# HYDROLOGY

## Introduction

This report describes the existing conditions of water resources in the Sheppard Creek Post-Fire Project area. It is broken into the following sections.

- Hydrologic Processes[1]
- Hillslope Erosion and Sediment Delivery
- Channel Morphology and Water Quality

## Information Sources

Information has been gathered from a variety of sources. Much of this information is in the form of spatial data that are presented and/or analyzed using a Geographic Information System (GIS). Some of the key spatial data includes annual precipitation, elevations, soil inventories, watershed boundaries, roads, and streams. Other information includes data that have recently been collected on the ground within or near the project area. These data include BAER assessments, soil condition surveys, fish habitat surveys, channel surveys, and culvert surveys. Finally, erosion and sediment delivery data are generated using a predictive model. Pertinent scientific literature is cited throughout the report to substantiate conclusions.

## Analysis Area

The size and location of analysis areas are variable and are dependent on which biophysical component(s) of the aquatic system are being analyzed. The affected environment section generally focuses on the immediate project area. Effects related to water yield, channel morphology, and water quality are addressed at the sub-watershed and/or stream reach scale. Each component of the analysis describes the scale at which the direct and indirect effects are being predicted. The predicted cumulative effects of the alternatives are described at the sub-watershed scale. In general, the temporal scale of the analysis is five years because this is the estimated time for the area to stabilize after fire and would most likely overlap with the implementation period. One exception relates to an alternative that proposes removal of trees adjacent to streams. In this case, the temporal scale ranges from decades up to 200 years in which time large woody debris is predicted to be available again.

## Affected Environment

The project area is located within four 6$^{th}$ code hydrologic units, or sub-watersheds. The vast majority of the project area is within the Sheppard Creek sub-watershed and very small

[1] Includes interception, infiltration, surface runoff, streamflow, and evapotranspiration.

portions are in the Plume Creek, Gregg Creek, and Griffin Creek sub-watersheds (Table 3-34).

**Table 3-34. Sub-Watersheds within the Project Area.**

| Sub-Watershed | Proposed Action Treatment Acres | Acres Burned[2] | Total Acres |
|---|---|---|---|
| Plume Creek | 261 | 1,147 | 3,630 |
| Gregg Creek | 142 | 1,569 | 5,966 |
| Sheppard Creek | 6,162 | 20,081 | 24,152 |
| Griffin Creek | 209 | 2,625 | 21,374 |

The project area has a long history of timber management and road construction due to its relatively gentle topography, stable soils, and high productivity. The area contains approximately 96 miles of road, most of which are maintenance level 2 and 3. Much of the area has experienced a variety of timber harvest during the past few decades.

During the summer of 2007, the Brush Creek Fire burned a large portion of the Sheppard Creek sub-watershed, and smaller portions of the adjacent sub-watersheds (Table 3-34). Fire suppression resulted in a variety of ground disturbing activities. Within the fire perimeter, about 60 miles of cross-country dozer line were constructed. In addition, several safety zones were constructed adjacent to roads. Through suppression rehabilitation, all of these areas were re-contoured and covered with slash material.

## Hydrologic Processes

The majority of precipitation occurs during the winter months in the form of snow. Elevations range between 4000 and 6000 feet, and average annual precipitation ranges between 25 and 30 inches. Annual peak discharges generally occur in April, May, or June. These flows are driven by snowmelt (by itself), mid-winter rain-on-snow, rain-during-snowmelt, or summer thunderstorms. During the last few decades, snow pack in the Pacific Northwest has been declining due to higher temperatures and decreased precipitation (Mote, et al. 2005; Mote 2003; Service 2004). In addition, the higher temperatures are causing snow to melt earlier in the year (Stewart, et al. 2004).

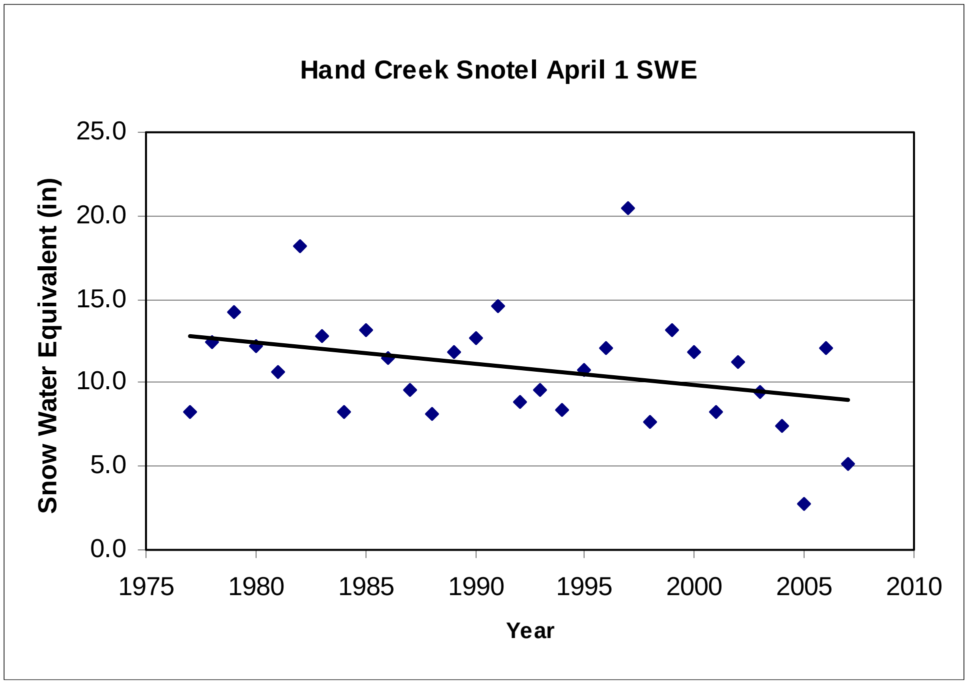
Snow water equivalent is the amount of water contained in snow, and is usually expressed in inches. The snow water equivalent on April 1 of each year is a common metric used in water supply forecasting and spring runoff. Snow water equivalent has been measured at the Hand Creek Snow Course since 1977. The April 1 snow water equivalent data suggests a slight downward trend (Figure 3-7).

The 2007 Brush Creek Fire changed forested conditions (and ultimately hydrologic processes) throughout the project area. The magnitude of change is variable and dependent on a number of factors such as annual precipitation, aspect, burn severity, and degree of tree mortality. In the short term, infiltration capacity is generally reduced through loss of ground cover, such as woody material, litterfall, and duff layers. Removal of the forest canopy and forest litter

[2] Source: Burned Area Reflectance Classification (Burn Severity).

reduces interception and evapotranspiration, which makes more water available for soil storage, surface runoff, and annual yield. This additional water can be expressed through individual storm events or annually through higher streamflow. This is a concern because a recently burned landscape can have substantially reduced infiltration over an unburned landscape and the resultant changes in surface runoff can increase peak flows considerably. Recent post-fire conditions in Montana produced very large flood events (up to 200 year) from relatively small rain events (5 to 10 year) (Parrett, et al. 2004).

**Figure 3-7. April 1 Snow Water Equivalent at the Hand Creek SNOTEL Site.**




The degree in which a wildfire releases heat and its associated effects on ecosystem components, particularly soil hydrologic processes, is called soil burn severity (Debano, et al. 1998). Soil burn severity is differentiated from vegetation burn severity (see Vegetation section earlier in this chapter) in that fire effects are to the soil instead of the vegetation. Some areas of the Brush Creek fire exhibit low vegetation burn severity with only scorched crowns but high soil burn severity when fire lingered at low intensities for long periods of time on the soil surface. Overall, the soil burn severity of the Brush Creek Fire was low to moderate (Table 3-35). The fire burned in a mosaic pattern with mixed degrees of severity. During the Burned Area Emergency Response (BAER) assessment, soils were tested for hydrophobicity on some of the highest burn severity sites. The degree of hydrophobicity on these sites was very minimal (less than one mm); probably because the extremely dry soil conditions were not conducive to heat transfer. Hydrophobic soil conditions would likely be undetectable by the spring of 2008.

**Table 3-35. Acres of Burn Severity.**

| | Plume Creek Sub-Watershed | Gregg Creek Sub-Watershed | Sheppard Creek Sub-Watershed | Griffin Creek Sub-Watershed |
|---|---|---|---|---|
| Unburned | 455 | 909 | 3,649 | 349 |
| Low Severity | 341 | 460 | 4,252 | 616 |
| Moderate Severity | 638 | 901 | 11,521 | 1,873 |
| High Severity | 168 | 208 | 4,308 | 136 |

When assessing the hydrologic condition of watersheds, it is important to consider the amount of forest vegetation that is removed by road construction, timber harvest, and/or fire. In general, removal of forest canopy by whatever means reduces interception and evapotranspiration. Loss of canopy can also change snow distribution and melt patterns. These modifications can make more water available for surface runoff and streamflow. Watersheds exhibit natural variability in flow and can accommodate some increase in water yield without damage to streams. Increases in the duration of higher stream flows have the potential to cause channel adjustments, particularly bank erosion, widening, and subsequent sedimentation. This is why it is important to assess the relative degree that water yield may be elevated above what might be considered a natural range.

The Equivalent Clearcut Area (ECA) is the method used to assess the relative degree of forest removal and associated changes in hydrologic processes (USDA 1976). The basic concept behind the ECA model is that forest vegetation at less than 100 percent canopy cover can affect water yield characteristics, particularly timing, duration, and annual yield. Canopy cover can be less than 100 percent from different timber harvest methods, insects and disease, wildland fire, or natural forest succession processes. Additionally, it uses elevation, aspect, and precipitation to estimate the water yield increase resulting from removal or natural change of forest cover. As forests grow back, the potential for water yield increases diminish. Equivalent Clearcut Acres prior to and following the Brush Creek Fire are shown in Table 3-36. The post-fire ECA values incorporate burned stands and an estimate of forested acres removed through fire suppression (e.g. dozer lines). Pre-fire ECA amounts for the Griffin Creek drainage are much larger than the other three drainages due primarily to the Little Wolf Fire of 1994.

**Table 3-36. Equivalent Clearcut Acres.**

| | Total Acres | Pre-Fire | | Post-Fire | |
|---|---|---|---|---|---|
| | | ECA | %ECA | ECA | %ECA |
| Plume Creek | 3,630 | 634 | 17% | 1,489 | 41% |
| Gregg Creek | 5,966 | 1,056 | 18% | 2,273 | 38% |
| Sheppard Creek | 24,152 | 4,574 | 19% | 6,664 | 27% |
| Griffin Creek | 21,374 | 9,215 | 43% | 9,915 | 46% |

It is important to note that ECA values may not necessarily correlate with stream channel conditions. Schakenberg and MacDonald (1998) found no significant correlation between ECA and stream channel characteristics, which suggests that ECA is a poor surrogate for the changes in runoff and erosion that may affect stream channel conditions. ECA values by themselves cannot fully describe overall watershed condition, but typically, water yield becomes a concern when 20 to 30 percent of a watershed is in a cleared condition. At these levels, it is important to assess the relative condition of stream channels, aquatic habitat, and water quality to determine if increases in water yield are affecting those resources. For this reason, it is important to determine ECA values, but compliment the information with stream channel conditions (see *Channel Morphology and Water Quality* Section).

Roads are included in the ECA calculations, but they do not have a hydrologic recovery component. Road networks change a variety of hydrologic processes at hillslope and small watershed scales. Road systems can change the sub-surface and surface flow patterns of hillslopes and streams. On well-maintained, out-sloped roads, surface runoff is in the form of sheet flow. In-sloped roads generally have a ditch at the base of the cutslope which functions as a conduit for concentrated runoff. Through interception of sub-surface flow and interception of precipitation, in-sloped road systems collect water on hillslopes and release it at designated points, generally culverts or cross drains.

Through processes described above, roads can change the way a watershed responds to precipitation and/or snowmelt. In general, road systems accelerate the movement of water from hillslopes to stream systems. Harr, et al. (1975) found that peak flows increased following road construction in the coastal range of Oregon. In small forested watersheds in Idaho, King and Tennyson (1984) detected change in hydrologic behavior when greater than 3.9 percent of a watershed was occupied by roads. Annual peak flows may increase during the next several years, due to decreased evapotranspiration and higher soil moisture (Harr 1979).

## Hillslope Erosion and Sediment Delivery

Landforms in the project area are the result of extensive glacial activity. Dominant landforms include alluvial deposits (flood plains, terraces, and fans), lacustrine deposits, and glacial till. Soils are typically thin on ridge tops and mantled by glacial till on lower slopes. Drainage patterns are generally dendritic. Surface soils are heavily influenced by volcanic ash.

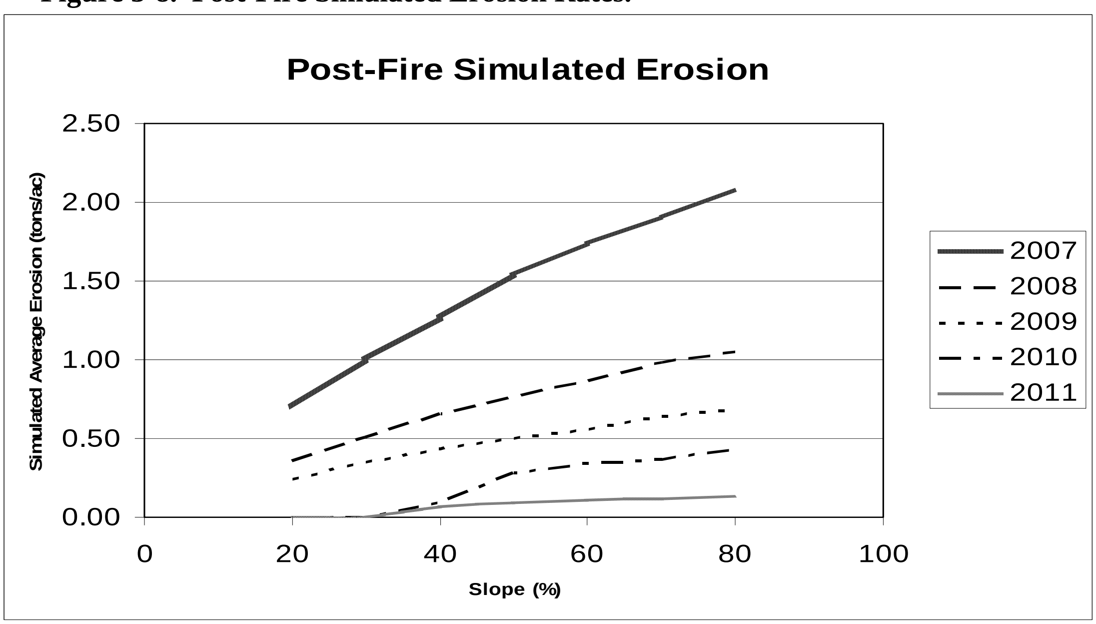
Hillslope erosion and sediment delivery are of primary concern following large wildland fire events. Sediment in streams can degrade macroinvertebrate and fish habitat by filling interstitial spaces and pools, and decrease inter-gravel dissolved oxygen concentrations; both of which inhibits fish reproduction (MacDonald, et al. 1991 and Meehan 1991).

The potential for soil erosion and sediment delivery in the project area is in a state of flux and would continue to change during the next few years as vegetation and soil cover reestablish. Surface erosion potential can be very high on a burned landscape because there is a decrease in vegetative cover, litter, duff, and down woody material. The relative degree of potential erosion is dependent upon a variety of factors such as burn severity, slope, and residual woody material. The amount of soil cover in a burned forest can increase rapidly over time due to litterfall and vegetation re-growth (Larsen and MacDonald 2006). During the BAER assessment of the Brush Creek Fire, litterfall (in the form of needles) was already present on the forest floor in low and moderate severity areas.

Potential erosion rates are predicted using a web-based computer model called Disturbed WEPP and WEPP:Road (http://forest.moscowfsl.wsu.edu/fswepp/). At best, any predicted erosion value may only be within 50 percent of the true value. Erosion rates are highly variable and most models can predict only a single value. Research has shown that observed values vary widely for identical plots or the same plot from year to year (Elliot, et al. 1995; Tysdal, et al. 1999). In addition, observed erosion rates can be very different from those predicted by Disturbed WEPP (Larsen and MacDonald 2007). The vast majority (approximately 80 percent) of potential erosion and sediment delivery is within the Sheppard Creek sub-watershed.

Even though the WEPP model has limitations (like any model), it can be powerful in illustrating how erosion potential changes over time. As surface cover increases over time through litterfall and vegetation regrowth, potential erosion would decrease. Sediment yields in burned forests can decrease by one or two orders of magnitude due to rapid vegetation regrowth (Robichaud and Brown 1999). Figure 3-8 displays the potential erosion rates for a typical hillslope in the project area that has sustained a high severity burn. The rapid decrease in predicted erosion rates between 2007 and 2011 reflects recovery. The predicted erosion rates are average values, given 30 years of simulated rain and snowmelt. The primary input parameter that causes the model to predict a decline in erosion over time is percent cover over the soil. Cover can be in the form of litterfall, down wood, and new vegetation growth. The majority of burned areas within the project area contain abundant down woody material, which not only provides cover, but also traps sediment and reduces the potential for delivery into stream channels. Hillslope erosion can result in sediment delivery to streams if the volume of eroded material exceeds deposition on the soil surface and behind obstructions. It is important to recognize that erosion rates could potentially be much higher if a high intensity thunderstorm occurs during the next year or two. Studies have shown that relatively high rainfall intensity can mask the effects of other variables such as percent cover and slope (Spigel and Robichaud 2007, Baker 1988).

**Figure 3-8. Post-Fire Simulated Erosion Rates.**



The Disturbed WEPP model predicts that between 30 and 80 percent of eroded material could potentially be transported to streams, depending on a wide variety of factors. Exhibit G-1 contains photos of several representative sites that illustrate the degree of down wood on burned hillslopes. Figure 3-9 is a recent photo of a high severity burned area with down wood. The WEPP model does not account for sediment obstructions (i.e. down wood) so the erosion rates (Figure 3-8) and sediment delivery predictions are likely exaggerated.

**Figure 3-9. A Typical Site Classified as High Burn Severity.**

*Note woody material on the ground that provides cover and can trap sediment.

Roads are also a source of erosion and sediment delivery. Roads, road construction, and road maintenance are considered the major source of sediment from upland forested watersheds (Brooks, et al. 1991). Some studies and observations indicate that as much as 90 percent of sediment from timber harvest areas originate from roads, and erosion related to forest roads are often much greater than other land management activities (Brooks, et al. 1991; Gibbons and Salo 1973). Because forest roads are the major contributors of sediment, they represent the greatest concern in terms of non-point source pollution, water quality, and aquatic habitat. The effects of roads can be exacerbated on a burned landscape because there is more water available as surface runoff and concentrated flow (as described in *Hydrologic Processes*). Hillslope erosion tends to be episodic and usually associated with fire (Kirchner, et al. 2001). By contrast, open roads are a continuous source of sediment. Regular road maintenance and use maintains the road surface as a perpetually disturbed site with easily detachable soil particles. The total miles of road by maintenance level are shown in Table 3-37.

**Table 3-37. Miles of Road in the Project Area.**

| Maintenance Level | Miles |
|---|---|
| 1 – Basic Custodial Care (closed) | 13.7 |
| 2 – High Clearance Vehicles | 34.7 |
| 3 – Suitable for Passenger Cars | 35.5 |
| 4 – Moderate Degree of User Comfort | 9.2 |

Sediment production on forest roads is sensitive to the level of use. Fine sediments from road surfaces are derived from the breakdown of surface material and fine sediments are forced upward as traffic passes. Reid and Dunne (1984) found that daily sediment production on heavily used roads (greater than four loaded trucks per day) was 7.5 times greater than the daily sediment production from roads not being used and that the majority of sediment was derived from the road surface as opposed to cut and fill slopes. Sediment production from roads can be reduced by surfacing them with gravel. Swift (1984) found sediment production to be significantly less on surfaced roads than on non-surfaced roads and that sediment production decreased with the thickness of gravel surfacing.

The bed material particle-size distribution is believed to be one of the first channel characteristics to change in response to management activities (Dietrich, et al. 1989; Madsen 1994). Wolman pebble counts (Wolman 1954) are the most common technique to assess changes in the surface particle-size distribution and thus evaluate management effects on aquatic habitat. Bevenger and King (1995) found that reaches disturbed by forest management had more fine sediment (less than 8 mm) than reference reaches.

When assessing the degree of road development in any given watershed, it is important to consider the location of roads in relation to sensitive soils, slope steepness, proximity to stream channels, and how many stream-road crossings may be present. Crossing density has shown a correlation with the amount of fine sediment in streams (Schnackenberg and MacDonald 1998). The project area contains approximately 96 miles of road (Table 3-37), and the majority of these roads are maintenance level 2 and 3. The miles of road in sub-watersheds that overlap with the project area are shown in Table 3-38.

**Table 3-38. Miles of Road in the Gregg, Plume, Griffin, and Sheppard Creek Sub-Watersheds.**

| Road Maintenance Level | Plume Creek | Gregg Creek | Sheppard Creek | Griffin Creek |
|---|---|---|---|---|
| 1 – Basic Custodial Care (closed) | 33.2 | 21.7 | 13.7 | 17.0 |
| 2 – High Clearance Vehicles | 18.9 | 21.9 | 34.7 | 26.3 |
| 3 – Suitable for Passenger Cars | 24.0 | 11.3 | 35.5 | 23.8 |
| 4 – Moderate Degree of User Comfort | 7.6 | 6.7 | 9.2 | 6.4 |
| 5- High Degree of User Comfort | 0 | 0 | 0 | 1.7 |
| Totals Miles | 83.7 | 61.6 | 93.1 | 75.2 |
| Total Road Density (mi/mi$^2$) | 2.8 | 3.4 | 2.5 | 2.3 |

Predicted average annual erosion rates on roads within the project area were estimated using the WEPP:Road model (http://forest.moscowfsl.wsu.edu/fswepp/), and range between 0 and

0.7 tons per acre. Roads that have no erosion would be maintenance level one roads that have been closed and fully revegetated.

## **Channel Morphology and Water Quality**

The project area contains a variety of stream channels from steep boulder-controlled channels in the headwaters to low gradient alluvial channels with active floodplains. Streams in dynamic equilibrium usually have a balance between stream power (energy) and sediment. In general, stream power is a function of flow and channel gradient, and it describes the relative ability of a stream to erode its bed and banks (Gordon, et al. 1992). In very general terms, streams with high stream power have larger materials (boulders and cobbles) compared to streams that have less power (gravels and sand).

Changes in either sediment availability and/or stream power can cause streams to adjust and sometimes degrade aquatic habitat and water quality. In forested watersheds, water yield is sometimes a concern because additional streamflow (beyond the range of variability) can increase stream power and cause channel erosion. Similarly, too much sediment can cause channels to adjust. Added sediment can also degrade water quality and particularly aquatic habitat.

It is important to assess the relative condition of stream channels in and downstream of the project area, especially if management history (i.e. high road density and timber harvest) suggests the potential for channel impacts. The vast majority of the Brush Creek Fire and proposed treatment units are within the Sheppard Creek sub-watershed. Therefore, the following discussions about channel morphology and water quality focus on the main stem of Sheppard Creek.

Some reaches of Sheppard Creek appear to be wider and shallower than might be expected, based on visual observation. This may suggest past impacts associated with timber harvest and road construction. Channel widening (bank erosion) causes an excess amount of sediment, which can deposit in pools or on the channel bed. Three reaches of Sheppard Creek were surveyed in 2007 (prior to the Brush Creek Fire), using the R1 Aquatic Ecological Unit Inventory method. Residual pool depth and the median sediment size are two indicators of sediment supply that are compared to reference values. Reference data has been collected in streams across the Flathead National Forest during the last several years in watersheds that have little or no human disturbance. In this analysis, residual pool depth and median sediment size are used to compare Sheppard Creek to reference conditions (Figures 3-10 and 3-11, respectively). The position of data points associated with Sheppard Creek indicates that it is below potential and most likely has been impacted to some degree by upland management activities.

Figure 3-10 contains a reference data set that uses bankfull width multiplied by gradient as a surrogate for stream power, which is plotted against median particle size. Figure 3-11 shows that two of the three Sheppard Creek sites (near "Snail" and Listle Creeks) suggest that these sites have elevated levels of fine sediment. These data suggest sediment from upstream sources (likely roads) is depositing in these two reaches. However, the Upper Sheppard Creek site (upstream of Road 538B) has recorded values well above all the other data points, suggesting this stream either scoured in the recent past or large material from upstream deposited in this reach. These channel adjustments may be the result of road construction and timber harvest that occurred in the late 1970s and early 1980s.

**Figure 3-10. Average Residual Pool Depth of Sheppard Creek Compared to Reference Values.**

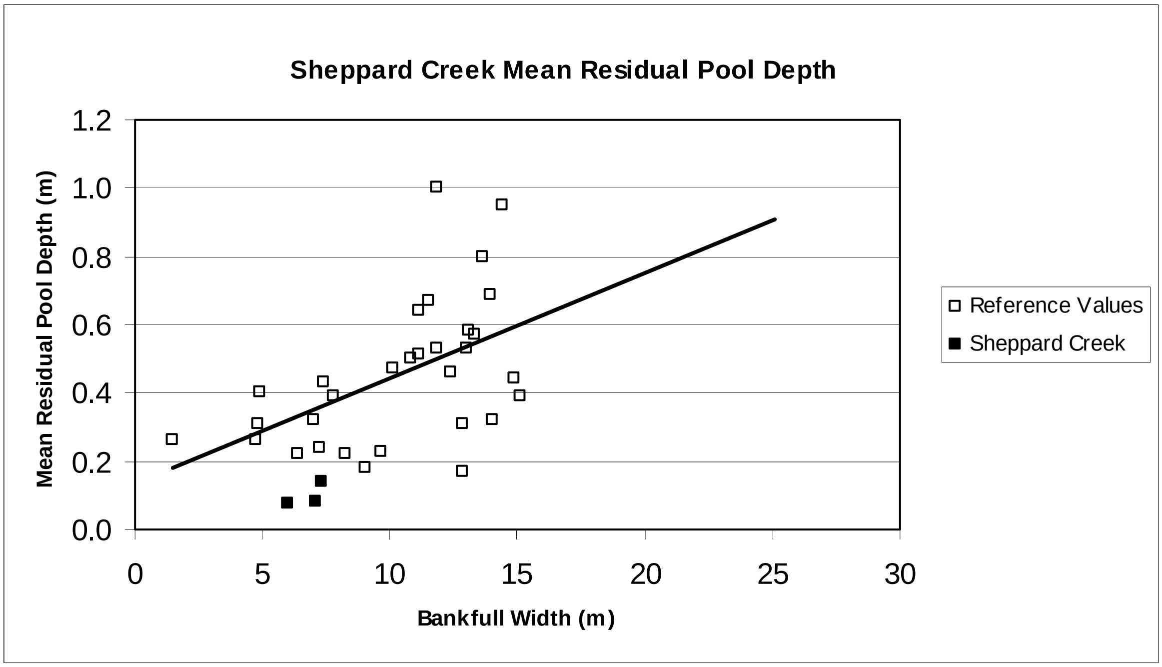
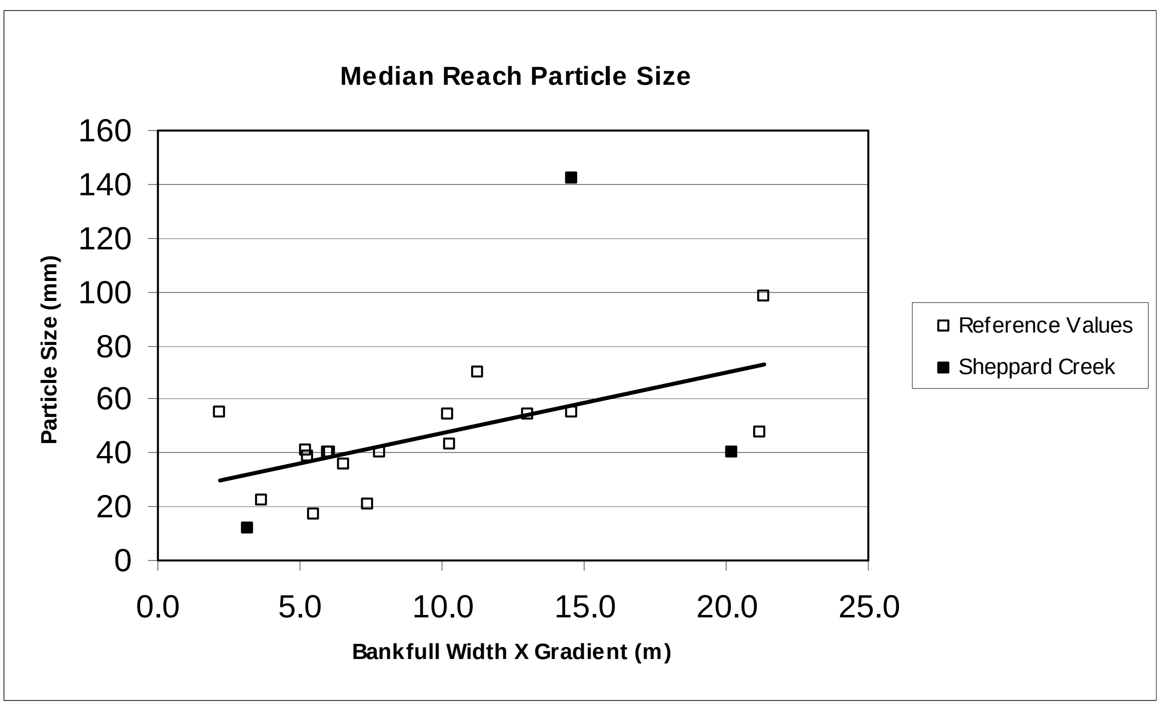



**Figure 3-11. Median Sediment Size of Sheppard Creek at Three Sites, Compared to Reference Value.**



The data in Figures 3-10 and 3-11 and visual observations suggest that Sheppard Creek has been impacted by management activities, and that the primary impact is likely sediment. This conclusion is not surprising given the management history and dense road network in the Sheppard Creek drainage. In addition, this conclusion is consistent with field investigations conducted by the Montana Department of Environmental Quality (Exhibit G-2). Even though the data in Figures 3-10 and 3-11 are suggestive, they should be interpreted with caution due to the very small sample size, extreme variability in the data (temporal and spatial), and variability associated with data collection.

The water quality beneficial use classification (Montana DEQ Administrative Rules) within the project area is B-1. B-1 waters are to be maintained suitable for drinking, culinary, and food processing purposes, after conventional treatment; bathing, swimming, and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl, and fur-bearers; and agricultural and industrial water supply (Montana DEQ 2006).

The main stem of Sheppard Creek is on the State of Montana's 303(d) List (Montana DEQ 2006). It is in Category 5, which means more than one beneficial use has been determined as impaired or threatened and a Total Maximum Daily Load (TMDL) assessment is required to address the factors causing the impairment. Sheppard Creek currently exceeds State standards for nitrogen, phosphorus, and sediment. As a result, aquatic life and cold-water fishery beneficial uses are not fully supported. The primary contact recreation beneficial use is partially supported. The DEQ cites crop production, riparian grazing, silviculture harvesting, and forest roads as the probable sources of water quality impairment. The DEQ further cites historic land management, primarily roads, and timber harvest activities on national forest lands as having contributed to the condition of Sheppard Creek. However, the lower reaches of the creek are on private lands that are managed for agriculture and this is believed to be impacting Sheppard Creek as well. An excerpt from DEQ's summary report is as follows.

> *"The most disturbance was found near the mouth in Star Meadows. The channel is severely entrenched and confined. There is very little vegetation diversity; almost exclusively non-native grasses for hay production and grazing near the mouth. Habitats and vegetation have been severely altered. Major land uses in the drainage are logging higher up in the drainage and grazing and hay production in the lower half of the drainage. Good management practices were observed in the logged areas with good streamside management zones intact in most places. There was some evidence of historic riparian logging observed. Grazing and hay production occurs up to the channel margins."*

Sinclair Creek is a small tributary to Sheppard Creek and it is also on the 303(d) list. However, this stream is in Category 4C which means it is considered to be "impaired," but a TMDL is not necessary. According to Montana DEQ, Sinclair Creek is listed because it partially supports standards that are associated with the primary contact recreation beneficial use. The likely cause is cited as "low flow" (http://deq.mt.gov/CWAIC/wqrep/2006/Appendix _H_Section%202_4C_Final.pdf). The Brush Creek Fire did not burn into Sinclair Creek and no management activities are proposed within this drainage area.

Post-fire conditions in the project area would likely increase nutrient levels (nitrogen and phosphorus) in surface water, including Sheppard Creek. Fire causes many compounds to oxidize which makes them available for leaching and/or aerial deposition into surface water. Nutrients can also be transported into streams attached to soil particles associated with increased post-fire erosion. During the burning process, some nutrients in the grass and duff are released into the atmosphere; however, most remain in the ash and are rapidly reabsorbed into the topsoil (DeByle 1981). In Sheppard Creek, nutrient levels are likely to increase during the next two to three years, but decrease as the area recovers.

Increased nutrient loading (particularly nitrogen and phosphorus) can stimulate primary production (e.g. algae growth) in streams (Hauer and Spenser 1998, Gangemi 1991).

## Environmental Consequences

The potential impacts of the action alternatives are set within the context of the burned landscape. On a post-fire landscape where salvage logging is proposed, the primary hydrologic concern is erosion and sediment delivery potential. Sediment delivery to streams ultimately affects water quality and can have long-term negative effects on aquatic habitat. Therefore, analysis of alternatives focuses on these elements.

All action alternatives are designed to avoid high-risk areas where burn severity was high and soil recovery could be impacted from logging activities. Summer tractor logging is limited to low risk areas where green or lightly burned foliage is abundant and erosion risk is low. Tractors are limited to slopes less than 25 percent. In addition, units proposed for summer logging would use "in-woods" processing thus ensuring operations would be conducted over slash to protect soils. This would also reduce erosion potential on harvest units.

Sensitive areas such as units within riparian zones, wetlands, springs, and seeps have rigorous limitations on tractor yarding to reduce the potential for soil damage. Log suspension using aerial cable, helicopter, or the presence of large logs to prevent log dragging on the ground limits disturbance in these areas.

### Uncertainties Associated with Effects Analysis

The general approach in this analysis is to separate the potential effects of proposed management from the potential effects of the post-fire environment. The potential effects of post-fire conditions and management activities must be considered in terms of risk.

The term *potential* is used throughout the analysis when referring to hillslope erosion and sediment delivery because the nature of the effects is probabilistic. For example, a temporary road could be a substantial source of sediment if a 25-year thunderstorm event occurred during project implementation. However, a high intensity thunderstorm may not occur between the time the road is constructed and obliterated. Further complicating predictions of erosion, the Sheppard Creek area is in a constant state of change due to post-fire recovery (litterfall, vegetation reestablishment, soil processes, etc.).

The WEPP model is used in this analysis to assess potential erosion and sediment delivery on proposed harvest units, roads, and stream crossings. As stated in the Affected Environment section, predicted erosion values may only be within 50 percent of the true value. Erosion rates are highly variable, and most models can predict only a single value. Research has shown that observed values vary widely for identical plots or the same plot from year to year (Elliot, et al. 1995; Tysdal, et al. 1999). In addition, observed erosion rates can be very different from those predicted by Disturbed WEPP (Larsen and MacDonald 2007). The model output used in this analysis is based on 30-year simulations of local climate. The WEPP output includes erosion and sediment delivery estimates that are ranked from the largest to the smallest (see example output in Table 3-39). In the table, it is clear the average value for predicted sediment delivery (0.33 tons/acre) is higher than what might be expected during a six year storm event. The model predicts erosion would be expected at the 15-year storm event and larger.

**Table 3-39. Example Output from the WEPP Model for a Typical Burned Hillslope in the Project Area.**

| Return Period | Precipitation (in) | Runoff (in) | Erosion (tons/acre) | Sediment (tons/acre) |
|---|---|---|---|---|
| 30 year | 35.76 | 1.64 | 14.06 | 10.0661 |
| 15 year | 31.76 | 0.00 | 0.10 | 0.0018 |
| 6 year | 28.76 | 0.00 | 0.00 | 0.0000 |
| 3 year | 26.01 | 0.00 | 0.00 | 0.0000 |
| 1.5 year | 21.35 | 0.00 | 0.00 | 0.0000 |
| Average | 23.95 | 0.05 | 0.47 | 0.3337 |

Given the uncertainties, the model output used in the analysis is very useful in comparing alternatives and particularly useful in contrasting the effects of proposed management activities.

## *Direct, Indirect, and Cumulative Effects*

### Alternative A - No Action

Natural recovery from the wildfire would continue, as described in the *Affected Environment* section. Surface runoff and potential soil erosion would continue to decline, especially during the first five years after the fire. Erosion and sediment delivery potential would be slightly less than that of the action alternatives. Activities such as road management (including decommissioning), fuels management, timber harvest, culvert upgrades, stream restoration, and recreation would continue and the effects of these past, present, and reasonably foreseeable activities are discussed below and in the affected environment. Cumulative actions that are considered negligible are described in the cumulative effects worksheet (Exhibit G-3).

## Direct, Indirect and Cumulative Effects Common to All Action Alternatives

The following analysis focuses only on proposed management activities that have the potential to affect hydrologic processes, hillslope erosion, sediment delivery, channel morphology, and water quality. Some elements of the action alternatives are not expected to have any measurable effects.

Removal of trees killed by fire would not measurably affect key hydrologic processes, particularly interception, evapotranspiration, streamflow, or annual yield. Proposed salvage logging over snow during the winter months would have no affect on hydrologic processes (infiltration, surface runoff, etc.) or the potential for soil erosion or sediment delivery. In addition, helicopter logging would not measurably affect hydrologic processes (infiltration, surface runoff, etc.) or the potential for soil erosion or sediment delivery.

The three action alternatives vary in the amount of potential disturbance through the amount of summer logging activities, road construction/reconstruction, number of culvert installations/removals, and the amount of harvest near streams (Table 3-40). Alternative D represents the highest potential for impacts, followed by Alternative B. Alternative C is the least impactive alternative.

**Table 3-40. Summary of Activities by Alternative.**

| Alternative | Summer Harvest (acres) | Temporary Road Construction (miles) | Temporary Road Reconstruction (miles) | Culvert Installations and Removals (number) | Bark Beetle Harvest[3] (acres) |
|---|---|---|---|---|---|
| Alt A | 0 | 0.0 | 0.0 | 0 | 0.0 |
| Alt B | 3039 | 9.6 | 17.3 | 12 | 0.0 |
| Alt C | 1905 | 2.6 | 6.4 | 3 | 0.0 |
| Alt D | 2747 | 3.1 | 8.7 | 3 | 527 |

Construction of temporary roads has a high potential to affect on-site hydrologic processes and erosion. During the time these roads are constructed and used, they would be vulnerable to surface runoff and associated erosion. Erosion potential is typically highest immediately following construction and would decrease as soil material settles. Some temporary roads would be constructed on historic templates, which mean the road prisms (cut, fill, and road surface) are already in place. Disturbance would only occur on the road surface on these sites. In some cases, trees that have established on road surfaces would be removed. Reconstruction of these temporary roads would increase erosion potential and some soil material may be delivered to streams, particularly near stream crossings.

Installation of culverts would cause ground disturbance at stream crossing sites which would result in direct sediment delivery to streams (Table 3-40). Once harvest activities are complete, these culverts would be removed which would cause additional disturbance and sedi-

[3] Harvest of spruce and Douglas-fir trees would only occur if they become infested with bark beetles. The 527 acres includes areas of proposed harvest within RHCAs. Some portions of RHCAs contain riparian areas, wetlands, springs, and seeps. Other areas of RHCAs are considered upland (dry) habitats. The wet portions of the proposed harvest areas would be protected through careful design of the logging system.

ment delivery. Each culvert installation and subsequent removal is expected to deliver approximately 0.7 tons of sediment (Exhibit G-4). Channel morphology would be directly affected by culvert installation and subsequent removal. While culverts are in place, channels would not have access to floodplains and water velocity would likely increase above normal levels. This may cause accelerated bank erosion immediately downstream of culvert sites.

Over 100 miles of haul route are designated in the project area. The total length of haul routes varies slightly by alternative due to differences in the units that are accessed (Table 2-10). Designation and use of haul routes requires a variety of BMPs be implemented. These practices are designed to improve road drainage and minimize adverse effects of these roads on water quality. BMP implementation is likely to generate very small amounts of sediment, but in the longer term, would reduce sediment delivery due to improved road conditions. See Appendix C.

Table 3-41 demonstrates that potential activity-generated sediment is substantially less that what might be expected from the burned landscape as a whole. It is also clear that road construction, road reconstruction, and culvert work has the highest potential for sediment delivery and subsequent water quality impacts.

**Table 3-41. Potential Sediment Production that may Result from Post-Fire Conditions and the Action Alternatives.**

| | **Potential Sediment (tons)** | | | |
|---|---|---|---|---|
| **Potential Background Sediment**[4] | **Alt. A** | **Alt. B** | **Alt. C** | **Alt. D** |
| 2009 Potential Sediment From Burned Area | 7200 | 7200 | 7200 | 7200 |
| 2010 Potential Sediment From Burned Area | 1800 | 1800 | 1800 | 1800 |
| 2011 Potential Sediment From Burned Area | 500 | 500 | 500 | 500 |
| | | | | |
| | **Potential Sediment (tons)** | | | |
| **Potential Activity Generated Sediment** | **Alt. A** | **Alt. B** | **Alt. C** | **Alt. D** |
| New Temporary Road Construction | - | 6.5 | 1.7 | 2.1 |
| Re-construction of Existing Road Prisms | - | 9.7 | 3.6 | 4.9 |
| Culvert Installation and Subsequent Removal | - | 8.4 | 2.1 | 2.1 |
| Summer Ground-Based Salvage Logging[5] | - | 148 | 93 | 145 |

[4] About 80 percent of the Brush Creek Fire burned within the Sheppard Creek sub-watershed. Therefore, it is assumed that roughly 80 percent of potential background sediment would be generated in that sub-watershed.
[5] Sediment yields that may result from ground-based logging are considered to be exaggerated. The WEPP model does not account for equipment operation and skidding over slash, which results from in-woods processing. Ground based logging accounts for skid trails, cable corridors, skyline corridors, and landings.

The effect of increased sedimentation caused by road and culvert work may increase nutrient levels (phosphorus and nitrogen). However, this potential effect is expected to be very small because of the small proportion of activity-generated sediment compared to potential sediment from burned areas.

Harvest units may be a source of nutrients as well. Logging activity would increase the amount of slash material in direct contact with the ground. Smaller materials generally contain the most nutrients. Therefore, the potential for nutrient leaching would be slightly higher in salvage units.

The increased nutrient levels resulting from salvage logging would be small compared to the increase caused by post-fire conditions. This conclusion is based on the following rationale:

- Some biomass (stems and treetops) would be removed by slash treatments, lowering the nutrient contribution from the unit as a whole;
- Smaller limbs, twigs, and needles are the portions of a tree that contain the most readily releasable nutrients (Page-Dumroese, et al. 1991) and most have already been partially or totally consumed by the wildfire;
- Salvage logging would not substantially change the chemical or hydrophobic characteristics of the post-fire soils;
- Over time, the natural process of blow down after a wildfire increases the amount of limbs on the ground;
- The increase in sedimentation (conduit of nutrients) due to salvage harvest is relatively small compared to the increased erosion/sedimentation caused by the wildfire.

The overall increase in nutrient levels associated with the proposed salvage activities should not be measurable above natural variation.

Cumulative impacts can result when the effects of one activity are added to or interact with other activities in a particular place and within a particular timeframe. It is the combination of these effects, and any resulting impacts, that are the focus of the following analyses. The potential cumulative effects associated with the action alternatives are analyzed by sub-watersheds. These relatively small drainages overlap the project area in such a way that cumulative impacts can be meaningfully analyzed. Past, present, and future land use activities are discussed for each sub-watershed to evaluate potential cumulative effects of the action alternatives. The sub-watersheds used in the analysis are shown in Table 3-42.

**Table 3-42. Sub-Watersheds within the Project Area.**

| Sub-Watershed | Total Acres | Description |
|---|---|---|
| Plume Creek | 3,630 | From Good Creek to the headwaters |
| Gregg Creek | 5,966 | From Good Creek to the headwaters |
| Sheppard Creek | 24,152 | From the confluence with Griffin Creek to the headwaters |
| Griffin Creek | 21,374 | From the confluence with Sheppard Creek to the headwaters |

**Plume Creek**

Past management activities in the Plume Creek sub-watershed include road management[6] and timber harvest. The vast majority of these uses have occurred on National Forest lands. Road management, timber harvest, and fuel reduction are common management practices today.

Approximately 1147 acres burned in the Plume Creek sub-watershed during the Brush Creek Fire, and less than 15 percent of the burn was considered high severity. The post-fire ECA is approximately 41 percent. Annual water yield may become slightly higher than average due to reduced evapotranspiration, but this effect may only occur during wet years. Changes in water yield may be offset by continued declines in winter snow pack.

Fire suppression activities during the Brush Creek Fire included construction of fire line and safety zones. Approximately 13 miles of cross-country dozer line was constructed and is incorporated into the post-fire ECA value. All dozer lines and safety zones were rehabilitated immediately following suppression activities. Rehabilitation of dozer line and safety zones involved removal of berms and placement of slash material on top of disturbed soil. In general, the quantities of slash were relatively high to ensure that accelerated erosion does not occur. On very steep dozer lines, water bars were constructed prior to slash placement for added protection. Accelerated erosion and sediment delivery from safety zones and dozer lines are not expected.

Alternative B proposes about one mile of temporary road construction near a ridge to access Unit 54. There is approximately 200 feet of green forest between the proposed road and a headwater stream. This buffer should prevent sediment delivery to the stream during road construction and use.

Alternatives B, C, and D propose 118 acres of summer salvage harvest. Summer salvage harvest of the 118 acres is not expected to contribute to long term cumulative effects in the Plume Creek sub-watershed. If direct and indirect effects are not anticipated, then cumulative effects are not likely to occur. Potential erosion and sediment delivery from the fire itself is far greater than what may result from summer salvage logging. Salvage harvest of dead, dying and incidental live trees would not affect the current ECA value for the sub-watershed.

Alternative D proposes 57 acres of salvage harvest along Plume Creek. Units B35 and B36 run approximately 3200 feet along Plume Creek. These units would be harvested with the special treatment zone designations described in the description of Alternative D in Chapter 2. These designations would minimize soil disturbance and erosion. However, removal of spruce or Douglas-fir trees within 100 feet of the stream would reduce long-term recruitment of woody material. Recruitment of woody material tends to be episodic and associated with fire. A lack of woody material could cause reduced channel stability during the next several decades. The effects of reduced woody material recruitment would depend on the relative proportion of these units occupied by spruce trees and the number of trees removed.

Future management activities in the Plume Creek sub-watershed are likely to be the same as the present. Any cumulative effects associated with salvage harvest or temporary road

[6] Includes construction, reconstruction, maintenance, and decommissioning.

construction is likely to be short term (less than five years). Harvest of spruce and Douglas-fir trees in Units B35 and B36 would likely contribute to adverse cumulative effects on channel stability, aquatic habitat, and water quality, depending on the amount that is harvested within 120 feet of the stream. These effects could contribute to long term cumulative effects that could last several decades and possibly one to two centuries.

**Gregg Creek**

Past management activities in the Gregg Creek sub-watershed include road construction, road maintenance, and timber harvest. The vast majority of these uses have occurred on National Forest lands. There is a small amount of housing development on private lands near the mouth of the sub-watershed. Road management (maintenance and removal), timber harvest, and fuel reduction are common management practices today.

The Brush Creek Fire burned approximately 1569 acres of the Gregg Creek sub-watershed, and only 13 percent was considered high severity. The post-fire ECA is approximately 38 percent. Average annual water yield may be slightly elevated during wet years, but may be offset by continued decline of snow pack.

Fire suppression activities during the Brush Creek Fire included construction of fire line and safety zones. Approximately seven miles of cross-country dozer line was constructed, and is incorporated into the post-fire ECA value. All dozer lines and safety zones were rehabilitated immediately following suppression activities. Rehabilitation of dozer line and safety zones involved removal of berms and placement of slash material on top of disturbed soil. In general, the quantities of slash were relatively high to ensure that accelerated erosion does not occur. On very steep dozer lines, water bars were constructed prior to slash placement for added protection. Accelerated erosion and sediment delivery from safety zones and dozer lines are not expected.

Alternative B proposes about one half mile of temporary road construction near a ridge-top that separates the Gregg Creek and Sheppard Creek drainages. The proposed temporary road would access Unit 85. There is a 200-foot buffer of green forest between the road and Gregg Creek, which should be sufficient to prevent any sediment that may be generated from the road.

Alternative B proposes 78 acres of summer salvage harvest. Alternatives C and D propose 44 acres of summer salvage harvest. Summer salvage harvest associated with any action alternative is not expected to contribute to long term cumulative effects in the Gregg Creek sub-watershed. If direct and indirect effects are not anticipated, then cumulative effects are not likely to occur. Salvage harvest of dead, dying and incidental live trees would not affect the current ECA value for the sub-watershed.

Future management activities in the Gregg Creek sub-watershed are likely to be the same as the present. Any cumulative effects associated with salvage harvest or temporary road construction is likely to be short term (less than 5 years).

Given the past , present and reasonably foreseeable actions in Gregg Creek, it is unlikely that Alternatives B and C would contribute to long term (>5 years) cumulative effects.

### Sheppard Creek

Past management activities in the Sheppard Creek sub-watershed include road construction, road maintenance, and timber harvest. The vast majority of these uses have occurred on National Forest lands. There is a small amount of housing development on private lands near the mouth of the sub-watershed. Road management (maintenance and removal), timber harvest, and fuel reduction are common management practices today. Much of the private lands in the valley bottom near the mouth of the sub-watershed are used for agriculture.

The Brush Creek Fire burned approximately 20,081 acres, which accounts for about 83 percent of the sub-watershed area. The majority of the fire was considered moderate in severity (Table 3-35) and approximately 18 percent in the high severity category. The post-fire ECA is approximately 27 percent.

Fire suppression activities during the Brush Creek Fire included construction of fire line and safety zones. Approximately 35 miles of cross-country dozer line was constructed and is incorporated into the post-fire ECA value. All dozer lines and safety zones were rehabilitated immediately following suppression activities. Rehabilitation of dozer line and safety zones involved removal of berms and placement of slash material on top of disturbed soil. In general, the quantities of slash were relatively high to ensure that accelerated erosion does not occur. On very steep dozer lines, water bars were constructed prior to slash placement for added protection. Accelerated erosion and sediment delivery from safety zones and dozer lines are not expected.

The action alternatives propose varying degrees of salvage timber harvest (Table 3-43). Summer salvage harvest associated with any action alternative is not expected to contribute to long term cumulative effects in the Sheppard Creek sub-watershed. Salvage harvest of dead, dying and incidental live trees would not affect the current ECA value for the sub-watershed.

**Table 3-43. Summary of Activities by Alternative in the Sheppard Creek Sub-Watershed.**

| Alternative | Summer Harvest (acres) | New Road Construction (miles) | Road Recon-struction (miles) | Culvert Installations and Removals (number) | Bark Beetle Harvest (acres) |
|---|---|---|---|---|---|
| Alt A | 0 | 0 | 0 | 0 | 0 |
| Alt B | 2667 | 8.5 | 18.7 | 12 | 0 |
| Alt C | 1624 | 2.2 | 6.6 | 3 | 0 |
| Alt D | 2447 | 3.1 | 8.4 | 3 | 521 |

Alternatives B, C, and D each have the potential to produce sediment in the Sheppard Creek sub-watershed (Table 3-44). The estimated potential sediment production values are relatively small in light of sediment production that may result from post-fire conditions alone.

**Table 3-44. Potential Sediment Production that may Result from the Action Alternatives in the Sheppard Creek Sub-Watershed.**

| | Potential Sediment (tons) | | | |
|---|---|---|---|---|
| **Potential Activity Generated Sediment** | **Alt. A** | **Alt. B** | **Alt. C** | **Alt. D** |
| New Temporary Road Construction | - | 5.7 | 1.5 | 2.1 |
| Re-construction of Existing Road Prisms | - | 9.7 | 3.6 | 4.7 |
| Culvert Installation and Subsequent Removal | - | 8.4 | 2.1 | 2.1 |
| Summer Ground-Based Salvage Logging[7] | - | 131 | 80 | 131 |

Sediment production associated with road construction, reconstruction, timber harvest, and culvert installation/removals would be short term and probably masked by background sediment production associated with the post-fire environment.

Alternative D proposes to harvest about 521 acres of spruce and Douglas-fir in and adjacent to riparian ecosystems. The majority of these areas are directly adjacent to Sheppard Creek and its tributary streams. These units would be harvested with the special treatment zone designations described in the description of Alternative D in Chapter 2, which would help minimize the potential for sediment delivery. However, removal of spruce trees within 120 feet of the stream would reduce long-term recruitment of woody material. Recruitment of woody material tends to be episodic and associated with fire. A lack of woody material could cause reduced channel stability during the next several decades and possibly up to 200 years. The effects of reduced woody material recruitment would depend on the relative proportion of these units occupied by spruce trees and the number of trees removed.

Through the Burned Area Emergency Response (BAER) program, eight culverts would be replaced (up-sized) in the Sheppard Creek sub-watershed in 2008. These culverts are presently under-sized and need to be replaced to accommodate any post-fire floods that may occur during the post-fire recovery period. The replacements could generate up to six tons of sediment but are expected to have long-term benefits to local channel morphology and water quality. In addition, these new culverts would reduce any long-term risks of culvert failure and associated sediment delivery.

Analysis of existing conditions within the Sheppard Creek sub-watershed focused on channel morphology, water quality, past timber harvest, and road management. The existing condition of Sheppard Creek itself suggests it has been impacted by past management, particularly by roads. Alternative D has the highest potential to exacerbate conditions in Sheppard Creek due to proposed harvest of spruce and Douglas-fir near stream reaches. Post-fire conditions make it challenging to separate the effects of management activities from burned conditions alone. However, it is very likely that removal of future woody material would limit the long-term recovery of stream and riparian conditions in Sheppard Creek.

[7] Sediment yields that may result from ground-based logging are over-estimated. The WEPP model does not account for equipment operation and skidding over slash, which results from in-woods processing.

The majority of the Sheppard Creek sub-watershed burned in the Brush Creek Fire, leaving little potential for future timber harvest or fuel reduction during the next several decades. Because upper Sheppard Creek is home to a pure population of westslope cutthroat trout and it is a 303(d) listed stream, the whole drainage is a priority for restoration work. Specifically, 18.6 miles of road are scheduled for decommissioning in the next one to three years. This work would reduce continuous sediment delivery to Sheppard Creek and improve overall watershed condition.

Given the past, present and reasonably foreseeable actions in Sheppard Creek, cumulative effects could result from the action alternatives in the form of increased sediment. However, these effects would likely be masked by background sediment and would be difficult to detect. The proposed road decommissioning in the area would likely offset elevated sediment caused by management activities, but this effect would not be realized for 10-15 years. Removal of spruce and Douglas fir, as proposed in Alternative D would likely contribute to long term cumulative effects in Sheppard Creek and its tributaries.

**Griffin Creek**

Past management activities in the Griffin Creek sub-watershed include road construction, road maintenance, and timber harvest. The vast majority of these uses have occurred on National Forest lands. Road management (maintenance and removal), timber harvest, and fuel reduction are common management practices today.

The Brush Creek Fire burned approximately 2625 acres in the Griffin Creek sub-watershed and only five percent was considered high severity. The post-fire ECA is approximately 46 percent.

Fire suppression activities during the Brush Creek Fire included construction of fire line and safety zones. Approximately six miles of cross-country dozer line was constructed and is incorporated into the post-fire ECA value. All dozer lines and safety zones were rehabilitated immediately following suppression activities. Rehabilitation of dozer line and safety zones involved removal of berms and placement of slash material on top of disturbed soil. In general, the quantities of slash were relatively high to ensure that accelerated erosion does not occur. On very steep dozer lines, water bars were constructed prior to slash placement for added protection. Accelerated erosion and sediment delivery from safety zones and dozer lines are not expected.

Alternatives B, C, and D propose 107, 50, and 69 acres of summer ground-based salvage harvest, respectively. In addition, approximately 0.7 miles of new temporary road construction is proposed in all action alternatives. Summer salvage harvest is not expected to contribute to long term cumulative effects. If direct and indirect effects are not anticipated, then cumulative effects are not likely to occur. Salvage harvest of dead, dying and incidental live trees would not affect the current ECA value for the sub-watershed.

Alternative D proposes to harvest 66 acres of spruce and Douglas-fir in Unit B26. This unit overlaps with a small tributary to Hand Creek (which eventually flows into Griffin Creek). These units would be harvested with the special treatment zone designations described in the description of Alternative D in Chapter 2. These designations would help minimize the potential for sediment delivery. However, removal of spruce trees within 120 feet of the stream would reduce long-term recruitment of woody material. Recruitment of woody material tends to be episodic and associated with fire. A lack of woody material could cause reduced channel stability during the next several decades. The effects of reduced woody material recruitment would depend on the relative proportion of these units occupied by spruce trees and the number of trees removed. Approximately 2700 feet of the tributary channel lies within Unit B26.

The temporary road construction is proposed about 600 feet up-slope from Sylvia Lake. The land between the proposed road and the lake is burned, so it is likely that this road could contribute sediment directly into Sylvia Lake.

Given the past, present, and reasonably foreseeable activities in Griffin Creek, it is unlikely that long term (greater than five years) cumulative effects would result from proposed management activities in Alternatives B and C. Removal of spruce and Douglas-fir, as proposed in Alternative D, would likely contribute to longer term cumulative effects due to the role that these trees would have provided in terms of long term aquatic habitat and channel stability.

## REGULATORY FRAMEWORK AND CONSISTENCY

The regulatory framework for aquatic resources provides management guidance and protection in the form of laws, executive orders, policy, regulation, and the forest plan. Water resources management is regulated by the Clean Water Act, the Environmental Protection Agency's Antidegradation Policy, Montana Water Quality Standards, the Montana Stream Protection Act, and the Streamside Management Zone Act. These are described in greater detail in Appendix D, along with other appropriate water quality regulatory citations below.

### Executive Orders

Wetlands are protected under Executive Order 11990. This act directs federal agencies to *"minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands."* Effects on the maintenance of natural systems, flora, fauna, habitat diversity, and hydrologic utility are to be considered when evaluating a proposed project that could potentially affect a wetland. Floodplains are protected under Executive Order 11988, which directs federal agencies to *"reduce the risk of flood loss, to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by floodplains"*.

### Forest Plan Direction

The Flathead Forest Plan, under Management Area Specific water and soils direction, requires that the forest:

- Maintain long-term water quality to meet or exceed State water quality standards;
- Monitor surface-disturbing activities to ensure standards are met;

- Refer to Forest-wide standards under Water and Soils for Best Management Practices, Landtype Guidelines, and standards applicable to projects or activities within specific Management Areas;
- Analyze and evaluate all project proposals to determine the potential water quantity and quality impacts;
- Develop mitigation measures to minimize adverse impacts; and
- Apply Best Management Practices (BMPs) during Forest Plan implementation to ensure that Forest water quality goals are met.

More recent forest plan direction is provided by the Inland Native Fish Strategy (INFISH) amendment (1995). INFISH provides detailed goals, objectives, and standards that provide protection of riparian, wetland, and aquatic resources. Riparian Habitat Conservation Areas (RHCA) are a key component of this direction.

All action alternatives are consistent with the water quality goals, objectives, and standards described above and outlined in the Flathead Forest Plan, as amended. This consistency is met primarily by application of Best Management Practices in timber harvest areas and roads associated with timber removals.

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# FISHERIES

## Introduction

This report describes the existing conditions of fisheries resources in four separate analysis areas that overlap with the Sheppard Creek Post-Fire Project area as described in the alternative maps in Chapter 2.

## Information Sources

Information used in this analysis is gathered from a variety of local surveys, published literature, and previous environmental analyses. Fish habitat conditions have been gathered through various surveys from 1979 to 2007. The oldest habitat surveys were generally qualitative descriptions and not repeatable, while surveys since 1995 have been based on peer-reviewed protocols and gathered quantifiable, repeatable data. Determining habitat condition trends prior to 1995 is not possible and the older surveys are only utilized when nothing else is available. Fish population samples have been gathered since 1972. All habitat and population data utilized in this analysis is available at the Tally Lake Ranger District office. In addition, local or regional monitoring studies were utilized to project trends from human and natural disturbance. Peer-reviewed scientific literature is used as the primary source of information regarding life histories, habitat requirements, and land management effects. This analysis also considers the 1996 Sheppard-Griffin Environmental Assessment (EA), the 2000 Good Creek Resource Management Project Final Environmental Impact Statement (FEIS), the 2001 Teepee Mountain Salvage EA, and the 2004 Logan Creek Ecosystem Restoration Project FEIS.

## Analysis Areas

The Sheppard Creek Project is located within four distinct analysis areas, each of which is discussed in the following sections. These analysis areas include Logan Creek, Upper Sheppard Creek, Sylvia Lake, and Good Creek (Figure 3-12).

### Temporal Bounds

The temporal period of this analysis is 100 years. Most of the causal impacts of the fire or salvage logging may dissipate in just a few years, while downstream responses may occur several years or decades into the future. For example, Roper, et al. (2007) found little channel response to natural, landscape disturbance within a seven-year sampling but a significant response after a 14-year sample. Empirical research suggests a lag time of years or even decades before stream channels react to anthropogenic impacts (Bauer and Ralph 2001). One alternative incorporates salvaging some dead and down logs in Riparian Habitat Conservation Areas (RHCAs). Some of these trees (within 1 tree height of distance) might otherwise fall

into the stream channels. This potential impact could reduce recruitment of woody material in the long term (>100 years) along individual stream reaches where this activity is proposed. Therefore, a 100 year timeframe was selected because it incorporates this potential effect.

