 acres); underburning 1,447 acres, jackpot burning 304 acres, and pile burning 882 acres.

Cumulative Effects

The cumulative effects for areas of concern (views from the Concern Level 1 and 2 Travel Ways and use areas identified as potentially affected by the Vulcan Project) are measured from State Route 21, County Roads 501, 502, and 602.

Within these view sheds, past clear-cut and seed tree timber harvest treatments on National Forest System lands and lands of other landowners are visible in the background. The Vulcan Project is not likely to add any cumulative impact to the background view because the treatments are not likely to produce forest openings that would be discernable at the background viewing distance.

Past timber treatments on National Forest System lands and lands of other ownerships are visible at the middle ground and foreground viewing distances. Much of this logging is readily apparent to observers, and some of it would not meet the Partial Retention VQO (visual quality objective). While much of the Vulcan Project activities are expected to be visible from the travel ways and use areas of concern, all the project activities are expected to meet Partial Retention VQO. As a consequence, there would be little added visual effect. The overall characterization of “large stands of continuous tree cover or areas broken by natural or man-made openings” and an overall appearance described as “a mixture of natural-appearing and logged forestlands” would not change as a result of the Vulcan Project.

ECONOMICS

The following is excerpted from the *Vulcan Vegetation Management Project Economics Report* by Larry Besemann, May 12, 2005. The full text of this report is incorporated by reference. The Economics Report examined the costs and benefits associated with wood products that would be removed under the various alternatives (Alternative A—No Action, Alternative B—Proposed Action, and Alternative C).

Timber values are from the current index from the transaction evidence appraisal the Forest Service uses to sell timber. Species groups were western larch and Douglas-fir and lodgepole pine, subalpine fir, and Engelmann spruce. The values represent delivered log prices to local mills.

Costs were gathered from experienced costs, Forest averages, recent timber sale appraisals, and Region appraisal programs.

Table 3-28. Economics Summary

	No Action	Alternative B	Alternative C
Timber Volume	0	9.3 million board feet (17,860 CCF)	8.9 million board feet (17,168 CCF)
Logging Cost	0	$622,778	$598,648
Delivered Product Value	0	$1,579,574	$1,537,604
Net Timber Product Value	0	$956,796	$938,956

Both Alternatives B and C generate funds in excess of costs. The excess funds (Net Timber Product Value) can be distributed to several areas. Returns to the treasury from receipts from selling timber are simply $0.50 per thousand board feet (MBF) or $0.26 per hundred cubic feet (CCF) and is the minimum distribution that is mandated. The remaining receipts can be distributed to the Roads and Trails Fund, which is 10% of receipts, the Salvage Sale Fund, which is generally 20% of the volume of non-salvage sales, KV-SAI (Knutsen-Vandenberg Sale Area Improvements), and Retained Receipts under stewardship contracts. Typically, the distribution in order of priority is mandatory returns to treasury, roads and trails fund, salvage sale fund, mitigated sale area improvements, and remaining sale area improvements. Retained receipts under stewardship contracts generally take the place of sale area improvement funds.

OTHER REQUIRED ANALYSES

Effects on Tribes of the Colville Reservation

The Tribes of the Colville Reservation reserve hunting, fishing, and gathering rights on Forest areas that include the Vulcan planning area.

The Colville Tribes were included in project scoping and thus were informed and invited to consult on the project and the proposed actions. There was no response received from the Tribal Council or any tribal members.

The Vulcan Project would not affect access to the area because no new road closures are proposed. Hunting may be improved as mule deer habitat would be improved and sight distances increased in treated stands. Traditionally gathered plants may be improved with the opening of closed forest canopies and reintroduction of fire. Fishing will not be affected.

Effects on Consumers and Civil Rights

The action alternatives would contribute to consumers, but only in a limited capacity. All action alternatives would provide wood products to one or more area sawmills, thus contributing raw materials that would become available to consumers. Because the amount of such material is small when compared to the regional wood products market, making this material available to the market will not measurably affect the price or availability of finished wood products.

All contracts and employment offered by the Forest Service contain Equal Employment Opportunity requirements. Therefore, no adverse or discriminatory effects to Civil Rights, Minority Groups or Women are expected with regards to access to federal contracts or jobs.

Low Income Residents of Ferry County (Includes Environmental Justice Analysis)

Environmental Justice means that, to the greatest extent practicable and permitted by law, all populations are provided the opportunity to comment before decisions are rendered on, are allowed to share in the benefits of, are not excluded from, and are not affected in a disproportionately high and adverse manner by government programs and activities affecting human health or the environment (USDA 1997).

Ferry County has some of the highest unemployment and poverty rates in the State of Washington (BST Associates 1994, and Cook and Jordan 1995). In 1989, the poverty rate was 23.7%, which was the highest in the state (Cook and Jordan 1995). Per capita income in Ferry County has historically been well below the state average (McGinnis et al. 1997).

Changes in the availability of firewood would likely affect low-income residents more than others because alternate sources of heat are more costly. The Vulcan Project would temporarily open several roads for timber harvest, and leave these roads open for firewood gathering for a short firewood-gathering period. Firewood (snags and downed wood that has been behind road closures, and logging slash created by the project) would be more available for a few years as a result of the Vulcan Project.

Effects on Farmland, Rangeland, and Forestland

The Vulcan Project area (National Forest System lands) contains no prime farmland. Effects to prime rangeland are discussed in the Range Resource Report and the Range Section of the environmental assessment. There are no "prime" forestlands in the affected portion of the analysis area, as defined in Forest Service Handbook 1909.15, section 65.21.

Effects on Wetlands and Floodplains

Effects on wetlands and floodplains are discussed in the Hydrology Report in the analysis file, and are summarized in the Effects Section of this environmental assessment.

Short-term Use vs. Maintenance and Enhancement of Long-term Productivity

The proposal is intended to restore and maintain sustainability and long-term productivity. Short-term and long-term effects are discussed for the various subjects in the Effects Section of this environmental assessment.

Adverse Effects That Can Not Be Avoided

Under both action alternatives, complete prevention of noxious weeds invading disturbed soils is not possible. Mitigation measures are prescribed that would be expected to substantially prevent weed invasion onto new sites, and to reduce weed spread from existing noxious weed infestations. Control and prevention measures included in the *Environmental Assessment for*

Integrated Noxious Weeds Treatment, Colville National Forest (1998), *Preventing and Managing Invasive Plants Final Environmental Impact Statement* (2005) and the *Colville National Forest Weed Prevention Guidelines* (1999) would be adhered to during all stages of the project. Additional discussion of effects on noxious weeds is included in the Noxious Weed Report in the analysis file.

Soil compaction and erosion as a result of logging is unavoidable. Sediment from soil-disturbing activities reaching streams is unavoidable. Many of these unavoidable effects are substantially mitigated by Best Management Practices included in this environmental assessment. Further discussion is included in the Soil and Hydrology Reports in the analysis file.

Smoke from burning forest fuels is unavoidable. By burning within prescription parameters documented in project burn plans, potential adverse effects will be substantially reduced. Adverse air quality effects from prescribed burning will be substantially less than would result from the same forest fuels burning under wildfire conditions. For more discussion about smoke and air quality effects, see the Fuels Report in the analysis file.

Snags and downed logs will be unavoidably lost as a result of timber harvest and prescribed burning. However, sufficient numbers will be left, and replacement cavity nester trees created so that Forest Plan standards (including Screening Direction) will be met, and additional snags and downed logs will be created by prescribed burning and subsequent secondary tree mortality. Regardless, adequate snags and downed logs will be retained to meet Forest Plan standards and thus maintain viability of dependent wildlife species. For more discussion, see the Terrestrial Wildlife Species Report in the analysis file.

Conflicts with Objectives of Other Land Management Plans, Policies, and Controls

There is no conflict with other plans, policies, or controls.

Public Health and Safety

There are a substantial number of health and safety hazards to Forest Service employees and private contractors involved with carrying out of any of the action alternatives. There are no hazards identified that are unusual or unique to the Vulcan Project. The health and safety hazards to Forest Service employees and contractors are addressed by the USDA Forest Service Health and Safety Code (Forest Service Handbook 6709.11), and by Occupational Health and Safety Administration requirements. Analysis of these health and safety hazards will not be repeated here.