**Spatial Bounds**

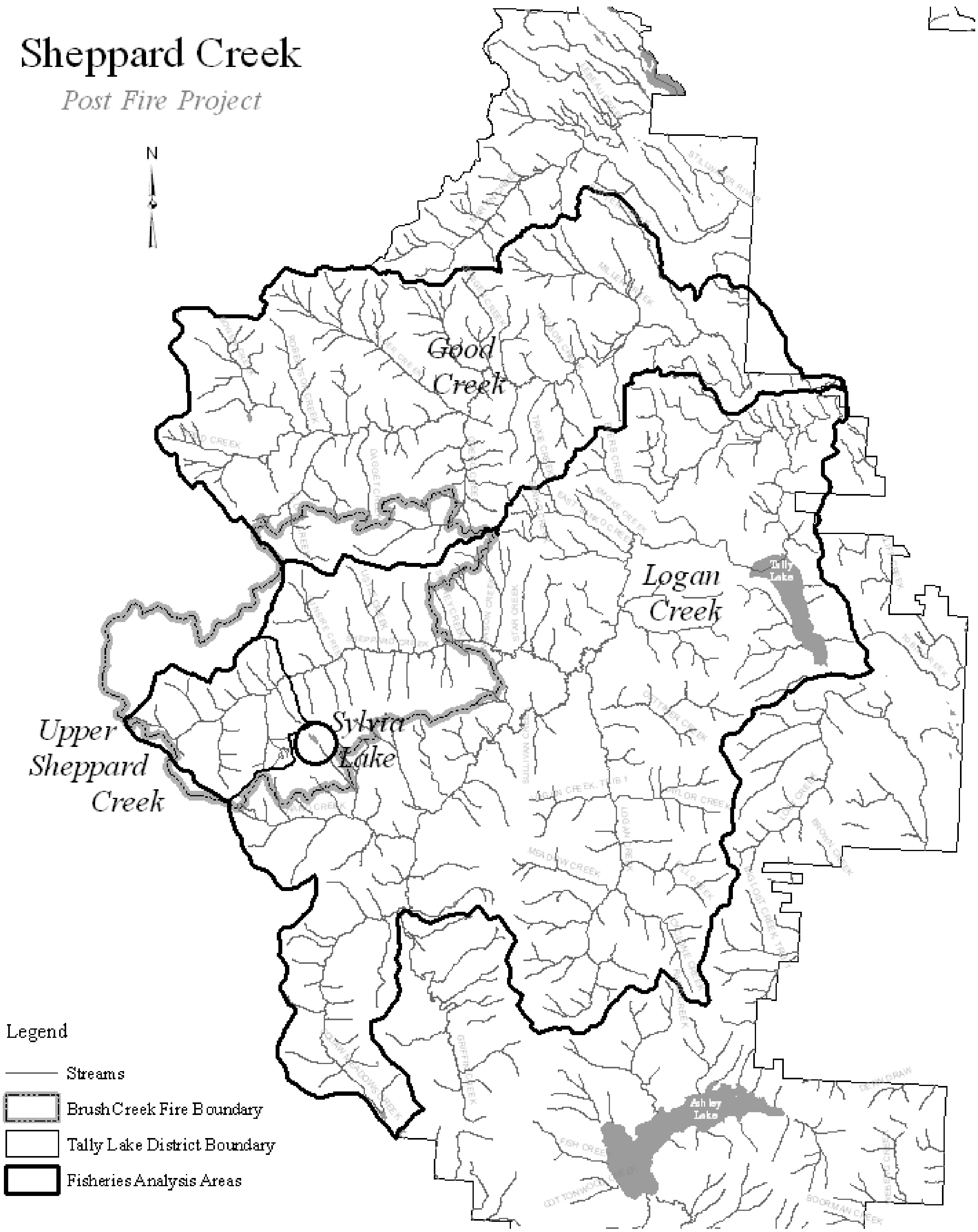
The Logan Creek analysis area includes three major tributaries of roughly equal size, namely Sheppard, Griffin, and Logan Creek. Fish can freely swim between these three creeks. The upstream limit of the Logan Creek population is a waterfall on Griffin Creek, a culvert at FR 538b on Sheppard Creek, and the extreme headwaters of Logan Creek. While upper Sheppard Creek beyond Forest Road (FR) 538B is a distinct analysis area, any impacts to upper Sheppard Creek's water quality would be observed downstream in this analysis area as well. The downstream limit is Tally Lake and likely the lower limit of any detectable change to fish habitat. Furthermore, while it is physically possible for fish to travel below Tally Lake, the warm water nature of the lake outlet hosts different fish species than lower Logan Creek and appears to separate the fisheries resources.

The Upper Sheppard Creek analysis area is distinct from lower Sheppard Creek and the rest of the Logan Creek analysis area (Figure 3-12). In 2001, a culvert designed as a fish migration barrier was installed at the crossing of Road 538b, to prevent further invasion of non-native brook trout. This barrier isolates the upper six miles of Sheppard Creek and its tributaries from the remainder of the Logan Creek population. Some fish probably emigrate downstream from Upper Sheppard Creek, but they cannot return. The upper limit of this analysis area is the extreme headwaters of Sheppard Creek and the lower limit is the culvert at Road 538b.

The Sylvia Lake analysis area encompasses a 23-acre lake that is located at the headwaters of Griffin Creek (Figure 3-12). This lake has no inlet and the outlet stream submerges under-ground several hundred feet from the lake. Fish populations in Sylvia Lake are completely isolated from others. This analysis area is defined as the lake and its short outlet channel.

The Good Creek analysis area incorporates the Good Creek sub-watershed. The upper limit of this analysis area is the extreme headwaters of each tributary. The lower limit is the confluence with Logan Creek and likely the lower limit of any detectable change to fish habitat. Furthermore, Good Creek's fish population has little to no interaction with the Logan Creek population above Tally Lake. The outlet of Tally Lake has warm water and different fish species than Good Creek, thus the outlet likely separates the fish population of the lake from lower Logan Creek and Good Creek.

**Figure 3-12. Fisheries Resource Analysis Areas.**



# Affected Environment

The existing condition of fish habitat and fish populations is not static, particularly in a post-fire environment. The Brush Creek Fire burned large proportions of the fisheries analysis areas, and the effects of the fire will be apparent in coming years as the habitat and populations adjust to changing conditions. Therefore, some of the discussions below are set within the context of change that is expected during the next one to five years.

## Logan Creek Analysis Area

### Logan Creek Fish Habitat

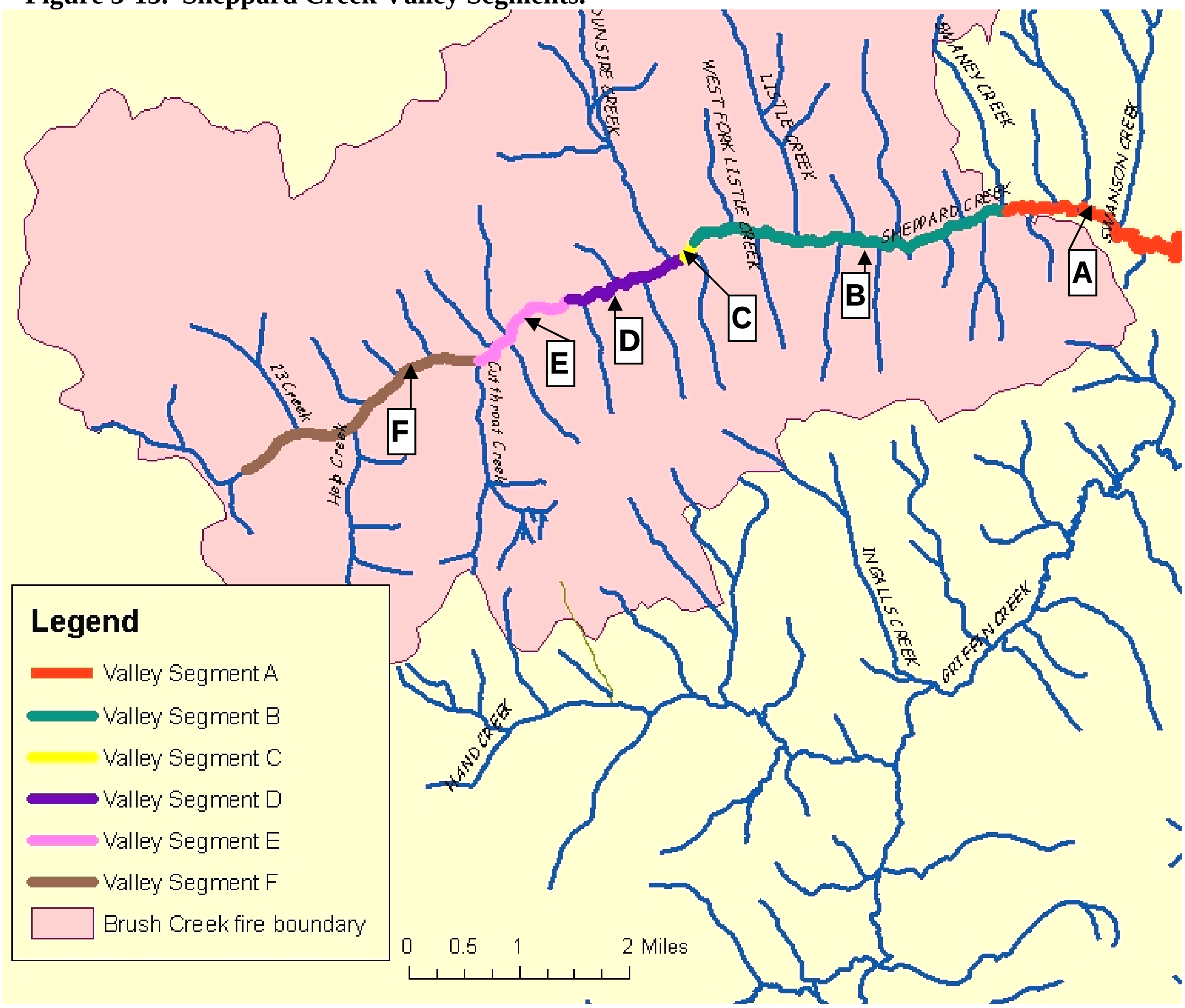
Fish habitat throughout the Logan Creek analysis area is in moderate condition. In general, streams are not limited by dissolved oxygen, pH, or excessive nutrients. All streams are capable of supporting coldwater fish. However, fish habitat has been impacted to some degree by past road construction, past timber harvest, and on-going livestock grazing. Sheppard Creek in particular has been identified by the Montana Department of Environmental Quality (DEQ) as an impaired water body (see *Hydrology* section).

The earliest habitat survey in any part of the Logan Creek analysis area was collected in 1979, several years after land management activities began. This makes it impossible to determine the historic, natural condition of fish habitat, or any trend since. In lieu of trend data, statements about habitat conditions in this analysis area are based on numeric comparisons between existing habitat conditions and reference conditions. Comparing existing data to similar streams that are in reference condition is one method of assessing habitat conditions (Kerschner, et al. 2004). This analysis utilizes a database of local reference streams to evaluate fish habitat condition (Exhibit F-3) and also incorporates goals and objectives provided by INFISH.

Lower Sheppard Creek has about eight miles of fish habitat and passes through four valley segments (Figure 3-13). A valley segment is a length of stream with similar gradient and floodplain characteristics that may have one or more fish habitat reaches. The uppermost valley segment (Segment D) begins at the fish barrier on FR 538B and extends downstream to just past the Dunsire Creek confluence. This valley segment meets INFISH goals in that it appears to have adequate wood and pools, and normal levels of fine sediment (Figure 3-14). Maximum water temperature is about nine degrees Celsius, which also meets INFISH goals. However, this valley segment appears to have unstable banks and shallow pools when compared to reference conditions. These conditions do not limit juvenile fish but greatly curtail the numbers of adult fish. Adult fish need deep waters and undercut banks to escape predators, rest from swimming, and to survive anchor ice conditions during the winter.

The cause of this reduced habitat condition may be the result of altered flow regimes triggered by past timber harvest and road construction. The Sheppard Creek sub-watershed has approximately 93 total miles of road (a density of 2.5 miles per square mile). Due to concerns about lingering impacts of high road density, a 1995 decision authorized reclamation of 36.6 miles of roads in Sheppard Creek. Over half of this project has been implemented and the remaining amount is scheduled to be implemented in 2009 or 2010. Timber harvesting began in the Sheppard Creek drainage in the late 1950s and some of the earlier harvest removed all the trees in riparian areas of tributary streams (broadly estimated to be 30 percent of total stream lengths based on aerial photographs). Livestock grazing within the Swaney Allotment also contributed to weakened stream banks, which in turn allowed the channel to become wider and shallower. In 1995, an assessment of the Swaney Allotment found only scattered areas of livestock damage on main Sheppard Creek, but more extensive trampled stream banks on various small, fishless tributaries.

**Figure 3-13. Sheppard Creek Valley Segments.**




Valley Segment C is a short, very steep cascade area just below the confluence of Dunsire Creek. The cascade is not a fish barrier and no habitat concerns are identified.

Valley Segment B extends for about 3.5 miles from near Dunsire Creek to Swaney Creek. This segment has sufficient numbers and quality of pool habitat, high levels of woody material, and cold water conditions. However, habitat surveys from 1992 and then 2007 suggest a declining trend of bank stability and pool habitat is becoming shallower. In addition, limited data suggests that this valley segment has elevated levels of fine sediment and that the trend is downward. It is assumed that this valley segment is experiencing the same cumulative effects as the upper one. Livestock grazing along the stream bank in this valley segment is common, but limited access allows only scattered points of bank trampling and subsequent sedimentation.

**Figure 3-14. Sheppard Creek Valley Segment D taken in October 2007.** Photograph illustrates wide channel, shallow pools, unstable banks and abundant woody debris.

The lowermost valley segment (Segment A) is a low gradient, sinuous channel with deep pools (Figure 3-15). Visual observations show that the stream bottom is almost completely covered in fine sediment. It is uncertain if this condition is caused by chronic sediment delivery from upstream sources or a natural condition. The stream banks are primarily lined with willow on National Forest lands but are unstable and eroding on private agricultural lands. The deep pools offer excellent adult fish habitat during the winter. Warm water temperatures during the summer (often greater than 15 degrees Celsius) routinely exceed tolerance for salmonids, forcing the fish to migrate out of the area.

Lower Sheppard Creek has three fish bearing tributaries: Dunsire Creek, Listle Creek, and Swanson Creek. The first one quarter-mile of Dunsire Creek is very high gradient and fish do not occupy the area. Several large beaver dams exist upstream of Road 113, and beavers continually attempt to plug the culvert. Road engineers have built a screen to protect the culvert but this is slowly becoming a fish barrier, and would one day fragment upper Dunsire Creek from the rest of the Sheppard Creek drainage. Trout live in the beaver ponds but spawn and rear in Dunsire Creek above the ponds for a length of about one mile. A 1979 survey noted excessive sedimentation in the spawning area (likely due to roads and timber harvest). A 1995 range assessment found some erosion from cattle grazing, especially in one tributary with a half mile of historic riparian timber harvest. An old, eroded stream crossing was removed in the early 1990s and a limited (unsuccessful) effort was made to dredge fine materials out of the spawning area.

**Figure 3-15. Sheppard Creek in Valley Segment A taken in August 2003.** Photograph illustrates deep pools, low gradient, and stream banks lined with willows.

Listle Creek has a moderately high gradient and was probably only historically used for spawning habitat. Inventories in 1979 and 1992 both noted high amounts of fine sediment, apparently caused by old roads and logging. Swanson Creek has an unstable channel due to old riparian clearcuts and some locations of cattle trampling but the stream does not appear to have excessive sediment. Other tributaries to Sheppard Creek, such as Swaney, Star, Sinclair, and a dozen other unnamed streams, are too small to support fish beyond the first several hundred feet of the stream. However, many of them have unstable channels due to past logging and some locations of raw, eroding banks due to cattle grazing. As a result, most of the tributaries are sources of sediment into Lower Sheppard Creek. Exhibit F-4 includes information about Logan Creek upstream and downstream of its confluence with Sheppard Creek.

## Logan Creek Fish Populations

Westslope cutthroat trout (*Oncorhynchus clarki lewisi*) is native to the Logan Creek analysis area and was once the dominate fish species. Westslope cutthroat trout (hereafter called cutthroat trout) had little competition for resources and, for the vast majority of the area, no predators. Cutthroat trout of the Logan Creek analysis area probably exhibited two life strategies. “Migratory” fish left their natal streams at age two or three and then traveled to the main stem of Logan Creek or Tally Lake for better forage conditions and grew large. They then returned to spawn in headwater tributaries at age five or six. “Resident” fish never left the spawning tributaries and did not grow very large. The only place cutthroat trout probably did not historically exist was above the waterfalls in Griffin Creek, as it is believed this area was fishless.

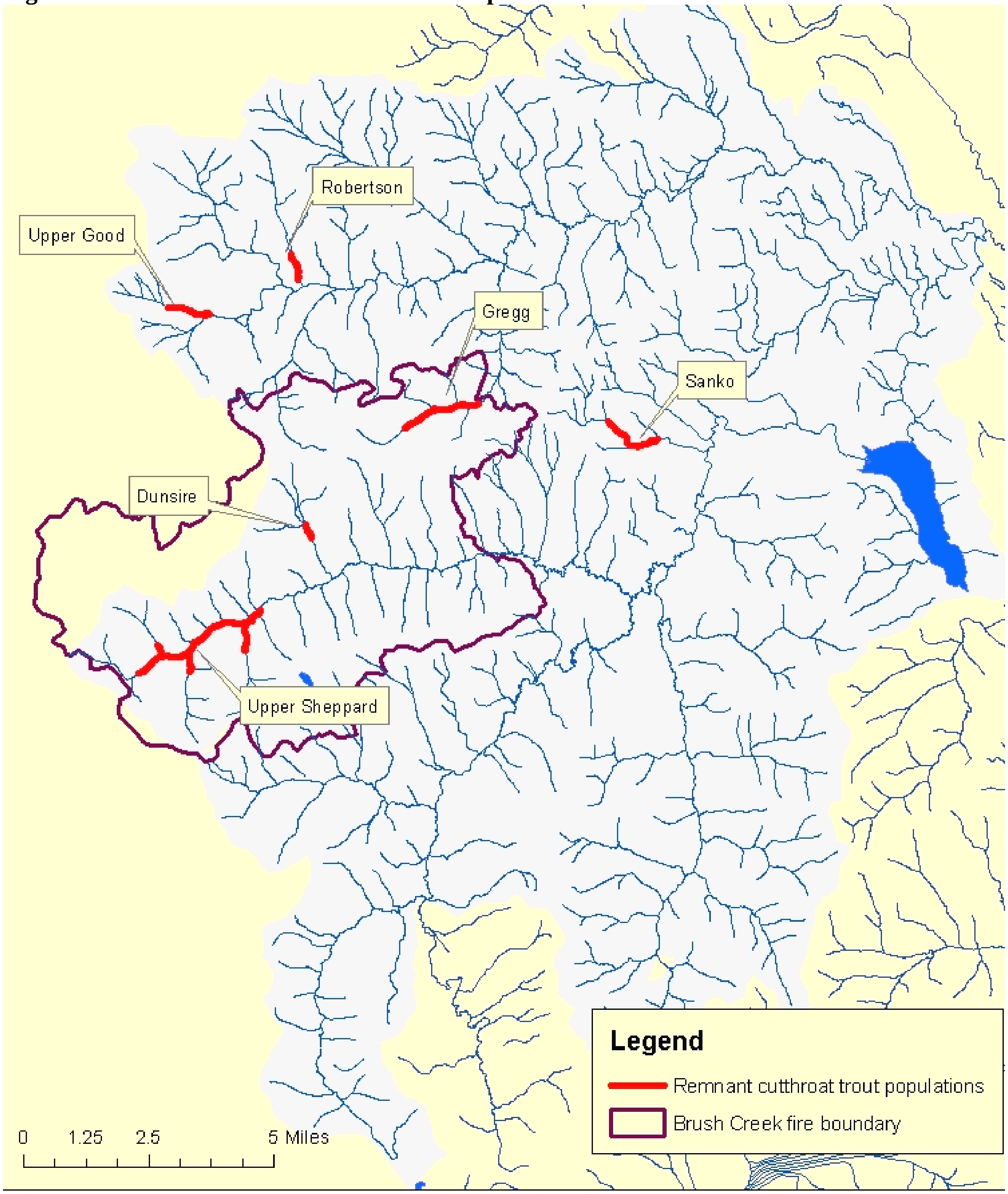
As disclosed in the 2004 Logan Creek FEIS, cutthroat trout are now extremely rare in the Logan Creek analysis area. Recent population surveys indicate the migratory life form is so rare they are probably not a viable population. Only a single, viable, resident population remains, located on a tributary called Sanko Creek. Occasionally, individual cutthroat trout of unknown genetic purity are captured in Griffin, Sheppard, or Logan Creek. These fish may be emigrants from Sanko Creek, upper Sheppard Creek (a separate analysis area), or upper Griffin Creek above the waterfall or a rare migratory fish. A very small cutthroat trout population may still exist in the headwaters of Dunsire Creek. This population had less than 50 fish prior to the Brush Creek Fire and was probably too small to be viable. It is unknown if any cutthroat trout in Dunsire Creek survived the fire. Direct mortality from wildland fire is rare but has been known to occur in small streams that burned with high severity (Rieman and Clayton 1997), which is the situation on Dunsire Creek.

It is estimated that cutthroat occupy only one percent if the historic habitat in the Logan Creek analysis area. Figure 3-16 illustrates the location and scarcity of cutthroat trout in the four analysis areas. The cause of this dramatic decline in cutthroat trout is primarily due to non-native brook trout (*Salvelinus fontinalis*). Brook trout were stocked throughout Northwest Montana in the 1940s and have become a widespread and dominant species. The presence of juvenile brook trout can result in reduced survival of juvenile cutthroat trout (Peterson, et al. 2004). Over time, this causes the cutthroat trout population to dwindle, even to the point of extirpation. In most streams of the Tally Lake Ranger District, the invasion of brook trout has ultimately resulted in the disappearance of cutthroat trout.

Sanko Creek is a small tributary to Logan Creek located a few miles west of Tally Lake, and it still hosts a viable population of cutthroat trout (over 2000 individuals). A beaver dam located a few miles above the stream mouth has thus far blocked any brook trout invasion. These three miles of Sanko Creek are believed to be the only sizable area anywhere in the Logan Creek analysis area, or even within the Stillwater basin, that has not yet been invaded by brook trout. Sanko Creek did not burn in the 2007 Brush Creek Fire. The beaver dam is old and may someday collapse, thus it is likely that brook trout would eventually overwhelm Sanko Creek. Preliminary investigations are underway to secure this population but nothing is reasonably foreseeable at this time.

Studies have shown that brook trout can invade almost any stream, but seem do best in smaller channels with slightly warmer temperatures (Adams 1999). Peterson, et al. (2004) concluded that lower elevation streams apparently give juvenile brook trout an advantage due to more moderate winter temperatures, although their study area was higher in elevation than anywhere on the Flathead National Forest. This may explain the situation in the Logan Creek analysis area. All of these streams are small, low gradient, not especially cold or groundwater controlled, and the area has no high elevation headwaters.

**Figure 3-16. Locations of Cutthroat Trout Populations.**




It is also likely that habitat degradation has played a role in brook trout invasion. Native fish generally tend to do better in watersheds with relatively little land management (Quigley and Arbelbide 1997) and conservation strategies advocate preserving habitat integrity as a possible means to minimize impacts from non-native species (Rieman, et al. 1993). There is some evidence that brook trout invasion may be facilitated by habitat degradation (Dunham, et al. 2002). However, there is no simple threshold of habitat conditions that define when cutthroat trout persist and when they disappear (Rieman, et al. 1999).

Another non-native fish that has had adverse impacts to cutthroat trout are rainbow trout (*Oncorhynchus mykiss*). Rainbow trout were stocked in Logan Creek just above Tally Lake and are now a wild, self-sustaining population. Rainbow trout are the dominate species of Logan Creek between Star Meadows and Tally Lake. They prefer larger streams and are seldom found in any small tributary to Logan Creek. Rainbow trout fill a similar ecological niche to cutthroat trout and can hybridize with cutthroat trout. The progeny are fertile and over the years, the population can become further and further hybridized. No genetic samples have been collected on the few random cutthroat trout still occasionally caught in Logan Creek, Sheppard Creek, or Griffin Creek. If these fish are the last of the migratory fish, they are probably hybridized with rainbow trout. Experience elsewhere in the Flathead Valley has found that if rainbow trout are present, the cutthroat trout are invariably hybridized to some degree.

Bull trout (*Salvelinus confluentus*) were historically present in Tally Lake. However, bull trout are extremely scarce today and considered functionally extirpated. Neither Tally Lake nor Logan Creek are considered critical habitat for bull trout recovery. Routine sampling by biologists has failed to catch any bull trout in Tally Lake since 1985. The Forest Service conducted population sampling in 1999 within lower Logan Creek but did not observe any bull trout.

**Logan Creek Post-Fire Conditions**

In late summer of 2007, the Brush Creek Fire burned a portion of the Logan Creek analysis area. Most of the fire burned within the Sheppard Creek area and a very small portion of the Griffin Creek area.

The fire did not immediately kill any brook trout in this analysis area, although some delayed mortality could be expected. Population surveys on lower Sheppard Creek have found brook trout are very numerous, averaging over 100 fish per 100 meters. The brook trout are small (averaging roughly four inches) and very few reach a desirable size for recreational fishing (generally seven inches or larger). The fish are smaller than expected, given Sheppard Creek's relatively large drainage area. Apparently, the Sheppard Creek brook trout begin to reproduce as early as two years old with few surviving past three years. This is a symptom of poor habitat conditions for adult growth and survival (detailed in sections below) while spawning and rearing habitat is not limited. Recreational fishing on Sheppard Creek is very sparse and has had a negligible impact on adult fish survival.

Within Griffin Creek, the fire burned the extreme headwaters of Hand Creek, Ingalls Creek, and a small fishless tributary. No fish habitat is located within the fire perimeter in these creeks. Downstream of the fire perimeter, Hand Creek contains a population of brook trout. Ingalls Creek has a sparse population of brook trout in the lower 300 feet, but a culvert on Road 538 blocks fish passage and most of Ingalls Creek is now devoid of fish. Headwater streams in the burned area are probably too small to transport fire-killed woody material downstream and alter fish habitat.

## Upper Sheppard Creek Analysis Area

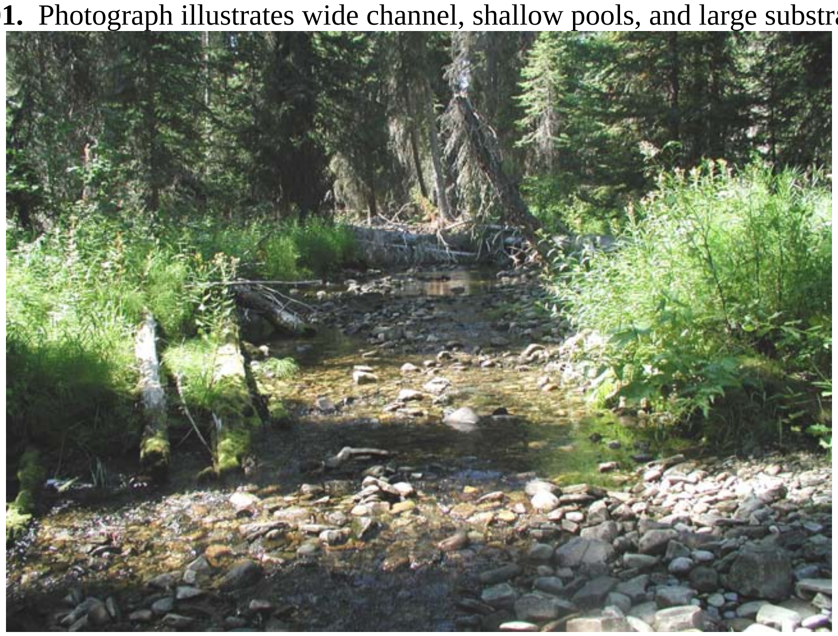
### Upper Sheppard Creek Fish Habitat

Upper Sheppard Creek has two similar valley segments. As disclosed in the Teepee Salvage Project EA (2001) and further discussed in the *Hydrology* section, upper Sheppard Creek appears to have scoured in the recent past. Finer sediments and gravels are generally absent; leaving large, unmovable substrate (64 to 256 mm diameter). Pools are quite shallow and infrequent compared to reference conditions (Figure 3-17). Channel stability appears to have declined over the years, although available data is too limited to make firm conclusions. Woody material appears to be abundant. There is some concern about unusually high water temperatures in this segment, which may be a result of wide channels and poor vigor of riparian trees. The combination of these habitat conditions has likely curtailed adult brook trout and cutthroat trout growth and survival. The cause of this condition is most likely due to the cumulative impacts of past timber harvest and high road density (4.3 miles per square mile). Another contributing factor is likely to be timber management in riparian areas on national forest and Plum Creek Timber Company lands.

The analysis area is within the Swaney cattle allotment, and a 1995 inventory found very little cattle use in the analysis area.

There are three small, unnamed tributaries that support fish habitat (Figure 3-13). In this analysis, these streams are referred to as 23 Creek, Help Creek, and Cutthroat Creek. The first two lack any information about current habitat conditions. Cutthroat Creek has two poorly designed road culverts that block upstream fish passage. The lower one, located at Road 2844, blocks fish for an estimated three-quarter mile of fish habitat. The upper one, located at Road 2845, is also likely to be a barrier that blocks another one quarter-mile of fish habitat, but this cannot be confirmed since fish cannot get past the lower one.

**Figure 3-17. Upper Sheppard Creek Valley Segment E taken September 2001.** Photograph illustrates wide channel, shallow pools, and large substrate.

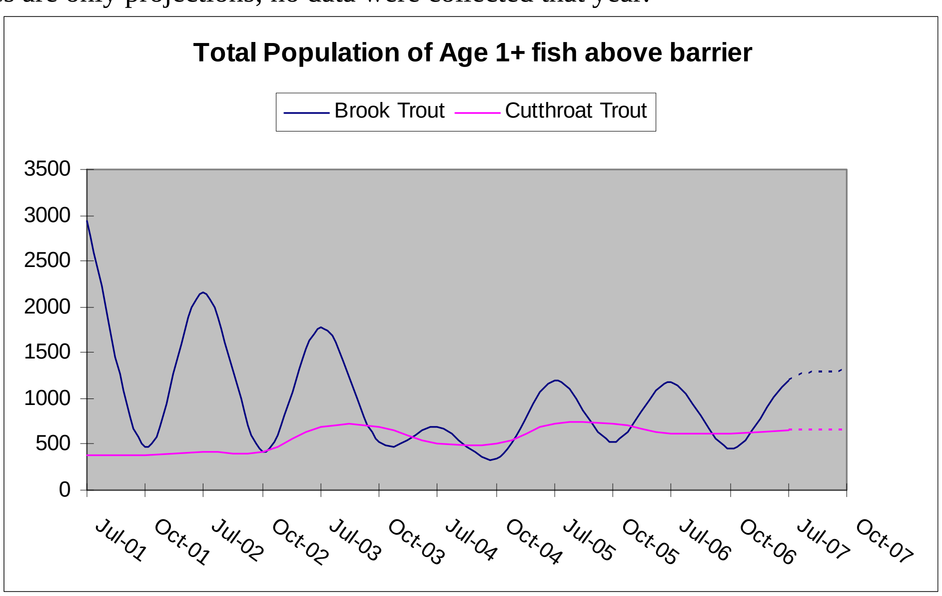


## Upper Sheppard Creek Fish Population

Unlike lower Sheppard Creek, the headwaters have always retained some numbers of genetically pure, native cutthroat trout. Unfortunately, brook trout have also invaded Upper Sheppard Creek, even in the extreme upper end of fish habitat. Various population surveys in the 1980s found brook trout out-numbered cutthroat trout but did not appear to be completely dominating the stream (Teepee Salvage EA 2001). However, cutthroat trout population monitoring in the late 1990s and early 2000s found a sharply declining trend. The entire upper Sheppard Creek population was estimated to be less than 400 individuals and it was determined the population would not persist unless an effort was made to reduce the numbers of brook trout. Only a single unnamed tributary (called "Cutthroat Creek" in this analysis) remained devoid of brook trout. This stream has a 100 meter length near the mouth that only has surface flows during very high runoff. The remaining mile of stream supports a small population of cutthroat trout, estimated to be about 50 individuals. This stream could support more fish, but about one mile of spawning habitat is inaccessible to cutthroat trout due to a poorly designed road culvert.

In 2001, the Forest Service replaced the culvert at FR 538B to block any further invasion of brook trout into upper Sheppard Creek. From 2001 to 2006, the Forest Service, Trout Unlimited, and other partners manually electroshocked and removed as many brook trout as possible during a one or two week period each year. During the six-year effort, over 9900 brook trout were removed from the stream. Cutthroat trout increased in numbers to about 600 to 700 fish (population fluctuates slightly). This helped stabilize the cutthroat trout population but recovery was not as dramatic as hoped. The problem is due to an insufficient effort to remove enough brook trout. Although many brook trout were removed each year, between 400 to 700 brook trout escaped and reproduced. The young-of-the-year brook trout continued to out-compete cutthroat trout juveniles. Figure 3-18 illustrates the upper Sheppard Creek population trend. Data prior to 2001 is not shown due to incompatible survey techniques.

**Figure 3-18. Total Numbers of Age 1+ Fish in Upper Sheppard Creek from 2001-2007.** The 2007 figures are only projections; no data were collected that year.



No effort was made to remove brook trout in 2007 due to the danger posed by the Brush Creek Fire. Recent research has shown that unless crews can remove every single spawning brook trout, annual suppression has only limited value (Meyer, et al. 2006). With this information, plus the slow response so far on Sheppard Creek, all future brook trout suppression may be discontinued.

**Upper Sheppard Creek Post-Fire Conditions**

Approximately 83 percent of upper Sheppard Creek was burned in a manner that most of the trees perished or may perish soon (based on vegetation burn severity analysis). Common management activities in this area include road management, timber harvest, and livestock grazing.

Portions of the Swaney Allotment are within Upper Sheppard Creek. Before the fire, cattle only lightly used the upper Sheppard Creek area and spent most of their time in the lower reaches. However, the loss of forested vegetation is likely to make the stream and riparian corridor more accessible by livestock.

**Sylvia Lake Analysis Area**

**Sylvia Lake Fish Habitat**

Sylvia Lake is about 23 acres and has a maximum depth of approximately 45 feet. The lake presumably has groundwater input and cold waters. Nutrient levels appear to be low since there is little aquatic growth in the littoral area. Only the southern outlet area has any macrophyte growth that provides reproductive habitat for frogs and toads. The campground area has a user-created boat launch. In 1981, gravel was hauled to the lake and placed near the boat launch to improve grayling spawning success, but it was soon buried under erosion from the boat launch. In 1999, the Forest Service created a boat ramp to encourage carry-down access and to restrict vehicles. This has partially curtailed erosion into the lake but some users still drive to the shoreline.

**Sylvia Lake Fish Population**

Sylvia Lake has no connecting water bodies and was historically fishless. Cutthroat trout were initially stocked from 1949 to 1953 but the population disappeared when stocking ceased. In 1958, Montana Fish, Wildlife, and Parks began to stock non-native grayling in Sylvia Lake. Grayling are extremely scarce in its native range (east of the Continental Divide) and Sylvia Lake (along with other lakes) is maintained to help preserve the species. While a very limited amount of natural spawning takes place on gravel bars on the southern end and near the carry-down boat access, the population is essentially maintained by periodic stocking. Recreational fishing for grayling is quite popular and catch rates can be substantial in spring and early summer. Montana FWP resumed stocking cutthroat trout in Sylvia Lake in 1997. The lake serves as a stocked fishery with no natural reproduction. Visual observations suggest no fish perished in the Brush Creek Fire.

### Post-Fire Conditions

Unlike the nearby streams, the ash fallout during the Brush Creek Fire resulted in a spike of nutrients that remained in Sylvia Lake and did not flush downstream.

## Good Creek Analysis Area

### Good Creek Fish Habitat

In general, the Good Creek sub-watershed has good fish habitat conditions but there are areas of concern. Details can be found in the 2000 Good Creek Resource Management Project FEIS project files. The majority of tributaries to Good Creek have good spawning habitat conditions (with little fine sediment deposition), but the Plume Creek and Gregg Creek tributaries are notable exceptions. The 2000 FEIS concluded poor conditions in Plume Creek may be natural, but that habitat conditions in Gregg Creek were due to the cumulative effects of past forest management. Improved analytical models and increased data acquired in subsequent years indicate poor conditions in Plume Creek may not be natural. Both of these streams have experienced erosion from channel changes. The headwaters of both streams were clearcut in the 1950s and 1960s, which resulted in the stream scouring down to boulders and washing finer sediments downstream. The middle and lower portions of Gregg and Plume Creeks became depositional areas for the sediment plus had additional erosion caused by unstable channels from changes in springtime runoff patterns. In addition to poor habitat conditions, the culvert on Road 60A at Gregg Creek is a barrier to any upstream fish migration. This has blocked approximately one-quarter mile of historic spawning habitat and rendered it fishless. Details on the condition of each portion of Plume and Gregg Creek can be found in Exhibit F-5.

It is unknown if there is any cumulative effect on substrate conditions in middle and lower Good Creek. Existing habitat surveys of this area did not quantify the condition. Habitat conditions of the headwaters area was surveyed in 1997 and was monitored once again in 2006. Habitat conditions remain very good in all aspects except for fine sediment. More fine sediment was noted in 2006 and the average particle size has decreased. It is uncertain whether or not this is a trend or a reflection of natural variability. Due to the importance of cutthroat trout and potential sensitivity of any disturbance on species composition, most land management activities were deferred in the headwaters area in the 2000 Good Creek Record of Decision.

Other than the substrate condition, the Good Creek FEIS found the majority of the Good Creek watershed has fish habitat near reference condition. Bowen Creek, the middle portion of Good Creek, and the headwaters of Good Creek appear to have less large woody material than expected for uncertain reasons. Pool frequency is less than expected in Miller Creek and lower Good Creek. The Good Creek FEIS concluded this may be due to past land management, natural conditions, or both. The residual depth of pools was not analyzed in the 2000 FEIS, but in recent years this feature has been noted as one indicator of cumulative effects. Plume Creek has shallow, low-quality pools that suggest the stream has been impacted by land management. The upper two miles of Gregg Creek also has shallow pools but pool depths appear to be deeper in the lower reaches. Several deep pools have been documented in the headwaters of Good Creek in 1997 and 2006.

**Good Creek Fish Population**

As described in the Good Creek Resource Management Project FEIS, Good Creek (with its 13 named tributaries) has over 50 miles of coldwater fish habitat. Historically, cutthroat trout utilized a migratory life form and were the predominate species throughout the drainage. Cutthroat trout spawned in the tributaries and extreme headwaters and then matured in middle and lower portions of Good Creek. However, the invasion of non-native fish has greatly reduced cutthroat trout numbers. Brook trout are believed to have invaded every single tributary except Robertson Creek (a small waterfall blocks fish passage). Rainbow trout, which can hybridize with cutthroat trout, are fairly common in middle and lower portions of Good Creek. Lake trout, which prey on cutthroat trout, also forage seasonally in lower Good Creek. It appears the migratory strain of cutthroat trout has been lost and only small, remnant populations exist in headwater tributaries as resident fish.

Within the Good Creek watershed, cutthroat trout are still abundant in just three locations representing only six percent of the historic stream length of the analysis area. The extreme headwaters of Good Creek contain a very small population (perhaps 200 to 300 fish) of genetically pure cutthroat trout. This population occupies about two miles of stream and a small (one meter high) waterfall is situated in the middle. Below the waterfall, brook trout have invaded but are not well established. There are no brook trout above the waterfall which may secure the upper mile from invasion. Another small cutthroat trout population exists in Robertson Creek. This stream was historically fishless but Montana FWP stocked it in 2001 to bolster cutthroat trout numbers. Neither the Good Creek headwaters nor Robertson Creek were impacted by the Brush Creek Fire. The third population exists in the headwaters of Gregg Creek. The upper two miles of Gregg Creek primarily held cutthroat trout (of unknown genetic purity) through the 1990s. However, in 1999 it was noted brook trout were increasing in numbers and cutthroat trout were decreasing. No further monitoring has taken place and it is uncertain if cutthroat trout are still present. Cutthroat trout are also still present (in very low numbers) in Alder Creek, Potter Creek, and Bowen Lake.

The 2007 Brush Creek Fire also burned a portion of Plume Creek. This stream only contains brook trout with historic cutthroat trout extirpated. Live brook trout were visually observed in Plume Creek after the fire was contained. The fire also burned the headwaters of Daggett and Trixie Creeks. These small brook trout streams only have about 200 meters of fish habitat near their confluence with Good Creek and were not immediately impacted by the fire.

Bull trout were reported to exist in the Good Creek watershed in 1937 and 1938 (USDA Forest Service c. 1939). The exact location of bull trout habitat is unknown, but the most likely area would be lower Good Creek where it may have suitable foraging habitat. No fish population data exists from the 1930s to 1971. Since 1971, over 40 fish population surveys have been conducted throughout Good Creek and none have found bull trout. Good Creek does not offer optimal spawning conditions for bull trout but it may be periodically used by bull trout to forage on prey species. Good Creek does not have designated critical habitat and it is not a priority watershed for bull trout.

### Good Creek Post-Fire Conditions

The Brush Creek fire burned portions of the extreme headwaters of the Good Creek Sub-watershed, within the Gregg Creek and Plume Creek drainages. The fire burned approximately 30 percent of Gregg Creek and 31 percent of Plume Creek. Since the fire burned only a small percentage of Daggett Creek, and no activity is proposed in this drainage with any alternative, Daggett Creek is not reviewed further.

## Environmental Consequences

The potential impacts of the action alternatives are situated in the burned landscape where the primary concerns for the fisheries resource are erosion and sediment delivery potential. Sediment delivery to streams affects fish habitat and ultimately fish populations. These effects can be short-term (one to five years) or long-term (several decades). Sediment delivery is associated with the *Soils* and *Hydrology* resources; therefore this analysis relies heavily on predicted effects in those sections of this chapter.

The general approach of the fisheries analysis is to separate the potential effects of proposed management activities from the potential future conditions of the post-fire environment. The term *potential* is used throughout the analysis when referring to sediment delivery because the nature of the effects is probabilistic, particularly in a post-fire environment. For example, a temporary road could be a substantial source of sediment if a 25 year thunderstorm event occurred during project implementation. On the other hand, a high intensity thunderstorm may not occur between the time the road is constructed and reclaimed. To further complicate predictions of erosion, the Sheppard Creek area is in a constant state of change due to post-fire recovery (litterfall, vegetation reestablishment, soil processes, etc.).

### <u>Direct, Indirect and Cumulative Effects of Alternative A- No Action</u>

Natural recovery from the wildfire would continue, as described in the *Affected Environment* section. Surface runoff and potential soil erosion would continue to decline, especially during the first five years after the fire. Aquatic habitat would begin to react to post-fire conditions within the next five years due to high flows and recruitment of woody material. Erosion and sediment delivery potential would be slightly less than that of the action alternatives. Activities such as road management (including decommissioning), fuels management, timber harvest, culvert upgrades, stream restoration, and recreation would continue and the effects of these past, present, and reasonably foreseeable activities are discussed below and in the affected environment. Cumulative actions that are considered negligible are described in the cumulative effects worksheet (Exhibit F-11).

### Effects in the Logan Creek Analysis Area

Post-fire erosion is a concern during the next few years because it can degrade fish habitat and impact populations. The *Hydrology* section of this DEIS contains detailed discussions about the potential for post-fire surface runoff, erosion, and sediment delivery. Erosion potential was the highest immediately following the fire and would decrease rapidly as the burned area recovers. Increased levels of suspended and bedload sediment are expected during 2008 and beyond. High stream flows may cause accelerated bank erosion, which could be another source of sediment. Furthermore, many burned riparian trees would die and fall over, leaving exposed root balls to contribute sediment. Trees that fall into the stream channel may divert flows and allow the stream to wander across the floodplain and scour new channels. This lateral movement and creation of new channels can be a substantial source of sediment. At the same time, the woody debris does trap sediment and deposits it in the floodplain.

The only impact of the fire in the Griffin Creek headwaters may be a short-term increase in sediment during the post-fire recovery period. Considering the burnt area is only five percent of the Griffin Creek watershed, the likelihood is small there would be a measurable increase of sediment in fish habitat downstream.

The initial runoff in the spring of 2008 may have the greatest amount of sediment delivery to Lower Sheppard Creek (see *Hydrology* section). As the burned area recovers, the potential for erosion and sediment delivery would decline. The rate of vegetative recovery is dependent upon the type and amount of precipitation during the recovery period, which is expected to be about five years. By 2011, sediment delivery potential is expected to return to pre-fire conditions.

Downstream of the fire area, the fire impacts to Tally Lake are expected to be very small. Tally Lake is very deep and unproductive. If post-fire sediments were transported to the lake, no change to productivity or eutrophication would be expected. Sediment deposition in lower Logan Creek is unlikely because of its steep gradient and confinement.

### Effects in the Upper Sheppard Creek Analysis Area

As a whole, upper Sheppard Creek would initially experience increased sedimentation, slightly increased water temperatures, wider and unstable channels, but also new woody material and new pools as a result of the fire. The additional woody material should greatly help reduce stream power in the upper Valley Segments and help restore degraded fish habitat. Over time, channel conditions would improve over current levels.

There is uncertainty how fish populations in upper Sheppard Creek would respond to post-fire conditions. Aquatic ecologists have noted that fish populations with connectivity to an array of habitat conditions, such as unburned areas, tend to be resilient (Bisson, et al. 2003; Rieman and Clayton 1997; Reeves, et al. 2006). Upper Sheppard Creek, however, is isolated from the rest of the Logan Creek analysis area due to an intentionally-placed barrier to fish migration at Road 538B. Both the cutthroat and brook trout above the culvert may migrate downstream and exit but there is no potential for the population to be re-founded from below.

An analysis of 17 streams in the Bitterroot Valley, that were burned in year 2000, found that in most cases cutthroat trout recovered quickly and even exceeding pre-fire population levels. Brook trout also recovered but at a slower rate. Only one particular stream, which had high severity burn, experienced a dramatic population shift with brook trout completely replacing native species. The author concluded that in most situations, wildfires will not alter species composition as long as there is connectivity to other populations (Sestrich 2005). Since upper

Sheppard Creek is isolated, there remains uncertainty how the population would respond. Dunham, et al. (2002) noted that brook trout tend to be more abundant in disturbed watersheds (unnatural flow regimes) and warmer streams. Upper Sheppard Creek would experience changes in flow regime (due to the fire and other cumulative impacts described earlier) and would have slightly warmer temperatures.

The most reasonable prognosis is that both cutthroat trout and brook trout would initially decline during the next one to three years due to suspended sediment and sediment deposition. Normally cutthroat trout would then recover more quickly, but since the fish in upper Sheppard Creek are isolated, they cannot rely on immigrants to bolster the population. Brook trout would begin to gain the advantage due to anticipated warmer water temperatures. After that it is exceedingly difficult to estimate population dynamics. The improved brook trout recruitment could curtail cutthroat trout survival, but on the other hand, the improved habitat conditions could help cutthroat trout survival.

A population viability model called “Vortex” was used to estimate risk of extirpation of cutthroat trout within 100 years, given the parameters of expected habitat conditions, existing population size and random catastrophic events such as floods, droughts or a re-burn of dense riparian fuels. The model’s primary value is to compare alternatives rather than estimate absolute population viability. After 100 simulations, the model estimates that there is a three percent chance of cutthroat trout extirpation and a 97 percent chance that the population remains viable (Exhibit F-8). Local observations of other small, isolated cutthroat trout streams on the Flathead National Forest are consistent with this estimate. There are approximately 15 other isolated cutthroat trout populations residing on the Flathead National Forest beyond those described in this analysis (exact number is unknown). Two of the 15 isolated populations have been lost since monitoring began in the early 1980s. Yew Creek and upper Buck Creek of the Swan Valley each had approximately one mile of fish habitat and cutthroat trout became extirpated roughly 30 to 35 years after isolation. Brook trout were not present in either stream and the extirpation is believed to be due to genetic inbreeding or a stochastic event. Upper Sheppard Creek and its tributaries would have about six times the available habitat of those streams (once the barriers on Cutthroat Creek are removed) but the presence of brook trout negates this benefit. Based on consideration of both the Vortex model and local experience, the likelihood of cutthroat trout extirpation is fairly low, but it should not be ruled out.

### Effects in the Sylvia Lake Analysis Area

Erosion from hillslopes immediately around the lake is likely to contribute sediment (and ash) to the lake, which would likely raise nutrient levels and subsequently primary production. Sylvia Lake is oligotrophic but it does have extensive littoral areas. An increase of macrophyte plant growth in the littoral area is likely as plants take advantage of sunlight and nutrients. Algae blooms are not expected because the spike in nutrient levels is too small to begin eutrophication. After a few years, the plants would have utilized the nutrient spike and die off. The amount of decomposition would be too small to affect dissolved oxygen levels or pH. Within a few years, fish habitat in Sylvia Lake is expected to be identical to that prior to the fire, with the exception of a few trees that may fall into the lake. The slight changes to fish habitat as a result of the fire are too small to affect fish populations in the long term.

There was virtually no fire suppression activity within the lake basin other than shrink wrapping recreational structures (which has no impact to fish habitat).

**Effects in the Good Creek Analysis Area**

Within both Gregg Creek and Plume Creek, there is a potential for post-fire sediment delivery. As described in the Sheppard drainage, sedimentation would likely result in streamside erosion and also indirect effects to the flow regime, which then trigger reduced channel stability and scoured stream banks. Modeling suggests that about 1300 tons of sediment could be expected in 2008 for both streams totaled. This is over 20 times the pre-fire levels and then should gradually subside by year 2011. The sediment deposition would be expected in the middle and lower portions of Plume Creek and Gregg Creek. These areas already have high levels of fine sediment. Sedimentation in downstream Good Creek would be too small to measure since the fire only burned eight percent of the watershed.

In the headwaters for Gregg and Plume Creeks, several riparian area clearcuts were implemented several decades ago resulting in 0.8 miles of degraded habitat. These young, regenerated stands are still too small to impact the stream and any fire killed seedlings would be swept downstream. Only the un-harvested riparian areas between the old clearcuts have potential to contribute large woody material (they total 0.65 miles of stream length). Gregg Creek also has about 1.3 miles of stream length with historic riparian harvests but due to the patchy nature of the fire, most of the headwaters of Gregg Creek were unburned. However, a one-half mile length of middle Gregg Creek flowing through a mature spruce stand got lightly burned. The trees in this area may perish and fall into Gregg Creek resulting in localized bank scouring, pool formation, and reduction of stream power. Ultimately the Brush Creek fire should help move about 0.65 miles of Plume Creek and 0.50 miles of Gregg Creek towards historic habitat conditions and INFISH goals.

No change is anticipated in water temperatures of either Gregg Creek or Plume Creek because the majority of these sub-watersheds have unburned, forested riparian areas to shade the stream from solar radiation.

## Direct, Indirect and Cumulative Effects of the Action Alternatives

Westslope cutthroat trout and brook trout are the primary fish species in the project area. Bull trout would not be affected by any of the action alternatives (see *Affected Environment* section).

The potential effects of the action alternatives vary by the amount of ground disturbance associated with summer logging, road construction/reconstruction, number of culvert installations/removals, and the amount of harvest near streams (Table 3-45).

Construction of temporary roads has the highest potential to affect fish habitat through sediment delivery. During the time these roads are constructed and used, they would be vulnerable to surface runoff and associated erosion (see *Hydrology* section). Studies have shown that road construction can result in sediment delivery to streams and often produces more sediment than is produced by timber harvest activities (Anderson and Potts 1987, Everest, et al. 1987; MacDonald, et al. 1991). New road construction, even for temporary roads, can potentially impact fish habitat (Reeves, et al. 2006; Karr, et al. 2004).

**Table 3-45. Summary of Activities by Alternative.**

| Alternative | Summer Harvest (acres) | Temporary Road Construction (miles) | Temporary Road Reconstruction (miles) | Culvert Installations and Removals (number) | Bark Beetle Harvest[1] (acres) |
|---|---|---|---|---|---|
| Alt. A | 0 | 0.0 | 0.0 | 0 | 0 |
| Alt. B | 3039 | 9.6 | 17.3 | 12 | 0 |
| Alt. C | 1905 | 2.9 | 6.6 | 3 | 0 |
| Alt. D | 2747 | 3.2 | 8.5 | 3 | 527 |

Installation of culverts would cause ground disturbance at stream crossing sites which would result in direct sediment delivery (Table 3-46). Once harvest activities are complete, these culverts would be removed causing additional sediment delivery. Each culvert installation and subsequent removal is expected to deliver approximately 0.7 tons of sediment (Exhibit F-9). Alternative B proposes 12 stream crossings, 11 of which would be located in intermittent streams and one located in fish habitat (Cutthroat Creek). Most of these new crossings are located on old road prisms. Approximately one half mile of road reconstruction would be located in the riparian corridors of Listle Creek and upper Sheppard Creek. There is a high potential for direct impacts to fish habitat at these locations.

Alternative B would not retard recruitment of wood into stream channels. Brown, et al. (2003) noted that 70 to 95 percent of large woody debris recruitment came from an area 60 feet from the stream. Reeves, et al. (2006) note that one site potential tree height would provide about 100 percent of all large woody debris recruitment. In the Sheppard Creek watershed, the overall average site potential tree height is about 120 feet. Therefore, the riparian buffers would be more than sufficient to ensure large woody debris recruitment for perennial and fish-bearing streams. Along intermittent or ephemeral draws, the riparian buffer may only protect about 70 percent of the woody debris recruitment on intermittent or ephemeral streams. It is assumed that since the majority of potential large woody debris will reach the channel, this is sufficient wood to trap sediment and reduce stream power. Streams like Sheppard Creek are dependent of wood and evolved with periodic disturbances like wildland fire to maintain productive habitat features (Rieman, et al. 2005; Beschta, et al. 2004). Alternative B does not alter this natural process and helps achieve INFISH goals.

Alternative C proposes three new stream crossings but does not propose any temporary roads that are close to streams or riparian areas. This alternative proposes 2.6 miles of new temporary roads and re-uses approximately 6.4 miles of historic roads within the analysis area. This alternative only has BMP work on about two miles of road and fewer acres of salvage harvest than Alternative B. There are no anticipated impacts from using temporary roads in Alternative C.

[1] Harvest of spruce and Douglas-fir trees on these acres would only occur if they become infested with bark beetles. The 527 acres includes areas of proposed harvest within RHCAs. Some portions of RHCAs contain riparian areas, wetlands, springs, and seeps. Other areas of RHCAs are considered upland (dry) habitats. The wet portions of the proposed harvest areas would be protected through careful design of the logging system.

Roughly four miles of the proposed 7.5 miles of new temporary road construction has little potential for impact. However, the other 3.5 miles of new temporary road construction proposed in Alternative B have a high potential for sediment delivery. These are the temporary roads that access units 1, 16, 17, 18, 19, 20, 54, 55, 58, 65, 110, and 113.

Sediment delivery associated with salvage harvest on upland sites in Alternatives B and C are expected to be very low, compared to background sediment delivery that may result from post-fire conditions (see *Hydrology* section).

Over 100 miles of haul route are designated in the project area. The total length of haul routes varies slightly by alternative due to differences in the units that are accessed. Designation and use of haul routes requires a variety of Best Management Practices (BMPs) be implemented that improve road drainage and minimize impacts on fish habitat. Implementation of BMPs may produce small quantities of sediment, but would reduce persistent sediment delivery in the longer term (several years) by improving road drainage.

In Alternatives B and C, no harvest activity is proposed in Riparian Habitat Conservation Areas (RHCAs). RHCAs are areas along streams, lakes, ponds, springs, and wetlands that have special management direction to protect water quality and fish habitat. Typically, RHCAs are 300 feet from either side of fish habitat, 150 feet from perennial streams and 50 feet from intermittent/ephemeral streams. Furthermore, some moist areas mapped as Riparian Landtypes (Sirucek and Bachurski 1995) extended beyond the numeric buffer and these were also designated as RHCA. Leaving RHCAs and Riparian Landtypes untreated generally allows natural processes to take place and helps buffer the effects of upland management activities. Leaving RHCAs in tact would not alter fish habitat or water quality (Exhibit F-12).

Alternative D has potential to directly and indirectly affect channel morphology and woody material recruitment, both of which are key elements of fish habitat. These potential effects apply mainly to Sheppard Creek and its tributaries where harvest of riparian spruce and Douglas-fir is proposed. About 45 percent of fish habitat within lower Sheppard, Dunsire, and Listle Creek would have infested Spruce and Douglas-fir riparian trees removed. Non-target species such as larch, lodgepole pine, and subalpine fir would be retained. All riparian units would be logged in the summer; winter logging for soil protection purposes is not feasible since many logs infested with bark beetles would be buried under snow and could not be located. Units B5, B12, B30, B31, B33 and B38 are located in riparian areas of the Sheppard Creek sub-watershed and would be skyline yarded in the summer. Direct erosion point-sources are likely where the skyline anchor points are established due to such immediate proximity to stream channels. Mitigation measures to prevent soil disturbance include preventing machinery from working in very moist soils, fully suspending the logs so they do not scour the ground, and leaving all unmerchantable slash. These measures would help reduce but not completely avoid sedimentation. In the longer term, this harvest activity could reduce recruitment of woody material. The spruce trees are likely to be 200 to 300 years old, and generally wood recruitment is episodic.

Valley Segment E and F (in upper Sheppard Creek analysis area) would have 71 percent of its stream length with riparian harvest treatments (12 units total). These valley segments already exhibit signs of scouring and poor habitat conditions. Alternative D would exacerbate this condition and trigger additional bank erosion. Even though Valley Segments E and F are in a different analysis area, they strongly influence fish habitat conditions in lower Sheppard Creek.

Impacts may also result in the Griffin Creek sub-watershed. Units B26, B28, and B47 are located in the headwaters of Hand Creek and Ingalls Creek, well above fish habitat. Harvest of trees in these units may reduce long term recruitment of woody material and cause changes in channel morphology and aquatic habitat. However, since the total lengths of the units are fairly small, these potential effects are not expected to impact fish habitat downstream.

Initially, this riparian harvest would have little or no impact on large woody debris cover or pool habitat. One study in Idaho and Montana found habitat response was delayed from disturbance events several decades prior (Roper, et al. 2007). However, in the coming decades, it is anticipated fish habitat would be impacted by Alternative D. Fish habitat and channel complexity is believed to be strongly influenced by “pulse” disturbance events such as the Brush Creek fire (Beschta, et al. 1995; Bisson, et al. 2003). Alternative D would remove a portion of potential woody material, and thus reduce the potential for long term recruitment.

Removal of dead spruce and Douglas-fir in riparian areas within the B units of Alternative D may also cause indirect impacts by making streams more accessible to livestock grazing. This could cause longer term, persistent impacts to stream banks and riparian vegetation.

Initially, this riparian harvest in Alternative D would have little or no impact on large woody debris cover or pool habitat. Monitoring from nearby Hand Creek, which had 29 percent of its fish habitat harvested in 1996, has not yet observed any clear trend of large woody debris abundance or pool habitat quality as compared to non-harvested areas (Exhibit F-6). This is believed to be a result of mild runoffs and little passage of time since the project was implemented. An empirical study of 33 streams in Idaho and Montana found habitat response was delayed from disturbance events several decades prior (Roper, et al. 2007).

The removal of a substantial amount of wood along about 45 percent of the length of fish habitat may also have a small impact on water temperature. Removing the boles of dead trees adjacent to or across the stream channel would expose more of the channel to solar radiation. Reeves, et al. (2006) noted that virtually all incidents in western North American with riparian post-fire logging results in some increase of water temperature but there is no known investigation that can quantify this impact.

Table 3-41 in the *Hydrology* section summarizes potential activity-generated sediment in the project area. The data in this table demonstrates that potential background sediment delivery is substantially more than what might be expected from proposed management activities.

None of the action alternatives are expected to have any effects on fish habitat in Tally Lake or Logan Creek. Therefore, there are no predicted effects on bull trout.
Cumulative impacts can result when the effects of one activity are added to or interact with other activities in a particular place and within a particular timeframe. It is the combination of these effects, and any resulting impacts, that are the focus of the following analyses. The potential cumulative effects associated with the action alternatives are analyzed in the Logan Creek, Upper Sheppard Creek, and Good Creek analysis areas. These areas overlap with the

project area in such a way that cumulative impacts can be meaningfully addressed. Past, present, and future land use activities are discussed for each analysis area to evaluate potential cumulative effects of the action alternatives.

**Logan Creek Analysis Area**

As stated in the Affected Environment section, the Logan Creek analysis area includes the Griffin Creek, Logan Creek, and Sheppard Creek drainages. The cumulative effects discussion below focuses only on the Sheppard Creek drainage because:

- The vast majority of the Brush Creek Fire burned within Sheppard Creek.
- Almost all proposed road construction and timber harvest are proposed within Sheppard Creek.
- Predicted post-fire and land management effects are most likely to be measurable at the sub-watershed scale.

Past management activities in Sheppard Creek sub-watershed include road management, timber harvest, agriculture, and housing development. Road management (maintenance and removal), timber harvest, livestock grazing, and fuel reduction are common management practices today. The private lands in the valley bottoms (Star Meadow, etc.) are used for agriculture and livestock grazing.

Through the Burned Area Emergency Response (BAER) program, eight culverts are to be replaced in the Sheppard Creek sub-watershed in 2008. These culverts are located at several small tributary streams to Sheppard Creek, and are presently under-sized and need to be replaced to accommodate any post-fire floods that may occur during the post-fire recovery period. The replacements could generate up to six tons of sediment, but are expected to have long-term benefits to local channel morphology and water quality. In addition, these new culverts would reduce any long-term risks of culvert failure and associated sediment delivery.

Fire suppression activities during the Brush Creek Fire included construction of fire line and safety zones. Approximately 35 miles of cross-country dozer line was constructed in the Sheppard Creek drainage, and is incorporated into the post-fire ECA value (see *Hydrology* section). All dozer lines and safety zones were rehabilitated immediately following suppression activities. Accelerated erosion and sediment delivery from safety zones and dozer lines is not expected (see *Hydrology* section).

Alternatives B, C, and D each have the potential to produce sediment in the Sheppard Creek sub-watershed (Table 3-46). The sediment production estimates associated with management activities are very small, compared to sediment production that may result from post-fire conditions alone (see Tables 3-41 and 3-46).

Sediment production associated with road construction, reconstruction, and culvert installation/removals would be short term, and probably masked by background sediment production associated with the post-fire environment (see Tables 3-41 and 3-46).

**Table 3-46. Potential Sediment Production that may Result from the Action Alternatives in the Sheppard Creek Sub-Watershed.**

| | Potential Sediment (tons) | | | |
|---|---|---|---|---|
| **Potential Activity Generated Sediment** | **Alt. A** | **Alt. B** | **Alt. C** | **Alt. D** |
| New Road Construction | - | 5.7 | 1.5 | 2.1 |
| Re-construction of Existing Road Prisms | - | 9.7 | 3.6 | 4.7 |
| Culvert Installation and Subsequent Removal | - | 8.4 | 2.1 | 2.1 |
| Summer Ground-Based Salvage Logging[2] | - | 131 | 80 | 131 |

Alternative D proposes to harvest 521 acres of spruce and Douglas-fir in and adjacent to riparian ecosystems. The majority of these areas are directly adjacent to Sheppard Creek and its tributary streams. Removal of spruce and Douglas-fir trees within an average tree height (120 feet) of the stream would reduce long-term recruitment of woody material. Recruitment of woody material tends to be episodic and associated with fire. A lack of woody material could cause reduced channel stability during the next several decades. The effects of reduced woody material recruitment would depend on the relative proportion of these units occupied by spruce trees and the number of trees removed.

Alternative B would have 12 new stream crossings, three on intermittent headwater streams and one on Cutthroat Creek. The streambeds would be disturbed both during the culvert installation and removal, resulting in about three tons of sediment to the stream.

Alternative B proposals may contribute to reduced brook trout numbers in lower Sheppard Creek for about two years but most of this effect would be due to sediment delivery from the fire itself (Table 3-41). Brook trout appear to have a very high tolerance for degraded habitat conditions, generally believed more so than other trout species (Dunham, et al. 2002). With these considerations in mind, it is concluded that the short term loss of brook trout spawning and rearing success would be noticeable and measurable, but it would not be so drastic to completely eliminate several year classes. Brook trout would rebuild the population due to improved survival and also continual recruitment from adjoining populations elsewhere in the Logan Creek analysis area.

Alternative B includes one new temporary road near Dunsire Creek that could have subtle, delayed impacts on channel morphology in lower Dunsire Creek (where brook trout dwell). It is improbable that the construction of this one temporary road would trigger habitat impacts in Dunsire Creek. Westslope cutthroat trout would be unaffected because they are located in the extreme headwaters above the road. As described earlier, if brook trout disappear from Dunsire Creek, it is only 0.3 percent loss of their current available habitat and of no consequence to the Logan Creek analysis area population viability. Alternative C proposes much

[2] Sediment yields that may result from ground-based logging are exaggerated. The WEPP model does not account for equipment operation and skidding over slash, which results from in-woods processing.

less road construction and fewer stream crossings, so the effects on brook trout may be slightly less than what might be expected in Alternative B.

There is no difference between the effects of Alternatives A and C within the Dunsire Creek drainage. It is possible the remnant cutthroat trout population and even the brook trout population could disappear as a result of the fire and the anticipated new screen and beaver dam barrier that blocks re-colonization.

The predicted effects of Alternative D are quite different than those of B and C. At the present time, most riparian zones in Lower Sheppard Creek (estimated 90 percent) are inaccessible to livestock due to dense vegetation and down woody material. Proposed harvesting in B38 and B39 along Listle Creek, B1 and B2 along Sheppard Creek, and B34 along Dunsire Creek may increase accessibility of livestock to stream banks. It is estimated that the total amount of stream length vulnerable to cattle grazing could increase from about 10 to 50 percent. Furthermore, it is reasonably foreseeable that cattle grazing on the Swaney Allotment will resume in year 2009 or 2010. This would result in even further bank trampling than previously took place. Cattle will be attracted to lush growth of forbs and grasses near the stream channels that no longer have overhead shade. Although downfall of trees will restrict cattle from wandering freely up or downstream, it is thought that cattle will still spend more time grazing in riparian areas and thus cumulatively impact more of the stream channel than before.

Dead trees and limbs that fall into the stream channel will either remain stationery (if large enough) or will be captured and piled up into aggregates. These pieces of large woody debris or debris jams will scour new pools that are likely to last for many decades. The woody material will also provide critical hiding cover for fish in a stream channel that is now exposed to sunlight. Monitoring in the Bitterroot Valley and in Swan Valley found pool habitat and the amount of woody debris to increase 0 to 4 fold within just 1 year after the fire (Jakober 2002, Crazy Horse EA 2004). A 21 year study of upland trees in the Bitterroot Valley found a gradual rate of snag attrition with 50 percent still standing after 7 years and 10 percent standing after 20 years (Lyon 1984).

The potential loss of large woody material (and subsequently pool habitat) in lower Sheppard Creek is likely to cumulatively add to existing impacts associated with the existing road system and past timber harvest. These effects could persist for several decades, and probably longer because the post-fire woody material that would eventually fall into streams would be removed. Large material such as this would not be available again for more than 200 years. This alternative may cause long term reductions in brook trout numbers. Brook trout are generally less sensitive to habitat conditions than westslope cutthroat, but they could still be impacted by increased sediment delivery and higher water temperatures.

In all the action alternatives, brook trout are likely to re-colonize in Sheppard Creek and its tributaries from other habitats such as Logan Creek and Griffin Creek. However, this colonization is likely to be slower if Alternative D were implemented.

Alternative D may also have cumulative effects to a small population of cutthroat trout in Dunsire Creek. It is uncertain if any cutthroat trout remain in Dunsire Creek after the fire. Their long-term prognosis is poor even with the No Action Alternative. Unit B34 is located in the riparian area of Dunsire Creek and harvest activities may influence this population. It is unlikely that the salvage harvest of Unit B34 would necessarily affect the population of cutthroat.

In summary, considering the past management history, existing conditions and reasonably foreseeable activities in Sheppard Creek, cumulative effects could result from proposed management activities in all the action alternatives. These effects would likely be in the form of increased sediment levels. However, these effects would likely be masked by background sediment and would be difficult to detect. The proposed road decommissioning in the area would likely offset elevated sediment caused by management activities, but this effect would not be realized for 10-15 years. Removal of spruce and Douglas fir, as proposed in Alternative D, would likely contribute to longer term cumulative effects in Sheppard Creek and its tributaries due to the role that these trees would have provided in terms of long term aquatic habitat and channel stability.

## Upper Sheppard Analysis Area

Past management activities in the Upper Sheppard analysis area include road management[3] and timber harvest. Almost all the land is managed by the Forest Service. Plum Creek Timber Company owns approximately 366 acres in the headwaters. Road management, timber harvest, and livestock grazing are common management practices today.

Fire suppression activities during the Brush Creek Fire included construction of fire line and safety zones. Approximately 5.5 miles of cross-country dozer line were constructed during the fire. All dozer lines and safety zones were rehabilitated immediately following suppression activities. Accelerated erosion and sediment delivery from safety zones and dozer lines is not expected (see *Hydrology* section).

Alternative B proposes temporary road construction on existing prisms, new temporary road, and salvage harvest during the summer. The temporary roads would require two stream crossings, one on the main stem of Upper Sheppard Creek and the other in an unnamed tributary. The streambeds would be disturbed both during the culvert installation and removal, which may result in approximately 1.4 tons of sediment. Implementation of Alternative B would result in some sediment delivery, primarily from temporary road construction. It is difficult to determine whether or not this material would deposit in the Upper Sheppard reach, or be transported further downstream. The Upper Sheppard Creek reach has scoured down to large material in the recent past (see Affected Environment above), so finer material deposited in this reach is not likely to adversely affect cutthroat. However, there may be some subtle impacts further downstream, but given the volume of potential sediment delivery, it is likely undetectable.

There is uncertainty about how fish populations in Upper Sheppard Creek will respond to the post-fire environment. Assuming that there is no catastrophic turbidity condition which forces the fish to migrate downstream, it is assumed brook trout would initially decline and then recover slowly, just as with the No Action Alternative. Cutthroat trout would also

[3] Includes road construction, maintenance, and decommissioning.

initially decline but it is challenging to estimate how well they can recover due to complex biological interactions with brook trout. The key question is how potential sediment delivery may reduce spawning and rearing success during the post-fire recovery period. The "Vortex" model was prepared with the assumption of a smaller initial population and then simulated from years 2009 to 2109. After running 100 simulations, Alternative B has a four percent chance of extirpation and 96 percent chance the population remains viable (Exhibit F-8). This is only a one percent change from the No Action Alternative and of no consequence considering random events and model uncertainty. Given the small degree of potential effects, it is determined that Alternative B would not reduce the population viability of cutthroat trout in Upper Sheppard Creek.

Alternative C also proposes temporary road construction on existing prisms, new temporary road, and salvage harvest during the summer. No stream crossings would be needed for this alternative, and the proposed new road construction is located approximately 550 feet above Upper Sheppard Creek. Cumulative effects of Alternative C on cutthroat or brook trout are not expected. As described in the No Action Alternative, the best available information is that the cutthroat trout population viability would probably remain viable during the analysis timeframe. The Vortex viability model was not prepared for Alternative C since it is indistinguishable from the No Action Alternative.

Alternative D also proposes temporary road construction on existing prisms, new temporary road, and salvage harvest during the summer, but includes 125 acres of harvest in units B10, B11, B12, B13, and B46. The "B" Units run parallel to Upper Sheppard Creek and an unnamed tributary. Spruce trees infested with bark beetles would be targeted for harvesting during the summer months of 2009 and 2010. The B units are partially or entirely located in Riparian Habitat Conservation Areas. In Alternative D, approximately 71 percent of the length of fish habitat would have riparian spruce and Douglas-fir removed if infested with beetles. Special Treatment Zones may be designated in these areas to reduce the effects of log removal and skidding.

Alternative D has the potential to exacerbate the impacts of past land management practices, reduce available fish habitat, and delay recovery of Upper Sheppard Creek. The magnitude of these effects is dependent upon the proportion of spruce and Douglas-fir in each unit and the amount of trees removed through harvest. Removal of trees and logs would reduce the long term recruitment of woody material into Upper Sheppard Creek. This effect is likely to reduce pool habitat (frequency and size), channel stability, and water temperature. In addition, a lack of woody material would reduce the stream's potential to capture finer sediments to form spawning and rearing habitats. This effect would likely persist for several decades.

Livestock would likely take advantage of partially cleared riparian areas for foraging, which may cause bank damage. Upper Sheppard Creek would be particularly vulnerable to increased use because of its proximity to Road 2885, which runs parallel to the riparian corridor. Currently, Upper Sheppard Creek only gets a small amount of cattle grazing. Removal of spruce and Douglas fir trees in the immediate riparian zone may increase the ability of livestock to access the stream and cause habitat damage (bank trampling, etc.). The degree of this potential impact would depend on how much spruce and Douglas fir are removed along the four mile reach of Upper Sheppard Creek.

Implementing Alternative D would probably delay any potential channel recovery that could have occurred from the reasonably foreseeable road reclamation. The cumulative effects of Alternative D could increase the potential for extirpation of cutthroat trout in Upper Sheppard Creek because of higher mortality levels associated with reduced carrying capacity. After 100 simulations with the Vortex population viability model, only 22 percent of the simulations predicted the presence of cutthroat trout in Upper Sheppard Creek by year 2109. Seventy eight percent of the Vortex model simulations ended with extirpation (Exhibit F-8). The mean time to extirpation was about 26 years. Brook trout would also greatly diminish in numbers due to poor habitat conditions.

A post-fire storm event and associated habitat change could raise the potential for cutthroat to move downstream past the FR 538B culvert, which is a barrier to upstream fish passage. Once below the culvert, recolonization of habitat would not be possible without human intervention. If neither brook trout nor cutthroat trout remain, the upper six miles of Sheppard Creek could potentially become fishless.

Approximately 2.4 miles of existing road are scheduled for reclamation in the Upper Sheppard Creek area. Removal of these roads is likely to reduce sediment delivery to the creek, but this positive effect is expected to be very small, compared to the predicted negative effects of Alternative D tree and log removal in the RHCAs.

In summary, considering the past management history, existing conditions and reasonably foreseeable activities in Upper Sheppard Creek, cumulative effects could result from proposed management activities in all the action alternatives. These effects would likely be in the form of increased sediment levels. However, these effects would likely be masked by background sediment and would be difficult to detect. The proposed road decommissioning in the area would likely offset elevated sediment caused by management activities, but this effect would not be realized for 10-15 years. Removal of spruce and Douglas fir, as proposed in Alternative D, would likely contribute to longer term cumulative effects in Upper Sheppard Creek and its tributaries due to the role that these trees would have provided in terms of long term aquatic habitat and channel stability.

## Sylvia Lake Analysis Area

Past management activities in the vicinity of Sylvia Lake include dispersed recreation (fishing, camping, etc. around the lake), road management, and timber harvest. These uses are still common today. All three action alternatives propose summer logging in Unit 90 (10 acres), which is located directly east of the lake on the other side of Road 538B. This unit would be accessed by a new temporary road, which would be located approximately 600 feet upslope from Road 538B. The proposed temporary road north of the lake could possibly cause additional sedimentation in Sylvia Lake, which could exacerbate the effects of existing uses and the post-fire environment around the lake. It is reasonably foreseeable that dispersed recreation and road management around the lake would continue. Given past, present and reasonably foreseeable activities (Exhibit F-11) and the proposed temporary road in the immediate vicinity, subtle cumulative effects may result from Alternatives B, C, and D.

## Good Creek Analysis Area

Past management activities in the Good Creek sub-watershed include road management and timber harvest. The vast majority of these uses have occurred on National Forest lands. There is a small amount of housing development on private lands near the mouth of the sub-watershed. Road management, timber harvest, and fuel reduction are common management practices today.

Approximately 2716 acres burned in the Good Creek sub-watershed during the Brush Creek Fire. Approximately 20 miles of cross-country dozer line was constructed and is incorporated into the post-fire ECA value. All dozer lines and safety zones were rehabilitated immediately following suppression activities. Rehabilitation of dozer line and safety zones involved removal of berms and placement of slash material on top of disturbed soil (see *Hydrology* section).

Brook trout and cutthroat trout in Gregg Creek and Plume Creek would likely have reduced spawning and rearing success for one to two years following the fire. Over time, habitat conditions would improve due to fire-killed trees creating new pools in Gregg Creek, plus the watershed restoration in Gregg and Plume Creek would reduce stream power, plus the new culvert at FDR 60A would have better fish passage.

Alternative B proposes two sections of new temporary road, one in the headwaters of Gregg Creek (0.5 mile) and one in the headwaters of Plume Creek (0.7 mile). Both of these proposed temporary roads are near ridge tops, and they both have at least 200 feet of green forest between them and the headwater stream. This buffer should prevent sediment delivery to the stream during road construction and use.

Alternatives B, C, and D all propose less than 200 acres of summer salvage harvest. Summer salvage harvest of is not expected to contribute to cumulative effects in the Good Creek sub-watershed (see *Hydrology* section).

Alternative D proposes 57 acres of salvage harvest along Plume Creek. Units B35 and B36 run approximately 3200 feet along Plume Creek. Removal of spruce and Douglas-fir trees within 100 feet of the stream would reduce long-term recruitment of woody material. Recruitment of woody material tends to be episodic and associated with fire. A lack of woody material could cause reduced channel stability during the next several decades. The effects of reduced woody material recruitment would depend on the relative proportion of these units occupied by spruce trees and the number of trees removed.

There was considerably more fire suppression effort in the Good Creek analysis area than in the Sheppard drainage. It is estimated that over 20 miles of lines were constructed using heavy machinery. All were mitigated as best as possible but some erosion is possible next spring. One particular dozer line is especially vulnerable to erosion since it traverses Gregg Creek in a moderately steep canyon. The amount of sedimentation from fire suppression is assumed to be small but detectable against the background sedimentation from the fire.

About 1.4 miles of fuel break along Good Creek itself (adjacent to FR 60) removed the majority of riparian trees along the north side of the stream. The fuel break left an average of

75 foot width of tree immediately adjacent to the stream along about 75 percent of the area, and cleared down to the stream the remaining 25 percent of the area. It is anticipated that the stand will regenerate naturally but meanwhile the action reduced the amount of woody debris recruitment into Good Creek. Calculating the lost potential tree recruitment from Brown, et al. (2003) findings, this would mean that roughly 20 percent of Good Creek's future large woody debris was removed along a 1.4 mile length. During the 100 year analysis time frame, this would mean that Good Creek would have slightly fewer pools and less hiding cover as a result of the fuel break. This should be a very subtle and gradual change. The stream is not immediately impacted by the fuel break but rather the natural process of riparian interaction has been disrupted.

It is reasonably foreseeable that in-stream restoration will take place in the extreme headwaters of Gregg and Plume Creek. Pieces of woody debris will be hand placed into the channels to reduce stream power and create new pools. It should also allow sediment and gravels to be retained instead of scouring downstream. Over time this will indirectly improve fish habitat conditions downstream and may also return the headwaters to perennial surface flow conditions.

Any cumulative effects associated with salvage harvest or temporary road construction is likely to be short term (less than five years). Harvest of spruce trees in Units B35 and B36 would likely contribute to adverse direct and indirect effects on channel stability, aquatic habitat, and water quality, depending on the amount that is harvest within 100 feet of the stream. These effects could contribute to long term cumulative effects that could last several decades and possibly one to two centuries.

However, in Plume Creek, Alternative D would add to the cumulative impacts of past actions. Upon implementation of units B35 and B36, about 90 percent of upper Plume Creek would have decreased recruitment of woody material due to both historic and proposed harvest. Implementation of Alternative D is likely to exacerbate these past impacts. Poor channel conditions in the headwaters caused by past riparian clearcuts would be further aggravated by this removal of spruce and Douglas-fir trees within one tree height of the stream. This would probably result in a gradual but measurable decline in brook trout spawning and rearing success. Brook trout would likely remain numerous throughout the Good Creek subwatershed. Implementation of Alternative D would likely negate any beneficial impacts to the restoration project on upper Plume Creek.

In summary, considering the past management history, existing conditions and reasonably foreseeable activities in Good Creek, cumulative effects could result from proposed management activities in all the action alternatives. These effects would likely be in the form of increased sediment levels. However, these effects would likely be masked by background sediment and would be difficult to detect. Removal of spruce and Douglas fir, as proposed in Alternative D, would likely contribute to longer term cumulative effects in Good Creek and its tributaries due to the role that these trees would have provided in terms of long term aquatic habitat and channel stability. This effect is not likely to be totally offset by future stream restoration work that is planned in the area but will have a long term beneficial effect.

## REGULATORY FRAMEWORK AND CONSISTENCY

Three government agencies share responsibility for managing the fishery resource. The Montana Department of Fish, Wildlife, and Parks have the primary responsibility for fish populations. The U.S. Fish and Wildlife Service is a regulatory agency for federally listed species. Management of fish habitat on National Forest System lands is largely a Forest Service responsibility.

Alternatives A, B, and C fully comply with all regulations that guide the Forest Service. Alternative D may not fully comply. The following paragraphs review each regulation and how the alternatives meet or fail to meet them.

Originally adopted in 1986, the Flathead National Forest Plan is the primary document that codifies management standards and guidelines governing activity on national forest system lands within the boundaries of the Flathead National Forest. This plan identified cutthroat trout and bull trout as management indicator species for all other fish species and prohibited "unacceptable fish losses." Alternatives A, B, and C would not likely to result in measurable fish losses. However, Alternative D has the potential to impact aquatic habitat and the isolated cutthroat population in Upper Sheppard Creek in the long term.

The Flathead Forest Plan was amended in 1990 (Amendment No. 3) to better define the standards for protection of fish populations. Amendment 3 established criteria applicable to 22 high-priority bull trout streams, none of which are in the project area. Amendment 3 also defined protection measures for any forest stream containing westslope cutthroat trout such as Sheppard Creek and Gregg Creek. These protections specified standards designed to protect stream temperature, large woody debris recruitment, and sediment delivery. All the alternatives comply with the specific habitat standards of Amendment 3. All alternatives would leave at least 40 recruitable trees per 1000 feet of stream length. Stream temperatures are not expected to exceed 17 degrees Celsius for any alternative. All alternatives control sediment sources by minimizing harvest equipment in riparian areas, minimizing new system road construction, and improving the existing road system.

The Forest Plan was again amended in 1995, by the Inland Native Fish Strategy (INFISH) (USDA Forest Service 1995). INFISH standards place a greater emphasis on protection of fish habitat than earlier standards in the Flathead Forest Plan. Numerous "priority" watersheds were established to recover bull trout. The only priority watershed in the analysis area is Tally Lake[4], and since no impact to Tally Lake is anticipated, all alternatives maintain priority watershed goals. INFISH also established Riparian Management Objectives (RMOs) and Riparian Habitat Conservation Areas (RHCAs) for all streams, whether or not they are "priority." RHCAs are the lands immediately adjacent to streams and wetlands. RMOs are habitat parameters that describe good fish habitat. Any activity within a RHCA must not retard the attainment of RMOs. Alternatives A, B, and C have no activity within RHCA and meet all RMO goals. However, Alternative D would retard attainment of RMOs and therefore does not comply with INFISH. This conclusion is based on the assumption that trees would be harvested within one tree height (120') of stream channels. In fish bearing streams, RHCAs are 300'. The removal of riparian spruce and Douglas-fir trees is likely to retard

[4] Tally Lake is the name of the priority watershed. This area is not limited to Tally Lake (proper) alone.

Sheppard Creek and Plume Creek from achieving pool habitat frequency RMO and width/depth ratio RMO. It is unclear if the additional 0.5 degree Celsius water temperature is a measurable increase and therefore unclear if that RMO is achieved in Alternative D. The RMO for large woody debris (20 pieces per mile) is less conservative than Amendment 3 and easily achieved on the Flathead National Forest. Alternatives B and C would be consistent with the RMO for woody material. However, Alternative D could potentially result in reduced recruitment of woody material along some stream reaches, and may not meet the associated RMO in the long term (several decades).

The U.S. Fish and Wildlife Service has determined bull trout are a threatened species as defined by the Endangered Species Act (ESA). Bull trout are the only listed fish species in the analysis areas. ESA requires a biological assessment for significant federal actions. This assessment will be prepared for the selected alternative later in this EIS process. Consultation with the U.S. Fish and Wildlife Service is required for any federal actions that could potentially affect bull trout.

The Regional Forester has determined westslope cutthroat trout are a sensitive species. The Forest Service seeks to protect their habitat and prevent population declines that would lead to protection by the ESA. A biological evaluation is required for the action alternatives (Exhibit F-9, to be completed prior to the preparation of the ROD). Alternatives B and C were determined they "May impact individuals or habitat, but will not likely result in a trend towards federal listing or reduced viability for the population or species." Alternative D was determined to "Likely to Impact Individuals or Habitat with a consequence that the action may contribute towards federal listing or result in reduced viability for the population or species."

# SOILS

## Introduction

This section discusses the effects to soil productivity. The analysis describes the burned area impact to soils and discussing the effects that may occur from the post-fire timber salvage proposals. The effects to the watershed resource as a whole are discussed in the *Hydrology* section.

## Information Sources

The project area was visited to observe soil conditions following the Brush Creek Fire. Eight units were surveyed using the current R1 monitoring protocol (USDA Forest Service 2007). This was an initial survey where further work would detail current soil condition for all of the proposed units during the late spring and summer of 2008.

As a gross approximation, preliminary soil analysis was conducted with GIS layers, including 10 meter digital elevation models (DEM), soil resource inventory, a geology layer, roads and trails, the 2006 vegetation map, and the stand history map for past timber harvest activity. Analysis was done by a qualified soils specialist to assess current soil conditions and identify specific design features and restoration activities to ensure compliance with Regional policy and direction related to soil quality. Where past harvest was identified, existing detrimental impacts were estimated for this DEIS using past forest monitoring data. Detrimental impacts from past activities in proposed salvage areas will be quantified with field exams in 2008. Current soil condition and potential impacts from project alternatives were evaluated against thresholds provided by the R1 Soil Guidelines (USDA Forest Service 1999). These guidelines were referenced to individual harvest and burn unit boundaries and do not apply to the watershed as a whole.

## Analysis Area

Each proposed salvage harvest unit is identified as the spatial bounds of the analysis area, as this is the area where potential direct and indirect effects would occur. The cumulative effects analysis area is the same, as effects are site-specific to the areas affected. The temporal bounds for the soils resource analysis are considered to be within ten years for short-term impacts and 50 years for long-term impacts.

## Affected Environment

The project area is characterized as broad sloped upper watersheds with incised slopes along drainages, especially along lower slopes adjacent to Sheppard Creek. The area has moderate to high productivity with ashcap soils and moderate climate and is very resilient to disturbance. The horizontally oriented underlying Belt metasediments and glacial till control erosion for much of the upper slopes and ridges, creating moderately deep soils with large rock prominent throughout the soil profile. Slopes may be steep though are very resistant to erosion. Rock bands and stepped slopes are common. In addition, intense thunderstorms sufficient to trigger erosion are not common. The highest slope instability is associated with streamside soils.

Current soil conditions are mainly impacted from wildfire, and secondarily impacted from past management activities such as timber harvest and road building. The wildfire produced mostly moderate burn severity, with high severity averaging two to ten percent within proposed salvage units. Roughly 56 percent of the burned area has past harvest history with 620 acres within proposed harvest units. Past harvest within these units is mainly from sanitation salvage and commercial thinning during the late 1970s and 1990s. Soil conditions in each proposed salvage unit are uncertain at this time, though initial surveys have found zero to two percent disturbance within proposed tractor units that had previous harvest. These surveys were on belt rock soils where recovery is robust and soils are resistant to initial disturbance. Past harvest conditions on glacial soils along the footslopes, where clay is more common along with wet soil conditions, have variable levels of soil disturbance based on initial observations.

The productivity of the area is related to the moderate climate. This location has some maritime and lake effect influences moderating temperatures and moisture, and produces 20-30 inches precipitation based on SNOTEL data from the Hand Creek station (NRCS 2008). Much of the moisture is from winter snow.

Glaciers carved valleys and plastered till on hillslopes within the Sheppard Creek drainage. The most active deposition is in the lower two-thirds of the Sheppard Creek Drainage. Sheppard Creek and adjoining sub-drainages have glacial moraine deposits and glacial trough walls. The till has variable sized rock, and is dense and brittle when moist (USDA and NRCS 1998).

The glacial influenced soils have variable stability depending on the type of deposition. Stable soils are associated with moraine and till deposits on moderate slopes. Unstable soils are found where drainages have active slope cutting undermining shallow till. Unstable areas may also have fine material accumulated from upslope sheetwash. Glacial trough walls can have unstable slopes where thin till remains along steep carved slopes, though till thickness is highly variable and difficult to predict.

Soils are generally characterized as having high rock content from the glacial and belt rock and high water holding capacity from the ashcap and clay influence, especially along lower footslopes. Subsoils average 50 percent rock for most of the project soils. Rock in surface soils is much more variable ranging from 15 to 60 percent. The soil rockiness is important for soil drainage though may also buffer machine impacts. The ashcap and loess influence on surface soils are not in themselves fertile, though provide an excellent growing medium. Ashcap soils have a very high water holding capacity and cation exchange capacity (Bulmer, et al. 2007). These soils may compact easily and erode once uncovered, but most of the project areas soils are mixed with gravel or cobble sized rock to buffer these impacts. The glacial soils and more highly developed alluvial soils have higher clay contents, especially in subsoils. Clay also enhances productivity with greater water holding capacity. These clay rich soils also have higher compaction and displacement risks when soils are moist.

The past timber harvest activities are indicative of very productive forests with robust re-growth throughout the watershed. Soil mapping indicates the lower two-thirds of the water-shed have high productivity soils. Past harvest units on the lower slopes along Sheppard Creek may have some reduced growth capacity from compacted and displaced soils on glacial material, based on observations in the field. In general, the regrowth was very strong after a large wildfire in 1889 that burned most of the upper reaches of the Sheppard Creek watershed. Lodgepole pine regrowth was extensive until bug-kill caused major die-off in the 1980s. Regeneration and growth of seedling- and sapling-sized stands in the 1994 Little Wolf fire have resulted in nearly complete tree vegetation coverage.

Downed wood is an important consideration for evaluating current soil productivity, especially in a burned area context since this is one of the more available forms of organic matter. Reconnaissance by crews gathering stand information classified downed wood amounts at 250 sites across the project area, though biased for logs over nine inches in diameter. The data showed most of the stands had less than five tons per acre (140 sites). Approximately 76 sites had downed wood levels within a range recommended by Graham, et al. (1994) for the habitat types within the project area, from 5 to 25 tons/acre. Thirty-four sites had very high amounts of coarse wood, over 25 tons per acre.

## The Fire

Soil conditions were altered from the Brush Creek Fire in the summer of 2007 with more severe effects in concentrated fuels areas. Most areas of previous timber harvest activity had lower burn severity compared to the mature stands where conditions were much more variable. In the mature stands, the wildfire resulted in much higher burn intensity with much of the stands crown torched. Soils were burned primarily with low to moderate severity with downed wood and forest floor somewhat retained.

The effect of fire on soil is described by burn severity, which depends on the duration of burning and the intensity (Certini 2005). Long duration burns tend to reach higher temperatures that penetrate deeper into soil resulting in more soil microbial kill and consumption of soil organic matter (Ibid.). Long duration burns result from heavy fuels burning close to the ground such as with downed logs and slash piles. Short duration burning can be associated with fast moving wildfire that blackens all the trees but leaves some of the forest floor intact. This usually results in low and moderate severity on the ground with heat only penetrating a few centimeters (Hartford and Frandsen 1992).

Forest stands previously harvested with silviculture systems that retained little biomass, such as clearcuts or seed tree methods, had very low fire severity from the discontinuous and sparse fuels. In terms of vegetation mortality, these areas had 25 percent high intensity (see Table 3-47). Sapling-sized stands typically had the outer perimeters scorched with much of the middle portion lightly burned.

In contrast, mature forest burned at the extremes: either fully engulfed crown fire or very light duff burns. Vegetation mortality was high with approximately 75 percent of these stands with substantial crown fire (Table 3-47). In mature stands where the fire burned lightly, the burning was very selective. These areas had the fire following thick duff deposits and roots that resulted in fire-killed trees of older trees; mostly large, old Engelmann spruce where duff and needle litter was thick. This fire behavior is not typical for the area since duff moisture is usually high enough to moderate burning on the forest floor. These conditions may be a result of drought during the past ten years. The end result of the Brush Creek Fire is a mixed severity large scale mosaic with soil conditions not necessarily following vegetation burn intensity patterns, i.e. crown scorch.

**Table 3-47. Vegetation Burn Severity from Brush Creek Wildland Fire in 2007.**

| Vegetation Burn Intensity | Past Timber Harvest Areas Burn Intensity (%) | No Harvest Areas Burn Intensity (%) | Vegetation Mortality from Wildfire |
|---|---|---|---|
| Low or No Fire | 65% | 5% | <30% trees killed |
| Moderate | 10% | 20% | 30-80% trees killed |
| High | 25% | 75% | >80% trees killed |

Soils experienced primarily moderate burn severity within mature stands that were almost completely crown scorched. Downed logs were only partially consumed and duff is a charred mat with some open bare patches. Soil condition surveys within the Brush Creek Fire found primarily moderate burn severity. Surveys of eight of the proposed Sheppard Creek salvage units found moderate severity burn from 54 to 82 percent within crown scorched burned areas (Exhibit H-1). High severity ranged from two to ten percent.

Soil conditions are poor within crown burn areas where all downed wood was completely consumed and current groundcover is sparse. This type of extreme burn is limited to small pockets within the proposed salvage areas. Duff in these areas is completely consumed or remains a light char. Coarse estimates based on the BAER report shows roughly 18 percent (4308 acres) of the watershed burned leaving high severity conditions (see the *Hydrology* section). A final assessment of soil conditions will depend on how much of the surface seed source was consumed. This assessment will occur this spring and early summer after vegetation green-up. If limited regrowth occurs, these areas are more sensitive to machine activities as described in Beschta, et al. (2004).

Soil erosion following the fire was not observed, though remains a risk as groundcover returns. Erosion modeling using the Water Erosion Prediction Project model (WEPP) found very low rates using a two year storm average; less than two tons per acre for most of the slopes within the project area (see the *Hydrology* section). The low rates are from the low frequency of thunderstorms that have enough intensity to drive surface erosion (see following paragraph). The highest erosion risk would be associated with road drainage onto bare slopes and adjacent stream areas where streams are incised. Hydrophobic conditions that may increase erosion risk were not found extensively throughout the fire area (see the *Hydrology* section).

Site factors that increase risk for soil erosion are mainly from burn severities where groundcover is reduced and slopes are steep (Robichaud 2000, Certini 2005, Larsen and MacDonald 2007). Another large factor for soil erosion is the occurrence of extreme thunderstorms that produce substantial rainfall in a short amount of time (Larsen and MacDonald 2007). The project area has a relatively low risk for rainfall sufficient to trigger erosion in the first post-fire years as protective vegetation groundcover returns. In comparing data to erosion events that occurred following the 2000 Bitterroot wildland fires, the chance for producing the substantial erosion documented by Spigel and Robichaud (2007) is greater than one in 50 years compared to five to ten years for the Bitterroot. The Sheppard Creek Project area has convective storms with a modeled six hour intensity of 0.8 inches compared to a 1.2 inches for the Bitterroot (NOAA 1973). In addition, the Bitterroot case had much higher burn severity than the Brush Creek Fire.

## Past Harvest

The past timber harvest has affected soils with approximately 56 percent of the watershed impacted. Timber harvest was primarily using regeneration silviculture methods, primarily in the 1980s to address beetle-killed lodgepole pine stands (see the *Vegetation* section). Within the proposed units, most of the past harvest was shelterwood, sanitation/salvage, or commercial thinning where merchantable timber was retained. Roughly 27 proposed salvage units have had past harvest history, according to the Forest's records database, covering approximately 620 acres (see Table 3-48). Additional past cutting activities include ongoing firewood cutting and fire hazard reduction along the major road systems. Within the project area, timber harvest has created large openings. On the ground, current conditions after timber harvest vary according to method and recovery time.

Using timber stand records, Table 3-48 shows the extent of past harvest within proposed units. Units with highest potential for adverse conditions are within tractor units and units where regeneration occurred. Field surveys in all proposed units in the spring and summer would assess the current condition. Past field work has shown that conditions on the ground are highly variable and that predictions using stand records and monitoring averages are not sufficient to ensure activities can be limited to meet the 15 percent detrimental soil disturbance guidelines.

Soil conditions in terms of current Forest Service Regional policy is described with detrimental disturbance as an indication of long-term impacts to soil productivity. Indicators of soil disturbance such as extent of compaction, puddling, displacement, severe burning, and erosion are used to assess the amount of detrimental disturbance (USDA 1999). A measure of 15 percent aerial extent is used to determine compliance.

Observations in the project area found low impacts in the upper watershed since soils are rocky and slopes even to moderate, despite mostly tractor-based logging. Initial estimates found zero to two percent detrimental disturbance for eight units surveyed: units 50, 48, 86, 85, 51, 87, 65, and 52. The surveys concentrated on soils in the upper reaches of the watershed on primarily soils formed in belt metasediments. One of the surveys occurred in a proposed tractor unit with recorded history of sanitation salvage; no detrimental disturbance was evident.

**Table 3-48. Current Past Harvest Activities Within Proposed Units with Past Harvest Activities.**

| Unit | Log System | Acres | Past Harvest Acres | Past Harvest Type and Year |
|---|---|---|---|---|
| 7 | T | 27 | 27 | Commercial Thin 1980 |
| 8 | T | 49 | 28 | Commercial Thin 1978 |
| 10 | T | 22 | 15 | Seedtree/Shelterwood 1998 |
| 21 | T | 80 | 50 | Commercial Thin 1976 |
| 41 | T | 30 | 29 | Seedtree/Shelterwood 1998 |
| 42 | C | 8 | 8 | Sanitation/Salvage 1998 |
| 44 | T | 69 | 44 | Sanitation/Salvage 1999 |
| 45 | H | 156 | 23 | Sanitation/Salvage 1999 |
| 57 | T | 6 | 6 | Seedtree/Shelterwood 1999 |
| 58 | S | 16 | 16 | Sanitation/Salvage 1999 |
| 59 | S | 75 | 20 | Seedtree/Shelterwood 1978 |
| 63 | S | 28 | 21 | Sanitation/Salvage 1979 |
| 64 | S | 338 | 36 | Sanitation/Salvage 1979 |
| 67 | T | 10 | 10 | Sanitation/Salvage 1979 |
| 71 | C | 5 | 5 | Sanitation/Salvage 1979 |
| 72 | T | 98 | 98 | Seedtree/Shelterwood 1978 |
| 77 | S | 52 | 9 | Sanitation/Salvage 1998 |
| 82 | S | 21 | 7 | Clearcut 1988 |
| 86 | T | 44 | 5 | Sanitation/Salvage 1981 |
| 90 | S | 11 | 11 | Sanitation/Salvage 1999 |
| 91 | T | 34 | 28 | Sanitation/Salvage 1999 |
| 99 | T | 57 | 39 | Seedtree/Shelterwood 1976 |
| 101 | T | 15 | 7 | Seedtree/Shelterwood 1984 |
| 105 | S | 47 | 35 | Seedtree/Shelterwood 1976 |
| 106 | T | 6 | 6 | Seedtree/Shelterwood 1976 |
| 114 | H | 10 | 9 | Sanitation/Salvage 1999 |
| 126 | S | 28 | 28 | Selection Cut 1967 |

Soil conditions were more variable along the footslopes of Sheppard Creek. High soil disturbance was observed on some glacial soil with clay subsoil. Soil disturbance along these footslopes may be related to different eras of logging practices where dozer piling of slash was used as site preparation after logging. The poor soil conditions found could be related to increased moisture. The footslope areas have more available moisture from upslope subsurface flow and cooler temperatures along the valley bottoms. Much of these areas had mesic vegetation such as Engelmann spruce. In high disturbance areas, understory vegetation was robust, but favors exotic grass versus native forest understories. Conifer regrowth varied.

Flathead National Forest timber stand records and monitoring data were used to detail past harvest across the area and initially assess soil recovery rates after disturbance. Past monitoring showed an average recovery rate of ten percent for each decade (Basko 2007a). This rate is valid for the project area since productivity is moderate to high (USDA and NRCS 1998) and agrees with rates reported elsewhere (Froehlich, et al. 1985; Johnson, et al. 2007). Recovery mechanisms are mainly from root turnover; freeze/thaw is not common for this area

(Basko 2008, personal communication). The monitoring figures reflect the general trend for improved conditions over past methods and less site disturbance associated with skyline- and helicopter-based yarding.

Past monitoring on National Forest Lands in Northern Idaho and Northwestern Montana found the heaviest disturbance from tractor logging where slash was dozer piled (Basko 2002, Niehoff 2002, Basko 2007, Kuennen 2007). These methods were common prior to 1980 and led to greater than 20 percent detrimental disturbance across the area (Basko 2002, Basko 2007). Best management practices adopted in the 1980s lowered the average disturbance levels to 20 percent with designated skid trails and less dozer piling. Monitoring on the adjacent Kootenai National Forest showed a sharp drop in tractor disturbance with ranges in the 1980s from 18 to 27 percent detrimental disturbance down to less than 15 percent by the middle 1990s as these practices became more common place (Kuennen 2007, unpublished). Tractor harvest in the 1990s and 2000s ranges from 10 to 14 percent depending on the harvest system used. Monitoring shows skyline yarding averaging from five to ten percent and helicopter yarding at zero to two percent. These figures are similar to reported figures in the literature by Johnson, et al. (2007) for ash-cap soils, Clayton (1990) for Idaho batholith soils, and within the range for soil monitoring from the Idaho Panhandle National Forest (Niehoff 2002).

Soil conditions from past road building and harvest did not indicate any mass movement hazards. Unstable soils are congregated along the major Sheppard Creek drainage and typically excluded from contemporary timber harvest with riparian buffers. Mass movement along these areas prior to riparian exclusion was not found.

### Roads

The project area has a network of roads to accommodate vegetation treatments, wildland fire suppression, and other national forest objectives. Current mileage is approximately 96 miles for system roads and 62 miles of historic roads no longer on the Forest’s road management system. System roads are considered dedicated purposes and not managed for site productivity purposes. Non-system roads vary in designation, though overall, are considered part of the productive land base. Towards this, approximately 26.6 miles of road have been reclaimed and 19.3 miles are planned for reclamation to restore productive potential in the Sheppard Creek drainage (see Table 3-1). Major road related activities from the wildfire amounted to 3.6 miles of constructed control line along historic routes and 40.8 miles of dozer line excavation; fireline rehabilitation occurred directly following the wildfire.

## Environmental Consequences

The impacts from the project on soils are characterized through a risk assessment. Much of the risk was addressed using winter harvest mitigation for high disturbance potential tractor-based logging systems. This mitigation lowers potential compaction and displacement, which can limit recovery in a burned area environment. Less vulnerable areas lack winter-only restrictions. These areas have predominantly unburned vegetation, shallow slopes, and rocky soils where compaction and erosion would be minimized.

Since winter mitigation does not absolve all impacts, the tractor units are displayed according to risk based on recovery potential. Highest risk is associated with units with high burn severity, steep convex slopes where tractor harvest is planned, and where downed wood is scarce. Predicted effects would be refined after field data are gathered this spring and summer.

Alternative D has many areas proposed for salvage harvest in addition to those proposed for the other action alternatives that would address spruce and Douglas-fir bark beetle if an outbreak occurs. Winter mitigation is limited in these areas since snow cover would cover and hide fallen beetle infested trees. Thus, mitigation focuses on restricting equipment and log yarding to minimize impacts in these predominantly wet areas.

## *Direct and Indirect Effects*

### Alternative A - No Action

No adverse impacts to soils would occur. Recovery of existing impacted soils would continue through natural means (freeze/thaw cycles, root penetration into compacted soils, etc). Natural recovery from the wildfire would continue with leaf litter accumulating. Areas with past detrimental soil disturbance would continue to recover through natural means.

### Alternatives B, C, and D

The impact of the Proposed Action and action alternatives is set within the context of the burned fire landscape. The action alternatives vary in the degree they impact soil productivity. Winter harvest was designated for high-risk areas where burn severity was high and soil recovery could be severely impacted from logging activities. Summer tractor logging is limited to low risk areas where green or lightly-burned foliage is abundant and erosion risk is low. Tractors are limited to slopes less than 25 percent. Furthermore, summer tractor yarding would use “in-woods” processing to ensure a slash mat to reduce the risks of detrimental soils effects. Sensitive areas such as units within RHCAs have strong controls on tractor yarding to reduce the high potential for soil disturbance in wet areas. Log suspension using aerial cable, helicopter, or the presence of large logs to prevent logs dragging on the ground limits disturbance in these areas. In addition, ground-based equipment is excluded from streamside management zones (see the *Hydrology* section).

Though all alternatives comply with soil standards, the alternatives vary in the amount of potential soil disturbance. Three factors contrast the alternatives: acres of tractor yarding on sensitive soils, miles of temporary and permanent road construction, and miles of road reclamation. The highest expected impacts occur in Alternatives B and D. Impacts from temporary road construction are lower overall by favoring the use of old roads. To contract effects, road construction over an old road template versus new construction is distinguished.

Alternative B, the Proposed Action, has 3485 acres of ground-based harvest with tractor and tractor swing methods (Table 3-49) and the highest amount of temporary road construction. Of this, 841 acres have summer optional harvest where the wildfire burned with less severity and risk for adverse soil impacts are less. Alternative B has 17.3 miles of temporary road over old template and 9.6 miles of new temporary road construction. New temporary road construction is designed to have complete restoration to contour after salvage activities are completed. Temporary roads, using old road templates, would be reclaimed with drainage restored and surface scarified; seeded with native grasses; and intermittently covered with slash.

Alternative C has the least impact with reduced tractor harvest and less road construction. Ground-based systems are planned on 2408 acres with 319 acres planned for optional summer logging. Restrictions do not vary across specific units; rather, the amount of ground proposed is reduced. Temporary road construction is reduced to 6.6 miles over old road and 2.9 miles of new temporary road.

Alternative D has the greatest impact with the most ground-based harvest, though limits temporary road construction. Alternative D accesses the upper harvest units without the roads using additional helicopter yarding. However, total ground based yarding is highest at 3815 acres with 671 acres planned for optional summer logging (Table 3-49). Temporary road construction is 8.5 miles over old template and 3.2 miles of new construction.

The additional tractor based harvest in Alternative D includes stands with Douglas-fir and spruce that are in bottomlands or along mesic aspects that have low impacts from the wildfire. These stands account for 1048 acres with roughly 440 acres along riparian corridors. Planned harvest could not include winter mitigation to buffer effects in these predominantly wet areas since downed spruce and Douglas-fir beetle logs would be difficult to find under snow cover. Therefore, soil protection is through designated special treatment areas to exclude tractor use within RHCAs. Tractor restriction within these bottomlands is needed to lower risk for rutting and compaction where wet fine soils exist. Further identification of ground harvest suitability is planned during ground reconnaissance.

**Table 3-49. Unit Acreage for Seasonal Harvest Restrictions for Ground Based Harvest by Alternative. Ground Based Include Ground Cable, Tractor, and Tractor/Swing Logging Methods.**

| | Alternative B | Alternative C | Alternative D |
|---|---|---|---|
| Winter only | 2644 | 2089 | 3144 |
| Summer and winter | 841 | 319 | 671 |
| Total | 3485 | 2408 | 3815 |

## Logging Systems Impact to Soils

The main impacts from salvage harvest activities would be adverse soil disturbance from tractor-based harvest. Indirect effects are from secondary erosion that could occur. Additional risk, though not certain, is from removal of timber that would otherwise contribute to soil recovery in the burned area landscape. This impact is addressed in the soil biology discussion.

The long-term implications of salvage harvest on vulnerable soils in a burned environment is an issue identified from public comments (see Chapter 2) and cited in the literature (Beschta, et al. 1995; Beschta 2004; Karr, et al. 2004, Lindenmayer and Noss 2006). Wildland fire leads to reduced organic matter in the form of forest floor, woody biomass, and surface soils and varies according to fire intensity. Within this context, soil disturbance from salvage logging is most prominent with ground based harvest systems (see Klock 1975, McIver and Starr 2000). Given these implications, this project is designed to minimize compaction and erosion through preservation of the forest floor with snow covered soils or using a slash mat.

Expected impacts from the project activities would be highest for tractor based yarding and lowest for systems that use full or partial log suspension such as helicopter and skyline yarding (see Table 3-50). Predicted impacts are based on applicable forest monitoring, published research, and cross validated with unpublished data on neighboring forests. The Flathead National Forest has extensive monitoring and selected sales were chosen that best represent the proposed treatments (see Exhibit H-2). Table 3-50 shows the estimated detrimental disturbance from logging systems proposed for the Sheppard Creek Project. Detrimental disturbance occurs when long-term changes in soil properties and soil conditions result (USDA 1999). Estimated disturbance ranges are given to account for the variable performance of each logging method.

**Table 3-50. Predicted Soil Disturbance from Timber Harvest System for Sheppard Creek Project.**

| Logging System | Soil Detrimental Disturbance (%) | Citation |
|---|---|---|
| Helicopter | 0-2% | Clayton 1990, McIver and Starr 2000, Klock 1975, *Basko 2007 |
| Skyline | 5-10% | McIver and Starr 2000, |
| Ground Cable | 5-15% | **Niehoff 2002 |
| Winter Tractor | 5-10% | McIver and Starr 2000, Page-Dumroese 2006, USFS 2007 |
| Summer Harvester/Forwarder | 10-15% | Block et al 2002, Basko 2007, Niehoff 2002 |

*Basko 2007 is summarized soil monitoring for the Flathead NF.
**Niehoff 2002 summarizes soil monitoring for the Idaho Panhandle NF.

Tractor-based harvest over snow was estimated at five to ten percent detrimental soil disturbance. Over-snow logging works well with adequate snow cover and frozen ground, though substantial thaw adds additional risk. Within the project area, snow loads were eight feet deep this past winter and thus we are reasonably sure snow cover for the next winter or two should be satisfactory.

Summer tractor harvest has extremely high variability within burned area environments with data ranging from 4 to 28 percent detrimental disturbance in a recent survey (Page-Dumroese, et al. 2006). The Flathead National Forest had high values for the three units surveyed, though monitoring summarized in Exhibit H-2, showed a strong median of 13 percent. The isolated high disturbance levels emphasize the risks with warming spells and winter logging. Where summer harvest is planned outside of the RHCA areas, tractor logging using forwarders should lead to 10 to 15 percent disturbance. Green timber sale monitoring using similar systems resulted in 8 to 12 percent (Block et al 2002), and 4 to 13 percent (Basko 2007, Niehoff 2002).

Ground cable yarding (not using skyline yarding systems) and tractor swing logging methods would have less soil disturbance than typical harvester/forwarder or feller/buncher operations. The ground cable or swing operations have much reduced impacts from reduced machine traffic though monitoring data is scarce on the impacts. Klock (1975) found very high disturbance from tractor and ground cable. The expected disturbance here is lower given the smaller size class of material and abundant downed woody material that would buffer ground impacts. Expected impacts are conservatively estimated at 10 to 15 percent detrimental soil disturbance.

Partial and fully suspended logging systems have very low risk for impacts. Helicopter uses full suspension and most impacts are due to the large log landings required; detrimental disturbances are less than two percent (Clayton 1990, McIver and Starr 2000, Basko 2007). Skyline systems have partial suspension and thus less chance for gouging soil surface. Relatively high rates were found with forest monitoring at seven to nine percent detrimental soil disturbance, mostly from mixed systems where either an excavator is used for fuels after harvesting or feller buncher cuts timber. Pure skyline systems with hand felling crews in summer led to three percent (McIver and Starr 2000) and zero percent for winter (Basko 2007).

**Sensitive Soils**

Soils within the project area are more sensitive where the fire burned more extreme and/or site conditions have greater risk for adverse effects from logging. Conditions include steep slopes with tractor harvesting, clay soils, wet soil conditions as within much of the spruce and Douglas-fir units in alternative D, and high burn severity. Impacts of the salvage harvest were evaluated against the current conditions and environmental risks. Table 1 in Exhibit H-3 presents unit summaries with average slope, burn intensity from vegetation plots, and estimated risk. Mitigations are assigned for each unit to address the risk. Predicted detrimental disturbance is assigned. Soils with limitations listed in the Landtype Guidelines were addressed separately.

Table 3-51 is a subset of Table 1 in Exhibit H-3 showing highest risk units. Units are sorted according to logging system and denoted by alternative. Alternative B has optional summer harvest in areas where ground cable and tractor swing is planned for 159 acres. Alternative C has no high risk areas planned for logging. Alternative D has 609 acres planned for optional summer harvest. For Alternative D, most of the high-risk areas are riparian and have high burn intensity where vegetation is sparse.

Wet soils present a complicating factor for Alternative D's "B" units and other lower watershed units with convex topography. Removal of forest from wildland fire leads to higher moisture so summer logging has higher risk for rutting where clay soils exist. Han, et al.

(2006) looked at the combination of slash thickness and soil moisture to investigate effectiveness with forwarder/harvester operations – similar systems to proposed summer optional harvest. Han, et al. (2006) found slash was effective in limiting rutting in either wet or moist conditions but impacts were similar during very dry periods since dry soil strength was sufficient to buffer tractor impacts. Units chosen for optional summer harvest have slash available to buffer impacts. B units in Alternative D have special treatment areas to limit risk for disturbance and confine tractor traffic to dry ground.

**Table 3-51. High Risk Areas for Soil Disturbance from Logging Activities.**

| Logging System | Unit | Acres | B | C | D | RISK | Season | Severity | Slope | Projected Detrimental Disturbance |
|---|---|---|---|---|---|---|---|---|---|---|
| C | 131 | 14 | X | | X | High | all year | Crown | 20-35% | 5-15% |
| C | 18 | 18 | X | | X | High | all year | Underburn | 20-35% | 10-15% |
| C | 71 | 4 | X | | X | High | all year | H Underburn | 35-50% | 5-15% |
| TS (H) | 115 | 124 | X | | X | High | all year | Crown | 20-35% | 10-15% (<2%) |
| C | B1 | 16 | | | X | High | all year | Crown | 10-20% | 5-15% |
| C | B11 | 7 | | | X | High | all year | Crown | <10% | 5-15% |
| C | B13 | 8 | | | X | High | all year | Crown | 20-35% | 5-15% |
| C | B36 | 26 | | | X | High | all year | Crown | 0-35% | 5-15% |
| C | B4 | 27 | | | X | High | all year | Crown | 0-35% | 5-15% |
| T | B10 | 85 | | | X | High | all year | Crown | 10-35% | 15% |
| T | B17 | 23 | | | X | High | all year | Crown | 0-35% | 15% |
| T | B18 | 26 | | | X | High | all year | Crown | 0-35% | 15% |
| T | B2 | 23 | | | X | High | all year | Crown | 0-35% | 15% |
| T | B23 | 27 | | | X | High | all year | Mod | 10-35% | 15% |
| T | B3 | 7 | | | X | High | all year | Crown/ Underburn | 0-35% | 15% |
| T | B42 | 8 | | | X | High | all year | Crown | 20-50% | 15% |
| T | B43 | 14 | | | X | High | all year | Crown | 10-50% | 15% |
| TS | B34 | 38 | | | X | High | all year | Crown/ Underburn | 0-50% | 10-15% |
| TS | B44 | 31 | | | X | High | all year | Mod | 0-50% | 10-15% |
| *Total Acres* | | | *161* | *0* | *611* | | | | | |

The Flathead National Forest has guidelines for management on soil types with limitations. Landtypes 26D-7 and 26D-8, mapped for the middle Sheppard Creek watershed, have low water holding capacity and lower inherent fertility. The landtypes have sandy glacial till that is well drained, causing droughty conditions. These conditions were addressed by ensuring adequate organic matter in the form of slash and downed wood.

## Soil Erosion

The risk for soil erosion is highest during the first year after the wildland fire, until ground-cover returns. Erosion risk is low overall within the watershed from the structural influence of the belt metasediments and the low rainfall intensity. Erosion risk is localized along roads primarily and limited to surface erosion. No sign of mass failure was found during this past fall's reconnaissance of the project area. Risk is low given the strong slope control from horizontal oriented belt geology that underlies the project area.

A study of soil erosion in the Bitterroot Mountains found soil erosion was strongly linked to rainfall intensity (Spigel and Robichaud 2007). More specifically, this is heavy rainfall, with short duration, that occurs with summer thunderstorms. Three substantial rainfall events occurred during the summer following the wildfire documented in the study. The storm events were in the order of 5 to 10 year and 10 to 25 year events, but resulted in very large flooding in the realm of 100 to 500 year probabilities. The burned watersheds had up to 30 percent burned soils and were very steep with high elevation. Within plots, soil erosion was extremely variable with anywhere from 0 to 80 tons per acre. What is compelling is the high variability measured despite similar slopes, groundcover, and burn severity within the Bitter-root burn areas. The Bitterroot study showed similar results to a study by Amaranthus and Trappe (1993) in the Cascade Mountains.

The Sheppard Creek Project could have high intensity rainfall, though the probability is much lower given the more northern position and less orographic influence that lowers the chance for convective thunderstorms on the order that the Bitterroot experiences. As a coarse proxy, six-hour rainfall intensity records were used to compare the Bitterroot versus the Sheppard Creek area. The Bitterroot six-hour intensities were at 1.2 inches compared to 0.8 inches for Sheppard Creek (NOAA 1973). Rainfall intensities that triggered large erosion in the Bitter-root was from 0.5 to 0.6 inches for a ***30-minute*** period (Spigel and Robichaud 2007; Nickless, et al. 2002). In comparing the WEPP modeling to actual hillslope erosion, Spigel and Ro-bichaud (2007) found the 25-year probability most adequately modeled the results. WEPP results did better as an average rather than for individual hillslopes as reported elsewhere for post-fire erosion in Colorado (Larsen and MacDonald 2007).

Though a gully washer storm event is unlikely, localized erosion from salvage activities is a concern. The highest potential would be along temporary road and permanent road drainages where water is routed onto high intensity burn areas. This is a localized effect that is difficult to gauge. Application of BMPs would be used to lower incidence. Other sources for soil erosion are from temporary road construction where native surfaces are exposed to rainfall. Within units, these areas would likely have short-term increases of soil erosion above the recommended two tons per acre. Effects would decrease, as roads are obliterated immediately following project completion. Erosion risk is for less than five years as groundcover returns, typically over 50 percent.

Erosion from salvage yarding within units is less likely. Winter tractor logging and partial or full suspension units have the least risk with the low amount of ground disturbance. Summer optional harvest units have more, though these areas are slated for shallow slope areas, less than 25 percent slopes, and areas with abundant slash material to buffer machine tracks.

**Organic Matter**

Salvage logging impacts soil recovery after wildland fire by extracting remaining organic matter. The greatest impacts are within high intensity burn areas. Where wildfire burned hot, the forest floor is missing and most of the trees are blackened. These areas are sensitive since live above-ground biomass is essentially removed. Site conditions are largely moderated with the remaining forest structure in the form of dead wood. Dead down and standing wood ameliorate site condition by forming microsites that shelter vegetation regrowth, harbor moisture, and augment soil temperature with shade (Harvey, et al. 1987; Franklin, et al. 2002). These attributes improve soil growth potential, especially in dry areas such as south facing slopes. As standing dead falls, this wood is further incorporated as brown cubicle rot that acts as a sponge for moisture.

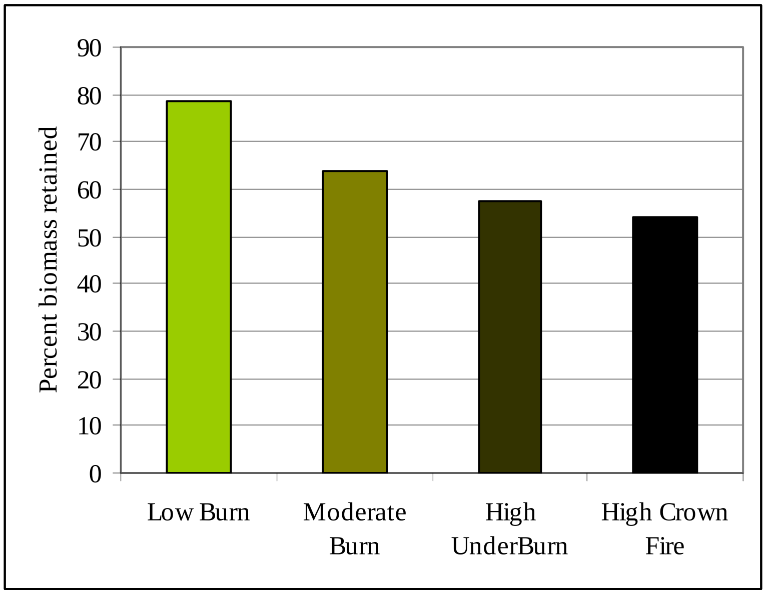
Dead and downed wood is well recognized as a critical element for soil productivity (Harvey, et al. 1987; Graham, et al. 1994) and managed actively by the Forest Service. Recommendations for minimal coarse wood levels to sustain productivity are outlined in Graham, et al. (1994). Preliminary data gathered in the fall of 2007 suggests most of the project area is on the low side of the recommended 5 to 25 tons per acre.

For the Sheppard Creek Project, effects to organic matter were evaluated using Beschta, et al. (1995)'s recommendation for leaving 50 percent of the material, especially in sensitive areas that burned hot. Using stand data collected during the fall of 2007, total standing biomass was estimated for trees greater than five inches DBH. Remaining trees after proposed harvest including green, non-merchantable cull, and wildlife-designated snags were compared against current standing biomass to calculate percent totals. Figure 3-19 shows the percent standing biomass predicted to be retained after harvest removal, by burn intensity class.

Using Figure 3-19, retention decreases in heavy burn areas since more trees are targeted for salvage. Figure 3-19 also shows that at least 50 percent of non-merchantable biomass is maintained when grouped by burn intensity. When evaluating this threshold by unit, 18 units were below with 40 to 50 percent retention. Standing biomass after salvage removal averaged 54 tons per acre on up to 78 tons per acre for low intensity fire. These figures align with reported downed wood estimates from Dumroese, et al. (2006)'s salvage harvest study. Dumroese, et al. (2006) found coarse wood ranged from 46 to 56 tons per acre after timber harvest on the Flathead National Forest.

Based on these gross estimations, sufficient material would be available to ameliorate site conditions for soil recovery. The most critical areas are the high crown fire areas where adequate retention is needed to promote soil recovery. Estimated biomass retention in these areas is just above 50 percent. Overall, decay would decrease for trees left standing from better exposure. Helicopter units where more material has the potential to be knocked down for safety reasons would have theoretical differences in decay compared to skyline or tractor units where more material is left standing.

**Figure 3-19. Percent Biomass Retained Grouped by Burn Intensity.***




*Data from 126 stands.

## Soil Biology

Impacts to microorganisms and soil fauna, including endo- and ecto-mycorrhizae are not quantifiable. Impacts would be highest in high burn intensity areas. Impacts are addressed by leaving unmerchantable cull logs and live trees as forest habitat and structure to sustain biologic potential (see Jurgenson, et al. 1997; Franklin, et al. 2002; Pyle and Brown 2002). Graham, et al. (1994) used ecto-mycorrhizae as a surrogate for optimal coarse wood amounts. All units would have coarse wood above the recommended standard of 5 to 25 tons per acre for these habitats. This coarse wood includes current downed wood on the forest floor and increases from falling snags during harvest operations. Additional downed wood accumulates as fire-killed retained trees fall over time.

An indirect effect that can result in adverse effects to soil productivity is from introduction of noxious weed species. Noxious weed species are a threat where groundcover is sparse and soil resources are abundant. Typically, available nutrients spike following fire and greatly reduce over the following two years (Choromanska and Deluca 2002). Noxious weeds invasion is a risk since these species are more adept than natives at exploiting abundant soil resources after fire.

Noxious weed invasion can impact soil productivity by shifting plant species composition. The shift in composition has biodiversity implications. The assumption is less diversity can lead to less productivity (Perry and Amaranthus 1997). Noxious weeds such as cheatgrass (*Bromus tectorum*) and spotted knapweed (*Centaurea maculosa*) influence below-ground soil function by changing soil nutrient status and water dynamics, creating legacy effects that favor opportunistic species (Norton, et al, 2004; Thorpe and Callaway 2006; Gundale, et al. 2007). The risk is highest where noxious weeds establish and hinder native plant recolonization, especially where the fire burned the hottest. See the Invasive Plant Species section of this chapter for details on exact locations.

**Roads**

Proposed temporary road building results in short term degradation of soil hydrology and longer-term reduction in soil biological function. Obliteration and reclamation efforts would greatly improve soil restoration over leaving roads in place. For the short term, reclamation improves soil hydraulic function adequately to address erosion potential, though reclaimed soil would have infiltration rates markedly lower than natural forest rates (Luce 1997, Foltz and Maillard 2003). For the long term, infiltration rates improve over time as freeze/thaw and plant roots improve soil porosity though rates would likely remain lower than adjacent natural forest soil (Switalski, et al. 2004). Soil biological function restores as forest floor and native plant communities returns. Moist areas in the lower to middle portion of the watershed have higher restoration potential. In addition, most of the project area has a northeast aspect, and thus cool and wet conditions that promote vegetation growth. Degraded biological condition is predicted for greater than 20 years.

## *Cumulative Effects*

Cumulative impacts are addressed from the perspective of the activities area, i.e. the proposed timber salvage units. Watershed level impacts are addressed in the *Hydrology* section. The combined impacts of the wildland fire, past timber management, and the salvage harvest proposals have potential risks. Impacts from all other activities; including mushroom harvest, recreational activities, and future management; are incremental when compared to the cumulative effects from the proposed project, the recent wildfire, and past management.

The project addresses this potential impact by maintaining at least 40 percent retention of all current standing biomass in the planned salvage units. This biomass retention along with minimizing soil disturbance should lower risk for adverse cumulative effects. At this time, data on the exact condition in units is sparse considering impacts from the wildland fire and impacts of past logging. Survey information from the spring and summer of 2008 would better ascertain the risk for cumulative effects within harvest units. Cumulative impacts from past logging are not likely since most of the past management used regenerative methods and salvage activities are focused on older stands.

## Project Design Features

Management practices designed to maintain soil productivity and prevent accelerated erosion are presented in the Features Common to All Action Alternatives section of Chapter 2. These requirements would be incorporated into timber sale contracts through the inclusion of the contract clauses.

## REGULATORY FRAMEWORK AND CONSISTANCY

- Flathead NF Forest Plan Management Direction - Forest wide standards for soil resources, (USDA 1986, page II-55), are:
  - Ensure that all resource management activities would maintain soil productivity and minimize erosion through implementation of:
    - Management direction presented in the Landtype Guidelines; and
    - Erosion Prevention Standards.
  - Design or modify all management practices as necessary to protect land productivity.
- The Soil and Water Conservation Practices (SWCP) Handbook (USDA Forest Service 1988) is incorporated by reference in the Forest Plan, describing Best Management Practices (BMPs) to be used in the planning and implementation of timber sale and associated activities. Specific BMPs for this project are described in Appendix C.
- Regional guidance is available from the Region 1 Forest Service Manual for Soil Management (USDA 1999). Region One policy states "Design new activities that do not create detrimental soil conditions on more than 15 percent of an activity area. In areas where less than 15 percent detrimental soil conditions exist from prior activities, the cumulative detrimental effect of the current activity following project implementation and restoration must not exceed 15 percent."
- National Forest Management Act (16 U.S.C. 1604) "timber harvested from National Forest System lands...only where soil, slope, or other watershed conditions will not be irreversibly damaged."