For the general public, there are a number of potential health and safety hazards.

SMOKE

Smoke in large amounts is not expected to affect the general public because burning would only be carried out when smoke will be readily dispersed into the upper atmosphere. Also, the public is not expected to enter areas where burning is actively in progress because signs warn against public entry. Smoke in lesser amounts, as may occur when smoke settles into valley

bottoms during evening hours following prescribed burns can reduce visibility. It is not expected that visibility would be reduced to the extent that driving safety would be impaired. Valley-bottom smoke can also adversely affect the breathing of a small number of susceptible individuals. The Forest Service routinely announces to the public in advance when burning is to take place, so that susceptible individuals can take the necessary precautions to avoid adverse health effects. For more discussion about smoke and air quality effects, see the Fuels Report in the analysis file.

DUST

During dry periods when unpaved roads are used in conjunction with any activity associated with the project (especially log hauling), dust will occur. In most cases, dust is not considered a serious health and safety hazard. However, in severe instances (which are occasionally associated with log hauling), visibility can be severely reduced, and breathing, especially in certain individuals, can be adversely affected.

INCREASED TRAFFIC

Implementation of any of the action alternatives will increase traffic on roads within, and leading to, the project area. By a small amount, this added traffic increases the chance of vehicle accidents.

LOGGING HAZARDS

The general public is routinely advised (with warning signs) to stay out of active logging areas. Where logging occurs along main open roads, the Timber Sale Contract contains provisions to protect the public while passing through the logging area. As a result, the risk to the general public from logging (other than traffic hazards discussed above) is very small. Such hazards include falling trees, debris on roadways, rolling rocks or other material, and encounters with moving logging equipment.

PRESCRIBED BURNING HAZARDS

The general public is routinely advised (with warning signs) to stay out of active prescription burn areas. During aerial ignitions, no one is allowed inside the ignition area. As a result, the risk to the general public from prescribed burning operations is very small. In addition to smoke (discussed above), the health and safety hazards to members of the public who enter active burn areas include being burned, being hit by falling trees or rolling material, stepping into stump or root holes, or being hit (and/or burned) with flammable materials used to ignite prescribed fires.

WEED TREATMENTS

Health and safety effects from treating noxious weeds are found in *the Environmental Assessment for Integrated Noxious Weed Treatment, Colville National Forest* (1998) and *Preventing and Managing Invasive Plants Final Environmental Impact Statement* (2005).

While there are health and safety hazards associated with the Vulcan Project (listed above), there are also public health and safety benefits.

IMPROVED ROAD SAFETY

Public safety on Forest roads would be improved following timber sales. Roads that are reconstructed for timber sales that are to be open to public use following the timber sale include measures to enhance public safety (i.e. wider curves, more frequent turnouts). In addition, road maintenance is accomplished on all roads used for timber sales, resulting in improved visibility and smoother running surfaces.

REDUCED WILDFIRE RISK

Implementing any of the hazard-fuel management actions will result in reduced risk of large wildfires that can threaten public health and safety.

Unique Characteristics of the Geographic Area

The Vulcan Project area contains no unique characteristics or features. There are no park lands, prime farmlands, wild and scenic rivers, ecologically critical areas, congressionally designated areas (such as wilderness, wilderness study areas, or National Recreation Areas), Research Natural Areas, municipal watersheds, or inventoried roadless areas. The area does contain steep slopes and highly erosive soils, threatened or endangered species or their habitat, floodplains and wetlands, and cultural sites. However, the effects to these resources have been examined in this environmental assessment, and there is nothing noted about these features that would suggest that they are unique, or that associated effects would be significant.

The Degree to Which the Effects are Highly Uncertain or Involve Unique or Unknown Risks

There were no highly uncertain, unique, or unknown risks identified in any of the effects analyses conducted for the Vulcan Project.

The Degree to Which the Action May Establish a Precedent for Future Actions with Significant Effects

The proposed actions do not set precedents. The Republic Ranger District has been conducting timber sales and prescribed burns for years; many of which are similar in scope and nature to those proposed in the Vulcan Project.