Forest Plan guidelines are met with all alternatives by designing logging systems to minimize disturbance and implementing soil and water conservation practices through design and implementation. The analysis considered and adhered to landtype guidelines listed in Appendix Q of the Forest Flan (USDA Forest Service 1986).

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# WILDLIFE

## Introduction

The wildlife section of this chapter is divided into sections for various habitats and groups of species. Snags and downed wood and old growth are unique habitats that fulfill key habitat components and general habitat requirements for many wildlife species. These habitats will be analyzed in two separate sections. The Forest Plan lists as Management Indicator Species all threatened and endangered species, sensitive species, and elk, mule deer, and white-tailed deer. Canada lynx and grizzly bear are the threatened species occurring in the project area. Sensitive species identified for the Flathead National Forest occurring in or potentially occurring in the project area include the gray wolf, bald eagle, boreal toad, fisher, Townsend's big-eared bat, and wolverine. Neotropical migratory birds are addressed in a separate section that includes an analysis of riparian habitats.

Wildlife species in this area have evolved in ecosystems influenced by fire, insects, and disease, and even stand-replacement fire is essential for the long-term survival of some species (Bunnell 1995; Caton 1996; Dixon and Saab 2000; Hutto 1995a; Saab and Dudley 1998; Smith 2000; Beschta, et al. 2004; Exhibit Rg-10). The proposed project contains two basic kinds of forest management activities that can affect wildlife use of habitat: 1) removal of dead and dying trees and 2) temporary road construction. Tables 3-52 and 3-53 provide a synopsis of historical and current Management Indicator Species (MIS) distributions at the sub-basin, sub-watershed, and project area scales, and were used to determine which species to carry forward into the analysis.

**Table 3-52. Presence and Status of Wildlife Management Indicator Species and Habitats in and Near the Sheppard Creek Project Area, Flathead National Forest** (Exhibit sections Q, Rb, Rd, Rg, Rn, Rr, Rs, and Rt).

| Wildlife Species | Status | Presence in Stillwater Subbasin | Presence in Project Area |
|---|---|---|---|
| Bald Eagle | Sensitive; MIS | Yes | Yes |
| Black-backed Woodpecker | Sensitive; MIS | Yes | Yes |
| Boreal Toad | Sensitive; MIS | Yes | Yes |
| Canada Lynx | Threatened; MIS | Yes | Yes |
| Common Loon | Sensitive; MIS | Yes | Yes |
| Elk, Mule Deer, and White-tailed Deer | MIS | Yes | Yes |
| Fisher | Sensitive; MIS | Yes | Probable |
| Flammulated Owl | Sensitive; MIS | Probable | Unlikely |
| Gray Wolf | Sensitive*; MIS | Yes | Yes |
| Grizzly Bear | Threatened; MIS | Yes | Yes |
| Harlequin Duck | Sensitive; MIS | Yes | Unlikely |
| Northern Bog Lemming | Sensitive; MIS | Yes | Probable |

| Wildlife Species | Status | Presence in Stillwater Subbasin | Presence in Project Area |
|---|---|---|---|
| Northern Goshawk | MIS | Yes | Yes |
| Northern Leopard Frog | Sensitive; MIS | Probable | Unlikely |
| Peregrine Falcon | Sensitive; MIS | Yes | Unlikely |
| Townsend's Big-eared Bat | Sensitive; MIS | Probable | Probable |
| Wolverine | Sensitive; MIS | Yes | Yes |
| Neotropical Migratory Birds | | Yes | Yes |
| Old Growth Associated Species | | Yes | Yes |
| Riparian Habitat Species | | Yes | Yes |
| Snag and Down Wood Habitat Species | | Yes | Yes |

MIS = Management Indicator Species.
* = Delisting of the Gray Wolf was published on February 27, 2008, becoming effective on March 28, 2008. In this document, the wolf is considered along with the grizzly bear in the section on Threatened Wildlife Species.

**Table 3-53. Species-Specific Habitat Occurrence and Other Issues Related to the Sheppard Creek Project Affected Area, Flathead National Forest** (Exhibit sections Q, Rb, Rd, Rg, Rn, Rr, RS, and Rt)**.**

| Wildlife Species | Habitat Comments Related to Project Area |
|---|---|
| Bald Eagle | No known or potential nesting habitat. At least three pairs may use parts of the area for breeding-season foraging. Most sightings have been near Sylvia Lake. |
| Black-backed Woodpecker | Habitat is abundant in the Brush Creek Fire area. Observed in high numbers until 1999 in the Little Wolf Fire area adjacent to the south. |
| Boreal Toad | Common in the area. Breeding habitat occurs in lakes, ponds, slow streams, and ditches. Fire caused the loss of riparian cover in many areas. Upland habitat occurs throughout the project area (see snags & downed wood habitat for post-fire conditions). |
| Canada Lynx | Much of the habitat in the fire area is now temporarily unsuitable, with the exception of numerous dense sapling stands and a handful of unburned mature stands. Sightings of lynx, including confirmed reproduction. Snowshoe hares abundant in unburned areas in and adjacent to the fire area. |
| Common Loon | No known breeding habitat for this species in or adjacent to the project area. Several observations feeding on Sylvia Lake within the fire area. |
| Elk, Mule Deer, and White-tailed Deer | Spring through fall use. Most hiding and summer thermal cover in fire area destroyed or reduced in quality by 2007 fire. Portions of two elk security areas remain within fire area provide marginal elk security within fire area. |
| Fisher | A recently severely burned environment is generally unsuitable habitat. Reported during the Brush Creek Fire just outside the fire perimeter. |
| Flammulated Owl | Single-story ponderosa or Douglas-fir old growth with open understory is rare to absent in the area. |
| Gray Wolf | Scattered reports, apparently foraging or traveling, increased dramatically in 2007 with the radio-collaring of a member of the new Ashley Pack nearby to the south. |
| Grizzly Bear | Scattered reports, apparently foraging or traveling. Fire reduced security cover. High-quality feeding habitat naturally not abundant. No denning habitat. |
| Harlequin Duck | Closest known reproduction is about 20 miles to the northeast. No potential nesting habitat. |
| Northern Bog Lemming | Only known occurrence on Flathead National Forest is in the Bowen Creek drainage about 3 miles to the northwest. Potential habitat scattered across the analysis area. Fire caused the loss of riparian cover in many areas. |

| Wildlife Species | Habitat Comments Related to Project Area |
|---|---|
| Northern Goshawk | Most nesting habitat destroyed by fire. Reported at edge of fire area in fall 2007. Nesting/Feeding habitat limited within fire area. Habitat occurs on edges and adjacent to fire area. |
| Northern Leopard Frog | Very rare in Western Montana. No reports in or near project area, although may have occurred in the area historically. Closest reports are near Eureka, MT, and west of Kalispell, MT. Possible habitat scattered across the analysis area. Fire caused the loss of riparian cover in many areas. |
| Peregrine Falcon | Nesting activity has not been documented in the project area; potential foraging habitat is not present. Closest known nesting 40 miles southeast. |
| Townsend's Big-eared Bat | Snags and bridges may provide roosting habitat; wetlands may provide feeding habitat. Fire caused the loss of riparian cover in many areas. |
| Wolverine | No denning habitat available; not expected to inhabit the analysis area. Expected to use the area when traveling to higher quality habitat. Confirmed past observation on Brush Creek divide on northwest edge of fire. |
| Neotropical Migratory Birds | Habitat in and adjacent to the fire area for a suite of Neotropical migratory birds. |
| Old Growth Associated Species | Much of the old growth in the fire area no longer meets habitat criteria—only one area of old growth had no fire. Limited potential for recruitment new old growth habitat. With the exception of the 1994 and 2007 fire areas, old growth is well distributed. Salvage units in the Proposed Action include current and possible old growth and recruitment old growth areas. |
| Riparian Habitat Species | Habitat in and adjacent to the fire area for a suite of riparian wildlife species, although much of the riparian habitat was impacted by the fire. |
| Snag and Downed Wood Habitat Species | Abundant snags and current and future down wood in project area. |

The criteria used to determine which species to not carry forward for further analysis included lack of habitat, and lack of effects to the habitat of a species from any of the alternatives (Table 3-54; Exhibits Rs-2, Rs-3, Rs-7, and Rs-15). Prior to the preparation of this document, a review was conducted of District and Forest wildlife records, the U.S. Fish and Wildlife Service (USFWS) list of Federally Threatened and Endangered species on the Flathead National Forest (Exhibit Rt-1), the Forest Service Region 1 Sensitive Species List (Exhibit Rs-1), and the Montana Fish, Wildlife and Parks website (Exhibit Rg-4).

**Table 3-54. Species and Rationale for Not Being Included in the Detailed Effects Analysis for the Sheppard Creek Project.** See Exhibits Rg-1, Rs-2, Rs-3, Rs-7, and Rs-15 for more information.

| Species | Rationale |
|---|---|
| Flammulated Owl | No habitat occurs within the proposed areas; therefore, each of the alternatives would have no impact on flammulated owls or their habitat. |
| Harlequin Duck | No sightings or potential nesting habitat. Closest known reproductive habitat 20 miles to northeast in a non-connected watershed. Effects on potential habitat far downstream would be negated by large meadow complexes and healthy streamside riparian areas. Therefore, all of the alternatives would have no impact on harlequin ducks. |
| Peregrine Falcon | No nesting habitat in or adjacent to the proposed areas and no affect on potential prey sources, therefore all of the alternatives would have no impact on the peregrine falcon. |

The evaluation of direct, indirect, and cumulative effects on wildlife species and habitats used the most recent and available information, as well as data related to past, present, and reasonably foreseeable events that have occurred or may occur in the analysis areas. Applicable past and present, and foreseeable events described in the Introduction section of Chapter 3 were considered during the evaluation of the affected environment and for the analysis of effects. The condition of the affected environment, together with applicable reasonably foreseeable events as described in the above-mentioned section, were considered during the analysis of the environmental effects of the alternatives. The listed events that are not specifically analyzed or mentioned in the following discussion were considered to have no potential effect or negligible effects on wildlife species.

# SNAGS AND DOWNED WOOD HABITAT

## Introduction

### General Dead Wood Habitat

Snags, broken-topped live trees, downed logs, and other woody material are required by a wide variety of species for nesting, denning, roosting, perching, feeding, and cover (Exhibit Rd-4, Bull et al. 1997). It is estimated that about one third of the bird and one third of the mammal species that live in the forests of the Rocky Mountains use snags for nesting or denning, foraging, roosting, cover, communication, or perching. Marcot and others (1999) list 57 wildlife species plus four species groups associated with snags, and 20 wildlife species associated with hollow living trees. On the Flathead National Forest, at least 42 species of birds and 10 species of mammals are dependent on dead wood habitat for nesting, feeding, or shelter (Exhibit Rd-2). In addition, large snags and downed wood play central roles in diverse ecosystem processes and functions such as nutrient recycling, shelter for growing trees, and habitat for wildlife and fish (Rose et al. 2001). It is prohibitively difficult and costly to artificially restore snags or downed logs, and natural restoration of snag or downed wood habitat can take decades or even centuries.

Reliance on dead wood habitat occurs at a variety of scales, from large landscapes, to small patches, to individual snags or downed logs. More mobile species that depend on dead wood habitat include black bears, Canada lynx, wolverines, marten, fisher, bats, woodpeckers, and small owls. Less mobile species that depend on dead wood include snowshoe hares (the primary prey of Canada lynx), red-backed voles (the primary of prey of marten, fisher, boreal owl, northern goshawk, and several other species), shrews, bryophytes, lichen, fungi, and protozoa (Bull and Blumton 1999, Raphael and Jones 1997; Brown et al. 2003). Bunnell et al. (2002) state that "dispersed retention of trees and snags strongly favors secondary cavity nesters and increases their abundance above that found in mature or old-growth forests." Many cavity excavators benefit further from leave patches in addition to dispersed retention of snags and trees (Saab and Dudley 1998, Bunnell et. al 2002).

Species that use dead wood in the post-fire environment appear to use species-specific micro-habitats. Homogenously managed stands are likely to not provide habitat for many species (Tobalske et al. 1991, Hutto 1995b, Saab and Dudley 1998, Lyon et al. 2000, Aubry and Raley 2002b, Kotliar et al. 2002, Saab et al. 2002, Brown et al. 2003). Likewise, any one stand would not provide habitat for all cavity-using species. Vegetation and snag conditions are naturally diverse across a forested landscape, including the Brush Creek Fire area. Maintaining this diversity would provide a wide variety of habitat conditions for bird, mammal, reptile, and amphibian species, as well as for a great variety of invertebrates, plants, fungi, and microbes. Maintaining ecological diversity at all scales is the "key to retaining resilience" to future stresses or changes (Franklin et al. 1989) and the key to maintaining viable populations of all wildlife species.

Standing and downed dead trees have many ecological roles in a landscape recovering from wildfire (Beschta et al. 1995, Saab and Dudley 1998, Smith 2000, Brown et al. 2003, Beschta et al. 2004, Saab et al. 2004). The snags and down logs that result from fire serve a vital role in the structure and function of healthy forest ecosystems and play an important role in post-fire recovery and long-term site productivity. Often, few or no green trees exist to replace snags that fall over time. Snags in such stands would not become available again until a new forest develops that has trees that are large enough and with sufficient decay. Species such as black-backed woodpeckers and olive-sided flycatchers appear to respond positively to the high densities of snags in burned forests and may depend on them. Hutto (1995b) found that 15 species of birds were more frequently found in post-fire habitats than in any other major cover type in the northern Rockies. Quigley (1996) suggests that post-fire salvage harvest that emphasizes the removal of larger snags is not compatible with contemporary ecosystem-based management.

## Snag Habitat

The number, species, size, and distribution of snags strongly affect snag-dependent wildlife. Too few suitable snags may limit or eliminate populations of cavity-using species (Raphael and White 1984, Thomas et al. 1979, Saab and Dudley 1998, ICBEMP 2000). Snags with old nesting cavities, broken tops, and decay are most likely to be used (Bull et al. 1986). Cavity-using birds have been proven to substantially reduce tree mortality and damage caused by forest pest insects (Beebe 1974; Otvos 1979; Torgersen, Mason, and Campbell 1990; Torgersen 1996; Bull et al. 1997). The scientific literature contains a wide variety of recommendations for desired densities of dispersed large snags and amounts left in patches (Agee 1998, Saab and Dudley 1998, Bull and Holthausen 1993, Bull 1994, Marcot et al. 1999, Lyon et al. 2000, Bunnell et al. 2002, Brown et al. 2003). Hutto (2006) suggests that attempting to mimic something more like a forest 10 years after a fire could emulate natural disturbances.

Large-diameter, taller snags are an especially important component of a burned landscape in forested ecosystems. The larger the diameter of the snag, the less the nestlings or young mammals are crowded and the better they are protected from weather and predators. Although smaller creatures can use many sizes of dead trees, larger birds and mammals require larger snags, and the larger the snag is, the more species can use it (Saab et al. 2004). The pileated woodpecker builds cavities that are then used for years by many other species (Bonar 2000), but it has very low or no nestling survival in any snag or tree smaller than 20” DBH. Large larch snags remain standing longer and are much more likely to develop suitable decay conditions for cavity-using species (McClelland 1979, Bull et al. 1997, Daenzer 2007). Large, durable snags most often selected for cavity nesting are believed to have decreased substantially west of the Continental Divide in Montana (Hillis et al. 2003; Exhibit Rd-9). Western larch, Douglas-fir, and deciduous tree snags are the species predominately used by cavity-using birds and mammals in this area. Most are relatively resistant to windthrow and are also much less likely to require felling for safety concerns and tend to be less of a fire hazard. Smaller-diameter snags also get some use as nest habitat by some species. However, their greatest value in the early post-fire environment is for feeding habitat, particularly when high densities of smaller-diameter snags are available. Also important is the role that smaller snags play in helping to keep other snags standing (Russell et al. 2006).

**Downed Wood Habitat**

Downed trees and other woody material are critical for many species (Maser et al. 1979). In the Pacific Northwest, 47 vertebrate species respond positively to downed wood (Bunnell et al. 2002). Downed logs and stumps are required for denning and resting, are vital for hunting below the snow in winter (Buskirk and Ruggiero 1994), and are also used as travel cover, particularly when living plant cover is absent. American marten often den and forage in the under-snow cavities that occur under downed logs. Canada lynx, fisher, and wolverine dens are associated with abundant woody debris, usually large-diameter logs (Bull et al. 2001). Winter wrens do most of their feeding underneath suspended logs (Stewart et al., 2004). Several amphibians and reptiles make use of large woody debris for shelter and breeding sites (Bull et al., 1997). Many ant species that need large-diameter downed logs are major predators of defoliating insects such as western spruce budworm (Torgersen and Bull 1995). Longer and larger-diameter downed trees are generally most important because they can be used by a far greater range of species. In addition, they provide stable and persistent structures as well as better protection from weather extremes. A variety of sizes and decay classes are needed in downed wood "in order to conserve functional processes that foster sustainable forest ecosystems" (Torgersen and Bull 1995).

## Analysis Area

The Brush Creek Fire area on the Flathead National Forest (Exhibit Rg-9) was considered for the evaluation of direct and indirect effects on snags and downed woody material habitat. This approximately 40 square mile area (about 25,370 acres) is large enough to include the home range of numerous wildlife species using snag and downed woody material habitats and is representative of effects of fires, natural tree mortality, timber harvest, and firewood cutting across the landscape. It is sufficiently large enough to evaluate the ability of the habitat to support populations of wildlife and plant species using dead wood habitats, but small enough to not obscure effects of the alternatives. All of the actions proposed in the alternatives that could directly or indirectly affect this resource are contained within this area. The Sheppard Creek drainage along with the upper portion of the Good Creek drainage and the lower portion of the Griffin Creek drainage was used for the consideration of cumulative effects, totaling approximately 119 square miles (about 76,200 acres; Exhibit Rg-9). This would place old growth inside the fire area in its context of a landscape in recovery from large fires over the past century. Larger-scale assessments were also conducted to address population viability concerns (Exhibits Rd-9 and Rg-1). For this project, the analysis of effects on snag and downed wood habitat spans as far as 100 years, enough time for some of the trees left in the units to acquire decay and other characteristics that make them useful to many wildlife species.

## Information Sources

Data used included pre-fire and post-fire aerial photography; stand exams; Northern Region Vegetation Mapping Project (R1-VMP) data; field surveys of snags and downed logs in and near the fire area; pre- and post-fire old growth surveys; project area field visits; post-fire walk-through surveys; post-fire Common Stand Exam plots; research literature; and GIS coverages and data sets for features such as general forest attributes, riparian areas, ownership, and roads. Where stand information was unavailable, interpretations were made based on a comparison with neighboring stands that did have information, or on photo interpretation and professional experience with these forest types. Burn severities for vegetation were derived from extensive field surveys and an aerial photo interpretation process (Exhibit P-4). See Exhibits Rd-1, Rd-3, Rd-5, Rd-8, and Rd-11, and Project Record section Q. For literature cited, see Exhibit Rd-12.

This analysis covered the standing and downed dead wood resource in terrestrial areas. See the Fisheries section of this document for consideration of large wood recruitment in aquatic systems. Also, see sections in this chapter on Old Growth Habitat and Old Growth Associated Wildlife Species and on Black-backed Woodpeckers.

# Affected Environment

## General Dead Wood Habitat

Snag and downed wood habitat and its use by wildlife vary dramatically across the analysis area, largely due to recent disturbance history (Exhibits Q-8, Rd-3, and Rd-14; Table 3-65, below). Fire and insects were the dominant disturbances prior to timber management, and extensive areas of snag habitat often occurred in areas dominated by a stand-replacing fire regime. Prior to the Brush Creek Fire, most of the surrounding area had not experienced a substantial fire event for the last 70 to 100 years, and perhaps as long as 250 years in some areas. The Little Wolf Fire and three smaller fires burned part of the area between 1994 and 2000. Numerous wildlife species make use of snag and downed wood habitat in the area (Exhibits Rd-2 and Rd-11).

For more information about standing and downed dead wood habitat conditions across the Flathead National Forest, see the Final Environmental Impact Statement for the Flathead's Forest Plan Amendment 21 (USDA 1999a) and Exhibits Rd-9, Rg-1, and Rg-3. See the Vegetation and Fire sections of this Chapter for more information. The effects of fire suppression actions in 2007, such as hazard tree reduction along roads, are included in the Cumulative Effects section below.

## Snag Habitat

Across the Direct and Indirect Effects Analysis Area (the Flathead National Forest side of the Brush Creek Fire area), the availability of quality snag habitat is well distributed and diverse, but is far more limited than would initially appear (Exhibit Rd-3). Within the area, the fire burned about 3600 acres (14 percent) at low vegetation severity, 5260 acres (21 percent) at moderate vegetation severity, and 16,300 acres (64 percent) at high vegetation severity, as described in the Vegetation section of this chapter. At the stand level, only 142 acres (one percent) in the area was not burned, although many areas of saplings were burned only along their edges and make up the bulk of the low vegetation severity acreage. Nevertheless, nearly

52 percent of the analysis area is made up of seedling/sapling stands without a large amount of overstory, or other non-forested areas such as shrub fields, rock, rivers, and wetlands, making little contribution towards snag or downed wood habitat. About 960 acres (four percent) of the Brush Creek Fire area was salvaged by the Gregg-Plume Timber Sale in 2007 and early 2008, leaving most of the larger larch and Douglas-fir (Exhibit Rd-14). About 72 percent of the analysis area was dominated by whitewoods such as lodgepole, subalpine fir, and spruce, which get far less use as nesting snags than do western larch or Douglas-fir.

In typical fire years in northwestern Montana, large western larch and Douglas-fir are unlikely to be killed by low-intensity fire. This is fortunate, as these species are most often selected by cavity nesters and also tend to resist windthrow. Underburning in the Brush Creek Fire, however, apparently killed most of the large larch and Douglas-fir, even those over 25" DBH. Many of these trees show no sign of fire until one pulls the ash aside to reveal that the root collar is gone. Field surveys in fall 2007 were unable to determine the extent of tree mortality in many stands dominated by larger western larch and Douglas-fir. In areas dominated by spruce or sub-alpine fir or by pole-sized trees of any species, nearly all the trees die soon after fire. In all but the most intensely burned areas, large numbers of additional spruce and Douglas-fir trees could be killed by bark beetles (see the Bark Beetle section of this document for more information on the potential for insect-killed trees).

Within the Direct and Indirect Effects analysis area, eight snag and live tree groups were developed to quantify the amount and distribution of snag habitat and snag recruitments (Table 3-55, Exhibit Rd-3). After examining patterns of the densities of different kinds of snags, these groups were based on three pre-fire tree species groups and two vegetation burn severity groups. An additional two groups were added to account for past timber harvest and areas where trees are naturally sparse. According to the large tree plot data discussed below, the whitewood-dominated stands should be further divided into those with and without a mixed-species component. Areas dominated by a single whitewood species (lodgepole pine, subalpine fire, or spruce) make up about 56 percent of the whitewood stands and 30 percent of all stands. Despite the fact that whitewood-dominated stands covered over 70 percent of the landscape, all eight groups are fairly evenly distributed across the analysis area (Exhibit Rd-3), even when considering pre-fire structure (i.e. sapling or mature forest).

**Table 3-55. Snag and Live Tree Groups across the Flathead National Forest Side of the Brush Creek Fire Area** (Exhibit Rd-3).

| | Vegetation Burn Severity * | Acres | % |
|---|---|---|---|
| Western Larch Dominated | High | 1265 ac | 5.0% |
| | Low to Moderate | 409 ac | 1.6% |
| Douglas-fir Dominated | High | 2037 ac | 8.0% |
| | Low to Moderate | 677 ac | 2.7% |
| Whitewood Dominated (i.e. Lodgepole Pine, Spruce, Subalpine Fir) | High | 7178 ac | 28.3% |
| | Low to Moderate | 847.5 ac | 3.4% |
| 5-15 trees and snags per acre due past harvest or natural growing conditions | n.a. | 3167 ac | 12.5% |
| 0-5 trees and snags per acre due past harvest | n.a. | 9751 ac | 38.5% |

* High = high-severity crown fire and high-severity underburning (over 80% of trees killed);
Low to Moderate = unburned, low severity (30 to 80% killed), and moderate severity (less than 30% killed)
(See the Vegetation section of this chapter and Exhibit P-4 for more information).

Multiple data sources were used to characterize the eight snag and live tree groups, looking at forested stands that were pole-sized or older. Table 3-56 is based on 250 random plots measured in fall 2007 (Exhibits P-11 and P-12), emphasizing the variability between plots. Table 3-57 shows similar patterns revealed by extensive post-fire walk-through exams that were used to update data collected for previous stand exams (Exhibit P-10). This second table also reflects fire-caused tree mortality. Both sources of tree data also indicate that stands dominated by a single species of whitewood (such as lodgepole pine or spruce) have dramatically fewer larger larch or Douglas-fir. In both tables, the 20-inch DBH and above category for larch focuses on the tree species of greatest value for bird and other wildlife species, that use large snags for nesting and feeding, providing habitat for keystone species such as pileated woodpeckers, this also acknowledges that more and larger wildlife species are able to fully use larger diameter snags. For a more detailed breakdown by vegetation burn severity, see Exhibits P-4 and Rd-3.

**Table 3-56. Density of Western Larch and Douglas-fir Snags and Live Trees 16"+ DBH and 20"+ in Pole-Sized and Mature Stands in the Flathead National Forest Side of the Brush Creek Fire Area.** Based on post-fire Common Stand Exam Plot data (Exhibits P-11, P-12, and Rd-3).

| Tree/Snag Species | DBH | Parameter | Dominant Tree/Snag Species Group | | | |
|---|---|---|---|---|---|---|
| | | | Western Larch | Douglas-fir | Single-species Whitewoods | Mixed Whitewoods |
| Western Larch Trees and Snags | 12"+ | Average | 34.3/ac | 6.2/ac | 2.26/ac | 10.4/ac |
| | | 90% C.I. | 28.4 to 40.2/ac | 3.1 to 9.3/ac | 0.8 to 3.7/ac | 7.4 to 13.4/ac |
| | 16"+ | Average | 12.9/ac | 3.2/ac | 1.1/ac | 5.0/ac |
| | | 90% C.I. | 9.9 to 15.9/ac | 2.0 to 4.6/ac | 0.6 to 1.7/ac | 3.3 to 6.3/ac |
| | 20"+ | Average | 4.8/ac | 1.4/ac | 0.8/ac | 2.6/ac |
| | | 90% C.I. | 3.3 to 6.3/ac | 0.8 to 2.1/ac | 0.4 to 1.2/ac | 1.6 to 3.6/ac |
| Douglas-fir Trees and Snags | 12"+ | Average | 7.6/ac | 43.7/ac | 2.8/ac | 11.7/ac |
| | | 90% C.I. | 1.7 to 13.5/ac | 40.6 to 46.9/ac | 1.5 to 4.4/ac | 8.6 to 14.7/ac |
| | 16"+ | Average | 3.9/ac | 20.3/ac | 1.5/ac | 5.7/ac |
| | | 90% C.I. | 2.2 to 5.6/ac | 16.8 to 23.9/ac | 0.8 to 2.3/ac | 3.7 to 7.6/ac |
| | 20"+ | Average | 1.3/ac | 8.0/ac | 1.1/ac | 2.6/ac |
| | | 90% C.I. | 0.6 to 1.9/ac | 6.0 to 10.0/ac | 0.6 to 1.7/ac | 1.6 to 3.7/ac |

**Table 3-57. Average and Maximum Density of Western Larch and Douglas-fir Snags and Live Trees 12-20" DBH and 20"+ in Pole-Sized and Mature Stands of all Vegetation Burn Severities in the Flathead National Forest Side of the Brush Creek Fire Area based on Post-Fire Field Reconnaissance in Fall 2007** (Exhibits P-10 and Rd-3).

| Tree/Snag Species | DBH | Condition | Dominant Tree/Snag Species Group | | |
|---|---|---|---|---|---|
| | | | Western Larch | Douglas-fir | Whitewoods (all) |
| Western Larch Trees and Snags | 12-20" | Live | 14.1/acre (up to 54/ac) | 3.0/acre (up to 36/ac) | 1.5/acre (up to 27/ac) |
| | | Dead | 14.3/acre (up to 48/ac) | 4.1/acre (up to 45/acre) | 3.4/acre (up to 35/ac) |
| | 20"+ | Live | 3.8/acre (up to 24/ac) | 0.7/acre (up to 8/acre) | 0.7/acre (up to 10/ac) |
| | | Dead | 2.9/acre (up to 14/ac) | 0.7/acre (up to 10/acre) | 1.0/acre (up to 10/ac) |
| Douglas-fir Trees and Snags | 12-20" | Live | 2.2/acre (up to 12/ac) | 6.0/acre (up to 32/ac) | 0.8/acre (up to 14/ac) |
| | | Dead | 7.0/acre (up to 27/ac) | 23.3/acre (up to 98/ac) | 4.2/acre (up to 40/ac) |
| | 20"+ | Live | 0.9/acre (up to 14/ac) | 1.5/acre (up to 16/ac) | 0.3/acre (up to 7/ac) |
| | | Dead | 0.9/acre (up to 12/ac) | 3.0/acre (up to 30/ac) | 0.9/acre (up to 13/ac) |

Multiplying the number of acres in each of the eight groups in Table 3-55 provides a weighted average of larch and Douglas-fir snags and live trees across the Flathead National forest side of the fire area. Currently, there are approximately 13.4 per acre of 12” DBH and larger, 6.3 per acre of 16” DBH and larger, and 2.9 per acre of 20” DBH and larger, as displayed in Table 3-63 in the Direct and Indirect Effects—Common to All Action Alternatives section below.

## Downed Wood Habitat

Some areas burned by the fire have low to very low amounts of large downed wood, especially where timber was harvested before the fire. Such areas most likely do not provide current or future habitat for species like the marten, which appear to depend on living forests that are rich in large downed wood (Bull and Blumton 1999, Buskirk and Ruggiero 1994). This situation would change dramatically over time, as described in the Direct and Indirect Effects sections below. Some areas had high amounts of larger downed wood prior to the fire, due to the advanced age and the late successional stage of many stands (i.e. over 250 years since last major fire).

For quantifying downed wood habitat in the analysis areas, we used counts of downed wood pieces on post-fire reconnaissance plots in the Brush Creek Fire area, as well as data collected in the Good Creek drainage, adjacent to the north and ecologically similar (Table 3-58 and Exhibit Rd-3). Both data sources show that the amounts of downed wood are highly variable across the landscape, ranging from less than one ton per acre to over 130 tons per acre. The distribution of sizes, species, and condition of downed wood also vary dramatically within and between stands, forest types, seral/structural stages, and fire regimes. “Late” seral-structural stage (mature forests) corresponds to the areas of high-quality downed log habitat; “mid” seral-structural stage (pole-sized forest) corresponds to the areas of moderate-quality downed log habitat (Exhibit Rd-3). These levels are not indicative of historical conditions because they reflect many years of fire suppression, tree harvest, and firewood cutting across the landscape.

**Table 3-58. Average Tonnages of Downed Wood in the Snag and Downed Wood Analysis Areas, Before and Immediately After the Brush Creek Fire.**

| Structural Stage | Average Via Brown’s Transects in Good Creek | Average Via Post-Fire Flots in Fire Area | Direct/Indirect Effects Analysis Area | | Cumulative Effects Analysis Area | |
|---|---|---|---|---|---|---|
| | | | Acres | % | Acres | % |
| Mid (pole-sized) | >8 tons per acre 11-30” diameter (19.7 tons per acre all sizes) | 10.4 tons per acre 9”+ diameter | 5,113 ac | 20.2% | 16,059 ac | 21.1% |
| Late (mature) | >17 tons per acre 11-30” diameter (30.9 tons per acre all sizes) | 14.9 tons per acre 9”+ diameter | 6,092 ac | 24.1% | 20,803 ac | 27.3% |

The newly created snags would fall over time (Lyon 1984, Harrington 1996, Stewart et al. 2004) with the rate varying by species, age, pre-fire vigor, type, and extent of fire injury, exposure to wind, slope position, soil moisture, water table depth, etc. Field inventory of current downed log conditions in most of the burned areas would not provide information of value for this analysis, as fire-killed trees have only just begun to fall. It was assumed that, unless salvaged or cut for firewood, most of them would eventually be full-length downed logs.

# Environmental Consequences

## *Direct and Indirect Effects*

### Alternative A- No Action

No additional actions, such as timber salvage, temporary road construction, road rehabilitation, herbicide spraying, and planting are proposed with this alternative. This would leave snag and downed wood habitat across the area to continue with relatively natural processes, along with fire suppression, occasional felling of hazard trees, and firewood gathering. The temporary closure order now in place that restricts firewood cutting in the Brush Creek Fire area would not be extended.

In this alternative, no additional snags would be felled except where they pose a threat to human safety, such as along trails and near administrative sites. No additional downed logs would be removed. Some of the fire-stressed trees would continue to die and bark beetle populations would be expected to increase, creating more snags over a larger landscape, as described in the Vegetation section of this chapter. Many of the larger, wind-throw resistant snags such as western larch would likely still be standing. After 50 or 100 years, some of the trees that were not injured by the 2007 fire would also have become snags, but most of the trees would still be too small to be of substantial value to most wildlife species.

The effects of the no action alternative on wildlife that use dead wood as habitat would vary over time and space. In the short term, this alternative would favor species associated with recent burns and the resulting large amount of snag and downed wood habitat and insectivorous prey (Hutto 1995a, Saab and Dudley 1998, Aubry and Raley 2002a, Smith 2000). Black-backed, three-toed, and hairy woodpeckers would find an abundance of habitat and would excavate cavities for many secondary cavity nesters such as bluebirds, kestrels, and chickadees. This alternative would provide the greatest potential response by these insectivorous bird species to future insect outbreaks (Fayt et al. 2005). As snag attrition occurs and vegetation succession proceeds, the abundance of bird species associated with the recent burn would decline. Mammals and birds that use large standing or downed dead trees for denning, feeding, security cover, and dispersal would increase as vegetation recovers. As the new forests mature and age, the remaining large snags and downed logs would again make the Brush Creek Fire area highly suitable for pileated woodpeckers, brown creepers, northern flying squirrels, southern red-backed voles, boreal and saw-whet owls, and many of the other species identified as old-growth associates (Flathead Forest Plan Amendment 21, USDA 1999a, Hayward and Verner 1994, Warren 1998). This would be particularly true in areas of burned old growth, due to the abundance of pre-fire tree decay allowing for easier excavation and the structural complexity of the habitat.

The No Action Alternative would provide for the greatest number of snags for primary and secondary excavators (Tables 3-60 through 3-63, below). About one third of the Direct and Indirect Effects analysis area would continue to have at least six 20”+ DBH larch or Douglas-fir per acre (Exhibit Rd-3). All existing snags would be available in several size classes with differing densities. This alternative provides the greatest opportunity to provide snag numbers that meet 100 percent population potential in the short term and long term. For more information related to cavity nesting birds, see the Black-Backed Woodpecker (a Sensitive Species) and Neotropical Migratory Bird sections of this chapter.

As snags begin to fall in the fire area, down wood levels would greatly increase, thereby increasing denning, nesting, and feeding habitat for down wood dependent species. In the long term, the levels of down wood would exceed the standards and guidelines of Amendment 21 in most of the previously unharvested areas. The burned areas that were mature, and old growth forests before the fire, are expected to have large amounts of persistent, large downed wood (Exhibit Rd-3). Nearly 32 percent of the analysis area (over 8000 acres) would support high or very high densities of dead lodgepole, spruce, or subalpine fir trees (Exhibit Rd-3). These acres would provide abundant large downed wood habitat, both in the short and long term, as they succumb to windthrow and gradually decay on the forest floor. Soil and nutrient-cycling conditions would be likely to improve as the organic matter from the logs incorporated (Brown et al. 2003, Stewart, et al. 2004; See also the Soils section of this chapter). Downed logs, shading from snags, and lack of seed sources may delay the regeneration of new trees in some stands. The intensity of a future fire would increase as snags fall and new understory growth contributes more fine fuels, as described in the Fire and Fuels section of this chapter.

The bulk of the Direct and Indirect Effects analysis area (84 percent) would continue to function as a Post-fire Reserve Area (Table 3-J, below), defined for this project as an area at least 150-acres in size that is at least one-quarter mile from post-fire salvage (Exhibit Rg-11; Issue Statement in Chapter 1). This 21,244-acre area fully represents the diversity of conditions across the fire area, has connectivity corridors between reserves, and includes all elevations and qualities of snag and downed wood habitat. For a discussion of areas that have not had any past vegetation management, see the Vegetation section.

## Common to all Action Alternatives

The action alternatives would salvage some of the burned areas (Tables 3-59 through 3-63, below), while leaving a diversity of conditions. The site-specific snag prescriptions for the Sheppard Creek Project (Chapter 2 of this document and Exhibit Rd-13) were based on field data on the expected availability of live and dead trees; fire severities; silvicultural objectives; scientific literature; and experts in post-fire ecological processes, timber salvage systems, and safety. They are based on current conditions, the extent of past actions in the analysis area, and aspects of the proposed salvage. Up to 73 percent of the burned-up old growth habitat of all tree species (Exhibit Q-7) would be salvaged, as would many acres of burned whitewood forests that have few or no large larch or Douglas-fir trees or snags. The snag prescriptions are the same in each action alternative, although in a few cases a unit that is much smaller in one alternative may have a different snag prescription reflecting its stand conditions.

In all action alternatives, the largest larch and Douglas-fir and most of the live trees would be retained by the prescription of minimum retention diameters. For example, in units dominated by western larch, the prescription would leave all 18" DBH and larger larch; in units dominated by Douglas-fir trees, it would leave all 15” DBH or larger larch plus all 25” or larger Douglas-fir. The snag prescription group (see Table 3-55, above) was assigned to each unit for analysis. However, the group will be determined in the field for each unit for its prescription. Snag prescriptions do not change between alternatives, although in a few cases a unit that is much smaller in a different alternative may have a different prescription reflecting its stand conditions. For all units in all alternatives, all live and dead black cottonwood, quaking aspen, paper birch, and ponderosa pine would be prescribed for retention. All live trees and snags designated for retention, as well as all unmerchantable stems, would be left standing wherever possible. All snags deemed to be hazardous could be felled, although they would be left on-site. High-quality wildlife snags left within 200 feet of an open road would be signed and painted to protect them from firewood cutting. For more information, see the alternative descriptions below and Exhibit Rd-13.

Direct and indirect effects can be compared at various scales—within proposed units (Table 3-59), across all acres proposed for salvage Tables 3-60 and 3-61, below), or across the Direct and Indirect Effects analysis area (Tables 3-62 and 3-63, below). Table 3-59 displays the weighted average of live and dead western larch and Douglas-fir inside salvage units before and after salvage. These numbers are the per-acre averages across all units. No larch over 20”+ is prescribed for removal in any alternative. Across the unit acres, an average of 2.5 Douglas-fir over 20” would be removed. Differences between alternatives are discussed below.

**Table 3-59. Trees and Snags Per Acre of Western Larch and Douglas fir within Proposed Units by Alternative** (Exhibit Rd-3).

| Alternative | | 12”+ DBH | | 16”+ DBH | | 20”+ DBH | |
|---|---|---|---|---|---|---|---|
| | | **Larch** | **Douglas-fir** | **Larch** | **Douglas-fir** | **Larch** | **Douglas-fir** |
| B | Pre-salvage | 9.7 | 17.2 | 4.3 | 8.0 | 2.1 | 3.4 |
| | Post-salvage | 5.5 | 1.5 | 3.8 | 0.9 | 2.1 | 0.9 |
| | **Reduction** | **- 4.2** | **- 15.7** | **- 0.5** | **- 7.1** | **- 0.0** | **- 2.5** |
| C | Pre-salvage | 9.0 | 15.9 | 4.1 | 7.4 | 2.0 | 3.3 |
| | Post-salvage | 5.4 | 1.5 | 3.6 | 0.9 | 2.0 | 0.8 |
| | **Reduction** | **- 3.6** | **- 14.4** | **- 0.5** | **- 6.5** | **- 0.0** | **- 2.5** |
| D | Pre-salvage | 9.7 | 16.9 | 4.3 | 7.8 | 2.1 | 3.4 |
| | Post-salvage | 5.5 | 1.5 | 3.8 | 0.9 | 2.1 | 0.9 |
| | **Reduction** | **- 4.2** | **- 15.4** | **- 0.5** | **- 6.9** | **- 0.0** | **- 2.5** |

For snags and downed wood habitat, it is also useful to compare results across an area that reflects the maximum extent of proposed salvage. Tables 3-F and 3-G display the percentage of total unit acreage that support various densities of large live or dead larch and Douglas-fir. These densities are all based on weighted averages, as in Table 3-59 above. At low densities of these trees (two or fewer per acre), there are little or no differences between alternatives.

**Table 3-60. Percentage of Acreage by Density of 16”+ DBH Live and Dead Western Larch and Douglas-fir within Salvage Units, by Alternative** (Exhibit Rd-3).

| Number per Acre of Larch and/or Douglas-fir that are 16”+ DBH After Salvage | Percent of Unit Acreage | | | |
|---|---|---|---|---|
| | A * | B | C * | D |
| 0 per acre | 0% | 0% | 0% | 0% |
| 1 to 3 per acre | 27% | 27% | 27% | 27% |
| 4 to 11 per acre | 32% | 73% | 52% | 73% |
| 12 to 19 per acre | 13% | 0% | 7% | 0% |
| ≥ 20 per acre | 28% | 0% | 14% | 0% |

* For comparison, Alternative A and C numbers are based on Alternative D unit boundaries, as they represent the maximum extent of salvage proposed.

**Table 3-61. Percentage of Acreage by Density of 20”+ DBH Live and Dead Western Larch and Douglas-fir in Salvage Units, by Alternative** (Exhibit Rd-3).

| Number per Acre of Larch and/or Douglas-fir that are 20”+ DBH After Salvage | Percent of Unit Acreage | | | |
|---|---|---|---|---|
| | A * | B | C * | D |
| 0 per acre | 0% | 0% | 0% | 0% |
| 1 to 2 per acre | 32% | 32% | 32% | 32% |
| 3 to 6 per acre | 40% | 68% | 54% | 68% |
| 7 to 9 per acre | 28% | 0% | 14% | 0% |

* For comparison, Alternative A and C are based on Alternative D unit boundaries, as they represent the maximum extent of salvage proposed.

Across the Direct and Indirect Effects analysis area, salvage harvest would reduce the acreage that has a relatively high density of larch and Douglas-fir by nearly half (Table 3-62). Table 3-63 displays the weighted average of live and dead larch and Douglas-fir across the analysis area. Across this same area, the percentage that would support high or very high densities of dead lodgepole, spruce, or subalpine fir trees would drop from 32 to 22 percent in Alternative C and from 32 to 13 or 14 percent in Alternatives B and D (Exhibit Rd-3).

**Table 3-62. Percent of Acreage Across the Flathead National Forest Side of the Brush Creek Fire Area that have at least Six Live or Dead Larch or Douglas-fir per Acre Larger than 12, 16, and 20” DBH (Diameter at Breast Height), by Alternative** (Exhibit Rd-3).

| Alternative | 12”+ DBH | 16”+ DBH | 20”+ DBH |
|---|---|---|---|
| A (No Action) | 45.67% | 33.16% | 33.16% |
| B (6,346 acres of salvage) | 45.67% | 19.79% | 16.45% |
| C (3,902 acres of salvage) | 45.67% | 24.79% | 23.14% |
| D (7,465 acres of salvage) | 45.67% | 18.94% | 15.59% |

Many of the proposed salvage units are nearly surrounded by past regeneration harvest. Much of this was clear-cutting and shelterwood harvest done in the 1970s and 80s. The 2007 Brush Creek Fire burned most of the past-harvest areas at moderate or high severities, leaving few live trees to provide large snags and downed wood in the future. These trees were originally left to provide seed and shelter for growing trees, and to function as larger-diameter wood for a healthy ecosystem. Some units had timber regeneration harvest in the past (seed-tree or shelterwood) that were later burned by the Brush Creek Fire. Several of these stands lack any live or dead trees to contribute additional snags or downed wood for many years.

**Table 3-63. Trees and Snags Per Acre of Western Larch and Douglas fir across the Flathead National Forest side of the Brush Creek Fire Area, by Alternative** (Exhibit Rd-3).

| Alternative | 12”+ DBH | | 16”+ DBH | | 20”+ DBH | |
|---|---|---|---|---|---|---|
| | Larch | Douglas-fir | Larch | Douglas-fir | Larch | Douglas-fir |
| A (No Action) | 5.4 | 8.0 | 2.5 | 3.8 | 1.2 | 1.7 |
| B (6,346 acres of salvage) | 4.4 | 4.1 | 2.4 | 2.0 | 1.2 | 1.0 |
| C (3,902 acres of salvage) | 4.9 | 5.8 | 2.4 | 2.8 | 1.2 | 1.3 |
| D (7,465 acres of salvage) | 4.4 | 3.8 | 2.4 | 1.9 | 1.2 | 1.0 |

Downed wood distribution would be highly variable across both fire landscapes as a result of varying vegetation burn severity and pre-fire vegetation (refer to discussion under Affected Environment). The patchy nature of many treatment areas should also help maintain the diversity of dead-wood habitat wildlife species (Machmer 2002). Exhibit Rd-10 provides information about Forest Plan monitoring of consistency with these standards.

Salvage harvest activities between May and August may have direct effects on individual cavity-nesting birds. Snags with existing cavities would be retained wherever it is safe to do so, however some would be removed for safety reasons. If a cavity-nesting bird were using the snag at the time of salvage operations, the nest and/or birds could be destroyed. Noise from the various proposed activities may impact juvenile dispersal, or may cause premature displacement of young or cause young to be prematurely abandoned. This would be expected to be limited.

All action alternatives would plant new trees in specific salvage harvest units, and on some landings and reclaimed temporary roads. This would allow snags to become available sooner than otherwise. Units not planted are expected to regenerate naturally. The planted trees would help provide canopy closure sooner than if trees were to only regenerate naturally.

All management practices and natural processes have negative effects on some species and positive effects on others. Leaving a full range of diverse conditions within all of the fire area is the way to ensure that all pieces would remain. In order to manage for all wildlife species in post-fire habitats, research has shown the landscape should be managed for a variety of snag densities across the burned area (Saab and Dudley 1998, Saab et al. 2002). To mimic historic or “natural” conditions, a mix of clumps and more widely distributed snags should occur within and among stands. Successful management and conservation of snag-using wildlife depend upon maintaining a sufficient number of large-diameter snags on a continuing basis. The prescriptions evaluated in this analysis supply snags over time through the retention of live trees and higher numbers of snags than might have been required when harvesting timber from green forests.

All action alternatives would extend the temporary closure order that restricts firewood cutting in the Flathead National Forest part of the Brush Creek Fire area.

Other aspects of the project, such as temporary road obliteration, burning of landing piles, road rehabilitation, dust abatement, and the application of herbicides along haul roads, would not have measurable effects on wildlife species that use snags and downed wood habitat.

## Alternatives B and D

Under Alternatives B and D, approximately 6346 and 7465 acres, respectively, of timber salvage would reduce snag and downed wood habitat appreciably (Tables 3-59 to 3-63, above). Helicopter logging would occur on 706 to 1464 of these acres, requiring felling of additional snags and other hazard trees in and near units as described below. Skyline and cable logging would occur on 2155 to 2186 acres, requiring felling of most trees, live or dead, within corridors, as well as the felling of nearby hazard trees.

Tables 3-59, 3-60 and 3-61, above, displays the weighted average of live and dead larch and Douglas-fir inside salvage units and the percentage of total unit acreage that support various densities of large live or dead larch and Douglas-fir. The differences between Alternatives B and D are due primarily to the removal of Douglas-fir trees in bark beetle units (Units B1 through B47) only in Alternative D. Alternative D has an additional type of prescription for snags in these "B" units, which would only be harvested if elevated levels of bark beetles are found, removing only trees that are infested with bark beetles or at risk of infestation. Although snags and logs would be removed from the Riparian Habitat Conservation Areas (RHCAs) in many of Alternative D's "B" units, only Douglas-fir less than 25" DBH and spruce would be taken. Tables 3-62 and 3-63, above, show similar patterns between Alternatives B and D.

Due to the bark beetle units, under Alternative D bark beetle populations are less likely to increase, as described in the Vegetation section. The indirect effect would likely be a reduction in beetle-created spruce and Douglas-fir snags and downed logs both inside and beyond the fire area.

In Alternatives B and D, an estimated 10 to 15 acres would be used as helicopter landings. These would not be located in RHCAs. By design, landings would avoid areas with concentrations of live trees and larch and Douglas-fir snags over 18" DBH. However, some larch and Douglas-fir snags and live trees would likely be felled for the construction of landings and to facilitate safe helicopter operations at the landings and along helicopter approaches. In general, this would require felling of hazard trees within 1.5 or two tree lengths, with additional distance required for landings which may also need clearing for a flight path.

Temporary roads would also have an effect on snag and downed wood habitat (Exhibit Rd-3). This is particularly true in Alternative B, where 6.9 miles of new temporary roads would be constructed through areas that have not had previous harvest and where snag and downed wood habitat is currently abundant. Over three miles of this would occur in areas dominated by larch and Douglas-fir. Also in Alternative B, 2.8 miles of new temporary roads would be constructed through previously harvested areas. In Alternative D, 2.2 miles of new temporary roads would be constructed through areas that have not had previous harvest, with about 1.2 miles of this in areas dominated by larch and Douglas-fir. Another 1.0 mile of new temporary roads would be constructed through previously harvested areas. The remaining 17 and 8.5

miles, respectively, of temporary road construction would occur on historic road templates and would have little effect on snag and downed wood habitat. Temporary road construction would require the felling and removal of snags and live trees from the road template and additional felling of hazard trees.

Only four percent (Alternative D) to eight percent (Alternative B) of the Direct and Indirect Effects Analysis Area would continue to function as post-fire reserve area (Table 3-64), defined for this project as an area at least 150-acres in size that is at least a quarter mile from post-fire salvage (Exhibit Rg-11). In Alternative B, the three areas average 684 acres in size, with the largest at 944 acres. In Alternative D, the two areas are 473 and 644 acres in size. Compared to the rest of the analysis area, these areas have far fewer western larch and Douglas-fir snags available, mostly due to past timber harvest. In both alternatives, this does not fully represent the diversity of conditions across the fire area, has poor connectivity corridors between reserves, and omits the lowest elevations. For a discussion of areas that have not had any vegetation management, see the effects analysis in the Vegetation section.

**Table 3-64. Post-Fire Reserve Areas on the Flathead National Forest Side of the Brush Creek Fire, by Alternative** (Exhibit Rg-11).

| | **Alternative** | | | |
|---|---|---|---|---|
| | **A** | **B** | **C** | **D** |
| Acreage in Post-fire Reserve Areas (and % of analysis area) | 21,444 ac (84%) | 2,051 ac (8%) | 6,783 ac (27%) | 1,117 ac (4%) |
| Number of Post-fire Reserve Areas | 1 | 3 | 7 | 2 |
| Largest Post-fire Reserve Area | 21,244 ac | 944 ac | 4,173 ac | 644 ac |
| % of Post-fire Reserve Area Acres Currently Low or Very Low in Snags and Trees | 49% | 72% | 57% | 88% |
| % of Post-fire Reserve Area Acres with Past Regeneration Harvest | 44% | 60% | 48% | 69% |
| % of Post-fire Reserve Area Acres in Pole and Mature Forests with Low or Moderate Vegetation Burn Severity | 8% | 8% | 10% | 6% |
| % of Post-fire Reserve Area Acres in Pole and Mature Forests Dominated by Western Larch and/or Douglas-fir | 20% | 6% | 12% | 10% |
| % of Post-fire Reserve Area Acres in Pole and Mature Forests Dominated by Whitewoods | 32% | 21% | 31% | 2% |

Alternatives B and D would salvage most of the trees in 47 to 56 percent of the burned areas that did not already have timber harvest. Short-term and long-term snag and downed wood across the Direct and Indirect Effects analysis area would be less than optimal for numerous wildlife species (Kotliar et al. 2002, Nappi et al. 2004, Hutto 2006, Hutto and Gallo 2006). Potential stand-level effects become important when one considers them in combination with the cumulative effects of past timber harvest, timber salvage, road construction, firewood cutting, and other factors discussed above and below for all action alternatives. Although the potential for insect outbreak may be decreased by Alternatives B and D, cavity-nesting species would be less able to respond to insect outbreaks due to the removal of a large amount of large snag habitat.

Other effects of Alternatives B and D are as described above for all action alternatives.

## Alternative C

Alternative C would retain many areas of recruitment old growth and that would typically provide the best areas for snag patches within the units. Under Alternative C, approximately 3902 acres of timber salvage would reduce snag and downed wood habitat (Tables 3-59 to 3-63, above). Skyline and cable logging would occur on 1494 acres, requiring felling of all trees, live or dead within corridors, as well as the felling of nearby hazard trees. There would be no helicopter logging.

Table 3-59, above, displays the weighted average of live and dead larch and Douglas-fir inside salvage units. The differences in Alternative C are primarily due to the existing tree densities in proposed units—the snag and live tree prescription for Alternative C is essentially the same as for the other action alternatives. No snags and logs would be removed from the RHCAs. Tables 3-62 and 3-63, above, show similar patterns for Alternative C.

Bark beetle populations are expected to increase, as described in the Vegetation section. The indirect effect would likely be an increase in beetle-created spruce and Douglas-fir snags and downed logs both inside and beyond the fire area.

In Alternative C, 1.9 miles of new temporary roads would be constructed through areas that have not had previous harvest and where snag and downed wood habitat is currently abundant (Exhibit Rd-3). Over half of this would occur in areas dominated by Douglas-fir. Another 1.0 mile of new temporary roads would be constructed through previously harvested areas. The remaining seven miles of temporary road construction would occur on historic road templates and would have little effect on snag and downed wood habitat. Temporary road construction would require the felling and removal of snags and live trees from the road template and additional felling of hazard trees.

About 27 percent of the Direct and Indirect Effects analysis area would continue to function as post-fire reserve areas (Table 3-64, above), here defined as areas at least 150-acres in size that are at least one-quarter mile from post-fire salvage (Exhibit Rg-11). The seven areas average 969 acres in size, with one area of nearly 4200 acres extending from Ingalls Mountain to the Help Creek drainage. Compared to the rest of the analysis area, these areas have comparable western larch and Douglas-fir snags available. Conditions in the post-fire reserve areas represent the diversity of conditions across the fire area, have connectivity corridors between reserves, and include all elevations. For a discussion of areas that have not had any vegetation management, see the effects analysis in the Vegetation section.

Alternative C would salvage most of the trees in 29 percent of the burned areas that did not already have timber harvest. It is expected that both short-term and long-term snag and downed wood across the Direct and Indirect Effects analysis area would be sufficient for wildlife species. Cavity-nesting species would be expected to respond to insect outbreaks due to the retention of a sufficient amount of large snag habitat.

Other effects of Alternative C are as described above for all action alternatives.

## *Cumulative Effects*

### Effects to All Alternatives

Snag and downed wood habitat conditions in the analysis area are largely the result of human activities -- fire exclusion, timber harvest, firewood cutting, and roads (Exhibits Rd-3 and Rd-14).

On all ownerships, most timber harvesting activities (Table 3-65) left few snags and large pieces of downed wood, particularly when lodgepole pine stands were harvested. After harvest, the tree densities and amounts of standing and downed dead wood were typically much less than would be left by natural processes, and the large live trees were often later removed. In many places across the analysis area, past timber harvest and roading created a substantial amount of "edge effect," where sun, wind, predators, and competitors, can penetrate further into what was previously interior forest. Regeneration harvests also dramatically reduced the potential of those sites to provide large snag or downed wood habitat in the event of fire or other disturbance. On Forest Service lands, 90 percent of this harvesting was done before Flathead Forest Plan Amendment 21 (USDA 1999a) came into effect in January 1999, although the shelterwood and salvage units may have met the later Amendment 21 standards for snags and downed wood (See Exhibit Rd-10 for implementation monitoring elsewhere on the Flathead National Forest to meet these standards). Outside the Brush Creek Fire area, the cumulative effects analysis area is likely to have a snag situation very similar to the adjacent Logan Creek analysis area, where 11,243 acres of regenerated stands (18 percent of the analysis area) have no snags visible on recent aerial photographs (Exhibit Rd-8).

**Table 3-65. Acreage and Percentage of Past Timber Harvest on All Ownerships in the Snag and Downed Wood Analysis Areas** (Exhibits Rd-3 and Rd-14).

| Harvest Type | Direct and Indirect Effects Area (25,370 ac) | Cumulative Effects Area (76,170 ac) |
|---|---|---|
| Regeneration Harvest (i.e. Clear Cut, Seed Tree, Shelterwood) | 10,484 acres (41.3%) | 29,731 acres (39.0%) |
| Non-regenerating Harvest (i.e. Commercial Thin, Liberation Cut, Selection Cut) | 1,498 acres (5.9%) | 6,540 acres (8.6%) |
| TOTAL | 11,982 acres (47.2%) | 36,272 acres (47.6%) |

Table 3-65 includes as regeneration harvest the salvage done with the Gregg-Plume Timber Sale, about 40 percent of which was burned by the Brush Creek Fire. Salvage of this portion of the sale began in the winter of 2007/2008. The unburned portion of the sale would be harvested in the next one to three years.

The Kootenai National Forest is proposing to salvage approximately 600 acres just west of the analysis area (USFS 2008; Exhibit U-3). This "Brush Creek Fire Salvage Project," would remove fire-killed trees from approximately 563 acres (23 percent of the fire area on Kootenai NF land). Leave trees would range from one to five trees per acre as well as unmerchantable trees, resulting in minimal levels of replacement snags and coarse woody material to provide for cavity-associated wildlife.

Looking only at private property, the greatest loss of snag and downed wood habitat has been on Plum Creek Timber Company lands at the head of the Sheppard Creek drainage, where about 75 percent of non-Forest Service lands have had regeneration harvest over the past 40 years. Timber salvage harvest after the Brush Creek Fire may be occurring on Plum Creek Timber Company Land on the approximately 80 acres not harvested prior to the fire. Past timber harvest on private land in the lower elevations of the analysis area has converted stands containing large live and dead trees into pasture or hayfields. Also on private land, removal of live and dead vegetation for the purpose of reducing wildland fire intensity has been accomplished and is expected to continue.

Across the 76,000-acre cumulative effects area, nearly 47 percent of the land currently has less than 15 trees and/or snags per acre. Some of this is due to natural growing conditions, but most is due to past harvest and most of these areas have fewer than five snags or trees per acre. About 51 percent of the cumulative effects area is pole or larger forest dominated by whitewoods. Only 12 percent of the area is pole or larger forest dominated by Douglas-fir or western larch.

Fires have been actively suppressed in the analysis area since the 1930s. This has affected snag and downed wood habitats through denser tree stocking, slower tree growths, and more intense fires, as described in the “Vegetation” and “Fire and Fuels” sections of this Chapter.

Suppression of the 2007 Brush Creek Fire required the felling of numerous snags and the removal of many pieces of downed wood. On the Flathead National Forest side of the fire, this habitat was removed from approximately 40.8 miles of mechanical/dozer fire line, 0.8 miles of hand-constructed line, and 1.6 miles of fire line constructed using a mechanical masticator. About 174 acres of shaded fuel break required the removal of all but the largest windfirm trees. About 53 acres of safety zones were constructed, many requiring the felling of trees and snags in or adjacent to the zones. Approximately 1820 acres of timber was felled near roads for the purpose of protecting public safety, typically within two tree lengths of roads open to public motorized use. Salvage of much of this material is expected to be completed in 2008. Burned Area Emergency Restoration work to be implemented near Sylvia Lake in 2008 would involve the felling of additional hazard trees, further reducing snag and downed wood habitat.

Between April and July, 2008, an influx of up to several thousand people are expected to harvest mushrooms from 24,700 acres in the burned area on the Flathead National Forest. Intense mushroom collection may cause disturbance impacts on some wildlife associated with dead wood habitats, such as fisher, wolverine, Canada lynx, or pileated woodpecker.

Some past prescribed wildland fires created small numbers of snags large enough for cavity nesters. These include the 70-acre prescribed burn near Elk Mountain and the 30-acre prescribed burn in Good Creek EIS (unit 208).

Bark beetle control measures planned on USFS lands include the use of dispersal pheromones and traps, starting in the summer of 2008 and continuing for several years. This could reduce the availability of snags killed by beetles and/or future need for timber salvage.

Across the analysis area, firewood cutters have removed many of the large snags from within 200 feet of open roads, as well as some of the downed logs (Bate and Wisdom 2004). Large snags of western larch, ponderosa pine, and Douglas-fir snags are very rare along open roads in northwest Montana. Firewood cutters using cable and winch systems can legally and easily access standing or downed dead trees in about five percent of the analysis area, where forests are within 200 feet of roads that are either open yearlong or seasonally. Firewood cutting is prohibited within 300 feet of any stream, river, or lake across the Flathead National Forest (Exhibit Rd-7). This should help protect snags and downed logs, particularly along Sheppard Creek. Flathead National Forest lands in the Brush Creek Fire area are currently closed to firewood gathering until timber salvage activities are completed.

Across all ownerships, at least 200 miles across the analysis area are open to public or private motorized use in the summer. This creates an Open Road Density (ORD) of 1.8 miles per square mile. At least 149 miles are open from fall to spring, with an ORD of 1.4 (Exhibit Rg-8). Looking only at Forest Service land, there are 191 miles open in summer (ORD = 1.7), and 141 miles open from fall to spring (ORD = 1.25).

Construction of roads, trails, campgrounds, and rock quarries required felling of many trees and snags. Regular maintenance of these routes and other areas requires hazard trees to be felled and fallen trees to be cleared. Approximately 127 miles of road have been built on federal land in the project area, mostly between 1950 and the mid-1980s. Use ranges from the heavily used and paved Star Meadow Road to roads that have been closed and are no longer drivable. Roads would continue to be constructed on private land. Nearly all trail construction in the project area took place prior to 1990. A small campground on Sylvia Lake has been maintained for many years. The quarries in the analysis area range from one to three acres.

For more information about many of the past, present, and reasonably foreseeable actions described above, see the Introduction to Chapter 3 of this document and Exhibit Rd-14. Other past, present, and reasonably foreseeable actions and activities would have minor or negligible effects on snags and downed wood habitat (Exhibit Rd-14).

## REGULATORY FRAMEWORK AND CONSITANCY

The Forest Service is required by the National Forest Management Act (NFMA) to "provide for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives," 16 USC 1604(g)(3)(B). To implement NFMA, the Forest Service's regulations, implemented on April 21, 2008, state that "the overall goal of the ecological element of sustainability is to provide a framework to contribute to sustaining native ecological systems by providing ecological conditions to support diversity of native plant and animal species in the plan area." A goal under the Flathead Forest Plan, as directed in Amendment 21 (USDA Forest Service 1999a), is to "ensure that Forest Service actions do not contribute to the loss of viability of native species."

Direction specific to snag and downed wood habitat is also provided by the Flathead's Forest Plan Amendment 21. Sufficient vegetation structure is to be retained, including large diameter trees, in timber harvest areas other than personal-use firewood permits. To comply with

Amendment 21, the retention amount must be consistent with native disturbance and succession regimes and provide for long-term snag and coarse woody debris recruitment, essential soil processes, species habitat (including feeding and dispersal habitat for small mammals and birds), and long-term structural diversity of forest stands.

A site-specific analysis of the past and existing condition snag and downed wood was done for the Sheppard Creek Project in accordance with Amendment 21 (Exhibit Rd-3). Site-specific prescriptions for snags and downed wood are given in sections and tables in Chapter 2 of this document and detailed in Exhibit Rd-8.

Although the minimum diameters are not always present in a given stand, the intent of the Forest Plan would be met or exceeded under all alternatives (Exhibits Q-10 and Rd-13). To provide for snag habitat needs, as well as living tree canopy and large trees, the following would be prescribed, as discussed in Chapter 2:

- Minimum retention diameters by species would keep the largest snags and most of the live trees within salvage units. For example, in units dominated by western larch, leave all 18" DBH and larger larch; in units dominated by Douglas-fir trees, leave all 15" DBH or larger larch plus all 25" or larger Douglas-fir. For more information, see the alternative descriptions below and Exhibit Rd-13.
- All black cottonwood, quaking aspen, paper birch, and ponderosa pine snags would be left standing wherever safe to do so (few if any of these species are expected).
- All of the live trees and snags that are designated for retention would be left standing wherever possible, unless they need to felled for reasons such as hazard trees, landing locations, skid trails, and skyline corridors.
- Leaving all unmerchantable snags or trees standing wherever possible, if safe to do so.
- Standing and downed trees within 75 feet of wetlands would not be removed and would be left standing wherever not a safety hazard.
- Sign and paint all high-quality wildlife snags left within 200 feet of a road open to wheeled motorized use by the public.

In addition, to provide for downed wood habitat needs, the following would be prescribed (Exhibits Rd-3 and Q-10):

- Except in limited situations, snags or live trees that are felled for safety concerns would be left on site.
- Site-preparation prescriptions would be designed to maintain as much of the larger downed material as possible and practicable.
- Unharvested dispersed and aggregated snags and live trees provide recruitment of future downed wood.
- Logs of all species that have any part extending into wetlands or wetland edges would remain in place.

Features common to all action alternatives also contribute to snag and downed wood habitat conditions at landscape scales. These include signing of high-quality snags along roads. In consideration of all direct, indirect, and cumulative effects described above, all alternatives comply fully with the snag and downed wood direction in Amendment 21 of the Flathead's

Forest Plan.  All alternatives would be consistent with NFMA direction for diversity of plant and animal communities and ecological sustainability.

Additional standards given in Amendment 21 include managing for wildlife dependent on old growth.  These are covered in the "Old Growth Habitat and Old Growth Associated Wildlife Species" section of this chapter.

All alternatives comply with the direction in the Forest Plan for MA 12, riparian management emphasis.  These include the goals for snag management, water quality and fish habitat. Refer to Hydrology and Fisheries sections of this Chapter for further discussion of effects.

# OLD GROWTH HABITAT AND OLD GROWTH ASSOCIATED WILDLIFE SPECIES

## Introduction

Old growth forests are typically distinguished by: (1) large trees for the species and site; (2) accumulations of large dead standing and fallen trees; (3) decay or breakage of tree tops, boles, or roots; (4) multiple canopy layers; (5) wide variation in tree size and spacing; and (6) canopy gaps and understory patchiness (Helms 1998). This structure and extensive diversity provide habitat for many plant and animal species. Snags, downed logs, rotting wood, fungi, mosses, lichens, and green tree canopy are essential for innumerable species of wildlife and plants (Carey 1996). Closed-canopy forest reduces snow depths, insulates plants and animals from cold winds, and provides protection from predators. Open understories or patches of open canopy provide foraging opportunities for prey and predatory species alike. Interior habitat shelters wildlife and plants and provides protection from predators, competitors, and parasites. For this project, "Old-Growth Forest Types of the Western Montana Zone" were used as the criteria to identify stands that qualify as old growth habitat (Green et al. 1992 [updated 2005]; Exhibits Q-1, Q-2, and Q-5).

The cool-moist forest that predominates in this area has diversity of trees, with shade-intolerant species that include western larch, Douglas fir, western white pine, and lodgepole pine. Shade-tolerant conifers include subalpine fir, grand fir, and Englemann spruce. Deciduous trees, such as cottonwood and aspen, are occasionally present. Historical fire regimes were relatively variable in the area (see the Fire and Fuels section). However, older stands in the analysis area often had a much longer fire interval between stand-replacement fires, due to various combinations of physiography, topography, and chance. Within this pattern, many tree species are very susceptible to even low-intensity understory burning and subsequent windthrow; some are particularly vulnerable to insect infestations following fires.

Old growth stands provide key habitat for many wildlife species. Amendment 21 to the Flathead National Forest's LRMP listed 31 old growth associated wildlife species. See Exhibits Q-4 and Q-6 for a list of these species, their habitat associations, and their presence in the analysis area. These include sensitive wildlife species (Exhibit Rs-1), and Neotropical migratory birds (Exhibits Rn-1 and Rn-2). Amendment 21 also named threatened, endangered, and sensitive wildlife species as Management Indicator Species (MIS), seven of which represent the spectrum of old growth habitats on the Flathead National Forest (Exhibit Rg-2).

Many wildlife species require specific attributes of old growth for habitat needs such as nesting, denning, security, and foraging habitat. Many kinds of lichens, mosses, and plants used by wildlife are primarily found in old growth habitat. Some animals, such as the fisher, are strongly tied to canopy cover and mature forest structure. Other old growth associated wildlife species seem to need only a portion of their home range to be in old growth. Examples include the Canada lynx, northern goshawk (Reynolds, et al. 1992), American marten, pileated woodpecker (McClelland et al. 1979), and bald eagle. Others, such as southern red-backed vole, chestnut-backed chickadee, winter wren, brown creeper, Swainson's thrush, varied thrush, hermit thrush, and northern flying squirrel, have relatively small home range sizes (less than 100 acres), with the necessary proportion of this home range being in old growth unknown.

Many types of disturbances, such as timber harvest and salvage, road construction, blow-down, fire, or insect or disease, can affect old growth habitat and old growth associated species. This is well illustrated by the pileated woodpecker, a "keystone" species that provides second-hand nesting structures for numerous old growth species such as boreal owls, kestrels, and flying squirrels (McClelland and McClelland 1999, Aubry and Raley 2002). A disturbance can reduce living tree canopy cover to levels below that needed by the pileated woodpecker's main food source, carpenter ants, forcing the pileated to forage and possibly nest elsewhere. Carpenter ants, which live mostly in standing and downed dead wood, can drastically reduce populations of species such as spruce budworm (Torgersen 1996), the most widely distributed and destructive defoliator of coniferous forests in Western North America.

Harvest or burning in stands immediately adjacent to old growth often negatively affects old growth and associated species, but may have some positive effects. Harvesting or burning can reduce the effective size of old growth stands by altering interior habitats (Russell and Jones 2001). Weather-related effects have been found to penetrate over 165 feet into a stand; the invasion of exotic plants and penetration by predators and nest parasites may extend 1500 feet or more (Lidicker and Koenig 1996). On the other hand, adjacent management can accelerate regeneration, reduce the risk of insect infestation, and increase the diversity of future buffering canopy. Roads can cause substantial edge effects on forested stands, sometimes more than the harvest areas they access (Reed, et al. 1996; Bate, et al. 2007). Roads that are open to the public expose many important wildlife habitat features in old growth and other forested stands to loss through firewood gathering and increased fire risk.

Effects on old growth associated species vary dramatically at the landscape level. Conversion from one stand condition to another can be detrimental to some species. This is especially true if their preferred habitat is spatially limited or is made up of small or narrow patches and limited interconnectedness (Keller and Anderson 1992, Richards et al. 2002). Timber harvest or fire can remove forested cover that provides habitat linkages that appear essential for the functioning of metapopulations (Lidicker and Koenig 1996, Witmer et al. 1998). Habitat fragmentation and reduced connectivity result in susceptibility to catastrophic events such as climatic factors and disease (Lesica 1996, U.S. Forest Service 1997). Strips of riparian old growth, as well as forested ridges and saddles are important travel corridors for many old growth associated species. Riparian corridors are particularly important for species such as fishers, harlequin ducks, and a variety of Neotropical migrant birds.

Many species of wildlife and plants that inhabit these old growth forest ecosystems benefit from fire and are attracted to burns for the flush of nutrients and new vegetation. Primary and secondary cavity nesters and denning species often benefit from snags and down logs created by fire (see the "Neotropical Migratory Birds" and the "Snags and Downed Wood Habitat" sections). The black-backed and other species of woodpeckers flourish in burned old growth that is not salvage harvested (see "Black-Backed Woodpecker" in the "Sensitive Wildlife" Section). Where burns result in a largely intact and live overstory with an open under- and mid-story, nesting habitat for species such as the flammulated owl and northern goshawk is often retained with improved conditions for foraging. Due to the larger trees in burned old growth, there is relatively more pre-fire tree decay in the dead trees, allowing for easier excavation and greater habitat complexity. This is especially true in western larch (Daenzer 2007).

The old growth stage of forest development is temporary, as are other forest stages (Green et al. 1992 [updated 2005]). In this part of northwest Montana, when fire kills all or most of the large old trees in old growth stands, they will not function as old growth habitat for approximately 100 years or more. This increases the importance of maintaining and managing for "Recruitment Old Growth," an objective of the Flathead Forest Plan (Amendment 21). These stands typically have at least 10 trees per acre of live larch or Douglas-fir over 15" DBH and had low or moderate fire severity, but do not qualify as old growth habitat (Green et al. 1992 [updated 2005]; Exhibits Q-1 and Q-2). Areas that burn with low to moderate vegetation severity often have an intact living tree canopy and quickly recovering under- and mid-stories. These will become old growth habitat much faster than areas with stand replacement fire or past timber harvest. In the post-fire environment, this "Recruitment Old Growth" typically has a relatively high amount of larger downed wood, making it especially good wildlife habitat as the living canopy recovers.

Depending on the size of the patch and the specific old growth associated species, unburned or lightly burned pockets still fully function as old growth habitat or provide the necessary old growth attributes for some old growth associated species. These pockets also contribute to diversity across the landscape, and become core areas or initial staging areas for old growth associates using and recolonizing burned areas (Lindenmayer and Franklin 2002, as cited in Noss et al. 2006).

## Analysis Area

The Sheppard Creek drainage along with the upper portion of the Good Creek drainage and the lower portion of the Griffin Creek drainage (Exhibit Rg-9) was considered for the evaluation of direct, indirect, and cumulative effects on old growth associated species and their habitats. The area extends approximately from Sunday pass in the north to near Lupine Lake in the south. This approximately 119 square mile area (about 76,200 acres) is large enough to include the home ranges of numerous wildlife species that use old growth habitats and to represent the effects of fire, natural tree mortality, timber harvest and salvage, fuel reduction, and firewood cutting across the landscape. All of the actions proposed in the alternatives that could directly or indirectly affect old growth associated species are contained within this area. An assessment at multiple scales was also conducted to address population diversity concerns (Exhibit Rg-1). See also Exhibits Q-3, Q-13, Rd-9, Rg-3, Rs-20, Rs-24, Rs-25, Rs-25, and Rt-11 for Region-wide assessments of some key old growth associated species. The temporal scale of the effects analysis extends 100 years into the future, enough time for recruitment old growth to function as old growth habitat and for snag and downed wood habitat to develop.

## Information Sources

Data used in this analysis included pre-fire and post-fire old growth surveys; pre-fire and post-fire aerial photography; stand exams; Forest Inventory and Analysis data; field surveys of snags and downed logs; post-fire walk-through surveys; wildlife monitoring and observations (Exhibit Q-6); Northern Region Vegetation Mapping Project (R1-VMP) data; and GIS coverages and data sets for features such as general forest attributes, slope, aspect, habitat type, road location, etc. See also project record Section Q. Population diversity concerns at the Flathead National Forest and larger scales are assessed in Exhibit Rg-1. Exhibit Q-10 details compliance with Flathead Forest Plan. See also the sections on “Vegetation” and “Snags and Downed Wood Habitat” in this chapter for more information about understory vegetation, noxious weeds, snags, and downed logs. For literature cited, see Exhibit Q-11.

## Affected Environment

Across the Interior Columbia River Basin (Quigley, et al. 1996), old forests have declined by 27 to 60 percent over the past 100 years and large residual trees and snags have decreased by 20 percent. Fire exclusion and timber harvest have altered the structure and composition of forests throughout the Basin, resulting in a 60 percent increase in susceptibility to insects, disease, and stand-replacing fires. These changes have contributed to declining habitat conditions for numerous species of wildlife associated with old growth forests. This same trend was found for all subbasins across the Flathead National Forest, despite their relatively high level of ecological integrity (Quigley, et al. 1996, USDA 1999a). For more information about old growth habitat conditions within the Flathead National Forest, see the Final Environmental Impact Statement for the Flathead Forest Plan, Amendment 21 (USDA 1999) and Exhibit Rg-1. Also see the reporting done for Forest Plan Monitoring Items 68 and 69, on file at the Flathead National Forest Supervisor’s Office.

Old growth was inventoried across the analysis area before the 2007 fire. This information was updated after the fire using post-fire old growth field surveys, pre- and post-fire aerial images, stand exam data, and on-the-ground knowledge (Exhibit Q-2). The definition of old growth habitat was based on Western Montana Zone criteria from Green et al. (1992 [updated 2005]; Exhibit Q-1) and includes considerations such as tree age, size, stand structure, and downed logs.

Only 29 acres of old growth in the Brush Creek Fire area was not burned. Nearly 2350 acres of old growth stands, or portions of those stands, that lost all or most of their large trees to the 2007 fire are no longer old growth habitat (Exhibits Q-1 and Q-2). This includes areas that had intense crown fire, as well areas that underburned. Typically, high-severity underburning occurs in Englemann spruce, grand fir, subalpine fir, and white pine stands, given the susceptibility of these species to even low severity fire. Apparently due to droughty conditions, this also occurred in many stands dominated by Douglas-fir and western larch. Another 562 acres require another growing-season field visit to better determine post-fire old growth status. Table 3-66 and Figure 3-20 display the amount and distribution of old growth habitats within the Brush Creek Fire and throughout the analysis area (Exhibit Q-5). The effects of fire suppression actions in 2007, such as cutting contingency lines through old growth habitat, are discussed in the Cumulative Effects section below.

**Table 3-66. Acres of Old Growth Habitat before and after the 2007 Brush Creek Fire** (Exhibit Q-5).

| Area | Old Growth Before Fire | Old Growth Lost Due Fire | Pre-fire Old Growth of Uncertain Status | Post-fire (Existing) Old Growth Acres and % of Suitable Landbase | "Recruitment Old Growth" * |
|---|---|---|---|---|---|
| Brush Creek Fire Area | 2937 acres | 2346 to 2908 acres | 562 acres | 29 to 591 acres (0.04 to 2.35%) | 105 to 1172 acres |
| Area Outside Fire | 4284 acres | 0 acres | 0 acres | 4284 acres (8.8%) | ** |
| Total Across Analysis Area | 7221 acres | 2346 to 2908 acres | 562 acres | 4313 to 4875 acres (5.8 to 6.6%) | ** |

* = Represents a minimum estimation. These stands have some larger trees, but do not qualify as old growth habitat (Green et al. 1992 [updated 2005]; Exhibit Q-1).
** = "Recruitment old growth" was not quantified outside the fire area.

About 105 acres in the analysis area appear at this time to be "Recruitment Old Growth Habitat" within the fire area (Exhibit Q-5). These areas had little fire and contain an older, larger overstory tree layer and numerous snags and downed logs. They are expected to develop a full compliment of old growth characteristics (Exhibit Q-1) far sooner than more intensely burned stands. Another 1067 acres in the fire area may have these conditions, but the extent of fire-caused mortality is unknown. Field visits in late spring 2008 will better determine whether these areas are likely to function as recruitment old growth. At that time, the 562 acres of uncertain old growth may be found to instead be additional recruitment old growth. It is expected that the actual acres of recruitment old growth in the fire area will end up much closer to the minimum than to the maximum.

Old growth habitat patch size varies considerably. The largest intact patch of old growth in the analysis area is on Forest Service land spanning from Alder Creek to Bowen Creek drainages. This 470-acre area has a considerable amount of edge due to past timber harvest. A 275-acre patch of uncertain old growth and uncertain recruitment old growth is in the Ingalls Mountain area. The two small pockets of old growth that survived in the fire area are seven and 22 acres, increasing to 41 and 56 acres, respectively, when adjacent uncertain recruitment old growth is considered. These small pockets are highly valuable wildlife habitat and would likely provide key core areas as old growth associates again begin using the recovering burned area.

The amount of edge between forested and early-seral/structural stage stands across the area is extensive. Wetlands and rocky areas create some of the edge, but numerous regeneration harvest units are adjacent to many of the old growth patches. This has created areas of blowdown and reduced the "interior integrity" of these stands, reducing (though not negating) their value as old growth habitat. Forested connections between old growth patches have been narrowed or severed by past timber harvest. Effective corridors should be wide enough to "contain a band of habitat unscathed by edge effects" relevant to species that rarely venture out of their preferred habitats (Lidicker and Koenig 1996).

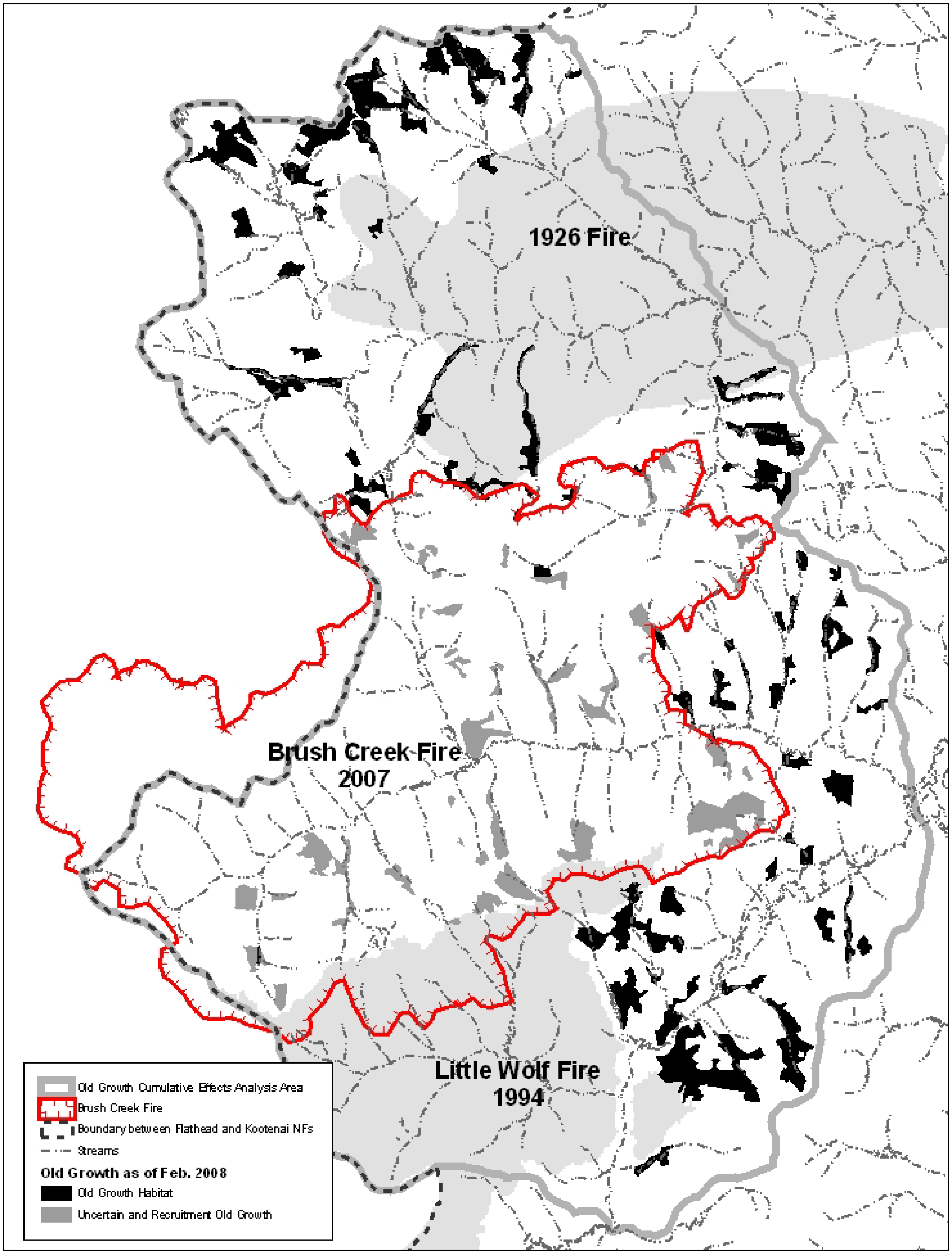
Old growth near water sources has particular value for wildlife providing travel corridors, summer thermal cover, old forest habitat, diverse foraging habitat, and a diversity of structural conditions. The strips of riparian forest are highly valued wildlife travel corridors, particularly in situations where past harvest has fragmented the forest cover to some degree and converted areas to early seral stages, as has occurred in much of the fire area. A high proportion of old growth is typically located in riparian areas, as these areas contain productive growing sites and experience the longest fire-free intervals, as well as being less likely to have had timber harvest activities. The spruce and subalpine fir forest type dominates the riparian areas in most drainages of the Salish Range. In late seral/old forest stands, loss of many of the live, large diameter overstory trees in riparian and upland areas from beetles, fire stress, or harvest, would reduce this critical component of old growth. After dying, these large trees would still be highly valuable forest structural and wildlife habitat components as large diameter snags and eventually downed wood.

Relatively effective fire suppression for approximately the last 70 years may have not provided the spatial distribution and percentage of forest stand ages typical of natural processes. Dense understories and mid-story canopies have increased, elevating the risk of stand-replacing fire in old growth habitat. Structures and processes typically provided by fire appear to be inadequately represented for some species. In addition, late seral/structural stage habitat for old growth dependent species may be less than desired in terms of amount, shape, size, distribution, and connectivity.

Past timber harvest and road construction created a substantial increase in "edge effect," across much of the analysis area where sun, wind, predators, and competitors can penetrate further into what was previously interior forest. The trend in harvesting late-seral/structural stage forests has slowed considerably, but fuel accumulation and conditions favoring insects and disease have often increased. In addition, the relatively dense network of roads in the analysis area makes old growth dependent species vulnerable to road mortality, trapping, firewood cutting, and other disturbance. See the "Snag and Downed Wood Habitat" in this chapter for additional information.

Large, stand-replacing wildfires with long fire-free intervals were not unusual for the natural disturbance regime of these generally moist and cool forests. Approximately 4313 to 4875 acres currently appear to be old growth following the fire within the analysis area (Table 3-66, above; Exhibit Q-5). This represents 5.8 to 6.6 percent of the land base capable of producing old growth habitat in the analysis area. On the Flathead National Forest side of the fire area, the amount of old growth habitat ***plus*** the recruitment old growth may be as low as 0.5 percent of the suitable landbase (Exhibit Q-5). Across the analysis area, the amount is expected to be between 6.0 and 8.2, depending on tree mortality that cannot be checked until spring 2008. Activities such as timber harvest have set back succession in many areas, and much of the area does not have the potential to function as old growth for decades. See Exhibits Q-5 and Q-9 for the range of natural variability in the amount of late seral or old forest and some additional information about recruitment old growth.

**Figure 3-20. Status of Old Growth Habitat across the Analysis Area.**



Numerous wildlife species make use of old growth habitat in the analysis area. Exhibits Q-4 and Q-6 display occupation by old growth associated species and provide more information about these species' habitat components, population trends, and risk factors. Before the Flathead Forest Plan, Amendment 21 decision of January 1999 (Exhibits Q-4 and Q-10), Old Growth Management Indicator Species (OGMIS) habitat was designated throughout this area. Monitoring results and other sightings suggest that these species are relatively common (Exhibit Q-6). For more information, see Exhibits Q-3, Rd-9, and Rg-3.

Additional information about the ability of components of old growth to provide habitat for wildlife species can be found in other sections of this chapter such as “Vegetation”; “Snags and Downed Wood Habitat”; and “Sensitive Wildlife Species”; and “Threatened Wildlife Species.”

# Environmental Consequences

## *Direct and Indirect Effects*

### Alternative A- No Action

No additional actions, such as timber salvage, temporary road construction, road rehabilitation, herbicide spraying, and planting, are proposed with this alternative. Barring future disturbance, old growth associated species and communities would eventually return to much of the burned area. Succession would progress until a late seral or “old growth” structure again develops in approximately 100 years or more. Some additional mortality would occur in fire-stressed old growth trees from factors such as cambium damage, increased bark beetle infestation, and blow down. These dead trees would contribute to high value wildlife habitat as large snags and large downed wood. However, spruce beetle and Douglas-fir beetle populations could increase under this alternative to attack trees on thousands of acres, as described in the “Bark Beetles” section. Enough large trees may die that many stands may no longer function as old growth habitat.

Many of the old growth areas that experienced low to moderate burn severity have the associated attributes of live, old, large trees; pre- and post-fire snags; decay; and downed wood. The attributes that are most limiting in these areas following the fire are also the attributes capable of the most rapid recovery. Understory vegetation is already starting to return immediately after the fire and mid-story vegetation would follow soon. Multiple canopy layers and substantial variation in diameters would take at least 30 years to develop.

Retaining all live trees, pre-fire and fire-killed snags, and downed logs would allow these areas to recover to habitat suitable for old growth associates such as pileated woodpeckers, brown creepers, northern flying squirrels, southern red-backed voles, and many others (Forest Plan Amendment 21; Warren 1998) sooner than if these attributes were removed or further reduced. This would be particularly true in areas of burned old growth, due to the abundance of pre-fire tree decay that allows for easier excavation and the structural complexity of the habitat.

**Alternatives B and D**

No existing old growth habitat would be entered for timber salvage (Exhibit Q-7), as displayed in Table 3-67. However, a considerable amount of salvage would occur in areas where old growth values are currently uncertain. This is particularly true in Alternative D. All areas of proposed salvage where old growth values are uncertain will be field-reviewed for old growth habitat attributes in spring and summer 2008 (Exhibits Q-1 and Q-2). Any areas found to be old growth or recruitment old growth, or where this is still uncertain at the time of unit layout, will not be entered for timber salvage, as described in Chapter 2. Areas displayed as "Old Growth Lost to the Brush Creek Fire" burned and are clearly no longer old growth habitat (Green et al. 1992 [updated 2005]; Exhibits Q-1 and Q-2).

**Table 3-67. Proposed Salvage in Known and Uncertain Old Growth and "Recruitment Old Growth" Habitat** (Exhibits Q-5 and Q-7).

| | **Alt. A** | **Alt. B** | **Alt. C** | **Alt. D** |
|---|---|---|---|---|
| Old Growth Lost Due to the Brush Creek Fire | 0 ac | 1336 ac | 822 ac | 1710 ac |
| Number of Units with Old Growth and/or Recruitment Old Growth Concerns | 0 units | 32 units | 0 units | 53 units |
| Salvage in Known Post-fire Old Growth | 0 ac | 0 ac | 0 ac | 0 ac |
| Salvage in Pre-fire Old Growth with Uncertain Status as of March 2008 | 0 ac | 347 ac | 0 ac | 486 ac |
| Percentage of all Old Growth of Known Status or Uncertain Status as of March 2008 that would have salvage harvest | **0%** | **59%** | **0%** | **82%** |
| Salvage in Known Recruitment Old Growth | 0 ac | 66 ac | 0 ac | 72 ac |
| Salvage in Pre-fire Recruitment Old Growth with Uncertain Status as of March 2008 | 0 ac | 475 ac | 0 ac | 654 ac |
| Percentage of all Recruitment Old Growth of Known Status or Uncertain Status as of March 2008 that would have salvage harvest | **0%** | **46%** | **0%** | **62%** |

Alternative B would salvage in all or part of eight units (80, 99, 113, 123, 124, 129, 133, and 134) where old growth status is currently unknown. Alternative D would salvage in this habitat in all or part of 15 units (those listed for Alternative B plus Units B14, B22, B23, B27, B28, B32, and B47). There is a possibility that old growth conditions could persist after salvage in the "B" units in Alternative D, since only some of spruce and Douglas-fir would be removed and all other tree species would remain. However, as stated above, no salvage would occur in areas found during 2008 surveys to be old growth or recruitment old growth, or where this is still uncertain at the time of unit layout.

Alternative B would salvage in all or part of four units (54, 93, 99, and 108) identified as "recruitment old growth." Alternative D would salvage in this habitat in all or part of five units (54A, 93, 99, B32, and 108). Salvage would result in lesser-quality habitat, due to the reduction in large snags and downed wood and possibly also some of the live trees. Alternative B would salvage in all or part of 25 units (15, 21, 23, 24, 32, 48, 49, 50, 53, 54, 59, 68, 72, 73, 79, 80, 85, 94, 96, 99, 100, 108, 109, 125, and 128) where recruitment old growth status is currently unknown. Alternative D would salvage in this habitat in all or part of 40 units (those listed for Alternative B except for 21A and 54A instead of 21 and 54, plus B15, B19, B20, B21, B24, B25, B35, B37, B38, B39, B40, B41, B44, B45, and B47). Salvage would result in lesser-quality habitat, due to the reduction in large snags and downed wood and possibly also some of the live trees. In most cases, this would delay the return to old growth habitat conditions by many years. This salvage would leave a minimum of 0.1 percent and no more than 2.5 percent of the Flathead National Forest side of the Brush Creek Fire area in recruitment old growth habitat that would be capable of developing into old growth habitat far sooner than the remainder of the area (Exhibits Q-5 and Q-7).

Where the fire burned at high intensities, the salvage operations would incrementally increase the loss of old growth associated habitat values such as that used for Canada lynx denning, fisher denning and foraging, American marten denning and feeding, boreal owl nesting, and pileated woodpecker nesting and feeding. Salvage would lengthen the time interval until these habitat values return. Salvage would directly reduce habitat for some species such as the black-backed woodpecker.

No new high-contrast edge immediately adjacent to old growth habitat would be created by harvest activities because the Brush Creek Fire already created the edge in most of the units that would be salvaged.

Timber salvage may sever or narrow formerly forested connections that may serve as wildlife travel corridors. Fire-killed snags provide some security cover, and these snags and downed wood increase the likelihood of traversal by species seeking more continuous live forest habitat. Salvage would likely further contribute to the highly fragmented landscape that has resulted from the fire and past timber harvest. Leaving larger-diameter snag and downed-wood "legacy material" would improve the ability for recovering stands to provide connectivity, as would the retention of as many live trees as possible, and not entering areas where many of the trees are alive, would result in much better connectivity habitat than if these criteria were not maintained. These design criteria are integral to all action alternatives.

Alternative D includes additional salvage (Units B1 through B47) that would occur only if there is an outbreak of Douglas-fir and/or spruce bark beetles, as described in Chapter 2. In about one-third of the "B" units, the direct effect would be the removal of large-diameter spruce and Douglas-fir in 131 acres of pre-fire old growth with uncertain status, 6 acres of known recruitment old growth, and 174 acres of pre-fire recruitment old growth of uncertain status. In addition, most of the "B" units are in the kinds of areas that typically provide old growth habitat on the Tally Lake District—riparian buffers and slower-growing rocky hillsides. Trees would be removed from the riparian buffer areas around most of the streams, wetlands, and many ridge tops, reducing their contribution to wildlife connectivity. The indirect effect of this additional salvage would likely be a reduction in beetle-caused mortality of large trees both inside and beyond the fire area. Where beetle populations are at epidemic levels, this can be important for maintaining old growth habitat.

Temporary road construction effects are shown in Table 3-68. Alternative B is the only alternative that would construct temporary roads through or along unburned existing old growth habitat (Temporary Road "X" in the upper Gregg Creek drainage) or through recruitment old growth with uncertain status that is not inside a proposed salvage unit (Temporary

Road "FS1" in the upper Help Creek drainage). These and other temporary roads were dropped from Alternative D for multiple reasons.

**Table 3-68. Proposed Salvage in Known and Uncertain Old Growth and "Recruitment Old Growth" Habitat** (Exhibits Q-5 and Q-7).

| | Alt. A | Alt. B | Alt. C | Alt. D |
|---|---|---|---|---|
| Temporary Roads Through or Along Existing Old Growth | 0 feet | 1390 feet | 0 feet | 0 feet |
| Temporary Roads Through Old Growth with Uncertain Status as of March 2008 | 0 feet | 2510 feet | 0 feet | 2430 feet |
| Temporary Roads Through Recruitment Old Growth | 0 feet | 150 feet | 0 feet | 0 feet |
| Temporary Roads Through Recruitment Old Growth with Uncertain Status as of March 2008 | 0 feet | 6990 feet | 0 feet | 3300 feet |

For a discussion of the effects of wildlife mortality and disturbance, helicopter logging, helicopter landings, road obliteration, planting on landings and reclaimed temporary roads, and tree planting, see the section above on "Snags and Downed Wood Habitat" in this chapter. Other aspects of the project, such as burning of landing piles, road rehabilitation, dust abatement, and the application of herbicides along haul roads, would not have measurable effects on old growth habitat and old growth associated wildlife species. For effects on Former Old Growth Management Indicator Species, see Exhibit Q-9.

## Alternative C

No existing or recruitment old growth habitat would be entered for timber salvage, whether known or uncertain as of March 2008 (Exhibit Q-7), as displayed in Table 3-88 above. The 822 acres of "Old Growth Lost to the Brush Creek Fire" burned and is clearly no longer old growth habitat (Green et al. 1992 [updated 2005]; Exhibits Q-1 and Q-2). Staying out of the known or uncertain recruitment old growth habitat would leave all of this habitat, on the Flathead National Forest side of the fire area, capable of developing into old growth habitat far sooner than the remainder of the area (Exhibits Q-5 and Q-7).

Potential increase of bark beetles would be reduced by salvage in Alternative C. It would treat 19 percent of the acres rated as susceptible to spruce beetles, and 22 percent of the acres susceptible to Douglas-fir beetles, as discussed in the "Vegetation" section of this chapter.

No temporary roads would have impacts on old growth or recruitment old growth habitat (Table 3-68, above). These temporary roads were dropped from Alternative C for multiple reasons.

Where the fire burned at high intensities, the salvage operations would incrementally increase the loss of old growth associated habitat values, as discussed above for Alternatives B and D. See above also for discussions of the lack of creation of new high-contrast edge and the effects on wildlife travel corridors. For a discussion of the effects of wildlife mortality and disturbance, helicopter logging, helicopter landings, road obliteration, planting on landings and reclaimed temporary roads, and tree planting, see the section above on “Snags and Downed Wood Habitat” in this chapter. Other aspects of the project, such as burning of landing piles, road rehabilitation, dust abatement, and the application of herbicides along haul roads, would not have measurable effects on old growth habitat and old growth associated wildlife species.

## *Cumulative Effects*

### **Effects to all Alternatives**

Past regeneration harvest across varying ownerships converted former old growth into stands of seedlings, saplings, or pasture for livestock (see Table 3-65 above, and Exhibit Q-8). Other timber harvest removed all or most of the larger trees from numerous stands, especially in the lower elevations. In many places across the analysis area, past timber harvest and roading created a substantial amount of “edge effect,” where sun, wind, predators, and competitors, can penetrate further into what was previously interior forest. On Forest Service lands, 90 percent of this harvesting was done before Flathead Forest Plan Amendment 21 (USDA 1999a) came into effect in January 1999. Some past timber harvest specifically targeted old growth stands and large, old trees. Large downed wood has often been reduced during harvest operations and the removal of large trees reduces the accumulation of large downed wood for the foreseeable future. In many Forest Service stands, some of the larger trees were left, largely to provide seed sources or shelter for regenerating tree seedlings. After harvest, however, the tree densities and amounts of standing and downed dead wood were typically much less than would be left by natural processes, and the large live trees were often later removed.

About 960 acres (4 percent) of the Brush Creek Fire Area was salvaged by the Gregg-Plume Timber Sale in 2007 and early 2008, leaving most of the larger larch and Douglas-fir (Exhibit Rd-14). The unburned portion of the sale would be harvested in the next one to three years. No existing old growth was or will be harvested by this timber sale, nor would any recruitment old growth within the fire area have salvage harvest. Nearly 6200 acres across the Good Creek analysis area will continue to be managed for old-growth habitat.

Natural changes in the past century have had a dramatic effect on old growth habitat in and near the Brush Creek Fire area (Exhibits Q-8, Q-9, and Rg-1). Wildfires in 1910 and 1926 are still reflected in a lack of old growth in much of the Good Creek drainage; the 1994 Little Wolf Fire and subsequent bark beetle outbreaks substantially reduced old growth habitat in the Lower Griffin Creek drainage. Across the analysis area, some of the current old growth habitat has large numbers of trees now infested with Douglas-fir beetles. These conditions are typical of old growth habitat across the Salish Mountains.

Fires have been actively suppressed in the analysis area since the 1930s. This has contributed to a change in the structure of some old growth habitat by increased understory growth and denser mid-canopy trees (Lesica 1996). While enhancing habitat value for species like pileated woodpeckers and American marten, this reduced foraging habitat for species preferring a more open understory such as flammulated owls and northern goshawks. These structural changes have resulted in an increased risk of a stand-replacement wildland fire in old growth areas, as described in the “Vegetation” and “Fire and Fuels” sections of this Chapter.

During the 2007 Brush Creek Fire, suppression efforts and activities such as hazard tree reduction felled trees and cleared vegetation from old growth habitat. In the Gregg and Plume Creek drainages, about 100 acres of old growth outside the fire area (Exhibit Q-8) was felled as shaded fuelbreaks along roads. The felled trees were later included in the hazard tree removal sales. This occurred in about 17 acres of what was apparently still old growth within the fire as well. Suppression of the 2007 Brush Creek Fire required the felling of numerous snags and the removal of many pieces of downed wood as described in the “Snags and Downed Wood Habitat” section of this chapter.

The Kootenai National Forest is proposing to salvage approximately 600 acres just west of the analysis area (USFS 2008; Exhibit U-3). This “Brush Creek Fire Salvage Project,” would remove fire-killed trees from approximately 563 acres (23 percent of the fire area on Kootenai NF land). Treatments are not proposed in designated effective old growth or replacement old growth, although the project would reduce the amount of undesignated replacement old growth available by approximately 60 acres. Edge effects would not be increased beyond the impact of the fire. No roads would be constructed through old growth stands.

Between April and July, 2008, influxes of up to several thousand people are expected to harvest mushrooms from 24,700 acres in the burned area on the Flathead National Forest. Intense mushroom collection may cause disturbance impacts on some wildlife associated with old growth habitats, such as fisher, wolverine, Canada lynx, marten, northern goshawk, or pileated woodpecker.

Roads in the area dissect and fragment old growth habitat. Roads form physical and habitat barriers, increase risk of predation, create vehicle caused mortality, and increase access for trapping, hunting, and poaching. Across the analysis area, open roads facilitate access for firewood cutters, decreasing the snags and downed woody material important for many wildlife and plants using old growth habitat, as described in the “Snags and Downed Wood Habitat” section of this chapter and in Exhibit Rg-8.

Bark beetle control measures planned on USFS lands include the use of trap trees and dispersing pheromones and traps, starting in the summer of 2008 and continuing for several years. This could reduce old growth habitat values in some microsites, while maintaining old growth habitats across the landscape scale.

Other cumulative effects on wildlife using old growth habitats are varied. Probably due to trapping, lynx were extremely scarce in the first half of the century in Montana, with specimen records restricted to two western counties. The analysis area is part of MDFWP's Region 1, which now has an annual trapping quota of one lynx and one fisher. There have been no reports of wildlife feeding on calves or other livestock and no predator control efforts are anticipated. Recreation activities are somewhat limited, but may include hunting, hiking, fishing, boating, camping, snowmobiling, dog sledding, cross-country skiing, horseback riding, motorized trail use, and bicycling. All of these can disturb or displace wildlife. Driving on roads can cause some collision-related injuries or mortalities to wildlife. Human settlement occurs on most of the private lands, and subdivision continues to increase, which can cause a direct loss of old growth habitat or indirect effects on wildlife from dogs left at large. Livestock grazing on the Swaney and Island Meadows/Lemonade Springs Allotments and on private lands has likely altered understory plants in some old growth stands. Grazing has been suspended in the burned portion of the Swaney Allotment for two years, which will reduce weed spread and sedimentation in streams and wetlands. Fish stocking may have indirectly affected available prey for some old-growth associated wildlife, such as bald eagles.

For more information about many of the past, present, and reasonably foreseeable actions described above, see the Introduction to Chapter 3 of this document, the cumulative effects section for “Snags and Downed Wood Habitat”, above, and Exhibits Q-8 and Rd-14. Other past, present, and reasonably foreseeable actions and activities would have minor or negligible effects on old growth habitat and old growth associated species (Exhibits Q-8 and Rd-14). For more information, see the “Sensitive Wildlife Species,” Threatened Wildlife Species,” Vegetation,” “Hydrology,” “Fire and Fuels,” and “Soil” sections in this chapter.

## REGULATORY FRAMEWORK AND CONSISTENCY

The Forest Service is required by the National Forest Management Act (NFMA) to “provide for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives,” 16 USC 1604(g)(3)(B). To implement NFMA, the Forest Service’s regulations, implemented on April 21, 2008, state that “the overall goal of the ecological element of sustainability is to provide a framework to contribute to sustaining native ecological systems by providing ecological conditions to support diversity of native plant and animal species in the plan area.” A goal under the Flathead Forest Plan, as directed in Amendment 21 (USDA Forest Service 1999a), is to “ensure that Forest Service actions do not contribute to the loss of viability of native species.”

Another goal in Amendment 21 is to “maintain and recruit old growth forests to an amount and distribution that is within the 75 percent range around the median of the historical range of variability. Where current conditions are below this amount, actively manage to recruit additional old growth.”

For species associated with old growth forests, Amendment 21 has objectives to “maintain ecological processes and provide for natural patch size distribution” and to “manage landscape patterns to develop larger old growth patch sizes where needed to satisfy wildlife habitat requirements.” Across the landscape, “sufficient retention of forest structure (large diameter live trees, snags, and coarse woody debris)” should be left to provide for future wildlife movement through the matrix surrounding old growth forests.

Standards given in Amendment 21 include managing for wildlife dependent on old growth by protecting old growth forest consistent with the Vegetation Standard Section H6. Vegetation management within old growth shall be limited to actions necessary to: (1) “maintain or restore old growth composition and structure consistent with native succession and disturbance regimes”; or to (2) “reduce risks to sustaining old growth composition and structure.” For example, in warm-moist and cool-moist Potential Vegetation Groups, “large multistory or single-story conditions and shade intolerant species such as western larch, western white pine, ponderosa pine, and Douglas-fir" are to be maintained or restored. On these sites, the standard is to "reduce tree density and the proportion of shade tolerant species such as grand fir and subalpine fir in areas where fire exclusion has altered stand composition and structure." To the extent feasible, such vegetation management within old growth "shall retain old growth composition and structure consistent with native disturbance and succession regimes." Standard F4 requires the modification of treatments "as needed to meet habitat needs of old growth associated species," including modifying the "timing, extent, and intensity of vegetation treatments where needed to satisfy wildlife habitat requirements…."

At the landscape level, there is a standard to "prescribe landscape treatments that protect old growth forests from disturbances that threaten old growth composition and structure." This standard also states "treatments within existing old growth may be appropriate where current insect and disease conditions pose a major and immediate threat to other stands." Sufficient mid-seral/structural stage stands are to be maintained to allow for recruitment of old growth within the historical range of variability, emphasizing old growth development "in stands that are most likely to persist under native disturbance regimes, and that provide a patch size and pattern most advantageous to old growth associated wildlife species."

The Flathead Forest Plan Amendment 21 named all sensitive wildlife species as Management Indicator Species, seven of which represent the spectrum of old growth habitats on the Flathead National Forest (Exhibit Rg-2). These are the bald eagle, flammulated owl, boreal owl, black-backed woodpecker, fisher, Canada lynx, and northern goshawk. Conditions favorable to these species would generally also benefit other old-growth associated species found within the analysis area, such as brown creepers, Townsend's warblers, winter wrens, and northern flying squirrels, all of which are considered under the umbrella of MIS evaluation. The Flathead National Forest formerly used the pileated woodpecker, barred owl, and marten as Management Indicator Species (MIS) to represent species dependent on old growth stand characteristics. Amendment 21 replaced these by designating all sensitive wildlife species as Management Indicator Species and by developing a list of old growth associated species (Exhibits Q-4 and Rg-2).

Implementation of all alternatives would be consistent with standards in the Forest Plan related to old growth management. Alternatives B and D have proposed salvage units in some stands that may still qualify as old growth habitat or recruitment old growth. However, any areas found during 2008 field visits to be old growth or recruitment old growth, or where this is still uncertain at the time of unit layout, will not be entered for timber salvage, as described in Chapter 2. Alternative A would not respond as well as the action alternatives to the objectives and overall goals of old growth management in the Forest Plan. This is due to lack of protection of old growth stands in and near the fire area from an anticipated insect outbreak. See Exhibit Q-10 for more information.

All alternatives would be consistent with NFMA direction for diversity of plant and animal communities and ecological sustainability.

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# COMMONLY HUNTED BIG GAME

## Introduction

The three most common ungulates (white-tailed deer, mule deer, and elk) are used as Management Indicator Species for the commonly hunted big game species. At the forest level, meeting these species' habitat needs indicate that the needs of species such as black bear, moose, and mountain lion will also be met. Their basic habitat needs of cover, forage, and security are similar and may be altered by human actions in similar ways (Joslin and Youmans 1999, Witmer et al. 1998). During the formulation of the Flathead Forest Plan, it was assumed that standards designed for elk would also be adequate for mule deer because they both tend to use similar habitats. White-tailed deer are more closely associated with riparian features, and since nearly 60 percent of the Sheppard Creek post-fire elk analysis area is within one-quarter mile of water (Exhibit Rr-1), the habitat analysis for this project also applies to white-tailed deer.

Timber harvest, major insect epidemics, and particularly fire for this project, typically remove or alter hiding and thermal cover used by large mammals. In many situations, these disturbances create temporary foraging areas with associated increases in diversity and edge, which typically allows for proliferation of big game species (Dusek, pers. comm. 2005, Exhibit Rb-9). In northwest Montana, the extent that large animals will make use of a natural or man-made opening depends on an animal's experience, seasonal forage quality, proximity of security cover, presence of roads, and intensity of human use. Openings can decrease ungulates' ability to travel within their home ranges, as well as making them more vulnerable to predation and hunting. When sufficient downed woody material, residual understory trees, and wind-firm live trees and snags are available, timber harvest and salvage can maintain adequate hiding cover values.

Research findings and management guidelines for these species are generally consistent. A study of white-tailed deer summer habitat use for the Tally Lake Ranger District (Morgan 1993; Exhibit Rb-5) indicated that minimal impact would result from timber harvest on northern aspects, ridge tops, sites greater than 2450 feet from riparian zones, and in elevations below 3477 feet and above 4938 feet. Morgan also stressed the value of immature and pole-sized timbered stands. Research indicates that white-tailed deer prefer to have hiding cover within approximately 165 feet, and elk approximately 500 feet (Thomas and Toweill 1982). Spring, summer, and fall months are important periods when ungulates give birth to and nurse calves and fawns, grow antlers, build body condition, accumulate fat for enduring the winter months, and endure the stress of the big game hunting season. Mature Douglas-fir stands provide critical fawn-rearing habitats (Pac, et al. 1991) and should be associated with high-quality foraging areas and security.

Hunters can displace elk from preferred habitats to larger, less diverse patches of cover (Lyon and Canfield 1991). During hunting season, elk appear to require contiguous, nonlinear hiding cover patches over 250 acres in size, and more than one-half mile from open roads (Hillis et al., 1991) in order for the elk population to provide continued hunter opportunity and a diverse bull age structure (Youmans 1991). It has been recommended that for a stable or increasing population, and for opportunities to maintain or harvest large bull elk, at least 30 percent of an elk herd unit should be in hunting season security area (Hillis, et al. 1991).

The quality and quantity of wintering habitat influences ungulate population size and health. These habitats are often south-facing areas with large trees to intercept snow, along with breaks in the tree canopy that allow growth of ground-level forage (Thomas et al. 1979). Harsh winter weather and deep snow can cause intense crowding onto small portions of winter range. The importance of preserving these "critical" areas is well known, yet they typically provide little available forage, and thus non-critical winter range may also be important.

## Information Sources

The effects on elk and white-tailed deer are discussed in relationship to acres and the spatial arrangement of hiding cover lost, as well as ease of human access. The analysis was done through GIS analysis on the effects of the fire on the landscape, and the vegetation management and associated activities proposed (Exhibits Rb-7, and Rb-3). Hunting season security values were derived through GIS procedures that detected areas of continuous cover further than one-half mile from open roads and motorized trails (Exhibit Rb-1). Road information can be found in Exhibit Rg-8. For literature cited, see Exhibit Rb-9.

## Analysis Area

The analysis area for direct and indirect effects includes the Brush Creek Fire perimeter on the Flathead National Forest as well as the upper portion of Good Creek, and the lower portions of Griffin Creek. The cumulative effects boundary includes the area stated above and the portion of the fire that burned on the Kootenai National Forest west of the divide (Exhibit Rg-9). The Brush Creek Fire covered a large (29,921 acres) area mainly in Sheppard Creek, and generally consumed much of the vegetation over the fire area (Exhibit Rb-3) creating large openings that do not support hiding or summer thermal cover. In the short-term (15 to 20 years), these habitat conditions may not support the same number of animals that were found before the fire, resulting in the temporary displacement of some animals into adjacent, unburned areas. Therefore, the habitat conditions within drainages to the north of Sheppard Creek (upper portion of Good Creek) and to the south of Sheppard Creek (lower portion of Griffin Creek) were also analyzed. This area is large enough to include several home ranges of big game species and to represent the effects of the Brush Creek Fire, other past fires, timber harvest and salvage, and motorized access across the landscape. For this project, the analysis of effects on big-game habitat for cover and security span 15 to 20 years, at which time areas regenerated by this project, as well as the ingrowth of trees after the fire, are likely to provide hiding cover.

The Brush Creek Fire changed riparian habitat conditions, with some areas completely consumed by fire (see sections on "Fisheries" and "Hydrology" and Exhibit Rr-3). It is expected that this would result in a temporary displacement of white-tailed deer to more intact riparian habitat found adjacent to the fire area. Since nearly 60 percent of the entire big-game analysis area is within one-quarter mile of riparian features (Exhibit Rr-1), conditions within this area are representative of habitats within such "key use" areas for white-tailed deer. All of the actions proposed in the alternatives are contained within this area. Elk Habitat Analysis Units (HAU) were determined for the Flathead National Forest by wildlife biologists from the Forest and Montana Department of Fish, Wildlife, and Parks. The big game analysis area contains portions of eight elk HAUs. An additional assessment was also conducted to address population diversity concerns at the Forest scale (Exhibit Rg-1).

## Affected Environment

In general, the big-game analysis area provides habitat from the summer through the fall for populations of elk, mule deer, white-tailed deer, and all of the species represented in Forest Plan direction for Commonly Hunted Management Indicator Species. No areas of deer or elk winter range are found in the big-game analysis area (Exhibit Rb-8). White-tailed deer seasonal use of the analysis area is very common due to habitat conditions that include intact riparian cover, the existing stands of conifer trees, and the abundance of available forage in past timber harvest units and in meadows. Elk and mule deer that used the analysis area are relatively common and their populations are thought to be stable. The steeper, rocky terrain of high-quality mule deer habitat is more common in the upper portion of Good Creek where mule deer are more common. However, mule deer are often observed throughout the big-game analysis area. Moose use of the area is also relatively extensive; many riparian sites in the analysis area support vegetative types preferred by moose (Exhibit Rr-3). Mountain lion and black bear are also frequently reported. For population information for big game and other species under their MIS umbrella, see Exhibit Rb-2.

Within the big-game analysis area, the Brush Creek Fire changed the Sheppard Creek drainage from a cover-dominated landscape into an open landscape with 33 percent of the fire area providing scattered patches of cover. Approximately one-half of the cover patches remaining are past harvest units with the regenerating trees providing the cover. These areas should provide good quality hiding cover for big game and were designated as "cover" (Table 3-69) within the fire area. The remaining cover patches include more mature stands that were burned in the understory. Cover in these stands is more variable and will come from tree boles of the larger trees, limbs and boles of fallen trees, and some understory vegetation (Grifantini, et al., cited in McIver and Starr 2000). These areas were designated as marginal cover (Table 3-69) within the fire area. Because ungulates depend on vegetation for forage, bedding, cover, and thermal protection, they may abandon burned areas if fire removes these features with higher severity fires (Smith, 2000). It is expected that use by elk in this drainage will decline for the next few years, then rebound as cover returns in the next 15 to 20 years. The existing few cover patches within the fire are important to elk which are reluctant to forage over 500 feet from cover. Literature reports that standing dead trees may provide adequate cover within burns, and it is expected that ungulates may use the edges of these burned areas (Smith, 2000) unless tree downfall became too thick for much plant growth or foraging.

**Table 3-69. Pre-Fire and Post-Fire Hiding Cover Levels within the Fire Area and Big Game Analysis Area (Exhibit Rb-3).**

| **Fire Area Flathead NF only** (25,355 ac) | | **Big Game Analysis Area** (76,071 ac) | | **Excluding Fire area** (50,701 acres) |
|---|---|---|---|---|
| **Pre Fire Hiding Cover** | **Post Fire Hiding Cover** | **Pre-Fire Hiding Cover** | **Post-Fire Hiding Cover** | **Post-Fire Hiding Cover** |
| 86% | **33% total cover** (14% Cover + 19% Marginal Cover) | 84% | **66% total cover** (60% Cover + 6% Marginal Cover) | 82% |

Outside the fire area, available hiding cover is plentiful and evenly distributed across the analysis area (Exhibit Rb-3). Approximately 82 percent of the big-game analysis area, outside of the fire area, currently functions as hiding cover and/or summer thermal cover; only lakes, ponds, and recently regenerated areas do not. In the Salish Range, the primary foods for white-tailed deer from spring through fall are forbs, grasses, and shrubs. Most of the spring, summer, and fall foraging habitat (mostly openings) outside of the fire area have hiding cover nearby (Exhibit Rb-3).

The Brush Creek Fire narrowed and severed forested connections for big game or larger species within the fire area. There are no remaining forested connections within the fire area running north and south that do not require crossing areas of non-cover. Many past connections are now less than 400 feet wide and there are several areas now requiring travels of over one-third mile in areas not providing hiding cover. There are no riparian corridors along main Sheppard Creek that do not require crossing long distances (up to two miles), as the fire burned extremely hot in portions of this drainage. Outside the fire area, forested connections are plentiful and conditions do not limit travel (Exhibit Rg-7).

The maintenance of security during the hunting season is of particular concern for elk (Table 3-70). The big-game analysis area contains all or parts of 11 elk hunting season security areas (Exhibit Rb-1), which are defined as at least 250 acres of cover, all farther than one-half mile from an open road. Two security areas and a portion of a third one remain in the fire area. They consist of both cover and marginal cover and are not as large as the security areas outside the fire area. The blocks located within the fire area include almost half their acreage in marginal cover. Cover provided by these stands is more variable and will come from tree boles of the larger trees and burned trees that have fallen over. Because of the variability of the cover provided in these blocks, they are expected to provide marginal security areas. Outside of the fire area, security areas are fairly well distributed across the big-game analysis area. Hillis et al. (1991), whose recommendations are to be applicable to the Flathead National Forest, recommended that at least 30 percent of an elk herd's area should provide hunting season security for elk. The existing security areas currently make up less than 30 percent of the elk habitat analysis units. Much of this is due to the existing roaded landscape.

**Table 3-70. Existing Hunting Season Elk Security Areas, by Elk Habitat Analysis Unit (HAU) (Exhibit Rb-1).**

| Elk Habitat Analysis Unit | Acres in HAU | Approximate Hunting Season Security Area Acres (and % of HAU) | Comment |
|---|---|---|---|
| Alder Creek | 5,704 | 318 acres (6%) | Contains portions of two areas, one in Bowen Creek HAU and the other adjacent to the eastern boundary of Alder Creek HAU in Corduroy Creek. |
| Bowen Creek | 8,334 | 1,893 acres (23%) | Contains portions of two large security areas. |
| Gregg Creek | 6,805 | 971 acres (14%) | Western half of this HAU is in the fire area. |
| Plume and Upper Good Creeks | 10,603 | 1,608 acres (15%) | Southern quarter of this HAU is in the fire area. |
| Lower Sheppard Star Meadow | 14,923 | 676 acres (5%) | 253 acres of this security are in fire area and support moderate cover; half of the HAU is in the fire area. |

| Elk Habitat Analysis Unit | Acres in HAU | Approximate Hunting Season Security Area Acres (and % of HAU) | Comment |
|---|---|---|---|
| Upper Sheppard Creek | 10,713 | 364 acres (3%) | The entire HAU is within the fire area. 158 acres of this security area supports only moderate cover. |
| Lower Griffin Creek | 8,967 | 1,391 acres (16%) | 14% of the HAU is in private land. |
| Hand Ingalls Creeks | 12,408 | 1802 acres (15%) | Northern portion of this HAU is in the fire area. Most of the HAU burned in the Little Wolf Fire. Contains 4 blocks. |

The road mileages and densities on lands administered by the Forest Service in the analysis area are as shown in Table 3-71. Road restrictions in the analysis area are generally effective (Exhibit Rg-6). See the "Snags and Downed Wood Habitat" section of this chapter and Exhibit Rg-8.

**Table 3-71. Road Densities across Forest Service Lands in the Analysis Area Based on GIS Lengths (Exhibit Rg-8).**

| Travel Management Category | Road Miles | Road Density |
|---|---|---|
| Open in summer | 195 miles | 1.7 miles per square mile |
| Open fall through spring (includes hunting season) | 143 miles | 1.3 miles per square mile |

Moist sites are also an important characteristic of elk habitat. Numerous seeps and springs are well distributed across the big-game analysis area meeting the definition of "elk moist sites" as defined by the Forest Plan and Lyon, et al. (1985). There are about 790 acres that appear to match most elements of these special habitats within the big-game analysis area and 177 acres within the fire area (Exhibit Rb-7). Some of these sites within the fire area were burned over and cover is limited adjacent to them. Only about one-quarter of the 790 acres consist of more remote, upper-drainage perched sites, which provide the best habitat including habitat used as elk wallows. Within the fire area, approximately 10 acres appears to provide this habitat.

# Environmental Consequences

## *Direct and Indirect Effects*

### Alternative A- No Action

No additional actions, such as timber salvage, temporary road construction, or road rehabilitation, are proposed with this alternative. Vegetative conditions would continue to respond to the effects of fire, initially providing good available foraging habitat where there is adjacent cover. Hiding cover will be limited for the next 15 to 20 years. This will temporarily disrupt movement patterns throughout the Brush Creek Fire area. Hunting season security areas will also be limited until hiding cover is restored within the Brush Creek Fire area. The limited hiding cover is also expected to affect the use of available seeps and wet areas as hiding cover is limited around many of them. Outside the fire area, the available hunting security areas are expected to increase in acreage over the next 10 years, as many of the harvested stands would have regrown hiding cover.

Across the analysis area (including upper Good Creek and lower Griffin Creek), in summer at least 195 miles across the analysis area would continue to be open to public or private motorized use for an Open Road Density (ORD) of at least 1.7 miles per square mile. At least 143 miles are open during hunting season and spring, with an ORD of 1.3 (Exhibit Rg-8).

## Effects of Alternatives B, C, and D

Alternative C reduces the least amount of hiding cover remaining in the fire area (Table 3-72). Because so little hiding cover remains after the Brush Creek Fire, the remaining cover patches are expected to be important to the elk which are expected to forage on resprouting vegetation adjacent to the cover areas. Alternative D reduces available hiding cover six percent from the existing condition, the largest reduction among the action alternatives.

**Table 3-72. Acres of Hiding Cover Affected by Salvage Harvest and Remaining Percent of Hiding Cover for Large Mammals across the Analysis Areas.**

| Alt. | Acres of Cover or Marginal Cover Removed | | | % Cover Remaining Across Analysis Areas | |
|---|---|---|---|---|---|
| | Marginal Cover | Cover | Total | Fire Area FNF only (25,355 ac) | Big Game Analysis Area (76,071 ac) |
| A | 0 | 0 | 0 | 33% | 66% |
| B | 1550 | 262 | 1812 | 26% | 64% |
| C | 621 | 112 | 733 | 30% | 65% |
| D | 1862 | 389 | 2251 | 24% | 63% |

**Table 3-73. Effects to Hunting Season Elk Security Area by Elk Habitat Analysis Unit (Exhibit Rb-3).**

| Elk Habitat Analysis Unit | Effects to Elk HAUs (Acres and Blocks Remaining) | | | |
|---|---|---|---|---|
| | Alternative A | Alternative B | Alternative C | Alternative D |
| Gregg Creek | 971 acres (parts of 2 blocks) | 798 acres (part of 1 block) | 798 acres (part of 1 block) | 798 acres (part of 1 block) |
| Plume & Upper Good Creeks | 1608 acres (parts of 3 blocks) | 1561 acres (parts of 2 blocks) | 1561 acres (parts of 2 blocks) | 1561 acres (parts of 2 blocks) |
| Lower Sheppard Star Meadow | 676 acres (1 block + part of another) | 531 acres (1 block remaining) | 531 acres (1 block remaining) | 531 acres (1 block remaining) |
| Upper Sheppard Creek | 364 acres (1 block) | 207 ac. remain (security area lost with harvest) | 362 ac (1 block) | 152 ac. remain (security area lost with harvest) |

Alternative C affects the fewest hunting season security areas in the fire area by reducing one block below the recommended acreage, and reducing the acreage of another block within the fire area, but maintaining the security area (Table 3-73). Alternatives B and D reduce both hunting season security blocks within the fire area below the recommended 250 acres and, Alternative D reduced a third block by 11 acres, but maintained the security area. Both security blocks had approximately one-half their acreage contained in marginal hiding cover stands, in which cover is more variable and provided by tree boles and blown over dead trees. Because of the marginal condition of these security blocks, as well as the lack of hiding cover in the fire area, as discussed above, it is expected that elk usage in the drainage and therefore in these blocks would be reduced until cover conditions are more favorable

Salvage harvest would occur in 54, 33, and 68 acres in Alternatives B, C, and D (respectively) in areas that are defined as seeps or springs that could function as elk moist sites. Of these acres, approximately four acres (two sites) have harvest units in Alternatives B and D within habitat more likely to contain elk wallows based on topography and photo interpretation. Alternative C harvests approximately three acres and one site. Alternative B also proposes temporary road construction within one of the moist sites that is not expected to provide potential elk wallows based on topography. This road would be reconstructed on an old road template that already exists. Also, buffers of 150 feet around wetlands would require that all temporary roads built would not directly affect the moist sites. Best Management Practices would be implemented and include avoiding equipment operation in wet areas (wetlands, seeps, riparian areas, etc.). These activities can displace elk from these sites as well as remove vegetation that may provide hiding cover. Because of the lack of hiding cover in the fire area, and the lack of cover surrounding many of these areas, this drainage, as well as the seeps and springs, are not expected to receive concentrated use until cover conditions are more favorable.

Alternative B builds twice as many miles of temporary road than any other alternative. These roads will all be obliterated after harvest is complete and all roads will remain closed to the public while logging activity ensues. The existing road densities will not change with any action alternative.

Salvage harvest of some of the areas providing marginal hiding cover will further add to the distance that big game would have to travel in non-cover areas within the fire area. As regeneration naturally progresses (15 to 20 years), the majority of the fire area will provide hiding cover allowing less vulnerable travel throughout the Sheppard Creek and adjacent drainages.

Outside the fire area, hiding cover remains plentiful and evenly distributed. The effects of the salvage harvest across the entire analysis area reduced hiding cover values between one to three percent (see table 3-69 through 3-73 above). It is expected that the available hiding cover will increase over the next 10 years as many of the harvested stands would have regrown hiding cover. This will also increase the acreage of the existing hunting season security areas, providing larger security blocks throughout the area. Outside the fire area, there were no effects to the eight hunting season security blocks. The existing acres of seeps and springs will remain the same and may become more important for elk displaced from the fire area. Forested connections both north and south of the fire area are not affected by the action alternatives. Forested habitat east of the fire area allows travel north and south between upper Good creek and lower Griffin creek. Forested connections also remain north and south of the fire area that allow travel up and down Good and Griffin Creeks to the ridgeline and forest boundary.

Features that are common to all action alternatives (Chapter 2) will help maintain the structure within the riparian habitat. These include minimum snag retention guidelines in units designed to retain snags and down wood; features that are designed to maintain snags and down trees directly adjacent to wetlands (75 feet of wetlands); all action alternatives propose the planting of deciduous trees and shrubs along with conifer plantings to increase wildlife security in and near riparian areas; and the salvage of trees in all harvest units will focus on the dead and dying trees.

It is expected that harvest activities, including helicopter and ground harvest, temporary road construction and obliteration, and helicopter landings, would affect some hiding cover and cause temporary displacement of elk and other ungulates from activity areas. The analysis area does not provide winter range; therefore, winter harvest would have less effect on ungulates. Other aspects of the project, such as burning of landing piles, dust abatement, and the application of herbicides for weeds along haul roads, would not have measurable effects on ungulates within the analysis area. All action alternatives are expected to cause temporary displacement to ungulates within activity areas.

## *Cumulative Effects*

### Effects Common to all Alternatives

The Brush Creek Fire has created the most recent large change on the landscape, as well as the Little Wolf Fire of 1994. These fires changed a large portion of the cumulative effects analysis area from mixed seral conditions into early seral conditions Past timber harvest and road construction have also created much of the existing habitat conditions found within the analysis area. Past timber harvest and fires converted a considerable amount of the hiding and thermal cover into seedling stands. Many of the stands regenerated by timber harvest have progressed to hiding cover, although many of these were pre-commercially thinned, reducing the quality of cover for approximately five or ten years.

The discussion below summarizes some of past, current, and reasonably foreseeable activities that are listed in Chapter 1 of this document and discussed in detail in Exhibits Rb-6.

**Vegetation Management**

Past timber sales, and associated activities, have created much of the existing habitat conditions (vegetation and roads) for ungulates within the analysis area. Currently, implemented timber sales include the Gregg-Plume sale located in upper Good Creek. Harvest of the burned portion of this sale took place in the winter of 2007 to 2008. The unburned portion will be logged in the next one to three years. The Kootenai National Forest is proposing to salvage harvest approximately 600 acres of timber burned in the Brush Creek Fire (Exhibit U-3). Timber hauling could occur down the Sheppard Creek road starting the summer of 2008; removal of timber felled near roads, for the purpose of protecting public safety during the Brush Creek Fire, will be removed and is scheduled to be completed in 2008. Effects on hiding cover from the Gregg-Plume timber sale were included in the existing condition. During logging and hauling operations, there will be short-term disturbance to ungulates adjacent to activity areas, including the divide between the Flathead and Kootenai National Forests.

Past harvest on Plum Creek Timber Company lands, in the analysis area, includes 250 acres of regeneration harvest in the past 40 years. This activity is expected to continue. Private and State land represent approximately five percent of the analysis area. Salvage harvest may be occurring on some or all of the remaining 80 acres not already harvested prior to the fire. These activities may result in localized disturbance and potential loss of cover within harvest areas.

It is expected that ongoing and reasonably foreseeable salvage harvest, and associated activities within the cumulative effects analysis area, would cumulatively contribute localized and minor effects to habitat security, availability of hiding cover, fragmentation, connectivity on the landscape, or other habitat parameters required by ungulates. Most harvest units should again provide hiding cover within 15 to 20 years.

### Private Land Development and Vegetation Management on Private Land

Development of private land, including the construction of roads, clearing of vegetation, construction of residences, and installation of improvements, can create a variety of changes to the landscape. Depending on the magnitude, type, and location of developments and the amount of private land on the landscape, these activities can have varied effects, including habitat loss, increased fragmentation, decreased habitat security, and localized disturbance on ungulates. The majority of private land development near the fire area has occurred in the Star Meadow and Good Creek communities. The rate of development has been recently increasing.

### Human-Caused Disturbances

Numerous recreational opportunities across the analysis area, including motorized trail riding and even hiking, can cause displacement of big game species. Big game hunting takes a proportion of the ungulate population every year (Exhibit Rb-4), as do road collisions, and predation. Human population and access are dramatically increased over historical conditions. On National Forest System land, ease of human access has stabilized over the last decade or so, as new roads built for logging are generally reclaimed or closed soon after use. White-tailed deer are more adaptable to large landscape fragmentation and roading than are elk, and they probably have not been impacted as directly from past human activities. Overall, past harvest and fires have improved available food sources for white-tailed deer. Across the analysis area, as well as across the majority of the Tally Lake Ranger District, white-tailed deer numbers appear to be climbing, despite high hunting permit numbers and relatively easy motorized access.

### Riparian Disturbances

BAER activities in the Brush Creek post-fire environment include activities located in the riparian areas. Road reclamation is also planned for 2009 and 2010. These activities may cause short term disturbances to riparian dependent species such as white-tailed deer and increase in sedimentation to the stream, but result in long term benefits to the riparian systems. Beaver dams provide a flux of habitat and past beaver trapping may have affected riparian habitat availability. Grazing has been suspended in the burned portion of the Swaney Allotment for two years, which will reduce weed spread and sedimentation in streams and wetlands.

Past, ongoing, planned timber harvest, and further cumulative effects relevant to big game species, are discussed in sections on "Old Growth Habitat," and "Snags and Downed Wood Habitat" in this chapter, and in Exhibit Rg-9. These effects would be cumulative to those discussed above for each alternative.

## REGULATORY FRAMEWORK AND CONSISTENCY

Flathead National Forest Plan, Amendment 21, establishes a Forest-wide goal to "provide appropriate habitat and access to maintain desired hunting, fishing, and viewing opportunities, in coordination with the Montana Department of Fish, Wildlife, and Parks (MDFWP)." The Flathead Forest Plan has identified white-tailed deer, elk, and mule deer as Commonly Hunted Big Game Management Indicator Species (MIS) that use general forest habitat. Conditions favorable to these species would generally also benefit other big game species, such as moose, black bear, and mountain lion, which are considered under the umbrella of Forest-level MIS evaluation.

The MDFWP includes habitat goal recommendations in their big game management plans, specifically the Montana Statewide Elk Management Plan (MDFWP 2004). It is acknowledged in this plan that past wildfires have improved habitat conditions for elk. Forest Plan Amendment 21 has an objective to provide sufficient habitat to contribute towards meeting the objectives of MDFWP's management plans. The state elk plan calls for an increase in elk population in the Salish Elk Management Unit, which includes the Brush Creek Fire area. The Habitat Management Strategies for this area emphasize the need for consideration of elk security and hunter access in planning activities (MDFWP 2004; Exhibit Rb-1). The Forest Plan Amendment 21 objective to provide sufficient habitat to contribute toward meeting the objectives of MDFWP's management plans is met by all action alternatives. However, due largely to the Brush Creek Fire, elk security areas under all alternatives (including No Action) may not meet objectives of the Statewide Elk Plan for bull harvest (MDFWP 2004, Exhibit Rb-4).

Moist sites are also identified as an important characteristic of elk habitat and management considerations have been outlined in the Forest Plan (pages II-22 and 23). These apply to all management areas, in accordance with recommendations from the Coordinating Elk and Timber Management, Final Report of the Cooperative Elk-Logging Study, 1970-1985, January 1985 (Forest Plan Appendix DD).

All alternatives are consistent with biodiversity requirements for wildlife species. The analysis for the Forest Plan Amendment 21 assessed the forest-level viability of elk and mule deer (USDA Forest Service 1999a). Regardless of scale, species viability is not a concern for elk or deer. These species are habitat generalists, and all indications are that healthy populations are well distributed across the western states, Montana, and the Flathead National Forest. In Montana and on the Flathead National Forest, this is evidenced by liberal hunting seasons administered by the Montana Department of Fish, Wildlife, and Parks. In northwest Montana the rapid recovery of the gray wolf is also evidence of substantial ungulate populations, which comprise their primary food source. See Exhibit Rg-1 for more information.

# NEOTROPICAL MIGRATORY BIRDS & RIPARIAN HABITATS

## Introduction

Neotropical migratory birds regularly summer in North America and winter south of the Tropic of Cancer. Population declines in many of these species appear to be due to loss, modification, and fragmentation of breeding habitat; loss of wintering and migratory habitat; and brood parasitism (Montana Partners in Flight 2000). The United States portion of the Northern Rockies Bird Conservation Region has 28 species listed as "Birds of Conservation Concern" (USFWS 2002, Exhibit Rn-1; Table 3-74, below). These species are migratory and non-migratory birds not designated as federally threatened or endangered but represent the highest conservation priorities. Two of these are sensitive wildlife species on the Flathead National Forest, and three are listed as old-growth associates (Exhibit Q-4).

In forests, two especially important habitats to nesting birds are: 1) riparian habitat, because of the availability of water and variety of plant communities, and 2) old growth habitat, which has the highest density and diversity of birds nesting in tree cavities (McClelland and Schmidt 1995). Post-fire habitats may also be important to some Neotropical migrants, such as the olive-sided flycatcher and mountain bluebird (Saab et al. 2005, Smucker et al. 2005). Bird populations that breed in the western United States appear to be suffering from forest fragmentation in breeding habitat (Rotenberry et al. 1995, Hejl et al. 1995; Hejl et al. 2002; Turcotte and Desrochers 2003). For more information, see Exhibit Rn-2.

Riparian habitats occur along lakes, rivers, streams, springs, and seeps where the vegetation and microclimate are influenced by year-round or seasonal water and associated high water tables. Most plant and animal species in these areas are more productive and diverse than on nearby uplands, making these areas very important to many wildlife species. Within the Flathead National Forest, 36 bird, four mammal, three reptile, and two amphibian species are recognized as dependent upon riparian marsh habitat; 23 bird, seven mammal, and four amphibian species are recognized as dependent upon forested riparian areas (LRMP, Planning record 219.12[g], 1980). These include threatened and sensitive species (bald eagle, harlequin duck, common loon, western toad, northern leopard frog), and some Neotropical migrants. Some, such as the harlequin duck and common loon, must have clear, clean water for their aquatic food sources. Many riparian organisms have adaptations that lead to relatively fast recovery after fire (Reeves et al. 2006).

Timber harvest and salvage, insect epidemics, and fire can impact wildlife using riparian habitats, including changes in plant species, downed wood recruitment, water temperature, shading, humidity, erosion, water quality, and predator-prey interactions (Exhibit Rr-2). Protection from weather extremes can be lost, as can hiding cover, which is especially important around such riparian features as elk wallows. It is possible the post-fire salvage in and near riparian areas is particularly impactive (Beschta et al. 2004, Reeves et al. 2006), although research suggests that the resilience in burned riparian ecosystems increases with the amount of trees retained (Bisson et al. 2003).

## Information Sources

The effects on Neotropical migrants are discussed by using analyses presented in the sections on "Old Growth Habitat and Old Growth Associated Species," "Snags and Downed Wood Material Wildlife Habitat", "Fisheries," and "Hydrology." Riparian habitats were assessed by way of the Riparian Landtype Polygon coverage in the Flathead GIS library (Exhibits Rr-1 and Rr-3). The flammulated owl has a separate section under "Sensitive Wildlife Species." No impacts on the peregrine falcon would be expected (Exhibit Rs-7). The USFS Northern Region Songbird Monitoring Program (Hutto 1995a, Hutto and Young 1999, Hutto and Young 2002, Young and Hutto 2002; Exhibit Rn-4) has provided data on population trends, habitat relationships, and effects from past management activities for Neotropical migratory birds breeding in western Montana. These have been combined to determine population trends on a continental, regional, statewide, or physiographic region scale. Other Observations and Monitoring for Riparian Habitat Wildlife Species are in Exhibit Rr- 4. Wildlife population viability concerns on the Flathead National Forest, and larger scales, are assessed in Exhibit Rg-1. For literature cited, see Exhibits Rn-5 and Rr-5.

## Analysis Area

The evaluation of direct, indirect, and cumulative effects on Neotropical migratory birds and riparian habitats was done for the same spatial and temporal extent as that for old growth associated species and their habitats. An assessment at multiple scales was also conducted to address population diversity concerns (Exhibit Rg-1). See also Exhibits Rr-3 and Rn-6.

## Affected Environment

Populations of forest-associated birds that breed in the western United States appear to be affected by forest fragmentation in breeding habitat (Hejl et al. 1995). Harvest and extensive tree mortality further contribute to short-term fragmentation (Rotenberry et al. 1995). Post-fire environments may be very important to some of these species, and natural fire regimes appear to be important for the conservation of native bird faunas (Kotliar et al. 2002). Different bird species are associated with different vegetation burn severities, patch sizes, and time since fire, suggesting that a variety of post-fire conditions should be maintained across the landscape (Saab et al. 2005, Smucker et al. 2005).

Of the 28 species listed as "Birds of Conservation Concern" (Table 3-74), few have been documented in the cumulative effects analysis area (Exhibits Rn-1 and Rn-4). Parts of the adjacent Logan Creek analysis area, that seem to meet their habitat needs, were surveyed for the peregrine falcon and the flammulated owl, but none were detected (Exhibit Rs-5). Most of the others use habitats that are rare or nonexistent in the analysis area, and five others are not expected to occur anywhere in the Flathead National Forest (Exhibit Rn-1). Some are associated with post-fire habitats and may benefit from the 2007 fire. Other Neotropical migrants associated with post-fire habitats, such as the olive-sided flycatcher and the mountain bluebird, are commonly observed in the analysis area (Exhibit Rn-4). Species that may be found in open forests may benefit from fires that reinitiate the understory but do not consume all the large trees. Several species may be found in a variety of forest types and could be impacted by the loss of cover, as well as nesting and foraging habitat.

**Table 3-74. Birds of Conservation Concern in the Flathead Basin** (Exhibits Rn-1, Rn-2, and Rn-4 for more information).

| **Species *** | **Status and Habitat Association **** | **Observed in** | | **Relative Abundance in the Flathead Basin and Neighboring Areas** |
|---|---|---|---|---|
| | | **Fire Area** | **Cumulative Effects Area** | |
| American Golden-Plover | t | | | Rare |
| Black Swift | B; R | | | Rare |
| Brewer's Sparrow | b | | | Uncommon |
| Ferruginous Hawk | t | | | Rare |
| Flammulated Owl | B; Sens; OG | | | Occasional |
| Golden Eagle | B | YES | YES | Uncommon |
| Lewis's Woodpecker | B; OG | | | Occasional |
| Loggerhead Shrike | t | | | Occasional |
| Long-billed Curlew | B; R | | | Uncommon |
| Marbled Godwit | T; R | | | Rare |
| Peregrine Falcon | B; Sens; R | | | Rare |
| Prairie Falcon | t | | | Rare |
| Pygmy Nuthatch | B; OG | YES | YES | Common |
| Red-naped Sapsucker | B | YES | YES | Common |
| Solitary Sandpiper | T; R | | | Uncommon |
| Upland Sandpiper | t | | | Rare |
| Whimbrel | T; R | | | Rare |
| White-headed Woodpecker | t | | | Rare |
| Williamson's Sapsucker | b | YES | YES | Uncommon |
| Wilson's Phalarope | B; R | | | Common |
| Yellow Rail | t; R | | | Rare |

* Species not in table because no record in the Flathead Basin and Neighboring Areas = McCown's Longspur, Mountain Plover, Snowy Plover, Virginia's Warbler, and Yellow-billed Cuckoo.
** Status and Habitat Association: B = Direct evidence of breeding; b = Indirect evidence of breeding; t = No evidence of breeding; Sens = Flathead National Forest Sensitive Species; OG = Old growth Associated Species; R = Riparian Associated Species.

Overall, the area provides a considerable diversity of forested habitats, including old growth, snag, and downed wood habitats, and a variety of riparian areas. The existing conditions of habitats important for migratory birds are described in the sections of this chapter on "Old Growth Habitat and Old Growth Associated Wildlife Species" and "Snags and Downed Woody Material Wildlife Habitat." Additional information is provided for the flammulated owl in a separate part of the section on "Sensitive Wildlife Species." Physical conditions of the streams, wet meadows, ponds, seeps, and springs are further described in the "Hydrology" and "Fisheries" portions of this chapter. For more information about wildlife habitat conditions across the Flathead National Forest relevant to Neotropical migrants, see the Final Environmental Impact Statement for the Flathead's LRMP Amendment 21 (USDA 1999a) and Exhibit Rg-1.

Riparian wildlife habitats in the Brush Creek Fire area and the larger Cumulative Effects Area appear to be functioning well, with numerous and well-distributed ponds, seeps, and streams providing a diversity of habitats (Table 3-75, Exhibit Rr-3,Flathead National Forest 1995). Most of the bird species listed as "riparian associates" in Table 3-74 above, use the dense shrubs and deciduous trees found in these habitats. Riparian birds may have been displaced into less suitable habitats and/or concentrated in those riparian areas that remain relatively intact after the fire. The largest marshy areas are in Star Meadow, and in Bowen Creek, Hand Creek, and Dunsire Creek drainages. About 2340 acres of these areas are willow and sedge communities with fine silty soils. Another 1270 acres are also relatively flat, but dominated by Engelmann spruce, subalpine fir, or black cottonwood. About 790 acres are associated with seeps, springs, or wet depressions.

**Table 3-75. Riparian Habitats Across the Brush Creek Fire Area and the Larger Cumulative Effects Area** (Exhibit Rr-3).

| Riparian Landtypes | Brush Creek Fire (FNF side) | | Cumulative Effects Area | |
|---|---|---|---|---|
| | Acres | % of Area | Acres | % of Area |
| LAKE (Sylvia Lake) | 23 | 0.0% | 23 | 0.1% |
| FL1C (Valley bottom, gravel substrate, in subalpine-fir/spruce forest community) | 53 | 0.2% | 497 | 0.6% |
| NL1A (Nearly level, poorly drained fine substrate, wetland in subalpine-fir/spruce forest community) | 114 | 0.5% | 770 | 1.0% |
| NL1E (Nearly level, poorly drained fine substrate, wetland in sedge/willow community) | 163 | 0.6% | 2,345 | 3.1% |
| NL2A (Nearly level; gravel substrate; in subalpine-fir/spruce forest community along perennial stream) | 164 | 0.7% | 542 | 0.7% |
| SL2A, SL3A (Slightly sloping; gravel or boulder substrate; in subalpine-fir/spruce forest community typically along perennial streams) | 327 | 1.3% | 932 | 1.2% |
| MS3A, MS4A, MS5A, VS3A (Moderately to very steep; boulder or bedrock substrate; in subalpine-fir/spruce community along streams) * | 112 | 0.4% | 255 | 0.3% |
| WL5A, WS5A (springs, seeps, and wet depressions in subalpine-fir/spruce forest communities) * | 177 | 0.7% | 790 | 1.0% |

* These types are often not included in the Forest-wide GIS coverage but are typically discovered during field surveys and harvest unit layout. These acreages represent minimum amounts.

With the notable exception of the 2007 Brush Creek Fire area and the 1994 Little Wolf Fire area, forested riparian cover is nearly continuous across much of the cumulative effects analysis area (Exhibit Rr-3). Nearly 60 percent of the analysis area is within one-quarter mile of a stream, pond, or other riparian feature, which is a zone generally regarded as "key use" habitat for white-tailed deer (Exhibit Rr-1).

Wildlife species reported to be using riparian habitats in the analysis area include gray wolf, river otter, moose, white-tailed deer, mule deer, elk, black bear, beaver, coyote, bald eagle, red-tailed hawk, common loon, common raven, ruffed grouse, red-naped sapsucker, American robin, golden-crowned kinglet, hermit thrush, northern waterthrush, warbling vireo, Wilson's warbler, MacGillivray's warbler, fox sparrow, winter wren, common gartersnake, painted turtle, long-toed salamander, boreal (western) toad, pacific tree frog, and Columbia spotted frog (Exhibit Rr-4).

# Environmental Consequences

## *Direct and Indirect Effects*

The direct and indirect effects on riparian habitats and on habitats important for migratory birds are described in the sections of this chapter on "Old Growth Habitat and Old Growth Associated Wildlife Species," "Snags and Downed Woody Material Wildlife Habitat," "Hydrology," and "Fisheries," and "Riparian and Wetland Wildlife Habitat." Additional information is provided for the flammulated owl in a separate part of the section on "Sensitive Wildlife Species."

### Alternative A- No Action

Overall, this alternative would leave habitats across the analysis area to continue with relatively natural processes. Abundant large fire-killed snags would provide potential habitat for birds that excavate cavities, and subsequently for secondary cavity nesters, including some Neotropical migrants. Areas with heavy fire mortality and blowdown would provide structural diversity, downfall trees, and long-standing snags. Downed logs, shading from snags, and lack of seed sources may delay the recovery of new trees in some areas with high levels of dead trees (See the "Vegetation" section of this chapter). The probability of fire would increase in such areas as dead trees fall and new understory growth contributes fine fuels. Approximately three quarters of the road/stream crossings were burned in the Brush Creek Fire. The fire burned off vegetation growing in ditches, which could increase erosion rates into streams. None of these roads would receive Best Management Practices (BMP) improvements in this alternative, and this erosion would be expected to continue. See sections on "Fisheries" and "Hydrology" in this chapter for more information.

### Effects to all Action Alternatives

In Alternative D (Table 3-76), salvage harvest would overlap with nearly 300 acres of riparian landtypes (Exhibit Rr-3). This includes over half of the "B" units. The units with the greatest contribution to this effect are Units 35, B1, B2, B3, B4, B5, B7, B8, B9, B10, B34, and B36. In Alternative D, habitat values may be less than optimal for some Neotropical migrant species due to the removal of many snags and downed logs in and near riparian and wetland areas. In addition, in Alternative D connectivity along riparian habitat corridors could be severed or narrowed to less than 300 feet wide in numerous places (Exhibit Rg-7). See the “Fisheries” and “Hydrology” sections of this chapter for information about Alternative D’s proposed salvage in Riparian Habitat Conservation Areas and how it relates to the regulatory framework.

**Table 3-76. Salvage Harvest in Mapped Riparian Habitats** (Exhibit Rr-3).

| Riparian Habitat | Alt. B | Alt. C | Alt. D |
|---|---|---|---|
| FL1C (Valley bottom, gravel substrate, in subalpine-fir/spruce forest community) | 0.0 acres | 0.0 acres | 18.3 acres |
| NL1A (Nearly level, poorly drained fine substrate, wetland in subalpine-fir/spruce forest community) | 0.0 acres | 0.0 acres | 46.3 acres |
| NL1E (Nearly level, poorly drained fine substrate, wetland in sedge/willow community) | 0.0 acres | 0.0 acres | 27.2 acres |
| NL2A (Nearly level; gravel substrate; in subalpine-fir/spruce forest community along perennial stream) | 0.0 acres | 0.0 acres | 81. 0 acres |
| SL2A, SL3A (Slightly sloping; gravel or boulder substrate; in subalpine-fir/spruce forest typically along perennial streams) | 0.8 acres | 0.8 acres | 117.5 acres |
| TOTAL | 0.8 acres | 0.8 acres | 290.4 acres |

In Alternatives B and C, only one salvage unit (Unit 95) may overlap with less than one acre of a relatively dry riparian landtype (Table 3-76, Exhibit Rr-3). All snags and downed logs would be left in riparian and wetland areas, maintaining important habitat components. In addition, Alternative C would not salvage in many areas that would typically provide the best areas for snag patches and habitat diversity. In Alternatives B and C, no riparian connectivity would be severed (Exhibit Rg-7).

In all action alternatives, salvage harvest activities between May and August may have direct effects on nesting Neotropical Migrants, as well as on other wildlife species that use riparian habitats. Although little is known about the effects of salvage logging in stand-replacement fires on these species, it is expected that salvage of snags would have a slight negative effect on potential population numbers of cavity-nesting Neotropical migratory birds. Logging and tree felling during the nesting season may cause nest failure and death to both adults and young. Noise from the various activities proposed during the breeding season may impact juvenile dispersal, cause premature displacement of young, or cause young to be prematurely abandoned. Some temporary displacement of Neotropical migrants and other wildlife species is likely to occur.

Temporary road construction effects of Alternative B on riparian habitats would be considerably greater than with Alternatives C or D (Table 3-77). Temporary road construction would require the felling and removal of snags and live trees from the road template and additional felling of hazard trees, as described above for snag and downed wood habitats. In and near riparian habitats, additional drainage structures would be required, as well as other measures to prevent damage to moist areas. For more information about temporary road construction effects, see the “Fisheries” and “Hydrology” sections of this chapter.

**Table 3-77. Temporary Road Construction in Mapped Riparian Habitats** (Exhibit Rr-3).

| Riparian Habitat | Alt. B | Alt. C | Alt. D |
|---|---|---|---|
| FL1C (Valley bottom, gravel substrate, in subalpine-fir/spruce forest community) | 208 feet | 0 feet | 0 feet |
| NL1A (Nearly level, poorly drained fine substrate, wetland in subalpine-fir/spruce forest community) | 376 feet | 189 feet | 189 feet |
| NL1E (Nearly level, poorly drained fine substrate, wetland in sedge/willow community) | 0 feet | 0 feet | 0 feet |
| NL2A (Nearly level; gravel substrate; in subalpine-fir/spruce forest community along perennial stream) | 0 feet | 0 feet | 0 feet |
| SL2A, SL3A (Slightly sloping; gravel or boulder substrate; in subalpine-fir/spruce forest typically along perennial streams) | 1,890 feet | 313 feet | 599 feet |
| TOTAL | 2,474 feet | 502 feet | 788 feet |

Alternative D includes additional measures for controlling Douglas-fir and spruce bark beetle populations through additional salvage harvest, as described in Chapter 2. The direct effect would be the felling and removal of large diameter spruce and Douglas-fir. The indirect effect would likely be a reduction in beetle-caused tree mortality both inside and beyond the fire area. Where beetle populations are at epidemic levels, this can be particularly important for maintaining the ecosystem function of riparian areas. In Alternatives B and C, no additional measures are taken for controlling Douglas-fir and spruce bark beetle populations through additional salvage harvest. The indirect effect could be an increase in beetle-caused tree mortality both inside and beyond the fire area.

For a discussion of the effects of helicopter logging, helicopter landings, road obliteration, planting on landings and reclaimed temporary roads, and tree planting, see the section above on “Snags and Downed Wood Habitat” in this chapter. Other aspects of the project, such as burning of landing piles, road rehabilitation, dust abatement, and the application of herbicides along haul roads, would not have measurable effects on Neotropical migratory birds and other wildlife species using riparian habitats.

## *Cumulative Effects*

### <u>Effects to all Alternatives</u>

Most of the cumulative effects relevant to migratory birds and riparian habitats (Exhibit Rr-7) are described in the sections of this chapter on “Old Growth Habitat and Old Growth Associated Wildlife Species,” “Snags and Downed Woody Material Wildlife Habitat,” “Fisheries,” and “Hydrology.” These include loss and alteration of habitat due to timber harvest, habitat lost to the hazard tree removal efforts, past fires, road construction, and access for firewood cutting and furbearer trapping. Saab and Rich (1997) list threats, species, and relevant habitats of concern on the scale of the Columbia River Basin.

During the 2007 Brush Creek Fire, suppression efforts and hazard tree reduction felled trees and cleared other vegetation in some riparian habitats (Exhibit Rr-7). About 2.8 miles of fire-control line crossed mapped riparian areas, affecting about 32 acres. Most of this was the shaded fuel break outside the fire perimeter, which left some large trees standing where possible. Looking only at landtypes with clay to medium sand substrates (FL1C, NL1A, and NL1E; Table 3-76, above), dozer line impacted 1.5 acres, masticator machinery impacted 0.2 acres, and hand line impacted 0.2 acres. Other riparian impacts occurred at a water-truck draw site and places where corduroy "bridges" were placed in streams. Rehabilitation efforts in all these riparian areas were completed in September 2007. One additional area of impact was the wetland in T31N R25W Section 24 on a tributary to Gregg Creek. This wetland was reportedly used for filling hundreds of helicopter bucket drops until it was nearly drained. Hazard tree reduction along roads occurred in over 160 acres of riparian landtypes, mostly along Sheppard Creek. In about 22 of the riparian acres outside of Riparian Habitat Conservation Areas, some of the felled trees were sold, with completion of removal expected in 2008. This mostly involves cable equipment pulling logs to the road.

Other cumulative effects on wildlife using riparian habitats are varied. Recreation activities are somewhat limited, but several could impact riparian habitats or disturb or displace wildlife in riparian habitats. These include fishing, boating, camping, hunting, hiking, horseback riding, motorized trail use, and bicycling. Fish stocking in some of the creeks and lakes has altered species composition and may have increased the intensity of recreational fishing. On all ownerships, trapping of beavers and destruction of beaver dams has reduced the size of wetlands and other flooded areas. Driving on roads can cause some collision-related injuries or mortalities to wildlife, particularly in the denser-cover areas associated with riparian habitats. Human settlement occurs on most of the private lands, and subdivision continues to increase, which can cause considerable impacts on riparian habitat or indirect effects on wildlife from dogs left at large. Livestock grazing on the Swaney and Island Meadows/Lemonade Springs Allotments and on private lands has likely altered plant composition in some riparian areas and may have contributed some level of bank trampling or erosion. Grazing has been suspended in the burned portion of the Swaney Allotment for two years, which will reduce weed spread and sedimentation in streams and wetlands. See the "Fisheries" and "Hydrology" sections of this chapter for cumulative effects of stream habitat restoration and road and trail construction and maintenance. See Exhibits Q-8, Rb-6, Rd-14, Rn-6, Rr-7, and Rs-9 for more information about cumulative effects relevant to Neotropical migratory birds and riparian habitats.

## REGULATORY FRAMEWORK AND CONSISTANCY

On January 10, 2001, President Clinton signed Executive Order (E.O.) 13186, "Responsibilities of Federal Agencies to Protect Migratory Birds." On January 7, 2001, the USDA Forest Service and the USDI Fish and Wildlife Service signed a Memorandum of Understanding to complement the Executive Order. The 1988 amendment to the Fish and Wildlife Conservation Act mandates the U.S. Fish and Wildlife Service to "identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act of 1973." The Migratory Bird Treaty Act covers many ground-nesting and shrub-nesting birds. Under the Act, taking, killing, or possessing migratory birds, including nests and eggs, is unlawful. A list of Neotropical migrants protected by the

Migratory Bird Treaty Act is provided in 50 CFR 10.13. Some migratory birds are covered by state hunting regulations; others are protected by non-game status by the Montana Department of Fish, Wildlife, and Parks. There are currently no Flathead Forest Plan Standards specific to migratory birds. The flammulated owl and the peregrine falcon are sensitive species, and are discussed in this document and in other sections of the Project Record (Exhibits Rs-2, Rs-3, and Rs-7).

Upon review of the information regarding Neotropical migratory birds here and in the project record, no substantial loss of migratory bird habitat is expected from the implementation of any of the alternatives. The intent of the MTBA, the 2001 Executive Order, and the MOU to conserve and protect Neotropical migrants would be met under all alternatives. All alternatives would be consistent with NFMA direction for diversity of plant and animal communities and ecological sustainability.

For information about and consistency with the Forest Plan, INFISH requirements, Montana's House Bill 731 (the Streamside Management Zone act), and other regulatory requirements specific to aquatic systems, see the "Hydrology" and "Fisheries" sections of this chapter.

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# THREATENED WILDLIFE SPECIES

## Introduction

Tables 3-52 and 3-53 in the Wildlife Introduction section summarized the current conditions for threatened wildlife species in the project area—Canada lynx and grizzly bear. The United States Fish and Wildlife Service (USFWS) concurs with this list of species that "may occur" in the analysis area (Exhibit Rt-1). A Biological Assessment for these species will be prepared before the decision (Exhibit Rt-4); consultation with USFWS is in progress (Exhibits Rt-2 and Rt-3). This section on Threatened Wildlife Species is divided into two separate subsections, one for Canada lynx, and one for grizzly bear and gray wolf, with environmental consequences following the affected area for each. Cumulative effects, combined for all three species, and information about the Regulatory Framework and Regulatory Consistency for lynx and grizzly bear are at the end of the section. For literature cited, see Exhibit Rt-10.

The Gray Wolf became a USFS Region One sensitive species after removal of the Northern Rocky population from the List of Threatened and Endangered Wildlife, becoming effective on March 28, 2008. Because this was such a recent change, most of the information pertaining to the wolf is found in this section, with Regulatory Framework and Regulatory Consistency for wolf in the section on Sensitive Wildlife Species.

## Canada Lynx (Threatened)

### *Introduction*

In the Northern Rockies, Canada lynx (*Felis lynx*) is adapted to a fire regime that created new foraging opportunities in young stands and along edges, while leaving behind a mosaic of travel connections and dense older stands. Lynx typically forage in areas that support their primary prey, the snowshoe hare. These are most often sapling forests or multi-storied older stands that have a dense layer of saplings and lower branches. Cover and browse for hares are maximized at both ground level and at varying snow depths throughout the winter. Lynx most often den under downed logs in mesic older forests. Lynx use forested cover for traveling between patches of boreal forest (USFWS 2008a), frequently traveling along forested saddles, ridges, and riparian areas. Another important aspect of lynx habitat is winter snow that is deep and fluffy for extended periods.

The elimination of cover for this species and its primary prey, the snowshoe hare, can have negative short-term effects (Koehler and Aubrey 1994). This is especially true where large openings are created without travel connections between areas of dense young forest and older forests used for denning. The causes of this include timber harvest, precommercial thinning, and wildland fire. Stands up to about 15 years old, while unsuitable to lynx in the short term, are needed to provide foraging habitat in the future. An insect epidemic or fire can provide a great influx of downed logs, providing denning sites and cover for lynx kittens.

Timber salvage generally reduces existing or future downed woody material, while sometimes accelerating regeneration of the green canopy cover used by lynx and its prey. Non-target trapping mortality correlates with ease of human access into an area during prime trapping season. Human activity in spring and summer, especially motorized use, may force lynx to move kittens.

Following the information found in Ruggiero et al. (2000), primary lynx habitat in the Rocky Mountains and on the Flathead National Forest includes lodgepole pine, subalpine fir, and Engelmann spruce. Moist Douglas-fir types are considered secondary habitat that can support squirrels, an alternate prey species for lynx during periods when snowshoe hare densities are low. In Montana west of the Continental Divide, lynx habitat is primarily subalpine fir habitat types, generally between 4000 and 7000 feet.

## *Analysis Area*

The Sheppard Creek drainage along with the upper portion of the Good Creek drainage and the lower portion of the Griffin Creek drainage (Exhibit Rg-9) were considered for the evaluation of direct, indirect, and cumulative effects on Canada lynx. This area comprises three Lynx Analysis Units (LAUs); Upper Good, Sheppard, and Lower Griffin, which are consistent with a forest-wide protocol developed in November 1999 (Exhibit Rt-8). This approximately 119 square mile area (about 76,200 acres) is large enough to include the home ranges of three female lynx and numerous snowshoe hares, and to represent the effects of fire, natural tree mortality, timber harvest, fuel reduction, and firewood cutting across the landscape. All of the actions proposed in the alternatives that could directly or indirectly affect Canada lynx are contained within this area. An assessment at multiple scales was also conducted to address population viability concerns (Exhibit Rg-1). See also Exhibit Rt-11 for a Region-wide assessment. The temporal scale of the effects analysis extends 100 years into the future, enough time for new understory feeding habitat to develop in many areas.

## *Information Sources*

Data used included pre-fire and post-fire aerial photography; stand exams; Northern Region Vegetation Mapping Project (R1-VMP) data; field surveys of snags and downed logs; pre- and post-fire old growth surveys; project area field visits; post-fire walk-through surveys; research literature; and GIS coverages and data sets for features such as general forest attributes, slope, aspect, habitat type, and mapped lynx habitat.

## *Affected Environment*

Lynx range over much of Canada, Alaska, and the northern edges of the lower 48 states, although the only population strongholds in the United States are in Washington State, western Montana, and possibly northern Idaho (Claar, et al. 1999). Many National Forests in USFS Region One support lynx (USFWS 1998). Trapping and sighting data from Idaho and

Montana suggest a downward or stable trend in population since the mid-1980s. The analysis area is designated as Proposed Critical Habitat, in Subunit 12 of Unit 3 (Exhibit Rt-15).

Lynx and their sign have been recorded in and near the analysis area (Exhibit Rt-7). Snowshoe hares, the primary prey of lynx, appear to be very common throughout the Tally Lake Ranger District, particularly along roads, in moderately dense sapling-to-pole sized stands, and in some older stands. Numerous snowshoe hares and their tracks have been seen across the analysis area. Species, such as coyotes, bobcats, and mountain lions, that may compete with lynx for prey have also been observed in the area.

Nearly 93 percent of the analysis area is delineated as "mapped lynx habitat," as finalized through consultation with the USFWS. Both the Sheppard and Lower Griffin LAUs are in "low" functioning condition; the Upper Good LAU is in "moderate" functioning condition (Exhibit Rt-9). This is due mostly to large wildfires in 1994 and 2007 but also to past timber management. Tables 3-78 and 3-79 display the current situation of potential habitat for lynx (Exhibit Rt-8), using descriptions from the Northern Rockies Lynx Management Direction (Exhibit Rt-15). Currently, from 22 to 63 percent of lynx habitat, by LAU, is in early seral/structural stage condition and too young to be of use for lynx. Over most of the lynx habitat in the area, denning habitat is well distributed and many acres of heavy tree mortality can provide future structures for denning (Exhibit Rt-8). Most patches of denning habitat have feeding habitat nearby.

**Table 3-78. Calculation of Lynx Habitat by Lynx Analysis Unit (LAU), and Display of Temporary Non-lynx Habitat (i.e. recent stand-initiation areas)** (Exhibit Rt-8).

| Lynx Analysis Unit | Potential Habitat for Lynx (Acres or % of suitable habitat by LAU) | | | | |
|---|---|---|---|---|---|
| | Acres in LAU | Permanent Non-lynx Acres | Mapped Habitat Acres | Mapped Lynx Habitat % | Temporary Non-lynx [1] Acres (and % of habitat) |
| Lower Griffin | 21,374 ac | 1,933 ac | 19,441 ac | 91% | 6,893 ac (35.5%) |
| Sheppard | 24,151 ac | 2,173 ac | 21,978 ac | 91% | 13,643 ac (62.1%) |
| Upper Good | 30,648 ac | 1,274 ac | 29,374 ac | 96% | 6,363 ac (21.7%) |

[1] Stand initiation structural stage *that currently does not provide* snowshoe hare habitat.

**Table 3-79. Calculation of Lynx Habitat Components by Lynx Analysis Unit and Percentage of Mapped Lynx Habitat within each LAU, after the 2007 Brush Creek Fire** (Exhibit Rt-8).

| Lynx Analysis Unit | Current Potential Lynx Habitat (and % of mapped habitat in each LAU) | | | |
|---|---|---|---|---|
| | Sapling Feeding [2] | Multistory Feeding [3] | Multistory Non-feeding [4] | Other (Travel) [5] |
| Lower Griffin | 6552 ac (33.7%) | 1554 ac (8.0%) | 1474 ac (7.6%) | 2967 ac (15.3%) |
| Sheppard | 4433 ac (20.2%) | 397 ac (1.8%) | 1068 to 1148 ac (4.9 to 6.1%) | 2156 ac (9.8%) |
| Upper Good | 6135 ac (20.9%) | 5274 ac (18.0%) | 1677 to 1813 ac (5.7 to 6.2%) | 9788 ac (33.3 %) |

[2] Stand initiation structural stage *that currently provides* snowshoe hare habitat.

[3] Forested multi-storied structural stage *that currently provides* snowshoe hare habitat.

[4] Forested multi-storied structural stage *that currently does not provide* snowshoe hare habitat. In the Sheppard and Upper Good LAUs, this is provided as a range due to uncertainty of fire-caused tree mortality.

[5] Vegetative conditions that do not fit categories 1-4. An example is the stem-exclusion structural stage.

The effects of fire suppression actions in 2007, such as cutting contingency lines through multi-storied and sapling habitat, are discussed in the Cumulative Effects section below.

Refer to Exhibit Rg-7 and the section on "Old Growth Habitat and Old Growth Associated Wildlife Species" in this chapter for more information about the existing condition in terms of connectivity.

## *Environmental Consequences*

### Direct and Indirect Effects

#### Alternative A- No Action

No additional actions, such as timber salvage, temporary road construction, road rehabilitation, herbicide spraying, and planting are proposed with this alternative. The availability of denning and hiding sites would gradually increase, as would habitat used by numerous species preyed on by the lynx. As tree seedlings and shrubs recover across the burned areas, snowshoe hares should begin to colonize the area creating foraging habitat for lynx within 10 to 15 years. In lieu of another fire or other stand-replacing disturbance, this feeding habitat would gradually diminish in quality and quantity. This alternative would likely lead to an extensive amount of long-term future potential denning habitat, as there are many acres with high levels of tree mortality (Exhibit Rt-8). Under this alternative, additional insect-killed trees are likely in the future. The long-term effects on lynx are not likely to be negative because additional dead trees would supply denning habitat material and increase conifer seedling and shrub habitat favored by snowshoe hare.

#### Effects to all Action Alternatives

About 1020 acres of units in Alternative B, 112 acres in Alternative C, and 1427 acres in Alternative D are in stands that appear to be suitable lynx habitat (Exhibit Rt-8). Table 3-80 displays the amount of current habitat that would be converted to temporary non-lynx habitat. Table 3-81 displays the change in potential lynx habitats through salvage harvest. However, any areas in the Sheppard and Lower Griffin LAUs that are found during 2008 field visits to be suitable lynx habitat would not be entered for timber salvage, as described in Chapter 2. A small amount of sapling hare habitat and multistory hare habitat is within the boundaries of Units B15 and B24 in Alternative D. This would similarly be dropped if 2008 field surveys warrant it. About 1.3 to 6.9 miles of temporary road would be constructed through lynx habitats (Exhibit Rt-8; Table 3-82), although all of these roads would be closed to motorized public access during and after implementation of the proposal. Reducing impacts on Canada lynx partially drove the development of Alternative C.

The proposed salvage of fire-killed trees in all units can directly affect lynx habitat by reducing future potential denning habitat structures, although denning habitat would not be a limiting factor for the lynx population given the amount and locations of unharvested areas. On the other hand, removal of dead wood in some harvest units could accelerate regeneration into sapling stands preferred by snowshoe hares and hunting lynx and reduce the probability of fire spreading to lynx habitat of higher quality. In other areas that had low or moderate fire severity but do not support snowshoe hares, salvage harvest could reduce the ability of lynx to safely travel across the landscape or between areas of feeding and denning habitat.

**Table 3-80. Temporary Non-lynx (Unsuitable) Habitat and its Increase through Timber Harvest and Fuels Treatment as a Percent of Suitable Habitat across the Analysis Area (Exhibit Rt-8).** The numbers given are acres of change, with resultant percent of each type of habitat in parentheses. Assumes all vegetation manipulation occurs simultaneously.

| **Alternative** | **Temporary Non-lynx Habitat (Unsuitable)*, Increase in Acres (and Resulting Percentage of Suitable Habitat in each LAU**)** | | |
|---|---|---|---|
| | **Lower Griffin LAU** | **Sheppard LAU** | **Upper Good LAU** |
| A (No Action) | + 0 ac (35.5%) | + 0 ac (62.1%) | + 0 ac (21.7%) |
| B | + 265 ac (36.8%) | + 650 ac (65.0%) | + 104 ac (22.0%) |
| C | + 0 ac (35.5%) | + 112 ac (62.6%) | + 0 ac (21.7%) |
| D | + 332 ac (37.2%) | + 978 ac (66.5%) | + 117 ac (22.0%) |

* = Includes additional uncertainty in areas that appear to be “Other (Travel)” Habitat.
** = Percent of LAU does not include “permanent non-lynx habitat” such as dry Douglas-fir habitats, open water, and open rocky areas.

**Table 3-81. Change in Potential Lynx Habitats through Salvage Harvest.** The numbers given are acres of change. Exhibit Rt-8 includes a breakdown of this information by Lynx Analysis Unit.

| **Alternative** | **Sapling Feeding Habitat** | **Multistory Feeding Habitat** | **Multistory Non-feeding Habitat*** | **Other (Travel)**** |
|---|---|---|---|---|
| B | - 0 ac | - 0 ac | - 189 to 469 ac | - 551 ac |
| C | - 0 ac | - 0 ac | - 0 ac | - 112 ac |
| D | - 0 ac | - 8 ac | - 387 to 766 ac | - 653 ac |

* This is provided as a range due to uncertainty of fire-caused tree mortality.
** = Includes additional uncertainty in areas that appear to be “Other (Travel)” Habitat.

**Table 3-82. Miles of Temporary Road Construction in or Adjacent to Lynx Habitats.** Exhibit Rt-8 includes a breakdown of this information by Lynx Analysis Unit.

| **Alternative** | **Sapling Habitat** | **Multistory Feeding Habitat** | **Multistory Non-feeding Habitat*** | **Other (Travel)**** |
|---|---|---|---|---|
| B | 3.0 miles | 0.2 miles | 0.8 to 1.5 miles | 2.2 miles |
| C | 0.5 miles | 0.0 miles | 0.1 miles | 0.7 miles |
| D | 0.6 miles | 0.0 miles | 0.3 to 0.7 miles | 1.2 miles |

* This is provided as a range due to uncertainty of fire-caused tree mortality.
** = Includes additional uncertainty in areas that appear to be “Other (Travel)” Habitat.

Many of the proposed salvage units would be logged in winter, requiring snow plowing on roads. Indirectly, snowplowing can facilitate movement of competitors like coyotes to prey upon snowshoe hares.

The ability of lynx to travel across the analysis area would be most affected by salvage harvest and human access. The effects of cover loss on potential travel routes are discussed in the section above on “Old Growth Habitat and Old Growth Associated Wildlife Species.”

In any one location, lynx presence may overlap with potential disturbance due to salvage harvest, temporary road construction, or other activities. If active lynx denning is discovered in any proposed harvest or burn unit, activities would be modified if needed to protect denning stand conditions and maintain reproductive efforts.

For a discussion of the effects of wildlife mortality and disturbance, helicopter logging, helicopter landings, road obliteration, planting on landings, reclaimed temporary roads, and tree planting, see the section above on "Snags and Downed Wood Habitat" in this chapter. Other aspects of the project, such as burning of landing piles, road rehabilitation, dust abatement, and the application of herbicides along haul roads, would not have measurable effects on Canada lynx. Temporary roads and skid trails are not expected to receive use by over-snow recreationists. For more information on effects relevant to the lynx, see the sections of this chapter on "Old Growth Habitat and Old Growth Associated Wildlife Species" and "Snag and Downed Woody Material Wildlife Habitat."

## Gray Wolf (Recently changed to Sensitive) and Grizzly Bear (Threatened)

### *Introduction*

The gray wolf (Canis lupus) and the grizzly bear (Ursus arctos horribilis) are considered together because they are both wide-ranging species that could occur in any part of the analysis area, and they could be affected in similar ways by proposed activities. The grizzly bear is federally listed as a threatened species on the Flathead National Forest. The removal of the northern Rocky Mountain population of the Gray Wolf from the protection of the Endangered Species Act became official on March 28, 2008.

For wolves, adequate prey base and security from risk of mortality are the two major components that provide survival and recovery value (USFWS 1987, Witmer et al. 1998). Wolves in the Rocky Mountains appear to select landscapes with relatively lower elevation and flatter terrain. Habitat preferences appear to relate more to prey than to cover. The predominant prey of wolves in the northern Rockies is white-tailed deer, with lesser amounts of moose, elk, beaver, and smaller animals. Ungulate winter ranges, usually located in and near valley bottoms, are a critical factor for wolf survival. Another important habitat component appears to be corridors for travel and dispersal, typically with vegetative cover and relatively shallow snow. The effects of timber salvage and insect epidemics on wolves are best defined by effects on their prey, much of which depend on early seral/structural stages interspersed with cover, shelter, and water. Although lesser-used roads and trails can facilitate wolf travel, frequently used roads can reduce wolf habitat security and increase the potential for mortality (Thiel 1985). See Exhibit Rt-12 for more information.

When grizzly bears are away from denning habitat, or other areas that provide sufficient food and security, the effects of actions like timber salvage, fires, and insect epidemics are mostly limited to displacement and changes in the availability of cover. Bears are most vulnerable in areas with many roads and limited cover and escape habitat (Claar 1999). Fire and vegetation management can eliminate cover for security and thermal regulation and short-term changes in food availability (Witmer et al. 1998). Data collected from radio-collared grizzly bears after the Yellowstone fires of 1988 showed that bears tended to avoid burned sites during

1989, but not during subsequent years. The 1988 fires were apparently beneficial to bears, largely due to increased production of foods such as forbs and root crops (Blanchard and Knight 1993). See Exhibit Rt-13 for more background information.

## *Analysis Area*

For this project, the analysis of effects on gray wolves and grizzly bears includes the Brush Creek fire area on the Flathead National Forest as well as the upper portion of Good Creek and the lower portions of Griffin Creek. The cumulative effects boundary also encompasses the portion of the fire on the Kootenai National Forest west of the divide (Exhibit Rg-9). This analysis spans up to 20 years, at which time areas regenerated by this project, as well as the in-growth of trees after the fire, are likely to provide hiding cover. In addition, human activities associated with this project that could disturb or displace bears or wolves would have ceased.

## *Information Sources*

The effects on gray wolf and grizzly bear are discussed in relationship to acres and the spatial arrangement of hiding cover lost, as well as ease of human access. The analysis was done through GIS analysis of the effects of the fire on the landscape and the different types of vegetation management proposed (Exhibits Rb-1, Rb-3, and Rb-7). Hunting season security values were derived through GIS procedures that detected areas of continuous cover further than one-half mile from open roads and motorized trails (Exhibit Rb-1). Road information can be found in Exhibit Rg-8. Effects on connectivity cover are in Exhibit Rg-7.

## *Affected Environment*

In the contiguous 48 states, five areas in mountainous regions of Washington, Idaho, Montana, and Wyoming currently contain populations of wolves. The Sheppard Creek Project area is in the Northwest Montana Wolf Recovery Area (USFWS 1987), where the wolf population has exceeded its recovery goals since 2002 with an expansion in population and range every year since. The states of Montana, Idaho, and Wyoming are expected to manage the population between 900 and1250 wolves (USFWS 2008b).

The U.S. Fish and Wildlife Service recently concluded that the population of wolves in these states has achieved biological recovery objectives. Wolf population trend is upward, and the recolonizing population in northwestern Montana continues to expand. There are now several wolf packs in Montana. The analysis area has sufficient prey to support denning wolves spring through fall, although no wolf dens have been recorded there or on any other part of the Tally Lake Ranger District. Pack activity was recorded once in the analysis area in Fall 2007 (Laudon, pers comm. 2008), and a rendezvous site was detected in the project area in the upper Sheppard drainage in 1998. This and other wolf observations in and near the analysis area are in Exhibit Rt-7.

The analysis area is outside the Grizzly Bear Recovery Zone identified in the Grizzly Bear Recovery Plan (USFWS 1993, p. 59) and referred to as the Northern Continental Divide Ecosystem (NCDE). Federal lands within the proposed project area are designated in the Forest Plan as unoccupied grizzly bear habitat (II-24). However, grizzly bears are reasonably expected to occur throughout the area (Exhibits Rt-5 and Rt-13). The Occupation-beyond-NCDE portion of the analysis area is not "traditional prime habitat" (Tim Manley, pers. comm. 2005). Overall, the forage values for grizzly bears are moderate to low, the availability of travel corridors between forage areas is fair to good, and cover patches are abundant and well dispersed. No known or suspected grizzly bear denning habitat occur in the analysis area or elsewhere in the Salish Range (Tim Manley, pers. comm. 2005; Exhibit Rt-7), and radio-collared grizzly bears using the Salish Range den in the Whitefish Range. No geographic or man-made barriers exist within the area that would preclude grizzly bear movements to adjacent populations or Recovery Areas. Grizzly bears are reported in and near the analysis area (Exhibit Rt-7), although this is only a fraction of the sightings on the Whitefish Range to the east in the NCDE.

Potential wolf and grizzly bear prey is plentiful and well distributed across the analysis area. These are primarily ungulates (white-tailed deer, mule deer, moose, and elk), and beaver. Ungulate populations, especially white-tailed deer, appear to be at healthy numbers (Exhibit Rb-2). No specific ungulate calving or fawning sites have been identified in the analysis area, as these appear to be dispersed. Moose, beaver, and several smaller prey species are also yearlong residents.

The Brush Creek Fire changed the Sheppard Creek drainage from a cover-dominated landscape into an open landscape with only 14 percent of the analysis area providing what is typically thought of as cover (Exhibit Rb-3). Half of this is provided by dense saplings in past regeneration harvest units. Another 19 percent of the fire area provides marginal cover, mostly areas of understory fire where tree boles, tops and limbs of burned trees that have fallen over, and some understory vegetation provide the cover. In areas that burned at a high severity level, big game will probably be relatively scarce for the next few years until substantial vegetation regrowth occurs. Therefore, in areas that burned with a high vegetation severity, wolf and grizzly bear use is expected to be relatively low for the next few years. Across the 76,071-acre analysis area, the fire reduced cover from 84 to 66 percent, although cover is still plentiful and evenly distributed with and foraging habitat is sufficient. For more information about potential prey species, cover, and security from disturbance, displacement, and mortality (see sections in this chapter on "Commonly Hunted Big Game" and "Neotropical Migratory Birds and Riparian Habitat.)"

The relatively dense network of roads in the analysis area provides many opportunities for bears and wolves to forage on roadkills, while also posing a danger to the bears and wolves themselves. The risk of mortality to wolves and grizzlies generally decreases when either the open road density is low and/or when there is a high amount of cover. Across all ownerships, in summer approximately 200 miles across the analysis area are open to public or private motorized use for an Open Road Density (ORD) of 1.8 miles per square mile. Approximately 149 miles are open from fall to spring, with an ORD of 1.4 (Exhibit Rg-8). Looking only at roads on Forest Service land, there are 195 miles open in summer (ORD = 1.7), and 143 miles open from fall to spring (ORD = 1.3). Road restrictions in the analysis area are generally effective (Exhibit Rg-6). For the situation across the larger cumulative effects area for these species, see the Cumulative Effects section below, which also includes information about road densities by Geographic Unit.

The effects of fire suppression actions in 2007 are discussed in the Cumulative Effects section below.

## *Environmental Consequences—Gray Wolf and Grizzly Bear*

### Direct and Indirect Effects

#### Alternative A- No Action

No additional actions such as timber salvage, temporary road construction, road rehabilitation, herbicide spraying, and planting are proposed with this alternative. Since a large proportion of a grizzly bear's diet is plant material, including roots/tubers, leaves of grasses and forbs, and a variety of berries, the post-fire condition could be relatively attractive to grizzly bears (Blanchard and Knight 1993). An abundant ungulate prey base taking advantage of new vegetative growth in the fire area would be beneficial to both grizzlies and wolves. During subsequent seasons, the area would increasingly become more valuable for the next 30 to 40 years. This alternative would provide a relatively disturbance-free burned-area landscape condition that grizzly bears and wolves could exploit without having to avoid human presence. See the "Commonly Hunted Big Game" section of this chapter for more information.

#### Effects to all Action Alternatives

Each of these alternatives would, through a combination of helicopter and ground-based logging systems equipment, remove trees burned by the Brush Creek Fire. Timber salvage and temporary road construction in these alternatives would affect cover used by large mammals such as wolves or grizzlies and their prey, as discussed in the section in this chapter on "Commonly Hunted Big Game." The short-term loss of hiding cover would occur on from 733 acres (Alternative C) to 2251 acres (Alternative D) (Exhibit Rb-3). Most of this would be marginal cover, where limby dead trees provide a residual level of cover value for large mammals such as ungulates, grizzlies, and wolves. Salvage harvest would reduce the available secure habitat, as defined for elk during hunting season, particularly in Alternatives B and D. See the "Big Game" section of this chapter for more information.
Temporary displacement of individual wolves or grizzly bears might occur during preparation or implementation of activities. There would be no direct or indirect effects on wolves or grizzlies from disturbance to key habitat areas such as den sites, rendezvous sites, or whelping sites in or beyond the area where this project is proposed. Helicopter logging could lead to disruption of normal wolf and bear routines and may affect breeding and foraging behaviors.

The action alternatives are not expected to have any direct, indirect, or cumulative effects to grizzly bear denning habitat or high quality food sources. As a result of the action alternatives, there should be an increase in the quality of forage for ungulates. Due to disturbance and displacement, there could be a minor effect on prey species' habitat use patterns, but not their population levels or availability as prey. Other prey items, such as beavers, would not be affected.

Based on the nature and duration of the proposed project, the mortality risk for both wolves and grizzly bears would remain low-to-moderate. If gray wolf denning or rendezvous sites are identified in the project area in the future, existing Flathead Forest Plan standards and guidelines would be implemented to ameliorate potential adverse effects. The same would be true of grizzly bear dens, although this is extremely unlikely.

For a discussion of the effects of helicopter logging, helicopter landings, temporary road construction, road obliteration, planting on landings, reclaimed temporary roads, and tree planting, see the sections above on “Snags and Downed Wood Habitat” and “Big Game” in this chapter. Other aspects of the project, such as burning of landing piles, road rehabilitation, dust abatement, and the application of herbicides along haul roads, would not have measurable effects on grizzly bears and wolves.

## Cumulative Effects

### Threatened Wildlife Species

Timber harvest, fuel reduction, and pre-commercial thinning have altered the availability of cover habitat, prey habitat, lynx denning structures, and forested connectivity. This is discussed in general in the sections on “Old Growth and Old Growth Associated Wildlife Species” and “Snag and Downed Wood Habitat” in this chapter. These habitats have been harvested across national forest, corporate, and private lands (Table 3-65 [in deadwood cumulative effects]), typically leaving low amounts of cover and snags and large downed wood (Exhibit Rg-1). In past harvest units, snowshoe hares recolonized habitat as sapling trees filled in, and cover values simultaneously returned for large predators. Past pre-commercial thinning occurred on approximately 9760 acres across the analysis area, temporarily reversing this trend on small patches.

About 960 acres (four percent) of the Brush Creek Fire area was salvaged by the Gregg-Plume Timber Sale in 2007 and early 2008, leaving most of the larger larch and Douglas-fir (Exhibit Rd-14). The unburned portion of the sale would be harvested in the next one to three years. None of the Gregg-Plume units within the Brush Creek Fire area would remove any areas of living forested cover, nor would any lynx foraging habitat inside or outside the fire be affected. However, the salvage units would further reduce the quality of hiding cover that is provided by the dead trees, particularly in the low-intensity/high severity burn areas. Gregg-Plume units would not have any additional effect on fall security area, road densities, or temporary road openings, although lynx, grizzly bear, and wolf may be disturbed or displaced by harvest, thinning, burning, road construction, or other activities.

The Kootenai National Forest (KNF) is proposing to salvage approximately 563 acres (23 percent of the Brush Creek Fire area on Kootenai NF land) (USFS 2008a; Exhibit U-3). The Biological Assessment for this “Brush Creek Fire Salvage Project” has a Not Likely to Adversely Affect determination for all three species. According to the Environmental Assessment, point source disturbances during salvage may displace or disturb grizzly bears or wolves or their prey species, but disturbance from open and temporary road use would not increase. Ungulate prey conditions would be maintained, except for an issue with open road density in KNF Management Area 12 in the Little Wolf Watershed. Known or historic denning or rendezvous sites would not be affected, although the Wolf Prairie Pack uses the Little Wolf watershed as a portion of their home range. For lynx, the 14,500-acre Lynx Analysis Unit has 17 percent in unsuitable habitat due to timber harvest and wildfire. The proposed salvage activities would not move lynx habitat toward the desired conditions that are described in objectives VEG 01, 02, 03, and 04, but the project would not result in exceeding or violating any standards and guides set out by the Lynx Amendment.

Suppression of the 2007 Brush Creek Fire had many effects on Canada lynx, grizzly bears, and gray wolves, mostly in terms of loss of cover above that burned by the fire and disturbance and displacement from helicopters, heavy machinery, vehicles, and crews. Suppression required the felling and removal of numerous live and dead trees from approximately 43 miles of dozer line and hand line, about 174 acres of shaded fuel break, about 53 acres of safety zones, and about 1820 acres of hazard tree areas, as described in the "Snags and Downed Wood Habitat" section of this chapter. According to the Endangered Species Act Emergency Fire Consultation Checklist (Exhibit Rt-14) prepared October 19, 2007, nearly 74 miles behind yearlong or seasonal gates got intensive use, and 17.8 miles of bermed roads that had revegetated were temporarily reopened. Both base camps of the Flathead N.F. side were in residential areas in Star Meadow and on Farm to Market Road. From 300 to 600 people slept at these camps, but food and other attractants were attended, with daily garbage pick-up. All personnel were required to follow the provisions of the Northern Continental Divide Ecosystem Food Storage Special Order (Exhibit Rt-14) while on the fire. Specific to Canada lynx, suppression of the 2007 Brush Creek Fire reduced lynx foraging habitat by 143 acres, and non-foraging habitat by 88 acres. The greatest impact resulted from over 10 miles of the shaded fuelbreak in the Gregg and Plums Creek drainages outside the fire area. Burned Area Emergency Restoration activities, to be completed in 2008, include some activities that could cause minor displacement of threatened wildlife. For more information about these fire suppression and rehabilitation impacts relevant to threatened wildlife, see the "Old Growth Habitat and Old growth Associated Species," "Commonly Hunted Big Game," and "Neotropical Migratory Birds and Riparian Habitats" sections of this chapter.

Between April and July, 2008, several thousand people are expected to harvest mushrooms from 24,700 acres in the burned area on the Flathead National Forest. The March 2008 Biological Assessment for the "Brush Creek Wildfire Mushroom Harvest Project" (Exhibit Rt-14) has a Not Likely to Adversely Affect determination for all three species. Intense mushroom collection may disturb or displace lynx, wolves, and bears using the area, although relatively undisturbed forested habitat would still be available nearby. The wolf prey base (ungulates) is not expected to be occupying burned areas in pre-fire numbers during the first spring post-fire. Therefore, displacement effects on ungulates are expected to be minimal. To reduce potential impacts on bears and other wildlife, all permit holders for commercial harvest and camping will be required to comply with the food-storage and sanitation order and designated commercial campsites will have bear resistant dumpsters provided and daily Forest Service patrols should help minimize the risk of bears getting into human garbage and/or foods.

Cattle grazing may reduce the availability of vegetation eaten by grizzlies. Livestock grazing on private land in the upper elevations of the project area may have affected prey availability for lynx. Grazing has been suspended in the burned portion of the Swaney Allotment for two years, which will reduce weed spread and sedimentation in streams and wetlands. There has been no indication of wolves or grizzlies preying on stock in this area, and no predator control efforts are ongoing or anticipated.

Beaver control and fish habitat restoration may have changed and may continue to have minor changes on the prey that are available to threatened species. Beaver control has reduced the amount of moist habitat that supports other prey species.

Roads constructed across the analysis area have facilitated access for trapping, hunting, firewood cutting, and other exploits, as discussed in the "Snags and Downed Wood Habitat" section of this chapter. Firewood cutting along open roads has decreased downed logs particularly important for lynx and their prey species. Brushing of saplings along roadsides on most USFS roads in lynx habitat has reduced their value to snowshoe hares. Across the analysis area, open and closed roads facilitate human access, contributing to the risk of mortality or displacement (Exhibits Rg-5, Rg-8, and Rt-5). The densities of open roads on Forest Service land are shown in Table 3-69. Any road that is open seasonally or yearlong is considered as open, as these roads would be open during all or part of grizzly bears' non-denning season (April 1 to November 20). This definition is equivalent to "unrestricted road," as used in the Flathead Forest Plan. Restricted roads are physically closed yearlong by a gate, berm, or revegetation. Administrative uses of closed roads for reforestation or road-related work may also affect grizzly bear use of the area. These and other activities such as routine road maintenance, watershed improvements, trail reconstruction, and measures to control weeds are foreseeable and scheduled to occur. An increased emphasis on road closures over the last 15 years appears to have had a positive effect on ungulate survivability during hunting seasons.

Recreation activities in the area that could disturb or displace lynx, grizzlies, and wolves include boating, fishing, hiking, camping, motorized trail use, and cycling. Snowmobile access, which can provide easy winter access for trappers and possibly competitors, is generally limited on Forest Service lands in the analysis area, due to short seasons and relatively shallow snows. The analysis area is close to several population centers and is easily accessed. Most of the residents in the analysis area live there year round and subdivision and construction appear to be accelerating.

Hunting, trapping, and predator control of lynx, bears, and wolves may have had the greatest cumulative impact. Lynx, apparently much more common during pre-European times, were extremely scarce in the first half of the last century in Montana. The lynx trapping is currently closed in Montana. No further predator control efforts are anticipated although these species may have been affected by this in the past.

**Table 3-83. Open Road Densities by Geographic Units (GUs) in the Cumulative Effects Area to Compare with Forest Plan Direction (Rg-5 and Rt-17).**

| | Upper Good Creek | Star Meadow – Logan Creek | Sylvia Lake | Upper Griffin |
|---|---|---|---|---|
| Percent in Cumulative Effects Analysis Area | ~70% | ~35% | 100% | ~10% |
| Acres, All ownerships | 42,790 acres | 58,235 acres | 22,314 acres | 28,440 acres |
| Acres, USFS only | 41,660 acres | 48,973 acres | 21,487 acres | 22,037 acres |
| Maximum Flathead N.F. LRMP Open Road Density by GU | 1.3 to 1.8 miles/square mile | 1.8 to 2.2 miles/square mile | 1.3 to 1.8 miles/square mile | 2.0 to 3.2 miles/square mile |
| Existing Unrestricted Road Density by GU | 1.5 miles/square mile | 1.7 miles/square mile | 1.0 miles/square mile | 0.8 miles/square mile |
| Existing Restricted Road Density by GU | 1.1 miles/square mile | 1.6 miles/square mile | 1.4 miles/square mile | 0.8 miles/square mile |
| Total Unrestricted miles allowed under Road Density Standard | 85 to 117 miles | 138 to 168 miles | 44 to 60 miles | 69 to 110 miles |
| Existing Unrestricted miles in each GU | 100.2 to 101.2 miles | 128.6 to 129.9 miles | 34.0 to 34.4 miles | 28.7 to 29.0 miles |
| Existing Restricted miles in each GU | 72.2 to 73.0 miles | 123.6 to 124.8 miles | 45.9 to 46.4 miles | 28.5 to 28.8 miles |

Disturbance from other human activities has occurred over time and is expected to continue. These include road and trail maintenance and construction, road reclamation, timber harvest and salvage, campground construction and improvements, mineral extraction, weed control, site preparation and reforestation, pre-commercial thinning, fuel reduction, bark beetle control, prescribed fire, livestock grazing, fish habitat restoration, and mineral extraction.

No geographic or man-made barriers exist within the analysis area that would preclude lynx, wolf, or grizzly bear movements to adjacent populations or Recovery Areas.

Human access, available cover, and public attitudes largely determine mortality risk to lynx, wolves, and grizzly bears. There have been some grizzly and wolf mortalities due to management removal, mistaken identity, and highway mortality in and near this area. In consideration of habitat conditions, human use, human dwellings, roaded access, and the number of reported observations, the mortality risk to these three species is considered low-to-moderate. The spring black bear hunting season, administered by Montana Department of Fish, Wildlife, and Parks, is expected to continue in the analysis area, leading to a risk of shooting a grizzly bear due to mistaken identity.

There is no mandatory food storage order in or beyond the Occupation-beyond-NCDE Area outside the recovery zone, but its conditions are generally applied to USFS permitees, particularly those involving camping. However, food conditioning of grizzly bears occurs on private lands adjacent to the Forest and the potential for adverse impacts to grizzly bears on the Forest does exist. Brown Bear Resources (2003; Exhibit Rt-6) identified no grizzly bear attractants in the Tally Lake Ranger District. It is expected that agriculture and other vegetation alteration would continue on adjacent private holdings. This may result in management elimination of some grizzlies and a reduction of natural food sources.

These species' affected environment described above has been shaped by past and present cumulative effects. These effects would be cumulative with those discussed above for each alternative. Cumulative effects relevant to lynx, grizzly bears, and gray wolves are further discussed in sections on "Old Growth Habitat and Old Growth Associated Wildlife Species," "Neotropical Migratory Birds and Riparian Habitat," and "Snags and Downed Wood Habitat" in this chapter, and in Exhibits Rs-9 and Rt-14. See the "Commonly Hunted Big Game" section of this chapter for information about factors such as hiding cover for large mammals, secure habitat, and roads. For an assessment of these species' viability at the Forest level, see the Final Environmental Impact Statement for the Flathead's Forest Plan Amendment 21 (USDA 1999a) and Exhibit Rg-1.

## REGULATORY FRAMEWORK AND CONSISTENCY

The Forest Service is required by the National Forest Management Act (NFMA) to "provide for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives," 16 USC 1604(g)(3)(B). To implement NFMA, the Forest Service's regulations, implemented on April 21, 2008, state that "the overall goal of the ecological element of sustainability is to provide a framework to contribute to sustaining native ecological systems by providing ecological conditions to support diversity of native plant and animal species in the plan area." A goal under the Flathead Forest Plan, as directed in Amendment 21 (USDA Forest Service 1999a), is to "ensure that Forest Service actions do not contribute to the loss of viability of native species." See the analysis of forest-level viability of threatened and endangered wildlife species for Flathead National Forest's Forest Plan Amendment 21 and Exhibit Rg-1.

Threatened or endangered status affords a species and its habitat special protection from adverse effects resulting from federally authorized or funded projects. It is the responsibility of the Forest Service to design activities that contribute to the recovery of listed species in accordance with recovery plans developed as directed by the Endangered Species Act (ESA) (50 CFR part 402). The Flathead National Forest's Amendment 21 to the Forest Plan has a goal to "provide sufficient habitat to promote the recovery of threatened and endangered species and conserve the ecosystems upon which they depend." Section 9 of the Endangered Species Act of 1973, as amended, requires threatened and endangered species be protected from "harm" and "harassment" wherever they occur, regardless of recovery boundaries.

A Biological Assessment for Threatened and Endangered Wildlife Species (Exhibit Rt-4) will be prepared for the Preferred Alternative prior to the decision. U.S. Fish and Wildlife Service consultation is in Exhibits Rt-2 and Rt-3. If any active nesting, denning, or rendezvous sites for threatened or endangered wildlife species are discovered in any proposed harvest or fuel reduction unit, area of road construction or similar activity, activities would be modified, if needed, to protect habitat conditions and maintain reproductive efforts.

Canada Lynx – The contiguous United States population segment of the lynx, including Montana, became a threatened species on March 24, 2000. The Final EIS and Record of Decision for the Northern Rockies Lynx Management Direction (Lynx Amendment) were completed in March 2007 (Exhibit Rt-15). This decision amends the Flathead Forest Plan by providing lynx habitat management objectives, standards and guidelines (Table 3-84).

Although largely based on the earlier strategy, the 2007 decision replaces the interim application of the Lynx Conservation Assessment and Strategy (LCAS) (Lynx Biology Team 2000; Exhibit Rt-15). Proposed critical habitat for lynx was published on February 28, 2008, including the entire analysis area for this project (Exhibit Rt-15). Conferencing with the U.S. Fish and Wildlife Service is mandatory when the Forest Service determines that a Forest Service action is likely to jeopardize the continued existence of any species proposed for listing or is likely to result in the destruction or adverse modification of proposed critical habitat.

**Table 3-84. Northern Rockies Lynx Management Direction Relevant to the Sheppard Creek Post-Fire Project** (Exhibit Rt-15).

| | |
|---|---|
| Standard ALL S1 | New or expanded permanent development and vegetation management projects must maintain habitat connectivity in an LAU and/or linkage area. |
| Objective VEG O1 | Manage vegetation to mimic or approximate natural succession and disturbance processes while maintaining habitat components necessary for the conservation of lynx. |
| Objective VEG O2 | Provide a mosaic of habitat conditions through time that support dense horizontal cover, and high densities of snowshoe hare. Provide winter snowshoe hare habitat in both the stand initiation structural stage and in mature, multi-story conifer vegetation. |
| Standard VEG S1 | Unless a broad scale assessment has been completed that substantiates different historic levels of stand initiation structural stages limit disturbance in each LAU as follows: If more than 30 percent of the lynx habitat in an LAU is currently in a stand initiation structural stage that does not yet provide winter snowshoe hare habitat, no additional habitat may be regenerated by vegetation management projects. |
| Standard VEG S6 | Vegetation management projects that reduce snowshoe hare habitat in multi-story mature or late successional forests may occur only: 1. Within 200 feet of administrative sites, dwellings, outbuildings, recreation sites, and special use permit improvements; 2. For research studies or genetic tree tests evaluating genetically improved reforestation stock; or 3. For incidental removal during salvage harvest (e.g. removal due to location of skid trails). |
| Guideline VEG G5 | Habitat for alternate prey species, primarily red squirrel, should be provided in each LAU. |
| Guideline VEG G11 | Denning habitat should be distributed in each LAU in the form of pockets of large amounts of large woody debris, either down logs or root wads or large piles of small wind-thrown trees. |
| Guideline HU G9 | On new roads built for projects, public motorized use should be restricted. Effective closures should be provided in road designs. When the project is over, these roads should be reclaimed or decommissioned, if not needed for other management objectives. |

Grizzly Bear – The grizzly bear is listed as Threatened in Montana and is protected under the Endangered Species Act. The analysis area is outside the recovery zone known as the Northern Continental Divide Grizzly Bear Ecosystem (USFWS Grizzly Bear Recovery Plan 1993). It is listed in the Forest Plan as “unoccupied grizzly bear habitat,” based on habitat suitability combined with lack of consistent grizzly observations. However, grizzly bears are reasonably expected to occur anywhere in the analysis area (Exhibit Rt-13). Forest Plan direction includes pages II-24 through II-33 and Amendments 8, 9, and 11. Interagency Grizzly Bear Guidelines (1986) were adopted as Forest Plan Appendix OO. Numerous aspects of Forest Plan direction that apply to the analysis area are positive for grizzly bears (Exhibit Rt-5).

Gray Wolf – The Final Rule to Establish a Gray Wolf – Northern Rocky Mountain Distinct Population Segment and Remove from the Federal List of Threatened and Endangered

Species was published on February 27, 2008. See the "Sensitive Wildlife Species" section of this chapter and Exhibit Rs-3 for regulatory framework and consistency for this species.

**Threatened Wildlife Species Determination Statements:**

A. Canada Lynx – Based upon the location and nature of the proposed project and the analysis of potential impacts and cumulative effects, a determination of "May affect -- not likely to adversely affect" has been made for all alternatives. For Alternative A, this is due to cumulative effects. For Alternatives B, C, and D, this is due to temporary road construction, reduction in travel cover, snow plowing, and potential disturbance. All alternatives would be consistent with the direction found in the Northern Rockies Canada Lynx Direction (Exhibit Rt-15). Alternatives B and D have proposed salvage units in some stands that may still qualify as snowshoe hare habitat in multi-story mature or late successional forests, which would appear to violate Standard VEG S6. Alternatives B, C, and D would regenerate 112 to 653 acres of suitable lynx habitat in one or more LAUs that have more than 30 percent of their lynx habitat in a stand-initiation structural stage, inconsistent with Standard VEG S1. However, areas found during 2008 field visits to match these habitats, or where this is still uncertain at the time of unit layout, will not be entered for timber salvage, as described in Chapter 2. The project is not likely to result in the destruction or adverse modification of proposed critical habitat.

B. Grizzly Bear – Based upon the location and nature of the proposed project and the analysis of potential impacts and cumulative effects, a determination of "May affect -- not likely to adversely affect" has been made for all alternatives. For Alternative A, this is due to cumulative effects. For Alternatives B, C, and D, this is due to a short-term loss of hiding cover, disturbance, and temporary displacement.

# SENSITIVE WILDLIFE SPECIES

## Introduction

Sensitive wildlife species (Tables 3-52 and 3-53, above, and Exhibit Rs-1) are designated by the Regional Forester (FSM 2670.5) and managed under the authority of the National Forest Management Act. The Regional Forester removed the northern goshawk from the sensitive species list in July 2007 (Exhibit Rs-1). It is still analyzed for the forest as an old growth associate (Exhibit Q-12). The bald eagle was delisted in the lower 48 States on July 9, 2007. It will now be addressed as a sensitive species on the Flathead National Forest. Similarly, the Gray Wolf became a sensitive species after delisting of the Northern Rocky population on March 28, 2008. Because this was such a recent change, most of the information pertaining to the wolf is found in the "Threatened Wildlife Species" section of this chapter. Regulatory Framework and Regulatory Consistency for wolf is found in this section on Sensitive Wildlife Species. Due to similarities in most aspects of their habitat needs and many potential effects, the bald eagle and common loon were combined below, as were the northern leopard frog, western (boreal) toad, northern bog lemming, and Townsend's big-eared bat.

The peregrine falcon, harlequin duck, and flammulated owl are sensitive wildlife species that would not be affected by this project and thus will not be discussed further (Table 3-52, above; Exhibits Rs-2, Rs-7, Rs-15, and Rs-26). The Biological Evaluation for Sensitive Wildlife Species has been incorporated into the text of this document, with a separate signature page in the project file (Exhibit Rs-3). This section on Sensitive Wildlife Species is divided into separate subsections for each species, with environmental consequences following the affected area for each. Information about the Regulatory Framework and Regulatory Consistency for each species is at the end of this section. For literature cited, see Exhibit Rs-18.

## Bald Eagle and Common Loon

### *Introduction*

The bald eagle (*Haliaeetus leucocephalus*) was delisted in the lower 48 States on July 9, 2007 and then became a USFS Region One Sensitive Species. Timber harvest, wildfire, underburning, and other vegetation manipulation can impact current and potential nesting habitat by removing nest trees and screening cover. Away from their nests, bald eagles are most likely to feel the effects of timber harvest and insect epidemics through indirect effects on their food sources, such as changes in habitat quality for an aquatic prey species. Also, disturbance of eagles may increase and the availability of perch, roost trees, or security near foraging sites may decline. Stand-replacing fire spreading to nest stands can destroy potential nest trees and associated live vegetation and perches. Understory fires can create snags used for nesting or perching and can increase the chances that a forested stand would persist.

In Montana, bald eagles nest in stands containing very large trees with uneven canopy structure and in direct line of sight of a large river or lake generally less than one mile away (Montana Bald Eagle Working Group 1994). Bald eagles are opportunistic feeders. They prey on fish, waterfowl, and small mammals; steal food from other predators; and scavenge carrion. During the breeding season, important foraging habitat may be ten miles or further from their nest.

The common loon (*Gavia immer*) is also a USFS Region One Sensitive Species. Loons are totally dependent on water and are exceedingly awkward on land. They typically nest in shallow bays with vegetative cover, on lakes larger than 20 acres. Fish make up about 90 percent of a loon's diet, and clear water is required for their underwater foraging. The quality and quantity of water flowing into lakes affects their ability to support prey species as well as influencing water clarity. Water level fluctuations during nesting season can flood a nest or leave it high and dry, both of which are likely to cause failure. During the nesting season, Montana's loons are extremely sensitive to human disturbance. Timber harvest, insect epidemics, and fire can affect loons by altering the quantity and quality of water flowing into their nesting lakes. Timber salvage and hauling the timber in action alternatives could cause the disturbance of nesting or feeding habitat.

## *Information Sources*

Effects specific were evaluated by overlaying GIS-generated maps of Sylvia Lake with proposed activities. See also the "Fisheries" and "Hydrology" sections of this chapter. Wildlife population diversity concerns at the Flathead National Forest and larger scales are assessed in Exhibit Rg-1.

## *Analysis Area*

The boundary for cumulative effects includes the fire area and extends downstream to include Star Meadow (Exhibit Rg-9). This area takes into account potential effects on downstream water quality. This area does not support bald eagle or common loon nesting habitat, has limited foraging habitat, and is large enough to evaluate the effects of the alternatives within this area. All of the actions proposed in the alternatives are contained within this area. For this project, the analysis of effects on bald eagles and loons is 15 years, at which time actions with the potential for disturbing eagles and loons would be complete. In addition, regrowth of hiding cover for ungulates eaten by eagles as carrion and riparian area stabilization would have likely occurred. For more information about effects analysis methods, conclusions, and cumulative effects, see the "Hydrology" and "Fisheries" sections of this chapter and Exhibit Rr-7.

## *Affected Environment*

The Brush Creek Fire area is located in the Pacific States Bald Eagle Recovery Area and in Management Zone 7 (Upper Columbia Basin), which includes all of Montana west of the Continental Divide. This zone is in the middle of the core population and produces almost 40 percent of the eaglets produced in the state (Exhibit Rg-1). In the 2006 nesting season, there were 151 active bald eagle nests in western Montana (Exhibit Rt-7). Bald eagle populations and productivity are increasing in Zone 7, as well as across the state (Exhibit Rg-1). Population growth has been attributed largely to the substantial reduction of environmental contaminants. There are no bald eagles nesting within the Brush Creek Fire area. Three active bald eagle nests are within ten miles of the Brush Creek Fire to the east and south, with the third nest lying southwest of the fire area on private land within the Kootenai National Forest boundary. The Salish Mountains are not a documented migratory route, nor are there historical or currently known areas in or near the Brush Creek Fire area where bald eagles congregate to roost or feed.

There are no water bodies in the Brush Creek Fire area or analysis area that are large enough to support bald eagle nesting. Sylvia Lake, the only lake in the analysis area, has been used for summer foraging. The Brush Creek Fire burned the landscape adjacent to Sylvia Lake almost entirely around the lake. The fire did not appear to harm the fisheries in the lake, so foraging habitat for eagles and loons should still be available. Because the Brush Creek Fire area does not provide deer or elk winter range (Exhibit Rb-8), there is no concentrated winter foraging habitat available in the form of winter kills or road kills.

The southern edge of the common loon's breeding range extends into the United States across many of the northeastern states and into the Rocky Mountains. Northwest Montana supports nearly all of the loon reproduction in the western United States. The original extent of the population is unknown, although populations have declined with the settlement of the west. Currently, there are around 60 successfully breeding pairs and approximately 200 birds in the total Montana population (Evers 2004).

Sylvia Lake is the only water body in the analysis area large enough to support loon nesting. This lake is a high elevation lake that typically still holds ice at the time loons would be nesting. There are no documented reports of loons having ever nested on this lake, although loons have been observed feeding on it. The closest loon nesting lake downstream of the watersheds in the Brush Creek Fire area (Tally Lake) is below Star Meadow (just downstream of the fire area) which would act as a filter system for sediment generated by the fire or harvest activities. See the "Water Resources" and "Fisheries" sections of this chapter for more information. For more information about these two species and their habitat at various scales, including that of the Flathead National Forest, see Exhibit Rg-1.

## *Environmental Consequences*

### <u>Direct and Indirect Effects</u>

### Alternative A – No Action

No additional actions such as timber salvage or temporary road construction are proposed with this alternative. This alternative would leave all trees within the burn area standing. This would lead to a larger number of snags that could be used by eagles for perching, especially around the known feeding site of Sylvia Lake. Approximately three-quarters of the road/stream crossings were burned during the Brush Creek Fire. The fire burned off vegetation growing in ditches, which is expected to increase erosion rates into the streams. None of these roads would receive Best Management Practices (BMP) improvements in this alternative. However, the net impact of the alternatives would not threaten the fish population in downstream feeding lakes, such as in Tally Lake, which supports quality feeding habitat. See sections on “Fisheries” and “Hydrology” in this chapter.

**Effects Common to All Action Alternatives**

Because of the absence of bald eagle or common loon nesting habitat within the analysis area, and the lack of a concentrated winter foraging for eagles, this effects analysis will address the summer foraging habitat provided by Sylvia Lake Exhibits Rs-21 and Rs-22).

All action alternatives propose the summer/fall logging of unit 90 which lies approximately 200 feet east of Sylvia Lake, adjacent to the 538B road. This unit would require approximately 0.7 miles of temporary road construction which would be built during the summer just prior to logging. After harvest is completed, this temporary road would be obliterated. All action alternatives also include the harvest of unit 92, which is over 0.5 miles from the lake and not visible from the lake. Both these units would use Road 538B as their haul road, passing directly by Sylvia Lake. Logging activities in unit 90, temporary road construction and obliteration, and log truck traffic passing by the lake have the potential to disrupt foraging bald eagles and loons. There are some standing trees between the road and the lake that may help screen the passing trucks. These units total only 48 acres, and therefore should be logged in a relatively short time, limiting the time that eagles and loons may be disrupted from feeding.

All action alternatives also propose winter logging units within one-half mile of Sylvia Lake. Because these units would be logged in the winter, no disruption to eagle feeding is expected to occur. Although the fire burned almost the entire perimeter of the lake, there would still be green trees along the northwestern portion of the lake, as well as snags around the entire lake that would provide perch trees.

The effects of possible displacement of loons and eagles are expected to be minor for the following reasons: loons and eagles have been only occasionally sighted at Sylvia Lake, Sylvia Lake is a high elevation lake that is not known to support concentrated feeding; and there are many high-quality foraging sites that are located in lower elevations closer to the known nesting lakes such as Tally Lake and Lower Stillwater Lake.

Best Management Practices such as road repair and culvert replacements would have positive benefits for bald eagle food sources. Shrub planting in and around some harvest units near riparian areas would enhance habitat values for a variety of species preyed upon by bald eagles.

**Alternatives B and D**

In addition to the effects described above, Alternatives B and D include a 30 and 43 acre (respectively) unit located approximately 800 feet north of Sylvia Lake that could be logged in the summer. The 30 acre unit in Alternative B would be harvested with ground-based systems while the 43 acre unit in Alternative D would be helicopter logged. These units are not in direct line of sight of the lake because of the topography, and therefore may not cause as much of a disruption as units that are visible from the lake. The logs from these units would not be hauled by Sylvia Lake. Helicopter operations in the immediate vicinity of Sylvia Lake would be restricted for public safety and wildlife security. The small size of these units should allow them to be logged in a relatively short time, limiting the time that loons may be disrupted from feeding. Helicopters have been known to flush nesting birds; the effects they have on foraging birds are less known.

**Alternative C**

The effects of this alternative were discussed above in the "Effects Common to All Action Alternatives."

**Cumulative Effects**

**Effect Common to all Alternatives**

Past timber harvest, road construction and maintenance, fires, private land development, and riparian disturbances have also created much of the existing habitat conditions found within the analysis area as well as across the Flathead National Forest. The Brush Creek Fire has created the most recent large change on the landscape, as well as the Little Wolf Fire of 1994. The Brush Creek Fire burned hot enough to affect snags within and adjacent to riparian habitat. Water quality and quantity are expected to experience changes from the pre-fire condition.

The discussion below summarizes some of past, current, and reasonably foreseeable activities that are listed in Chapter 1 of this document and discussed in detail in Exhibits Rr-7 and Rs-9. Past, ongoing, and planned timber harvest and further cumulative effects relevant to bald eagles are also discussed in sections on "Hydrology," "Fisheries," "Old Growth Habitat and Old Growth Associated Wildlife Species," "Neotropical Migratory Birds and Riparian Habitats," and "Snags and Downed Wood Habitat" in this chapter, and in Exhibit Rr-7. For an assessment of this species' viability at the Forest level, see the Final Environmental Impact Statement for the Flathead's Forest Plan Amendment 21 (USDA 1999a) and Exhibit Rg-1.

Vegetation Management

Past timber sales and associated activities have created much of the existing habitat conditions (vegetation and roads) for the bald eagle within the analysis area. Currently, implemented timber sales include the Gregg-Plume sale located in upper Good Creek. Harvest of the burned portion of this sale took place in the winter of 2007-8. The unburned portion would be logged in the next one to three years. The Kootenai National Forest is proposing to salvage harvest approximately 600 acres of timber burned in the Brush Creek Fire (Exhibit U-3). Timber hauling could occur down the Sheppard Creek road starting the summer of 2008; removal of timber felled near roads for the purpose of protecting public safety during the Brush Creek Fire would be removed and is scheduled to be completed in 2008. During logging operations, there may be short-term disturbance to snag and riparian-dependent species. Motor vehicles can kill or injure bald eagles, particularly when they are heavy and lethargic from consuming road-kill deer.

Past harvest on Plum Creek lands, within the analysis area, includes 250 acres of regeneration harvest in the past 40 years. This activity is expected to continue. Private and State land represent approximately five percent of the analysis area. Salvage harvest may be occurring on some or all of the remaining 80 acres not already harvested prior to the fire. These activities may result in localized disturbance and potential loss of habitat such as decreased roost sites, and screening cover within harvest areas.

It is expected that ongoing and reasonably foreseeable salvage harvest and associated activities within the cumulative effects analysis area would contribute localized and minor effects to habitat loss, increased fragmentation or connectivity on the landscape, or habitat parameters required by the bald eagle.

Private Land Development and Vegetation Management on Private Land

Land development, including the construction of roads, clearing of vegetation, construction of residences, installation of improvements, as well as vegetation management, can create a variety of changes to the landscape. Depending on the magnitude, type, and location of developments and the amount of private land on the landscape, these activities can have varied effects, including habitat loss, and localized disturbance. Since no nesting habitat is present within the cumulative effect area boundary, the main effect of these activities would be to water quality that provides downstream feeding habitat. The majority of private land development near the fire area has occurred in the Star Meadow and Good Creek communities. The rate of development has been recently increasing.

Firewood Gathering

Motorized access has greatly facilitated the removal of potential roost snags for firewood. Firewood gathering on National Forest land is a permitted use that occurs along most open roads; however, during the salvage activities, a temporary closure order would be in place to restrict firewood cutting in the Brush Creek Fire area. Over time, the availability of snags and down wood will be reduced along the road influence zone. Firewood gathering can also cause minor short-term localized displacement to species using the area. Ongoing and reasonably foreseeable firewood gathering activities within the Cumulative effects Analysis Area will cumulatively result in localized and minor effects on snag habitat and associated wildlife species. See the “Snags and Downed Wood Habitat” section of this chapter for more information.

Mushroom Harvest

Between April and July, 2008, several thousand people are expected to harvest mushrooms from 24,700 acres in the burned area on the Flathead National Forest. The possibility of disturbance of foraging loons with increased visitor use at Tally Lake led to a “May Impact Individuals and Habitat” determination for the common loon (Exhibit Rs-9).

Riparian Disturbances

Burned Area Emergency Restoration (BAER) activities in the Brush Creek post-fire environment include activities located in the riparian areas. Road reclamation is also planned for 2009 and 2010. These activities may cause short term disturbances with an increase in sedimentation to the stream, but result in long term benefits to the riparian systems. Grazing has been suspended in the burned portion of the Swaney Allotment for two years, which will reduce weed spread and sedimentation in streams and wetlands. Recreation activities in the area that could disturb bald eagles include boating and fishing.

## Black-Backed Woodpecker

### *Introduction*

The black-backed woodpecker (*Picoides arcticus*) is closely associated with recently burned forest habitats and depends heavily on the larvae of wood-boring beetles. A dynamic mosaic of recent burns across a landscape may be required to sustain populations (Dixon and Saab 2000, Wisdom et al. 2000). In western Montana, black-backed woodpeckers appear to be strongly dependent upon one to six year-old burns (Hutto 1995a, Caton 1996, Hitchcox 1996, Hejl and McFadzen 2000, Saab et al. 2004). Black-backed woodpeckers seem to primarily use areas that burned at moderate to high severities and that support high densities of bark beetles and borers (Hejl and McFadzen 2000, U.S. Forest Service 2007 (Exhibit Rs-6)). Low-severity burns seldom contain the density of beetles needed by black-backed woodpeckers (Powell 2000), although adjacent unburned areas may provide foraging opportunities (Dudley 2005). Dudley and Saab (2007) estimated an average home range size of 511 acres of high quality habitat per nesting pair.

In the northern Rockies, black-backed woodpecker abundance correlates not to burn size but to the number of remaining snags (Hutto 1995b). Based on findings by Hejl and McFadzen (2000), black-backed woodpeckers prefer areas where 50 percent or more of the trees were killed by fire. Black-backed woodpeckers occurred in severely and moderately burned areas that had at least 40 percent canopy closure before the fire and were at least 200 acres (Russell et al. 2007, U.S. Forest Service 2007 (Exhibit Rs-6)). It is possible that populations could reach source levels (providing enough successful reproduction for dispersion) in recent burns, but may drop to sink levels (successful reproduction too low for long-term self-sustaining populations) when large burns are far apart in time or space (Hutto 1995b). Black-backed woodpeckers appear to be drawn away from the unburned forests within about 30 miles of a burn (Hoyt and Hannon 2002).

Black-backed woodpeckers generally nest in post-fire stands that have not been salvaged (Caton 1996, Hejl and McFadzen 1998, Hitchcox 1996, Saab and Dudley 1998, Koivula and Schmiegelow 2007), and that have relatively high tree and snag densities (Saab and Dudley 1998). Hejl and McFadzen (2000) found that salvage logging virtually eliminated black-backed woodpeckers from a stand, even with the retention of some fire-killed trees. This is supported by findings summarized by McIver and Starr (2000) and Hutto (2006). Wisdom and others (2000) recommend avoiding post-fire salvage logging in portions of large burned forests to maintain contiguous burned areas of at least 387 hectares (956 acres). The following are additional relevant recommendations from selected black-backed woodpecker literature (summarized in U.S. Forest Service 2007 (Exhibit Rs-6)):

- Retain stands with high prey densities in post-fire areas proposed for salvage logging (Powell et al. 2002).

- In post-fire areas proposed for salvage logging, retain unlogged portions of the project area for 0 to 5 years following fire (Kotliar et al. 2002, Saab et al. 2004, Hutto 2006).
- Apply different salvage treatments across the burn including variation in live tree and snag distributions, sizes, and species left uncut (Kotliar et al. 2002).
- Retain large snags (>20" DBH) in order to lengthen the time a burn is suitable for foraging and nesting and retain clumps of trees versus uniformly distributed trees in order to promote snag longevity (Saab and Dudley (1998).

## *Information Sources*

Data used included pre-fire and post-fire aerial photography; stand exams; Northern Region Vegetation Mapping Project (R1-VMP) data; project area field visits; post-fire walk-through surveys; post-fire Common Stand Exam plots; and research literature. Where stand information was unavailable, interpretations were made based on a comparison with neighboring stands that did have information, or on photo interpretation and professional experience with these forest types. Burn severities for vegetation were derived from extensive field surveys and an aerial photo interpretation process (Exhibit P-4). See Exhibits Rs-6 and Rs-10, and Project Record section "Rd."

## *Analysis Area*

For this project, the analysis area for direct and indirect effects on black-backed woodpeckers is the Brush Creek Fire perimeter on the Flathead National Forest. This approximately 40 square mile area (about 25,370 acres) is large enough to include the home range of several pairs of black-backed woodpeckers and is representative of effects of fires, natural tree mortality, timber salvage, and firewood cutting across the landscape. It is sufficiently large to evaluate the ability of the habitat to support populations of this species, but small enough to not obscure effects of the alternatives. All of the actions proposed in the alternatives that could directly or indirectly affect this resource are contained within this area. The cumulative effects boundary also encompasses the portion of the fire on the Kootenai National Forest west of the divide (Exhibit Rg-9), totaling 29920 acres. Larger-scale assessments were also conducted to address population viability concerns (Exhibits Rg-1, Rs-6, Rs-20, and Rs-24). The temporal scale of the effects analysis extends 100 years into the future, enough time for areas of dense trees to develop, with the potential for becoming black-backed woodpecker habitat if they burn.

## *Affected Environment*

The black-backed woodpecker lives in boreal and montane conifer forests in Alaska, Canada, and the northern coterminous United States. The species is a permanent resident of the region, although it is rarely seen outside of fire-blackened areas. In Montana, the black-backed woodpecker is not a federally listed or candidate species with the US Fish and Wildlife Service (USFWS), nor is it currently petitioned for listing. The black-backed woodpecker has an S2 status with Montana Department of Fish, Wildlife, and Parks (MDFWP), meaning it is "at risk because of very limited and potentially declining numbers, extent, and/or habitat, making it vulnerable to global extinction or extirpation in the state." Samson (2006) concluded that habitat in the Northern Region exceeds amounts needed for a minimum viable population (Exhibit Rs-20).

Black-backed woodpeckers have been reported in the expansive habitat created by the 2007 Brush Creek Fire (Exhibit Rs-5). Following the Black-backed Woodpecker Northern Region Overview (U.S. Forest Service 2007 (Exhibit Rs-6)), the Brush Creek Fire created nearly 3630 acres of high-quality black-backed woodpecker habitat on the Flathead National Forest, making up six potential home ranges (Exhibit Rs-10). For more information related to black-backed woodpecker habitat, see the "Snags and Down Wood" section of this chapter. The effects of fire suppression actions in 2007, such as hazard tree reduction along roads, are included in the Cumulative Effects section below.

Table 3-85 displays the current habitat of black-backed woodpeckers in other fire areas close to the Brush Creek Fire in time and space. Over 3000 acres of the Robert Fire area had timber salvage, but a substantial amount of potential black-backed woodpecker habitat remained, although the value of this habitat to black-backed woodpeckers is nearly over. In the Chippy Creek Fire area, there is a proposal to log eight percent (approximately 3750 acres) of the National Forest System (NFS) lands burned by the fire. Exhibit Rs-6 provides information about other fires more distant in time or space, such as the Skyland Fire, which is 60 miles and further to the east, and the Little Wolf Fire, which was partially in the analysis area but over 12 years ago. At the scale of the ecological province recommended by the Black-backed Woodpecker Regional Overview, there are currently at least 54,000 acres of black-backed woodpecker habitat (Exhibit Rs-6).

**Table 3-85. Contribution of Other Fire Areas to Black-backed Woodpecker Habitat within Five Years and Approximately 30 Miles of the Cumulative Effects Area** (Exhibit Rs-6)**.**

| Fire Name (and Land Management Agency) | Approx. Fire Acres | Year Burned | Shortest Distance to Brush Creek Fire |
|---|---|---|---|
| Chippy Creek (Lolo NF and Flathead Indian Reservation) | 99,100 | 2007 | 28 miles |
| Robert (Flathead NF and Glacier National Park) | 52,700 | 2003 | 25 miles |
| Sun Dog (Flathead NF) | 1,500 | 2006 | 32 miles |
| Westside Reservoir Fires (Flathead National Forest) | 21,800 | 2003 | 31 miles |
| Wedge Canyon (Flathead NF and Glacier National Park) | 53,300 | 2003 | 33 miles |

## *Environmental Consequences*

### <u>Direct and Indirect Effects</u>

### Alternative A- No Action

The fire created a considerable amount of potential high-quality habitat for black-backed woodpeckers on the Flathead National Forest (Exhibit Rs-10). There are currently 3629 acres in six blocks greater than 511 acres in size (207 to 1466 acres). Under this alternative, no additional salvage, harvest, or other actions are proposed. No additional snags would be felled except for safety concerns and as firewood adjacent to open roads. Spruce beetle, Douglas-fir beetle, and other wood-boring beetle populations would be expected to increase, creating an adequate prey base for large numbers of black-backed woodpeckers across the burned and adjacent landscape. Black-backed woodpecker populations would begin to naturally decline following the decline in beetle larvae approximately six years post-fire. Other effects relevant to this species are disclosed in the "Snag and Downed Wood Habitat" section of this chapter.

**Effects Common to All Action Alternatives**

Salvage harvest in potential black-backed woodpecker habitat has been shown to virtually eliminate black-backed woodpecker use (Caton 1996, Hejl and McFadzen 1998, Hitchcox 1996, Saab and Dudley 1998, Hutto 2006, Koivula and Schmiegelow 2007, and McIver and Starr 2000). This analysis assumed that salvaged units would no longer provide habitat for the black-backed woodpecker, even though some fire-killed trees would be retained within many of the salvage units. The number of potential home ranges created on the Flathead National Forest side of the Brush Creek Fire would be reduced from six to zero in Alternative D, to one in Alternative B, and to two in Alternative C (Table 3-86). Salvage harvest would fragment the home ranges that would remain in Alternatives B and C.

**Table 3-86. Effects of Salvage on Potential Habitat for Black-Backed Woodpecker on Flathead National Forest Lands in the Brush Creek Fire Area** (Exhibit Rs-10).

| Alternative | Acres Salvaged | # of Patches | # of Home Ranges Remaining After Salvage | Acres in Quality Habitat in 200+ Acre Patches |
|---|---|---|---|---|
| **A (No Action)** | 0 acres | 6 | 0 of 6 | 3629 acres |
| **B** | 1832 acres | 3 | 5 of 6 | 834 acres |
| **C** | 886 acres | 6 | 4 of 6 | 1955 acres |
| **D** | 2200 acres | 2 | 6 of 6 | 455 acres |

If salvage areas are used as breeding habitat during salvage operations, nesting activities could be disrupted and nest trees or snags could be felled while in use. Winter salvage operations would remove the risk to nesting birds but would disturb foraging and roosting at a time when energy reserves may be low and birds are susceptible to thermal stress. Disturbance from salvage operations, including helicopter logging and associated human activity, may temporarily displace individuals using habitat near salvage units, but would have no long-term impact. Disturbance associated with temporary road construction may temporarily displace individuals but would not have a long-term impact on the use of suitable habitat. A relatively small fraction of available trees and snags would be felled along their path. Refer to the "Snags and Down Wood Habitat" section and Exhibits Rs-10 and Rd-4 for additional information.

If an insect outbreak occurs, Alternative D includes measures to control bark beetle populations via additional salvage. All action alternatives, but particularly Alternative D, may reduce prey and subsequently black-backed woodpecker numbers in and near the fire area.

## Cumulative Effects

### Effects Common to All Alternatives

Past and present cumulative effects, in addition to those described above, have shaped the black-backed woodpecker's affected environment. For an assessment of this species' viability at larger scales see Exhibits Rg-1, Rs-6, Rs-20, and Rs-24. See Exhibit Rd-14 and the Snag and Downed Wood Habitat section for more information about cumulative effects on snags, the majority of which are relevant to black-backed woodpeckers. The effects of most of these past actions and events are imbedded in the environmental baseline described above (Exhibit Rs-10). See Exhibit Rs-9 for more information about cumulative effects on sensitive wildlife species.

Across the range of the species, the natural pattern of beetle outbreaks has been altered through silvicultural and fire management practices. Silvicultural practices directed at maximizing wood production by harvesting trees before they are susceptible to bark beetle attacks, and salvage logging of beetle-infested, fire-killed, and wind-killed trees reduced the occurrence of beetles in some areas. Fire management policies have lengthened natural fire regimes and allowed more frequent occurrences of beetles.

Tables 3-85 and 3-86, above, lists recent large fires close enough to the Brush Creek Fire area to be relevant for local black-backed woodpeckers. Dead trees were salvaged from some areas of Forest Service, State, Tribal, and private lands in most of these fire areas, but a considerable amount of potential black-backed woodpecker habitat was left (Exhibit Rg-1).

Past timber harvest has been the greatest factor limiting the current distribution of potential habitat in the analysis area, with a smaller effect from firewood cutting. On the Flathead National Forest side of the fire area, over 11,800 acres have had past regeneration or partial harvest. This includes 935 acres of black-backed woodpecker habitat removed by the 2007-2008 Gregg-Plume Timber Sale, which reduced the potential across the Brush Creek Fire area from seven to six home ranges. The Kootenai National Forest is proposing to salvage approximately 600 acres just west of the analysis area, reducing high-quality black-backed woodpecker habitat on 28 percent of their project area (Exhibit U-3). Open roads continue to provide access for firewood cutters, decreasing snags potentially used by black-backed woodpecker as feeding and nesting sites, as discussed above in the section on "Snag and Downed Wood Habitat" (Exhibits Rd-7 and Rd-10). No vegetation management activities are planned on national forest lands in the analysis area in addition to those proposed in the action alternatives. Future wildfire, insect outbreaks, and timber harvest activities in the area may have cumulative effects on habitat black-backed woodpecker habitat.

Suppression of the Brush Creek Fire actively eliminated some potential black-backed woodpecker habitat. The largest impact was the 389 acres of roadside hazard tree felling which removed high-quality black-backed woodpecker habitat in four of the six home ranges (Exhibit Rs-9).

# Fisher

## Introduction

The fisher (*Martes pennanti*) is also a USFS Region One sensitive species. This larger, weasel-like predator has a strong affinity for forested riparian habitats (Witmer et al. 1998). Such areas are vulnerable to habitat fragmentation due to factors such as fire, timber harvest, and timber salvage (Powell and Zielinski 1994). Fishers avoid insular patches of forested habitat and may require forested riparian travelways between feeding and denning sites (Heinemeyer and Jones 1994, Witmer et al. 1998). They rarely stray far from streams or other wet sites. Areas of otherwise suitable habitat can be isolated when cover in travel ways between home ranges is removed (Fisher and Wilkinson 2005).

In the Northern Rockies, fishers evolved under a disturbance regime that created numerous openings in a matrix of mature forested habitats. The conversion of a percentage of older age classes to younger age classes can promote a diversity of prey species and thus have long-term benefits for fisher populations (Jones 1991). A pulse of large logs on the ground due to fire or insect epidemics can provide denning structures and cover for fisher and several prey species, but these areas are likely to be avoided until the living canopy cover again exceeds 40 percent. Fishers would likely avoid stands up to 50 years old and probably not select them until 80 to 100 years for lodgepole pine or 120 to 160 years for mixed conifers (Jones 1991). Fishers are apparently tolerant of human activity, but the ease of human access into an area correlates with fisher mortality through direct or incidental trapping (Claar, et al., 1999). The average home range for a female fisher in this area is expected to be about 15 square miles (Jones 1991, Heinemeyer and Jones 1994). See Exhibit Rs-8 for more information about this species.

## Information Sources

The effects to the fisher were analyzed using GIS-generated predicted habitat (Exhibit Rs-8). Forested riparian connectivity was defined as pole-sized or larger forests (mid to late seral) in a zone that extends 300 feet away from riparian features such as lakes, ponds, wetlands, and streams. Within the fire area, these areas were overlayed with the vegetation severity map. Areas that burned with a moderate or low severity, or did not burn at all were defined as fisher habitat. This data layer was superimposed on digitized layers depicting the proposed units. Spatial effects were determined by overlaying the map of predicted habitat with alternative maps (Exhibit Rs-8). Open road density calculations are given in Exhibit Rg-8. See also the sections in this chapter on “Snags and Downed Wood Habitat” and “Old Growth Habitat and Old Growth Associated Wildlife Species.”

## Analysis Area

The analysis area for direct, indirect, and cumulative effects includes the Brush Creek Fire perimeter on the Flathead National Forest as well as the upper portion of Good Creek, and the lower portions of Griffin Creek (Exhibit Rg-9). This analysis area was chosen because the Brush Creek Fire eliminated much of the fisher habitat within the fire area (primarily the

Sheppard Creek drainage), most likely displacing fisher from this area into adjacent habitat (including Good Creek and Griffin Creek). For this project, the analysis of effects on fisher spans as far as 100 years at which time areas regenerated by this project, as well as the in-growth of trees after the fire, are likely to be used by fisher.

## *Affected Environment*

There have been several attempts to reintroduce fishers in Montana, including one effort about 25 years ago approximately 15 miles northeast of the analysis area. During the Brush Creek Fire, two unconfirmed fisher were reported just north of the fire area, in Good Creek which is within the fisher analysis area. This species has also been reported three times in the Griffin Creek drainage, just south of the fire area. For these sightings, plus historical and trend information, see Exhibits Rs-5 and Rs-8.

In the Brush Creek Fire area, 45 percent of the area within 300 feet of the riparian features was killed by a hot crown fire, while an additional 21 percent was a hot understory burn that killed the majority of the trees as well. Only 24 percent of the riparian area buffer burned at a moderate or low severity, or did not burn at all. The patches of fisher habitat remaining after the fire within the 300 foot riparian buffer, mostly located in the tributaries to Sheppard Creek, are extremely fragmented. Much of the main stem of lower Sheppard Creek burned at a high vegetation severity (Exhibit Rs-8). Because fisher are dependent upon forested habitat and living canopy cover, the Sheppard Creek drainage, as well as those portions of riparian that burned in upper Good Creek and lower Griffin Creek, may be avoided by fisher for up to 100 years or more. Outside the fire area in upper Good Creek and lower Griffin Creek, there are 3025 acres of mid seral forests and 6005 acres of late seral forests within 300 feet of water (Exhibit Rs-8).

Within the fire area, forested connectivity within and beyond 300 feet of riparian features is no longer provided for fisher by the post-fire conditions. Outside the fire area within upper Good Creek, forested connectivity within and beyond 300 feet of riparian features, is sufficient for the whole upper Good Creek area to be available as fisher habitat. Within the lower Griffin Creek drainage, the Hand Creek tributary burned in the Little Wolf Fire and provides very little fisher habitat. Downstream from Hand Creek, forested connectivity within and beyond the 300 foot riparian feature is sufficient for the majority of this area to be available to fisher (Exhibit Rs-8). This connectivity has been severed or narrowed by past timber harvest in some areas. Forested saddles may contribute to connectivity for dispersal (Powell and Zielinski 1994) and thus the analysis of forested connectivity in uplands as well as riparian zones was also used for the fisher. The analysis area (excluding the fire area) appears to support sufficient habitat for five female fisher home ranges. It appears the current distribution of habitat for fishers would allow dispersal to continue outside the fire area north of Star Meadow from Swanson Creek, and north to upper Gregg Creek, although continuous patches of mid or late seral forested areas are not provided. Suitable denning and feeding habitat occurs in adjacent drainages.

Sections on “Snags and Down Wood Habitat” and “Old Growth Habitat and Old Growth Associated Wildlife Species,” further discuss the potential of the area to provide habitat components. For more information about this species and its habitat at various scales, including that of the Flathead National Forest, see Exhibit Rg-1.

## *Environmental Consequences*

### <u>Direct and Indirect Effects</u>

#### Alternative A- No Action

No additional actions, such as timber salvage or temporary road construction, are proposed with this alternative. No harvest would take place within 300 feet of the riparian habitat, so all remaining trees and down wood would remain for future habitat. Thus, this alternative would have no direct effect on existing fisher habitat. Vegetative conditions would continue to respond to the effects of fire, providing limited habitat for the fisher for up to 100 years.

#### Effects Common to all Action Alternatives

Existing fisher habitat would not be affected by any alternative, as the connected suitable habitat was burned with the Brush Creek Fire. The remaining patches of habitat are not expected to be used because of their isolation. The Sheppard Creek drainage is likely to be avoided by fisher until the living canopy cover again exceeds 40 percent, which may be up to 100 years. Proposed harvest within 300 feet of the riparian would affect the number of future snags and large down woody material remaining which would provide fisher habitat in the future. The remaining trees would become the future snags and down wood that could function as denning and resting habitat and would be important in the post fire environment. Table 3-87 shows the acres harvested within future fisher habitat.

**Table 3-87. Vegetation Management Effects by Alternative on Future Potential Fisher Habitat** (Exhibit Rs-8).

| | Alt. A | Alt. B | Alt. C | Alt. D |
|---|---|---|---|---|
| Acres harvested within 300 feet of riparian areas (future fisher habitat) | 0 ac | 1172 ac | 720 ac | 2047 ac |
| Percentage of future fisher habitat (5993 acres) proposed for harvest | 0% | 20% | 12% | 34% |

Features common to all action alternatives that would help maintain structure that would provide future fisher habitat include: snag and downed wood retention in units; the retention of snags and down trees directly adjacent to wetlands (75 feet of wetlands); and the planting of deciduous trees and shrubs along with conifer plantings to increase wildlife security in and near riparian areas.

All action alternatives build temporary roads that cross through future fisher habitat. These road crossings would be obliterated and the effects to the riparian habitat negated by the time fisher are again using the Brush Creek Fire area.

Outside the fire area, in upper Good Creek and lower Griffin Creek, the fisher habitat would not be affected by any action alternative. The existing habitat would continue to support sufficient habitat for five potential fisher home ranges. These areas would provide important habitat for fisher until the Brush Creek Fire regains some mid to late seral stands. There is the potential that the proposed harvest would cause temporary disturbance to fisher where harvest units occur along the perimeter of the fire area adjacent to fisher habitat. This may cause temporary displacement from the immediate area.

## Cumulative Effects

### Effects Common to All Alternatives

Past timber harvest, road construction and maintenance, fires, and fire fighting have likely affected fisher habitat in this area as well as across the Flathead National Forest. The Brush Creek Fire has created the most recent large change on the landscape, as well as the 1994 Little Wolf Fire. The Brush Creek Fire burned hot enough to affect snags and down wood within and adjacent to riparian habitat. Water quality and quantity are expected to experience changes from the pre-fire condition. These past activities have also created much of the existing habitat conditions found within the analysis area.
The discussion below summarizes some of past, current, and reasonably foreseeable activities that are listed in Chapter 1 of this document and discussed in detail in Exhibits Rr-7, Rs-9, and Rt-14. Cumulative effects relevant to fishers are further discussed in sections on "Old Growth Habitat and Old Growth Associated Wildlife Species," "Snags and Downed Wood Habitat", in this chapter, and in Exhibit Rr-7. For an assessment of this species' viability at the Forest level, see the Final Environmental Impact Statement for the Flathead Forest Plan, Amendment 21 (USDA 1999a) and Exhibit Rg-1. Exhibit Rs-25 is an assessment of the fisher and its habitat at level of USFS Region One.

Vegetation Management

Past timber sales and associated activities have created much of the existing habitat conditions (vegetation and roads) for the fisher within the analysis area. Currently, the only implemented timber sale is the Gregg-Plume sale located in upper Good Creek. Harvest of the burned portion of this sale took place in the winter of 2007-8. The unburned portion would be logged in the next one to three years; the Kootenai National Forest is proposing to salvage harvest approximately 600 acres of timber burned in the Brush Creek Fire (Exhibit U-3). Timber hauling could occur down the Sheppard Creek road starting the summer of 2008; removal of timber felled near roads for the purpose of protecting public safety during the Brush Creek Fire would be removed and is scheduled to be completed in 2008. During logging operations, there may be short-term disturbance to riparian-dependent species.

Past harvest on Plum Creek lands, within the analysis area, includes 250 acres of regeneration harvest in the past 40 years. This activity is expected to continue. Private and State land represent approximately five percent of the analysis area. Salvage harvest may be occurring on some or all of the remaining 80 acres not already harvested prior to the fire. These activities may result in localized disturbance and potential loss of habitat within harvest areas.

It is expected that ongoing and reasonably foreseeable salvage harvest, and associated activities within the cumulative effects analysis area, would cumulatively contribute localized and minor effects to habitat loss, increased fragmentation or connectivity on the landscape, or habitat parameters required by the fisher.

Private Land Development and Vegetation Management on Private Land

Land development, including the construction of roads, clearing of vegetation, construction of residences, and installation of improvements, as well as vegetation management, can create a variety of changes to the landscape. Depending on the magnitude, type, and location of developments and the amount of private land on the landscape, these activities can have varied effects, including habitat loss, increase in fragmentation, and localized disturbance on snag or old growth-dependant species. Because of the amount of riparian habitat on private lands, and the connectivity they provide these areas provide an important part of territory requirements of riparian species. The majority of private land development near the fire area has occurred in the Star Meadow and Good Creek communities. The rate of development has been recently increasing. Cumulatively reasonably foreseeable activities could potentially reduce the amount of habitat for riparian-associated species. Protection of the riparian habitat is provided by state law as stated above.

Firewood Gathering

Motorized access has greatly facilitated the removal of potential snags for firewood. Firewood gathering on National Forest land is a permitted use that occurs along most open roads; however, during the salvage activities, a temporary closure order would be in place to restrict firewood cutting in the Brush Creek Fire area. Over time, the availability of snags and down woody material will be reduced along the road influence zone. Firewood gathering can also cause minor short-term localized displacement to species using the area. Ongoing and reasonably foreseeable firewood gathering activities within the cumulative effects analysis area would cumulatively result in localized and minor effects on riparian–dependant species. See the “Snags and Downed Wood Habitat” section of this chapter for more information.

Riparian Disturbances

BAER activities in the Brush Creek post-fire environment include activities located in riparian areas. Road reclamation is also planned for 2009 and 2010. These activities may cause short term disturbances with an increase in sedimentation to streams, but result in long term benefits to the riparian systems. Trapping of beavers and destruction of beaver dams has reduced the size of wetlands and other flooded areas. Grazing has been suspended in the burned portion of the Swaney Allotment for two years, which will reduce weed spread and sedimentation in streams and wetlands.

Trapping

Open roads facilitate access for trappers and firewood cutters, potentially decreasing fisher populations and the downed logs important for fisher and their prey species. The analysis area has an annual quota of two fisher harvested through trapping.

Mushroom Harvest

Between April and July, 2008, several thousand people are expected to harvest mushrooms from 24,700 acres in the burned area on the Flathead National Forest. If fishers are present, intense mushroom collection would cause disturbance impacts leading to a "May Impact Individuals and Habitat" determination for the fisher (Exhibit Rs-9).

## Northern Leopard Frog, Townsend's Big-Eared Bat, Northern Bog Lemming, and Western Toad

### *Introduction*

The northern leopard frog (*Rana pipiens*, recently changed to *Lithobates pipiens*), Townsend's big-eared bat (*Plecotus townsendii)*, northern bog lemming (*Synaptomys borealis*), and western toad (*Bufo boreas boreas*, recently changed to *Anaxyrus boreas*), are USFS Region One sensitive species (Exhibit Rs-1). They are discussed together because of similarities of most aspects of their habitat needs and many potential effects.

In western Montana, northern leopard frogs (Exhibit Rs-12) primarily occur in low elevations or valley bottom dense sedge wet-meadows or cattail marshes. They reproduce in slow-moving or standing water that includes lakes or ponds (temporary or permanent), springs, backwaters, or beaver ponds in streams. Adults feed in damp meadows and wet forests nearby. Historically, the northern leopard frog was widespread in Montana, especially in the Flathead and lower Clark Fork river drainages, but appears to have been extirpated throughout most of the western part of the state (Maxell et al. 2003, Werner et al., 2004). In past years, this species has been documented at only a few western sites: near Kalispell (a lake complex), near Eureka (a set of small ponds about 30 miles to the northwest), and near the Nine Pipe National Wildlife Refuge. None have been documented on the Flathead National Forest since a record in the Swan Valley about 1950. Numerous amphibian surveys have been completed on the forest, district, and within the analysis area over the past 12 years, (Exhibit Rs-5), although potential habitat occurs within the analysis area.

Townsend's big-eared bats (Exhibit Rs-11) forage on insects high in living forest canopy near wet meadows (Dobkin, et al. 1995). Caves, tree cavities, rock outcrops, buildings, or mines may provide sites for roosting, communal nurseries, or winter hibernation (Reel, et al. 1989; Tuttle and Taylor 1994). The species has a widespread distribution but a notable decline has been reported in the western United States (Dobkin, et al. 1995). They have not been recorded in the analysis area, and potential roosting habitat has not been surveyed for occupancy. Abandoned mines south of the Brush Creek Fire area in Logan drainage were surveyed for bats but none of this species were found. Townsend's big-eared bats were found in bat surveys at numerous locations on the adjacent Kootenai National Forest in 1993. A broad survey in 2005 did not capture any big-eared bats in western Montana (Hendricks and Maxell 2005, Exhibit Rs-5). Nevertheless, the species may be present. Roosting habitat may be provided by abandoned mines or by abandoned buildings on private land. There are numerous wet meadow feeding areas with adjacent snags for roosting within the analysis area (See Exhibit Rs-11).

The northern bog lemming (Exhibit Rs-4) is a rare rodent found in wet meadows containing standing water and extensive coverage of sedges and species such as sphagnum moss. Important habitat components include fallen logs and other woody debris. They winter above ground but below the snow, and summer beneath the surface (Burt and Grossenheider 1980). The bog lemming has few populations in the lower 48 states, known from eight locations in Washington, four locations in Idaho, and 13 locations in Montana (Reichel and Beckstrom 1993). Since about 10,000 years ago, this species has become a glacial relict with localized primary habitat. A single documentation exists for this species on the Flathead National Forest, a trapping record from 1992 at the head of Bowen Creek, approximately four miles north of the fire boundary. This species was also found north of the Bowen Creek site on the Kootenai National Forest and in two or three locations on the west side of Glacier National Park (Reichel and Beckstrom 1993). Other potential habitat in the project area has not been surveyed for bog lemmings. The area appears to contain suitable habitat scattered throughout, although most of these sites are not expected to have all of the necessary habitat components.

In Montana, the western (boreal) toad (Exhibit Rs-13) has an S3 status with MDFWP, defined as "Potentially at risk because of limited and potentially declining numbers, extent, and/or habitat, even though it may be abundant in some areas." Historical data indicate that western toads were widely distributed and very common in Montana and other western states, but the species has apparently undergone severe population declines in the past 25 years (Currim 1996). Surveys in the late 1990s indicate that they now occupy less than 10 percent of suitable habitat (Maxell 2000). Western toads breed in lakes, ponds, streams, and road ditches, with a preference for shallow, warm areas with mud bottoms. Adult western toads are largely terrestrial and will travel considerable distances from water (Muths 2003). Western toad adults and tadpoles have been found in numerous locations in and near the project area (Exhibit Rs-5). Many reports in the analysis area were of tadpoles found in roadside ditches or adults found away from breeding habitat.

Possible risks to these four species include grazing, road construction, adjacent vegetation management, and factors that may disrupt hydrologic function. Timber harvest and salvage, insect epidemics, fires, and road construction and maintenance can affect these species through soil compaction, changes in vegetative cover, or by altering the quantity and quality of water flowing into wet meadows. In addition, timing of recruitment of large woody material into wetland edges can be altered. Snags used by bats as roosting structures can be removed. Because they use dry habitats for much of their lives, individual toads or tadpoles can be killed directly by wildfire, salvage activities, and road construction or maintenance activities. Roads can be obstacles for toads as they are slow moving and vulnerable to being run over by vehicles, and they may also be more susceptible to predation when crossing roads. Other factors associated with amphibian population declines include pollution, pesticides, habitat destruction and alteration, increases in UV radiation, and the introduction of predators or competitors. Some of these may function to facilitate the spread of infectious bacteria and fungus (Carey 1993, Muths 2003). Other studies indicate potential declines in Northern leopard frogs and some toad species may be attributed to canopy closure resulting from forest succession (Werner and Glennenmeier (1999) in Pilliod et al., 2003).

Effects of fire on amphibians and associated habitat alteration are species-specific, not completely understood, and variable among habitats and regions (Pilliod et al., 2003). In addition to direct mortality (which is thought to occur rarely) indirect effects can include increases in solar radiation and temperature, sedimentation and substrate composition, nutrient pulses, productivity, and decreases in duff, litter, and woody debris. A more open canopy within the riparian environment may favor species like the leopard frog and western toad, which seem to survive better in open or burned habitat (Pilliod et al., 2003). One post-fire study of the Moose Fire in Glacier National Park documented immediate dramatic increases in the numbers of western toad breeding sites and toadlets in areas burned by wildfires (Guscio, 2007). More recently, western toads studied one year after the 2003 Robert Fire (also in Glacier National Park), were found exclusively in burned habitats after breeding in the burn area (Guscio, 2007). Researchers have not yet been able to determine what apparently draws toads to these areas.

For more information about effects analysis methods, conclusions, and cumulative effects, see the "Hydrology," "Fisheries," "Neotropical Migratory Birds and Riparian Habitats," "Snags and Downed Wood Habitat," and "Vegetation" sections of this chapter. For more information about these species and their habitat at various scales, including that of the Flathead National Forest, see Exhibit Rg-1.

## *Information Sources*

Most of the effects on northern leopard frogs, Townsend's big-eared bats, northern bog lemmings, and western toads were evaluated by overlaying GIS-generated maps of riparian landtypes (NL1E and NL1A) with proposed salvage units and temporary road construction.

## *Analysis Area*

The analysis boundary for direct and indirect effects on these four species is the Brush Creek Fire perimeter on the Flathead National Forest. All of the actions proposed in the alternatives are contained within this area. The boundary for cumulative effects is the Sheppard Creek drainage down to Star Meadow as well as the upper portion of Good Creek and the lower portion of Griffin Creek (Exhibit Rg-9). This area was chosen because of the terrestrial mobility of some these species, but it is also appropriate for riparian-dependent species with scattered populations and limited habitat and mobility. For the northern leopard frog, northern bog lemming, and western toad, the analysis of effects extends out 15 years, at which time post-fire riparian conditions and effects of the alternatives are likely to stabilize. The analysis of effects on the bat and its habitat extends out 100 years, at which time post-fire riparian vegetation (including snags) and effects of the alternatives are likely to stabilize. A larger-scale assessment was also conducted to address wildlife population diversity concerns (Exhibit Rg-1).

## *Affected Environment*

In the analysis area, about 277 acres appear to provide year-round habitat for bog lemmings and northern leopard frogs, as well as breeding habitat for western toads and feeding sites for Townsend's big-eared bats (Exhibit Rr-3). This potential habitat was identified as Riparian Landtypes NL1A and NL1E (USDA Forest Service 1995), which are relatively level areas in flat valley bottoms with relatively fine substrates (Table 3-88). Toad reproduction has been found in over 86 locations on Flathead National Forest lands and over 80 percent of these have been in NL1E or NL1A. All land in the project and cumulative effects area is close enough to potential breeding ponds to be potential upland habitat for western toads.

**Table 3-88. Riparian Landtypes NL1A and NL1E in the Analysis Area (Exhibit Rr-3).**

| Landtype | Gradient | Substrate Material | Habitat Type or Vegetation Community | Total Acres |
|---|---|---|---|---|
| NL1A | Nearly level, valley bottom 2-4% slopes | Clays, silts, fine and medium sand | Subalpine fir | 114 |
| NL1E | Nearly level, valley bottom 2-4% slopes | Clays, silts, fine and medium sand | Willow and sedges | 163 |

The Brush Creek Fire changed riparian habitat conditions, with some areas completely consumed by fire (see sections on "Fisheries" and "Hydrology"). Some mortality may have occurred in and near the fire through burning, smoke inhalation, and heat stress, although preliminary research indicates that terrestrial amphibians are as common in burned areas as in similar but unburned plots (Bury 2004). Some riparian areas retained snags and green trees while in other areas all adjacent vegetation was consumed. Many snags were created by the fire in upland habitat, in and adjacent to the riparian areas, in the fire. Burning of duff, litter, logs, stumps, and vegetation decreased hiding cover for western toads, but post-fire seeding and sprouting of shrubs is expected result in an overall increase in low hiding cover. During the summer months, most bats are able to arouse quickly during the day, so that escape and relocations to unburned areas can easily occur. Snag roosts, depending on age and condition, can become highly combustible. Most bats utilizing trees and snags have multiple roosts throughout the forest (Carter et al., 2000).

## *Environmental Consequences*

### <u>Direct and Indirect Effects</u>

#### Alternative A- No Action

Alternative A would have no direct effect on northern leopard frogs, Townsend's big-eared bats, northern bog lemmings, western toads, or their habitats. No additional actions, such as timber harvest, temporary road construction, or road rehabilitation, are proposed with this alternative. This would leave riparian habitat across the analysis area to continue with relatively natural processes, such as the resprouting of shrubs and post-fire reseeding. Riparian areas with heavy tree mortality and burned down logs would provide structural diversity, with some long-standing snags of species and sizes valuable to wildlife. The fire burned off vegetation growing in ditches, which is expected to increase erosion rates into the streams. Approximately three quarters of the road/stream crossings were burned in the Brush Creek Fire. None of the roads would receive BMP improvements in this alternative. Ongoing actions such as firewood cutting, road maintenance, and motorized access that may impact western toads would continue at current levels. For more information about the effects of no action on riparian area dependent species, see the "Hydrology" and "Fisheries" sections of this chapter.

### Effects Common to all Action Alternatives

Table 3-89 summarizes the direct and indirect changes in habitat acres due to each alternative. Leopard frogs, western toads, and big-eared bats are inactive during the winter and typically hibernate in subterranean burrows or roost in snags, caves, or buildings. Salvage activities during this period would have less impact on these species and their habitat than activities occurring during the spring or summer.

**Table 3-89. Summary of the Features of the Action Alternatives Relevant to Northern Leopard Frogs, Townend's Big-eared Bats, Northern Bog Lemmings, and Western Toads.**

| Feature | Alt. A | Alt. B | Alt. C | Alt. D |
|---|---|---|---|---|
| Potential breeding/rearing habitat impacted by harvest | 0 acres | 0 acres | 0 acres | 74 acres |
| Potential breeding/rearing habitat impacted (feet) by temporary road construction | 0 feet | 376 feet | 189 feet | 189 feet |
| Upland foraging habitat harvested | 0 acres | 6346 acres | 3902 acres | 7391 acres |
| Required winter logging acres (% of total harvest) | 0 acres | 2644 acres (42%) | 2089 acres (54%) | 3144 acres (43%) |
| Temporary road construction | 0 miles | 26.9 miles | 9.5 miles | 11.7 miles |
| System road construction | 0 miles | 0 miles | 0 miles | 0 miles |

Alternative D is the only alternative with proposed timber salvage that would impact year-round habitat for bog lemmings and northern leopard frogs, as well as breeding habitat for western toads and feeding sites for Townsend's big-eared bats (Exhibit Rr-3). This alternative proposes salvage harvest in 74 acres of these areas (Units 35, 38, 43, 69, B1, B2, B3, B5, B18, and B34). Approximately 65 of these acres would be winter logged and thus should have less impact than logging during the time when most of these species would be active.

Alternatives B, C, and D would directly impact one riparian area with 188 feet of temporary road construction through a wooded wet area (Temporary Road "N"). Alternative B would also construct temporary road through an additional 187 areas of this habitat (Temporary Road "P"). These areas may contain scattered mossy habitat. Research indicates that bog lemming use of scattered mossy areas is low, therefore the potential risk of impacts to individuals would be low (Reichel and Beckstrom 1993). Best Management Practices would be implemented and include avoiding equipment operation in wet areas (wetlands, seeps, riparian areas). The temporary road construction would be rehabilitated after use and the effects of this road to toad habitat should diminish over time. For information about sedimentation and other potential effects and benefits of harvest, temporary road construction, and road repair, see the "Hydrology", "Fisheries", and "Neotropical Migratory Birds and Riparian Habitats" sections of this chapter.

Protection of the riparian habitat would occur through a combination of protective measures in the Montana Streamside Management Zone Law, Montana Water Quality Act, and INFISH standards (See "Fisheries" and "Hydrology" sections of this chapter). Features common to all action alternatives that would help maintain the structure within the riparian habitat include snag and downed wood retention in units, retention of snags and down trees directly adjacent to wetlands, and the planting of deciduous trees and shrubs along with conifer plantings to increase wildlife security in and near riparian areas. These features would help to maintain the structures that provide habitat for all four of these species.

Salvage activities, increased vehicle use, road maintenance, and temporary road construction may kill individual adult and juvenile toads using upland habitats (Table 3-89, above). Such mortality would be infrequent and would not be expected to affect this species at the population level.

Specific to northern bog lemmings, salvage activities, temporary construction, and road maintenance activities, if located within 100 meters of suitable sphagnum moss habitat, could remove cover, and/or interrupt water flow thus causing drying of sphagnum habitat (Reichel and Beckstrom 1993). These activities could also compact the moss mat (in summer) or snow cover (with lemming tunnels) in winter. Of these proposed harvest acres, only 27 acres lies within the NL1E habitat which is most likely to provide bog lemming habitat. These acres generally lie along the edges of the wetland, or bogs. These activities could result in the loss of potential habitat or individual mortality from harvest activities.

Specific to Townsend's big-eared bats, proposed activities could reduce potential roosting habitat adjacent to the feeding habitat by removing trees killed by the Brush Creek Fire. Disturbance or mortality of bats could occur if bats were using a snag that was cut down. Salvage and road activities are not expected to alter the availability of mosquitoes and other insects eaten by bats. Effects would be site-specific, affecting individuals rather than colonies, and are not likely to affect the viability of Townsend's big-eared bats. Analysis area feeding habitat, outside of the fire area would not be affected by the action alternatives. Only two percent of the feeding habitat in the analysis area would be affected by salvage harvest activities (Exhibit Rs-11).

Although riparian connectivity may be affected for a few years because of the effects of the Brush Creek Fire, low hiding cover from the sprouting of shrubs and post-fire seeding would result in an overall increase in low hiding cover. The Star Meadow complex could be a source area that would supply dispersing individuals back into the Sheppard Creek drainage.

## Cumulative Effects

### Effects Common to All Alternatives

Past timber harvest, road construction and maintenance, fires, fire suppression, private land development and riparian disturbances have created much of the existing habitat conditions found within the analysis area, as well as across the Flathead National Forest.

The discussion below summarizes some of past, current, and reasonably foreseeable activities that are listed in Chapter 1 of this document and discussed in detail in Exhibits Rr-7, Rs-9, and Rd-14. Cumulative effects relevant to the northern leopard frog, Townsend's big-eared bat, northern bog lemming, and western toad are further discussed in sections in this chapter on "Hydrology," "Fisheries," "Old Growth Habitat and Old Growth Associated Wildlife Species," "Neotropical Migratory Birds and Riparian Habitats," and "Snags and Downed Wood Habitat." For an assessment of these four species' viability at the Forest level, see the

Final Environmental Impact Statement for the Flathead Forest Plan, Amendment 21 (USDA 1999a) and Exhibit Rg-1.

Vegetation Management

Past timber sales and associated activities have created much of the existing habitat conditions (vegetation and roads) for these species within the analysis area. Currently, the only implemented timber sale is the Gregg-Plume sale located in upper Good Creek. Harvest of the burned portion of this sale took place in the winter of 2007-8. The unburned portion would be logged in the next one to three years; the Kootenai National Forest is proposing to salvage harvest approximately 600 acres of timber burned in the Brush Creek Fire (Exhibit U-3). Timber hauling could occur down the Sheppard Creek road starting the summer of 2008; removal of timber felled near roads for the purpose of protecting public safety during the Brush Creek Fire would be removed and is scheduled to be completed in 2008. During logging and hauling, a risk of individual mortality of toads may occur, as well as short-term disturbance.

Past harvest on Plum Creek lands, within the analysis area, includes 250 acres of regeneration harvest in the past 40 years. This activity is expected to continue. Private and State land represent approximately five percent of the analysis area. Salvage harvest may be occurring on some or all of the remaining 80 acres not already harvested prior to the fire. These activities may result in localized disturbance and potential loss of habitat within harvest areas.

It is expected that ongoing and reasonably foreseeable salvage harvest and associated activities within the cumulative effects analysis area would cumulatively contribute localized and minor effects to habitat loss, increased fragmentation or connectivity on the landscape, or habitat parameters required by these four species.

Private Land Development and Vegetation Management on Private Land

Land development, including the construction of roads, clearing of vegetation, construction of residences, installation of improvements, as well as vegetation management, can create a variety of changes to the landscape. Depending on the magnitude, type, location of developments, and the amount of private land on the landscape, these activities can have varied effects, including habitat loss, increase in fragmentation, and localized disturbance. Because of the amount of riparian habitat on private lands, and the connectivity they provide these areas, provide an important part of territory requirements for riparian species. Because of past human-caused disturbances, these habitats are assumed to be limited on private land. The majority of private land development near the fire area has occurred in the Star Meadow and Good Creek communities. The rate of development has been recently increasing. Cumulatively reasonably foreseeable activities could potentially reduce the amount of habitat for riparian-dependant species. Protection of the riparian habitat is provided by state law as stated above.

Riparian Disturbances

Some BAER activities in the Brush Creek post-fire environment would occur in riparian areas. Road reclamation is also planned for 2009 and 2010. These activities may cause short term disturbances with an increase in sedimentation to the stream, but result in long term benefits to the riparian systems. Trapping of beavers and destruction of beaver dams has reduced the size of wetlands and other flooded areas. Grazing has been suspended in the burned portion of the Swaney Allotment for two years, which will reduce weed spread and sedimentation in streams and wetlands. In addition, fish stocking in some of the creeks and lakes has altered species composition which may affect the survival of tadpoles and juveniles.

Fire and Fire Suppression

The Brush Creek Fire of 2007 and the Little Wolf Fire of 1994 created the most recent large change on the landscape. The effects of the Brush Creek Fire itself are described above in the Affected Area section for these species.

Suppression efforts and hazard tree reduction during the Brush Creek Fire felled trees and cleared other vegetation in some riparian habitats (Exhibit Rr-7). An NL1E area on a tributary to Gregg Creek was reportedly used for filling hundreds of helicopter bucket drops until it was nearly drained. In some areas recently burned trees were felled adjacent to the riparian areas where they were potential hazards along the roads. See the section in this chapter on “Neotropical Migratory Birds and Riparian Habitats” for more information.

Firewood Gathering

Motorized access has greatly facilitated the removal of potential roost snags for firewood. Firewood gathering on National Forest land is a permitted use that occurs along most open roads; however, during the salvage activities, a temporary closure order would be in place to restrict firewood cutting in the Brush Creek Fire area. Over time, the availability of snags and down woody material will be reduced along the road influence zone. Firewood gathering can also cause minor short-term localized displacement to species using the area. Ongoing and reasonably foreseeable firewood gathering activities within the Cumulative effects Analysis Area would cumulatively result in localized and minor effects on snag habitat and associated wildlife species. See the “Snags and Downed Wood Habitat” section of this chapter for more information.

Mines

Bat roosts may occur in some of the five historic mines located within the analysis area. None of the mines are currently active. Any abandoned mine on NFS land that is considered for closing for safety reasons is always checked for bats beforehand.

Mushroom Harvest

Between April and July, 2008, several thousand people are expected to harvest mushrooms from 24,700 acres in the burned area on the Flathead National Forest. The possibility of squashing adult toads when driving to collect, and while collecting, mushrooms led to a “May Impact Individuals and Habitat” determination for the western toad (Exhibit Rs-9).

# Wolverine

## *Introduction*

Wolverines (*Gulo gulo*) are a USFS Region One sensitive species. Remoteness and isolation from human impacts and a diverse prey base seem to be the most important habitat components (Witmer et al. 1998). Adults are mostly solitary and range widely over a variety of habitats, with home ranges in Montana averaging 150 square miles (Exhibit Rs-19). The literature suggests wolverines readily avoid human activity (Ruggiero, et al. 1994). With few exceptions, wolverine dens described to date have been located in alpine, subalpine, taiga, or tundra habitat. Reports of dens in low elevation, densely forested habitats are rare (Magoun and Copeland 1998). Wolverines feed primarily on rodents and carrion, although they eat berries, insects, fish, birds, and eggs when available. Movements to lower elevations during winter may be to take advantage of ungulate mortalities on winter ranges (Butts 1992). Trapping and roadkill mortality of wolverines is thought to be additive to natural mortality (Krebs et al. 2004). New genetic data (Tomasik and Cook 2005) suggest that gene flow between wolverines in North America has declined since historic times.

There were possible wolverine sightings along Brush Creek divide in August 1996 along the boundary of the fire area as well as in the Lemonade Springs area (about six miles south of the fire boundary). These may have been young, dispersing individuals. The location of one harvested in 1990 was given as “Good Creek.” Another in 1978 was reported as harvested at “Tally Lake,” which could be anywhere on the Tally Lake Ranger District. There have been confirmed sightings over the past five years in Whitefish Divide, approximately 10 miles to the northeast across the Stillwater Valley, and in the drainages of the North and Middle Forks of the Flathead River in Glacier National Park, upper Grave Creek, and Ten Lakes area. These are the closest suspected denning habitats, all of which have a considerable amount of ungulate winter range nearby.

## *Information Sources*

Potential wolverine dispersal habitat was identified as the entire analysis area. GIS was used for quantification of potential disturbance of wolverines and changes in cover, as described in the “Commonly Hunted Big Game” section of this chapter. See also the portions on connectivity in the “Old Growth Habitat and Old Growth Associated Wildlife Species” section.

## *Analysis Area*

The analysis area for direct and indirect effects includes the Brush Creek Fire perimeter on the Flathead National Forest as well as the upper portion of Good Creek, and the lower portions of Griffin Creek. The cumulative effects boundary includes the area stated above as well as the portion of the fire on the Kootenai National Forest west of the divide (Exhibit Rg-9). These analysis areas were chosen because the wide-ranging nature of the wolverine and because expected travel areas include the divides on either side of the Sheppard Creek drainage where effects of the alternatives would occur. For this project, the analysis of effects on wolverines spans as far as 15- 20 years, at which time areas regenerated by this project, as well as the in growth of trees after the fire, are likely to provide hiding cover. In addition, human activities associated with this project that could disturb or displace wolverines would have ceased.

## *Affected Environment*

There is no suitable wolverine denning habitat (large, isolated tracts of land supporting a diverse prey base), and no winter range that might support winter feeding habitat for the wolverine within the analysis area. Because of these factors, it is expected that the wolverine analysis area provides only dispersal or travel habitat. Wolverines have been documented in the analysis area on the divide between the Kootenai and Flathead National Forests, and it is expected that wolverine may travel along the divides north and south of the Sheppard Creek drainage as well.

Within the wolverine analysis area, the Brush Creek Fire changed the Sheppard Creek drainage from a cover-dominated landscape into an open landscape with 33 percent of the fire area providing scattered patches of cover. Because of the lack of cover within the fire area, it is expected that use by ungulates in this drainage will decline for the next few years, then rebound as forage increases and cover returns in the next 10-15 years.

Outside the fire area, available hiding and thermal cover is plentiful and evenly distributed across the analysis area (Exhibit Rb-3). About 82 percent of the big-game analysis area outside of the fire currently functions as hiding cover and/or summer thermal cover; only natural openings, lakes, ponds and recently regenerated areas do not.
The Brush Creek Fire narrowed and severed forested connections for big game and large species within the fire area. There are no remaining forested connections running north and south within the fire area that do not require some travel within areas of non-cover. Along main Sheppard Creek, there are no riparian corridors that do not require crossing up to two miles of non-cover, as the fire burnt very hot in portions of this drainage. Many past linkages are now less than 400 feet wide and there are several areas now requiring travels of over one-third mile in areas not providing hiding cover. Outside the fire area, forested connections do not limit travel.

For more information about the distribution of vegetative cover see the “Commonly Hunted Big Game,” “Old Growth and Old Growth Associated Wildlife Species,” and “Vegetation,” sections in this chapter. For more information about this species and its habitat at various scales, including that of the Flathead National Forest, see Exhibits Rg-1 and Rs-23.

## *Environmental Consequences*

### <u>Direct and Indirect Effects</u>

#### Alternative A- No Action

The Brush Creek Fire created large blocks of unsuitable habitat for the wolverine within the analysis area as described above in the “affected environment section.” No additional actions, such as timber salvage or temporary road construction are proposed with this alternative. Thus, this alternative would have no direct effect on existing wolverine travel habitat. Vegetative conditions would continue to respond to the effects of fire, initially providing limited habitat for the wolverine until hiding cover is re-established across the landscape and ungulate use of the area increases. This is expected to occur within 15-20 years.

**Effects Common to all Action Alternatives**

There is no suitable wolverine denning habitat (large, isolated tracts of subalpine habitat which supports a diverse prey base), and no winter range that might support winter feeding habitat for the wolverine within the analysis area. Because of these factors, it is expected that the wolverine analysis area provides only dispersal or travel habitat. The Brush Creek Fire created large areas that wolverine may avoid because of the lack of hiding cover. Thirty-three percent of the area provides scattered patches of cover with the action alternatives reducing that to 26, 30, and 24 percent in Alternative B, C, and D respectively. Salvage harvest of some of those areas providing marginal hiding cover would further add to the distance that big game would travel in non-cover areas within the fire area. As regeneration naturally progresses (15-20 years), the majority of the fire area would provide hiding cover allowing travel throughout the Sheppard creek and adjacent drainages. Because wolverine use of the area is expected to decline until hiding cover is re-established, salvage harvest and activities associated with it are not expected to change this factor. Temporary displacement may occur as a result of project activities. Displacement from habitat that provides mainly travel between higher quality habitat would only affect individuals and is expected to be of a short duration.

For more information about the distribution of vegetative cover see the “Commonly Hunted Big Game,” “Old Growth and Old Growth Associated Wildlife Species,” and “Vegetation,” sections in this chapter. For more information about this species and its habitat at various scales, including that of the Flathead National Forest, see Exhibit Rg-1.

**<u>Cumulative Effects</u>**

**Effects Common to All Alternatives**

The Brush Creek Fire has created the most recent large change on the landscape, as well as the Little Wolf Fire of 1994. These fires changed a large portion of the cumulative effects analysis area from mixed seral conditions into early seral conditions Past timber harvest and road construction have also created much of the existing habitat conditions found within the analysis area.
The discussion below summarizes some of past, current, and reasonably foreseeable activities that are listed in Chapter 1 of this document and are discussed in detail in Exhibits Rs-9 and Rt-14.

<u>Vegetation Management</u>

Past timber sales and associated activities have created much of the existing habitat conditions (vegetation and roads) for wolverine within the analysis area. Currently, the only implemented timber sale is the Gregg-Plume sale located in upper Good Creek. Harvest of the burned portion of this sale took place in the winter of 2007-8. The unburned portion would be logged in the next one to three years; the Kootenai National Forest is proposing to salvage harvest approximately 600 acres of timber burned in the Brush Creek Fire (Exhibit U-3). Timber hauling could occur down the Sheppard Creek road starting the summer of 2008; removal of timber felled near roads for the purpose of protecting public safety during the Brush Creek Fire would be removed and is scheduled to be completed in 2008. During logging and hauling operations, there may be short-term disturbance to wolverine traveling through the area including the divide between the Flathead and Kootenai National Forests.

Past harvest on Plum Creek lands, within the analysis area, includes 250 acres of regeneration harvest in the past 40 years. This activity is expected to continue. Private and State land represent approximately five percent of the analysis area. Salvage harvest may be occurring on some or all of the remaining 80 acres not already harvested prior to the fire. These activities may result in localized disturbance and potential loss of cover within harvest areas.

It is expected that ongoing and reasonably foreseeable salvage harvest and associated activities within the cumulative effects analysis area would cumulatively contribute localized and minor effects to habitat security, availability of hiding cover, fragmentation or connectivity on the landscape, or other habitat parameters required by the wolverine.

Mushroom Harvest

Between April and July, 2008, several thousand people are expected to harvest mushrooms from 24,700 acres in the burned area on the Flathead National Forest. If wolverines are present, intense mushroom collection would cause disturbance impacts leading to a "May Impact Individuals and Habitat" determination for the wolverine (Exhibit Rs-9).

Private Land Development and Vegetation Management on Private Land

Development of private land, including the construction of roads, clearing of vegetation, construction of residences, and installation of improvements, can create a variety of changes to the landscape. Depending on the magnitude, type, and location of developments and the amount of private land on the landscape, these activities can have varied effects, including habitat loss, increased fragmentation, decreased habitat security, and localized disturbance on wolverine. The majority of private land development near the fire area has occurred in the Star Meadow and Good Creek communities. The rate of development has been recently increasing.

Given the low level of use the analysis area receives from the wolverine, these activities would contribute minor effects to habitat security, availability of hiding cover, fragmentation or connectivity on the landscape, or habitat parameters required by wolverine over the next 10 years.

## REGULATORY FRAMEWORK AND CONSISTENCY

In accordance with FSM 2673.42, determinations have been made on the degree of impact the proposed activities may have on sensitive species (Table 3-90 and Exhibits Rs-1 and Rs-3). Along with Chapter 1, Chapter 2, and the sub-section above on each species, these determination statements meet the requirements of the Biological Evaluation for Sensitive Wildlife

Species. These statements are based on available information on the distribution, presence in the project area, habitat requirements, and management strategies for these species, as well as the project design and location. These determination statements are for the segment of the population using the Affected Area, not the entire population. They are also based on an additional analysis that assessed viability at the forest scale (Exhibit Rg-5). All alternatives would be consistent with NFMA direction for diversity of plant and animal communities and ecological sustainability.

**Table 3-90. Biological Evaluation Determinations for Sensitive Wildlife Species** (Exhibit Rs-3)**.**

| Sensitive Wildlife Species | ALTERNATIVE | | | |
|---|---|---|---|---|
| | A | B | C | D |
| Bald Eagle | NI | MIIH | MIIH | MIIH |
| Black-backed Woodpecker | BI | MIIH | MIIH | MIIH |
| Western (Boreal) Toad | NI | MIIH | MIIH | MIIH |
| Common Loon | NI | MIIH | MIIH | MIIH |
| Fisher | NI | MIIH | MIIH | MIIH |
| Flammulated Owl | NI | NI | NI | NI |
| Gray Wolf | NI | MIIH | MIIH | MIIH |
| Harlequin Duck | NI | NI | NI | NI |
| Northern Bog Lemming | NI | MIIH | MIIH | MIIH |
| Northern Leopard Frog | NI | MIIH | MIIH | MIIH |
| Peregrine Falcon | NI | NI | NI | NI |
| Townsend's Big-eared Bat | NI | MIIH | MIIH | MIIH |
| Wolverine | NI | MIIH | MIIH | MIIH |

NI = "No Impact."
MIIH = "May Impact Individuals or Habitat but would not likely result in a trend toward federal listing or reduced viability for the population or species".
BI = "Beneficial Impact."

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# RECREATION

## Introduction

Recreational opportunities occurring within the analysis area most likely to be affected by proposal in the action alternatives include camping, fishing, hunting, cabin rental, hiking horseback riding, bicycling, motorized road, and trail use. Some of these activities are concentrated in particular sites while others are dispersed along the roads, trails, streams, and in general forest areas.

## Information Sources

Information for this analysis was gathered through observations made during routine maintenance and surveys of recreation facilities. Trail locations and improvements were cataloged using Global Positioning System (GPS) equipment and software. Road mileages reported were gathered through use of the Flathead National Forest's GIS database.

## Analysis Area

This analysis evaluates the recreation resources most likely to be affected by all actions presented in the Sheppard Creek Post-Fire Project. Although the Brush Creek Fire area encompasses approximately 30,000 acres, this analysis will focus on recreational activities, within the fire perimeter specific to National Forest System lands, on the Flathead National Forest. Some roads and trails extending outside the fire perimeter may be affected by proposed management actions.

## Affected Environment

The Recreation Opportunity Spectrum (ROS) is used as a means of describing recreational settings and activities as described in the Forest Plan. ROS classifies the Sheppard Creek Project analysis area within a spectrum from semi-primitive motorized to rural. Visually, much of the area is culturally modified but attractive in appearance with moderate evidence of the sights and sounds of man. What facilities there are have been located in concentrated developed areas and integrated into the natural environment. Interaction between users is high in developed areas and low to moderate in general forest areas. Open forest roads and maintained trails provide the focus for most year-round recreational activities (e.g., pleasure driving, wildlife viewing, fishing, biking, hunting, snowmobiling, and firewood gathering).

## Areas of Special Recreational Interest in the Sheppard Creek Post-Fire Project Area

Recreational areas marked with an asterisk (*) have the potential to be directly or indirectly affected by features of the action alternatives; the other recreational areas are listed for informational purposes only.

### Trails

Elk Mountain Trail 252 offers both motorized and non-motorized users 11 miles of high alpine views along the divide between the Flathead and Kootenai National Forests. The trail ends at the summit of Elk Mountain. An old fire lookout still remains; however, it recently blew over and is in a state of disrepair. The Kootenai National Forest had the administrative responsibilities for the lookout. In addition to the lookout, there is a restored lookout's cabin approximately 1.5 miles from the summit of Elk Mountain. The Flathead National Forest is responsible for administration of that cabin. To access Elk Mountain there are three choices, two small feeder trails and a small trailhead located at Brush Divide off Forest road 113.

Dunsire Pass Trail 258 is a feeder trail to Elk Mountain trail approximately one half mile in length. This trail offers access from the Dunsire gravel pit, a popular place to camp for the Back Country Horseman and other users with trailers. Of all the trails in the Sheppard Creek Project area, this trail experienced an almost complete burn over. Efforts to reestablish the trail corridor have already started. Due to the trail's steep grade, it is a non-motorized route.

Ingalls Mountain Trail 171 connects the Star Meadow area to Sylvia Lake and then onto Conner Mountain offering 11 miles of motorized and non-motorized access. This trail provides for several types of users such as hikers, mountain bikers, horse riders, and motor cyclists. Access to Trail 171 is located off Forest Road 538 or at Sylvia Lake. In addition, the trail also intersects with the Griffin Creek Trail 480.

Griffin Creek Trail 460 is three miles long; a portion of the trail was an old wagon route that serviced the lookout at Ingalls Mountain. This trail intersects with Ingalls Mountain trail and travels south to Forest Road 538. The trail is both motorized and non-motorized. During the Little Wolf Fire portions of the trail were burned over. In 2006 and 2007, the trail was reconstructed to Forest Service standards. The final segment would be completed in 2008.

Sanders Mountain Trail 172 is approximately five miles in length. This trail has not been maintained to Forest Service standards due to mixed ownership with Plum Creek and lack of easement. The current trail condition is not known.

Table 3-91 below summarizes the effects to trails in the Sheppard Creek Area.

**Table 3-91. Burned Over Affected Trails and Existing Type of Use in the Sheppard Creek Area.**

| Trail Name and Number | Overall Length | Affected Length | Motorcycle | Horse | Bike | Hike | ATV |
|---|---|---|---|---|---|---|---|
| Elk Mountain #252 | 11 miles | 4 miles | Yes | Yes | Yes | Yes | No |
| Dunshire Pass #258 | 0.5 miles | 0.5 miles | No | Yes | Yes | Yes | No |

| Trail Name and Number | Overall Length | Affected Length | Motorcycle | Horse | Bike | Hike | ATV |
|---|---|---|---|---|---|---|---|
| Ingalls Mountain #171 | 11 miles | 3.5 miles | Yes | Yes | Yes | Yes | No |
| Griffin Creek #460 | 3 miles | 1 mile | Yes | Yes | Yes | Yes | No |
| Sanders Mountain #172 | 5 miles | 0 miles | No | Yes | Yes | Yes | No |

## Other Routes

There are several old logging roads and trail routes in the Sheppard Creek Project area that residents use to access national forest lands. These old roads and trail routes are not system trails and have not been recorded or listed as district trails. Any future management of these routes would be very limited. Unless motorized use is occurring on these segments, access and use of these routes would not change substantially.

Off Highway Vehicle (OHV) and motorized use would continue on open forest roads providing they are street legal according to the State of Montana regulations. Opening the forest through fuel reduction would not increase legal off road use because of the new national OHV Policy. The OHV policy requires each national forest or ranger district to designate roads, trails, and areas open to motor vehicle use, by class of vehicle. There are no designated routes or closed roads designated for OHV use in the Sheppard Creek Project area.

Fishing at Sylvia Lake for native grayling and cutthroat trout is a popular activity for avid anglers. The lake has a small boat launch in the developed campground. In addition, Forest Service roads within the Sheppard Creek Project area provide convenient access to many of the District's other streams both in and outside the analysis area. Fishing in the Sheppard Creek Project area can be characterized by a feeling of solitude that is provided by the limited number of anglers.

Snowmobiles have a legal season, from December 1 to May 15, on roads closed yearlong or seasonally to motorized use. There are a few roads north of Star Meadow and near Gregg Creek that are open to snowmobiling from December 1 to March 31. There are no managed or groomed snowmobile trails within the analysis area, and there is little data available on use patterns. During some years, residents within the project area must rely on snowmobiles as a means of ingress/egress to their property. Snowmobiling by non-residents occurs at modest levels.

Open and closed roads receive the majority of recreation use within the analysis area. Primary activities associated with the use of the road system includes pleasure driving, hunting, snowmobiling, berry picking, OHV users, mountain biking, and firewood gathering.

Roads are primarily used for firewood gathering. The network of roads open year-round and seasonally, along with the supply of dead lodgepole pine, offers firewood-gathering opportunities for the surrounding communities of Whitefish, Kalispell, and Olney. The increasing number of year-around and seasonal residents in the Star Meadow and Good Creek areas also utilize the roads for a variety of forest activities.

The open and closed road system in the Sheppard Creek Project area is an essential part of big game hunting season. Road use is high during this time of year throughout the Sheppard Creek drainage because it connects with the interior roads on the Tally Lake Ranger District. The spring bear season also sees higher levels of road use, but to a lesser degree than the fall hunting season. The open road system allows hunters to access areas by motorized vehicles from where they may continue on by non-motorized means, either traveling cross-country or on roads that have been closed seasonally or year-around. The closed road system provides easy walking, horseback riding, or mountain biking access that facilitates game retrieval within the project area.

There are no large unroaded areas within or near the project area, and there are no unroaded lands identified as inventoried roadless areas in the 1977 Roadless Area Review and Evaluation process (RARE II). In addition, there are no congressionally designated wilderness areas, research natural areas, or wild sections of designated wild and scenic rivers.

A campground is located at the eastern end of Sylvia Lake and has three developed campsites, a small boat launch, and a restroom. This campground is popular during the summer months for campers desiring a less developed experience with plenty of recreational opportunities such as hiking, swimming, fishing, small craft boating, and picnicking.

The Star Meadow Cabin located 23 miles from Whitefish is a popular cabin rental for users from the Flathead Valley and across the United States. This cabin is rented through a national reservation system used by the Forest Service. The cabin sleeps six comfortably, has electricity, a hand pump well, and an outdoor restroom. The paved access road offers year round accessibility.

## Environmental Consequences

### *Direct, Indirect, and Cumulative Effects*

#### Alternative A – No Action

Alternative A does not propose any new activities and does not change current management in the project area. Recreation resources would be affected by the implementation of Alternative A. Trail maintenance would increase for all trails through the next decade from deadfall over the trail corridors.

#### Alternative B – Proposed Action

**Hiking and Trail Access**

In Alternative B there would be timber harvest operations affecting Elk Mountain Trail 252 with helicopter logging along two miles of the divide on both sides of the trail. Vistas would be opened up looking east into the Tally Lake Ranger District. Units 38, 39, and 45 burned as a high intensity crown fire on both sides of the Elk Mountain trail corridor. At least 80 percent of the existing trees were burned and would be removed which would open the canopy, improve the views, and provide a park like setting once the grasses and forest vegetation grow back. Unit 40 also burned as a high intensity crown fire where tractor skidding would be used during the winter months to remove 80 percent of the dead trees, for approximately one half mile, opening the corridor along the trail. Through out the Elk Mountain trail where the fire burned, there would be less trail maintenance in years to come through the cutting units with the removal of the burned trees.

Dunsire Pass Trail 252 was severely burned over and only has some live vegetation left in pockets; however, due to how hot the fire burned, there would be very few trees left on the landscape. Unit 48 calls for tractor removal of the dead trees; approximately 95 percent of the existing trees burned on the upper segment of the trail. The area would remain open for many years until the trees and brush reestablish in the area.

Ingalls Mountain Trail 171, heading east, would have both tractor and helicopter logging for approximately two miles along the trail corridor. The area burned as a severe understory burn in unit 112; through unit 114, the area burned as a severe crown fire where 80 percent mortality is expected. In units 120, 121, and 124 approximately 30 to 80 percent mortality is expected. The removal of the dead trees would provide open areas along the trail with improved vistas looking south. Ingalls Mountain trail heading west to Mount Conner would have approximately a half mile of salvage along the trail corridor by tractor. The area burned as a severe crown fire in units 30, 31, and 21, opening the canopy with the removal of 80 percent of the existing trees and providing vistas to the south. Trail maintenance for the next several decades would be reduced by the removal of dead trees along the corridor where the fire burned.

Griffin Creek Trail 460 would not be affected by salvage operations. No harvest units are planned along this trail.

Sanders Mountain Trail 172 would have less than one third mile of dead trees removed along the corridor in units 11 and 19 by winter tractor logging. The fire burned as a severe crown fire with the likelihood that 80 percent of the over story would be removed by salvage operations. The potential for opening of vistas would be minimal due to the small amount of tree removal planned along the Flathead and Kootenai Forest boundaries.

## Alternative C

### Hiking and Trail Access

In Alternative C there would be salvage harvest operations affecting Elk Mountain Trail 252 with tractor logging in winter for less than one half mile along the divide. One new clearing would open up an area near Brush Divide looking southeast into the Tally Lake Ranger District. Unit 40 burned as a high intensity crown fire along the Elk Mountain trail corridor. At least 80 percent of the existing trees burned and would be removed which would open the canopy, slightly improve the view, and provide a park like setting once the grasses and forest vegetation grow back. In unit 40, on the Elk Mountain trail, there would be less trail maintenance in years to come with the removal of the burned trees.

Dunsire Pass Trail 252 was severely burned over and only has some live vegetation left in pockets; however, due to how hot the fire burned, there would be very few trees left on the landscape. Unit 48 calls for tractor removal of the dead trees; approximately 95 percent of the existing trees burned on the upper segment of the trail. The area would remain open for many years until the trees and brush reestablish in the area.

Ingalls Mountain Trail 171, heading east, would be tractor logged in the winter for approximately one half mile along the trail corridor. The area burned as a severe understory burn in unit 112 where 80 percent mortality is expected. The removal of the dead trees would slightly improve vistas looking south. Ingalls Mountain trail heading west to Mount Conner would have approximately one half mile of salvage along the trail corridor by tractor. The area burned as a severe crown fire in units 30 and 31, opening the canopy with the removal of 80 percent of the existing trees and providing vistas to the south. Trail maintenance for the next several decades would be reduced by the removal of dead trees along the corridor where the fire burned.

Griffin Creek Trail 460 would not be affected by salvage operations. No harvest units are planned along this trail.

Sanders Mountain Trail 172 would have less than one-quarter mile of dead trees removed along the corridor, in unit 11, by winter tractor logging. The fire burned as a severe crown fire with the likelihood that 80 percent of the over story would be removed by salvage operations. The potential for opening of vistas would be minimal due to the small amount of tree removal planned along the Flathead and Kootenai Forest boundaries.

## Alternative D

### Hiking and Trail Access

In Alternative D there would be timber harvest operations affecting Elk Mountain Trail 252 with helicopter logging along two miles of the divide on both sides of the trail. Vistas would be opened up looking east into the Tally Lake District. The units 38A, 39, and 45 burned as a high intensity crown fire on both sides of the Elk Mountain trail corridor. Approximately 80 percent or more of the existing trees were burned and would be removed which would open the canopy, improve the views, and provide a park like setting once the grasses and forest vegetation grow back. Unit 40 also burned as a high intensity crown fire where tractor skidding would be used during the winter months to remove 80 percent of the dead trees, for approximately one half mile, opening the corridor along the trail. Throughout the Elk Mountain trail where the fire burned, there would be less trail maintenance in years to come through the cutting units with the removal of the burned trees.

Dunsire Pass Trail 252 was severely burned and only has some live vegetation left in pockets; however, due to how hot the fire burned, there would be very few trees left on the landscape. Unit 48 calls for tractor removal of the dead trees; approximately 95 percent of the existing trees burned on the upper segment of the trail. The area would remain open for many years until the trees and brush reestablish in the area.

Ingalls Mountain Trail 171, heading east, would have both tractor and helicopter logging for approximately two miles along the trail corridor. The area burned as severe understory burn in unit 112; through unit 114, the area burned as a severe crown fire where 80 percent mortality is expected. In units B28, 120, 121, and 124 approximately 30 to 80 percent mortality is expected. The removal of the dead trees would provide open areas along the trail with improved vistas looking south. Ingalls Mountain trail heading west to Mount Conner would have over one half mile of salvage along the trail corridor by tractor and helicopter. The area burned as a severe crown fire in units 30, 31 and 21A, opening the canopy with the removal of 80 percent of the existing trees and providing vistas to the south. Trail maintenance for the next several decades would be reduced by the removal of dead trees along the corridor where the fire burned.

Griffin Creek Trail 460 would have two segments, logged by helicopter, near the intersection of Trails 460 and 171 in unit B28. The area burned moderately with 30 to 80 percent mortality expected. Vistas would not improve due the landscape features of the area.

Sanders Mountain Trail 172 would have one half mile of dead trees removed along the corridor in units B17, 11, and 19 by winter tractor logging and helicopter. The fire burned as a severe crown fire with the likelihood that 80 percent of the over story would be removed by salvage operations. There is potential to improve vistas with the removal of dead trees along the trail corridor on the Flathead and Kootenai National Forest boundaries.

## Effects Common to all Action Alternatives

- There would be no increase or loss of motorized trails or non-motorized trails in the analysis area.
- There would likely be a short-term loss of hunting and fishing during the timber removal; however, there would be no net loss of acres once the timber salvage was completed.
- There would be no net loss of acres available for snowmobile use.
- There would be a short-term increase in open and closed roads during timber salvage. This would return to the present exiting condition once timber harvest is completed.
- There would not be a change in unroaded areas.
- There would be no increase in campsites or dispersed sites.
- There would be no change in the Star Meadow Cabin rental program during or after timber salvage operations.

**Table 3 - 92. Sheppard Creek Trail Management Area Designation**

| Trail Number and Name | Management Area Designation | Description of Designation |
|---|---|---|
| #252 Elk Mtn<br>#258 Dunshire<br>#171 Ingalls<br>#172 Sanders | MA 2C | Provide for a variety of primitive and semi-primitive dispersed recreation opportunities. To meet roaded natural appearing ROS. |
| #460 Griffin | MA 15 | Emphasize cost efficient production of timber while protecting the productive capacity of the land and timber resources using roads. |

## REGULATORY FRAMEWORK AND CONSISTANCY

The Forest Plan (pg. II-21 #13) established Forest-wide recreation standards that relate directly to the Sheppard Creek Project analysis. Listed here are the goals and objectives that provide the framework for managing the recreation resources in the Sheppard Creek area.

- #13- System trails located in resource development areas must be included in the project environmental analysis. Any decision to abandon the trail must be clearly documented. To the extent possible, trails should be protected during project activities, and when it is not practical to preserve an existing trail, the trail should be relocated temporarily or permanently.

In addition to the forest standards the Forest Plan (pg. III-7 Recreation MA 2 through 2C #1, #2; MA 2 #3; MA 2C #1)

MA 2 through 2C

- #1- Maintain existing facilities such as trails, trailheads, toilets, hitch racks, stock ramps, registration boxes, and informational signs.
- #2- Consider the Management Area's ROS classification in determining trail maintenance levels.

MA 2

- #3- Maintain trails for non-motorized use. Permit the use of motorized equipment only for trail maintenance, area administration, and emergency situations.

MA 2C

- #1- Maintain trails for motorized access opportunities.

The Forest Plan for MA 15 directs the management of other resources in a manner consistent with the timber management goals. Roaded natural-appearing recreation opportunities would be provided. Please see Table 3-92 for details.

Management areas 2, 2B, and 2C all allow for removal of timber salvage and other forest products as long as the values specific to the management area are protected or enhanced. The alternatives only propose to salvage post-fire products and do not propose to manage timber long-term within these areas. Salvaging timber within these areas can be accomplished while protecting the trails, trailhead facilities, developed campgrounds, and dispersed camping sites. Design criteria outlined in Chapter 2 of this document protects the trail corridor, tread, and trail improvements. There would be no long-term affect on motorized and non-motorized use on existing trails currently open to these specific uses. The ROS would be maintained for developed sites, trail maintenance levels, and trailheads. No trails would be abandoned in this analysis.

# SCENERY

## Introduction

The topography of the Sheppard Creek drainage was shaped by the continental ice mass that left behind a landform of rounded mountains. These mountains are typically forested with dense stands of timber that offer limited natural texture, color, line, and variety in shape. Some natural openings occur on south and west aspects and along ridge tops. These landscapes are referred to as "common" landscapes where landforms and features are not of unusual or spectacular scenic quality.

There are many viewing opportunities from homes and roads located within and adjacent to the area.

## Information Sources

Information for the scenery resource was gathered systematically from established viewpoints. These viewpoints are described in detail below.

## Analysis Area

The analysis area for the scenic resources is the project area boundary described on the alternative maps in Chapter 2. For this analysis, two viewing locations were chosen as a representative range of views in the area and are the basis for analysis and modeling of the various alternatives. These viewpoints are described below. The time frames for this analysis are from the beginning of implementation of activities to a point in the future when grass, shrubs, and small trees are established in areas disturbed by treatments, approximately 2020.

## Affected Environment

### Introduction and Regulatory Framework

The Flathead National Forest scenic resource is managed by direction provided in the Forest Plan for both forest-wide and management area standards. Visual quality is assessed and evaluated using methodologies found in the following Forest Service Handbooks: National Forest Landscape Management, USDA, Forest Service Handbook Nr. 462, April 1974; and Landscape Aesthetics, USDA Forest Service Handbook Nr. 701, December 1995.

### Forest-Wide Standards for Visual Quality

The Forest Plan establishes forest-wide standards for visual quality:

1. In each MA, meet or exceed the recommended VQO. Where management area goals and objectives can be fully achieved and a higher VQO met without increased cost or reduced future options, the higher VQO should be achieved.

2. Visual resource analysis would normally be part of all project planning for specific areas listed in the Forest Plan on page II-22. The Sheppard Creek project is not within one of these specified areas.

3. Through the use of proper design and scheduling of activities, potential impacts on the visual resource would be dispersed and not concentrated with an area or travel corridor within a short timeframe. Achieving the long-term visual quality goal on the forest would work in direct proportion to how well the cumulative effects of time and space are addressed. The time and space principles especially need to be applied to the key areas mentioned above. These areas are not viewed as a whole at one time; however, they are viewed sequentially from primary use areas, travel routes, or recreation sites.

4. Special concerns due to catastrophic events will be handled on a case by case basis.

### Management Area Standards for Visual Quality

The Forest Plan includes Management Area (MA) standards for the Scenic Resource as described in the table below. Treatment activities are proposed in Management Areas 2C, 7, 12, 15 and 17 for the Sheppard Creek Post-fire Project.

**Table 3-93. Visual Quality Objective (VQO) by Management Area**

| Management Area | VQO Description |
|---|---|
| MA 2C | The Visual Quality Objective (VQO) for this management area is retention where management activities are not visually evident. Activities may only repeat line, form, color, and text frequently found in the characteristic landscape. |
| MA-7 and MA 12 | The VQO for these management areas is partial retention where human activity may be evident but must remain subordinate to the characteristic landscape. |
| MA-15 | The visual quality objective for this management area is modification or maximum modification.<br>- Modification VQO is where human activity may dominate the characteristic landscape but must, at the same time; utilize naturally established form, line, color, and texture. It should appear as natural occurrence when viewed in the foreground (0 to ½ mile) or middleground (1/4 to 3-5 miles).<br>- Maximum modification is where human activities may dominate the characteristic landscape but should appear as a natural occurrence when viewed as background (3-5 miles to infinity). |
| MA-17 | The Visual Quality Objective for these areas would be influenced by the adjacent management area. |

## Pre-Fire Conditions

The analysis area has been subject to natural wildland fires for the last several thousand years. Fire history studies indicate much of this landscape burned in a series of large stand-replacing wildland fires and smaller mixed severity fires. Over time, these areas have become densely forested. Stand replacement fires created large openings while mixed severity fires tended to create open stands of fire tolerant tree species. Currently, patterns or modifications to the landscape due to fire are not evident to the average visitor since only one large wildland fire (the Little Wolf in 1994) has occurred on a small part of the visuals analysis area for well over 100 years.

Since the 1950s, the landscape features of the Sheppard Creek area has been modified through timber harvesting and road construction. Many harvested openings are in various stages of vegetative recovery as seen throughout the area. More intensive timber management activities and associated road building began in the 1960s. Road construction and harvesting has taken place since then in most drainages, with the majority occurring in the 1970s and 1980s. Timber harvesting has created some obvious alterations to the landscape. About 56 percent of the project area has had some type of timber management activity; 90 percent of this activity has been even-aged regeneration treatments.

## Post-fire Conditions

The Brush Creek Fire can be visually characterized as a mosaic of timberlands burned to varying severities with fingers and small islands of green trees. Wildland fire is a natural occurrence and maintains the appearance of a natural, although altered, landscape.

The majority (64 percent) of the area burned in a high severity as it affected the vegetation. Scorched tree crowns and blackened boles are visible throughout much of the area. The Brush Creek Fire also burned with low to moderate effects to the tree crowns but burned hotter, longer, and deeper into the soil than has been observed in other large wildfires in the past. This fire behavior damaged and possibly killed tree roots and tree boles close to the surface without affecting the appearance of the trees. The visual evidence that the tree has died may not appear until this summer. Estimates of the extent of the vegetation burn severity from the Brush Creek Fire are below.

**Table 3-94. Vegetation Burn Severity**

| Vegetation Burn Severity | Percentage | Acres | Description of Mortality From Fire |
|---|---|---|---|
| Low or No Fire | 15% | 3,789 | < 30% of the trees were killed |
| Moderate | 21% | 5,258 | 30 to 80% of the trees were killed |
| High | 64% | 16,319 | > 80% of the trees were killed |

**Viewpoint Descriptions**

Viewpoints used for this analysis were selected based on the number of potential viewers, possible vegetation treatment, and logging systems as described in the alternatives. The following describes the viewpoints that would be used for further analysis on the effects of the proposed management activities on the scenery in the area. A viewpoint location map is available for review in Exhibit I-1.

Viewpoint One: Star Meadow Road (#539), section 8 (near Hope Ranch).

Viewpoint Two: Star Meadow Guard Station.

## Environmental Consequences

No significant issues related to scenery were identified. The following effects indicator was used to focus the scenery analysis and disclose any relevant effects.

- A qualitative assessment of change in scenic quality

Each of the action alternatives involves prescriptions and management activities that would result in a change from the existing character of the project area. Activities included in the action alternatives should meet the scenery objectives allocated in the Forest Plan.

### *Direct and Indirect Effects*

**Alternative A (No Action)**

The fire created large patch openings of varying sizes that are more characteristic of naturally occurring vegetation patterns. Over time, these landscape-scale patterns would improve the overall scenic quality of the area.

In about 10 to 15 years, many standing dead trees (snags) would fall down creating a variety of visual effects across the landscape. In locations where fire severity was high, large openings would be created across the landscape. In mixed fire severity, a mosaic pattern with a variety of size openings would be visible.

As time passes, stands of young trees would re-establish themselves across the landscape. In 40 to 50 years, these young trees would be about 40 to 50 feet high and take on the appearance of a forest. Areas with high burn severity may take longer to re-establish due to soils that were damaged during the fire. Visual recovery would take longer than 40 to 50 years.

No reforestation activities would occur and vegetation recovery would take place at a slower rate than if planted.

Trees that are weakened and not killed by fire are more susceptible to attack by insect and disease. Of concern is the Douglas-fir bark beetle. These and other diseases such as root rot would create patches of dead trees in the surrounding forest that did not burn. These patches would initially appear as clusters of red-needled trees. Red needles, visible on dead trees, are often dropped one to two years after they appear. In the long-term, these dead trees would appear as patches of dead, gray-bark trees.

## Effects Common to All Action Alternatives

The following information describes the short-term effects or changes as a result of implementation of the action alternatives, as seen from the viewpoints.

Short-term effects include views of stumps, log landings along roads, burn piles along roads, skyline corridor evident on the landscape, tractor skid trails, and temporary road construction.

Implementation of any action alternative may create some changes to views into and within the project area. The proposed treatments would be spread throughout the burned areas. Structure of the forest would change from dense stands of snags to stands with more openings and fewer snags per acre. Delineation between the dense stands of snags and openings with fewer snags may be noticeable.

## Alternative B

Nineteen units are wholly or partially within MA 2C, which has a visual quality objective of retention. Retention VQO provides for management activities that are not visually evident. Landscapes within this management area are visually more sensitive foreground (zero to one half mile from the observer). These units are primarily within the trail corridor of Trail 171 (Ingalls Mountain Trail), Trail 258 (Dunsire Pass Trail), and Trail 252 (Elk Mountain Trail).

Out of these 19 units, 13 are tractor units and six are helicopter units. Seven of the 13 tractor units are required to be winter logged, which greatly reduces impacts to visuals due to reduced soil scarification. Impacts from salvage logging would be:

- visible stumps (12 inches and lower) from the trail,
- tree marking paint on unit boundaries bordering the trail corridor,
- varying amounts of slash within the corridor would be noticeable in the short-term (one to five years), and
- tractor skid trails across the two system trails would be noticeable in the short-term (one to five years).

After five years, brush is established which screen stumps, slash, and tractor skid trail crossings. Any noticeable tree marking paint would be covered by black paint where needed.

The rest of the units (116) are within maximum modification VQOs where management activities may dominate the characteristic landscape. Of these 116 units, approximately 2156 acres would be winter logged and 2798 acres would be summer logged. Within the summer logged acreage, about 246 acres of those acres would be helicopter logged. As stated above, winter and helicopter logging greatly reduce impacts to visuals as there is little ground disturbance. Helicopter landings would be rehabilitated within one to two years after use.

Approximately 2118 acres would utilize summer skyline/cable logging systems. These systems take logs from stump to a landing using a system of cables to which logs are attached. The corridors often leave vertical lines of scarified soil on the landscape. Exposed mineral soil in these corridors would be covered with slash. Within five to ten years, brush and seedlings would be well established in the corridors thus blending the corridors with the rest of the stand.

**Alternative B Viewpoints:**

<u>Viewpoint One: Along Star Meadow Road (#539), section 8</u>

From this viewpoint, all or portions of units 125, 126, 127, 128, 129 and 130 are visible. Units 125 and 127 are winter tractor units which would blend in with the existing openings and not pose a visual concern. Units 126, 128, and 129 are skyline units (summer log) that face Star Meadow and would have short-term visual effects from the skyline corridors as viewed by local residents. Unit 130 is a tractor unit with a portion to be winter logged and a portion to be summer logged; the eastern and northeastern boundary are adjacent to an existing opening and would blend with that opening.

<u>Viewpoint Two: The Star Meadow Guard Station</u>

From this view point, units 124 (portion), 125, 126, and 127 are visible. Unit 125, 126, and 127 would have similar visual effects as described above for viewpoint one. Unit 124 is partially visible from the Guard Station and is prescribed for summer tractor yarding. Some short-term effects from skid trails may be evident.

**<u>Alternative C</u>**

Fourteen units are wholly or partially within MA 2C, which has a visual quality objective of retention. These units are primarily within the trail corridor of trails 171 and 252. All 14 of these units would utilize tractor yarding. Eleven of the 14 units are required to be winter logged. The rest of the units (82) are within maximum modification areas where management activities may dominate the characteristic landscape. Of these 82 units, approximately 1513 acres would be winter logged and 1508 acres would be summer logged. Approximately 1402 acres would utilize summer skyline/cable logging system. Impacts from salvage logging for these units are the same as described above for Alternative B.

**Alternative C Viewpoints:**

<u>Viewpoint One: Along Star Meadow Road (#539), section 8</u>

From this viewpoint you can see all or portions of the same units as Alternative B. The impacts from the proposed treatments are the same as described above.
<u>Viewpoint Two: The Star Meadow Guard Station</u>

From this view point, units 125, 126, and 127 are visible. The impacts to these units are the same as the description for viewpoint two in alternative B.

**Alternative D**

Nineteen units are wholly or partially within MA 2C, which has a visual quality objective of retention. Retention VQO provides for management activities that are not visually evident. Landscapes within this management area are visually more sensitive in the foreground (zero to one half mile from the observer). These units are primarily within the trail corridors of trails 171 and 252. Out of the 19 units, 14 would be tractor logged and five would be helicopter logged. Nine of the 14 tractor units are required to be winter logged. The rest of the units (173) are within maximum modification where management activities may dominate the characteristic landscape. Of these 173 units, approximately 2012 acres would be winter logged and 4223 acres would be summer logged. Approximately 2371 acres would utilize summer skyline/cable logging system. Impacts from salvage logging for these units are the same as described above for Alternative B.

**Alternative D Viewpoints:**

Viewpoint One: Along Star Meadow Road (#539), section 8

From this viewpoint you can see all or portions of the same units as Alternative B. The impacts from the proposed treatments are the same as described above.

Viewpoint Two: The Star Meadow Guard Station

From this view point, the same units as Alternative B are visible. The impacts to these units are the same as the description for viewpoint two in alternative B.

## *Cumulative Effects*

**Effects to all Action Alternatives**

As mentioned earlier in this section, past harvest, road construction, and other management activities have placed unnatural shapes and textures on the landscape in several areas. Visibility of some of these features will continue.

## REGULATORY CONSISTENCY

The No Action Alternative and the proposed activities in the action alternatives would comply with the visual resource objectives in the Forest Plan for all Management Areas.

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# HERITAGE RESOURCES

## Introduction

Heritage resources involve the conservation of archeological, cultural, architectural, and historic sites and artifacts. This section describes the existing heritage resource conditions of the Sheppard Creek Project area and how the No Action and action alternatives would affect the various components of this resource. The effects analysis focuses on those areas where potentially ground-disturbing activities, such as timber harvesting, are proposed. Activities that only involve the use of hand crews and no heavy equipment, such as prescribed burning, would typically not receive consideration from heritage resource personnel.

## Information Sources

The Flathead National Forest is taking a multi-phase approach to cultural resource compliance [36 CFR 800.3(c)] for the Sheppard Creek Project analysis. This is possible because of the site-specific nature of cultural resources and cultural resource compliance. The first phase is a reconnaissance level inventory of known cultural resources and a sampling of areas with a high probability for the occurrence of additional cultural resources. A pre-survey files search for information on previously recorded heritage sites in the proposed project area is also conducted. This phase includes initial consultation with the Confederated Salish and Kootenai Tribes of Montana (CSKT) to identify any concerns they may have regarding traditional cultural properties, traditional use plants, and areas of spiritual importance in the analysis area. The second phase occurs prior to actual project implementation and requires a thorough inventory of all proposed undertakings so as to locate, record, and evaluate the historical significance of any identified heritage resources. It is at this time that Section 106 consultation with the Montana State Historic Preservation Office (MtSHPO) would be completed to determine the historic significance and National Register eligibility of any identified sites, potential project effects to such sites, and methods for avoidance or management of adverse effects. The Region One Programmatic Agreement (R1PA) between the USDA Forest Service, the MtSHPO, and the Advisory Council for Historic Preservation (ACHP) provides a streamlined consultation process.

The field inventory strategy is defined in the Site Inventory Strategy (SIS) (Exhibit K-1) and involves pedestrian reconnaissance in areas proposed for future timber harvest or other ground-disturbing activity. Regardless of the degree or type of harvesting prescription, heritage resource personnel inventory the affected areas based upon topography with "high probability areas" (ridge tops, peaks, stream terraces) receiving 100 percent coverage, "medium probability areas" (slopes less than 30 percent, rock outcrops, erosional surfaces) receiving 40 percent coverage, and "low probability areas" (slopes in excess of 30 percent, north-facing slopes, heavily timbered slopes with abundant deadfall and understory) receiving 10 percent coverage.

Any heritage resource sites discovered during the two-part inventory are recorded and their National Register eligibility status evaluated in consultation with MtSHPO.

## Analysis Area

The analysis area for heritage resources, which encompasses all lands within the boundaries of the Sheppard Creek Project area defined in Chapter 1, was selected because all proposed management activities would occur within this area. The effects on heritage resources would not extend beyond the project boundary.

## Affected Environment

### Previously Identified Heritage Resources

Prior to the two-phase inventory, the forest's Heritage Resource staff conducted an in-house files search for information on known, previously recorded heritage resources in the Sheppard Creek Project analysis area. General Land Office plat maps, BLM Land Status Records, historic forest maps, and the forest's cumulative site and survey atlas were all referenced for site information.

The file search identified five recorded cultural sites in the Sheppard Creek Project study area. All five are historic period sites. There have been at least thirteen previous cultural resource inventories in the analysis area.

### Results of Survey Methodology

As of this writing, a complete pedestrian inventory for discovery of important cultural resources has not been completed for the entire Sheppard Creek Project analysis area. None of the known, recorded sites appear to be eligible for listing on the National Register of Historic Places. Surveys have been and would continue to focus on areas proposed for ground-disturbing activities, such as timber harvest units and road construction. Additional field review would occur during the snow-free periods beginning in 2008 within the boundaries of the Sheppard Creek Project implementation areas.

Discussions with the Confederated Salish and Kootenai Tribes are on-going but have not identified any concerns in the project area. Consultation with the CSKT will continue.

### REGULATORY FRAMEWORK

The USDA Forest Service is mandated to comply with the National Historic Preservation Act of 1966 (NHPA) [Public Law 89-665]. "Section 106 of the NHPA requires that Federal agencies with direct or indirect jurisdiction over Federal, federally assisted, or federally licensed undertakings afford the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity for comment on such undertakings that affect properties included in or eligible for inclusion in the National Register of Historic Places (NRHP) prior to the agency's approval of any such undertaking" [36 CFR 800.1]. Historic properties are identified by a cultural resource inventory and are determined as either eligible or not eligible for the National Register. Eligibility is reviewed, and concurrence given, by MtSHPO. Sites that are determined eligible are then either protected in-place or adverse impacts must be mitigated. This process takes place prior to any decisions relative to the project.

The Flathead National Forest operates under the terms of the R1 Programmatic Agreement between Region One of the Forest Service, the MtSHPO, and the Advisory Council for Historic Preservation. The Programmatic Agreement provides a streamlined process for complying with section 106 of the National Historic Preservation Act as amended (NHPA). The efficiencies provided by the PA should allow more time for the Forest Heritage program to fulfill the Forest's responsibilities under section 110 of NHPA.

The Confederated Salish and Kootenai Tribes have reserved treaty rights under the Hellgate Treaty of 1855. These include hunting, gathering, and grazing rights. The Forest Service also has obligations under the American Indian Religious Freedom Act (AIRFA) of 1978 to "protect and preserve for American Indians their inherent right of freedom to believe, express, and exercise the traditional religions of the American Indian" [Public Law 95-442]. Executive Order 13007 of 1996 further directs federal agencies to accommodate access to, and ceremonial use of, Indian sacred sites by Indian religious practitioners and to avoid adversely affecting such sites.

The Confederated Salish and Kootenai Tribes have been identified as a tribal group concerned about the management of heritage resources on the Flathead National Forest. The tribes were contacted in the initial planning stages of the Sheppard Creek Project in order to establish lines of communication between the two parties, to advise them on the scope of the undertaking including potential effects, and to make their resource concerns (if any) an official part of the project record. Consultation with recognized tribal governments is further defined and required by the Native American Graves Protection and Repatriation Act (NAGPRA) of 1990 [Public Law 101-106], the 1992 amendments to the National Historic Preservation Act (NHPA), and the 1999 revisions to the implementing regulations in 36 CFR Part 800; Protection of Historic Properties.

The Flathead Forest Plan incorporates the requirements under the following statutes: the National Historic Preservation Act of 1966 (as amended) and the American Indian Religious Freedom Act (1978). Forest Plan standards applicable to this project which reflect the mandates under the above statutes include:

- Inventory procedures: "Cultural resource inventories will be conducted on all ground disturbing projects that are generated, licensed, permitted, or allowed to occur by the Forest Service;"
- Evaluation procedures: "Identified cultural resources will be evaluated in relation to published criteria for eligibility to the NRHP;"
- Protection/preservation measures: "Known, significant cultural resource sites on the Forest will be protected from inadvertent or intentional damage or destruction;"

- Coordination/consultation procedures: "The Forest will make an effort to coordinate cultural resource issues and concerns with appropriate Native American groups, other Federal and State agencies, the historical and archaeological communities, and the general public."

## Environmental Consequences

As described in the regulatory framework section above, the Forest Service is required under several statutes to protect and manage cultural sites. These requirements are carried forward in the Flathead Forest Plan standards for heritage resources (Forest Plan, pages II-18 to II-21).

Heritage resource inventories are required by the Forest Plan prior to all ground disturbing projects in order to locate and identify historic or Native American sites or artifacts. Once sites or artifacts are identified in a project area, protective measures are carried out that would ensure preservation of the values associated with the site.

Heritage resources can be diminished in value by any change in their historical, architectural, archaeological, or cultural character. Adverse impacts to heritage resource sites can result in damage or complete destruction of the sites; effects of this damage may be irreversible.

### *Direct and Indirect Effects*

#### Effects Common to all Alternatives

Implementation of the No Action Alternative would neither directly nor indirectly effect cultural resources because there would be no change to the integrity of important cultural resources as a result of no activities being implemented. Implementation of an action alternative would also neither directly nor indirectly affect cultural resources because there would be no change to the integrity of important cultural resources as a result of avoidance or mitigation of activities in the vicinity of heritage resources.

Although the field inventory would be completed prior to specific project implementation, adherence to the regulations for implementing the National Historic Preservation Act ensures that important cultural resources are identified prior to project implementation and that project effects are identified and either avoided or mitigated through project redesign. Site significance and project effects are determined through consultation with MtSHPO and the CSKT.

It is recognized that even the most intensive field surveys may not locate all cultural sites. The portions of this project that would be implemented through a timber sale contract under any action alternative would include the "B6.24# Protecting of Cultural Resources" clause which enables the Forest Service to modify or cancel a timber sale contract to protect heritage resources, regardless of when they are identified.

## *Cumulative Effects*

### Effects Common to all Alternatives

There would be no cumulative effects to identified heritage resources in the Sheppard Creek Project analysis area from any proposed activities. However, any such effects would be identified as part of the consultation process with MtSHPO and the CSKT and appropriate avoidance or moderating measures would be developed.

## REGULATORY CONSISTENCY

Protection of historic and prehistoric heritage resources is prescribed in a number of laws including the National Historic Preservation Act of 1966 (as amended in 1980). Implementing regulations for the NHPA are codified in 36 CFR 800. Forest Plan standards and guidelines are designed to meet the requirements of these regulations. All Sheppard Creek Project alternatives are consistent with the laws and regulations listed above and incorporated into the requirements of the Flathead Forest Plan. Section 106 compliance and consultation with MtSHPO for this project has been completed.

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# ECONOMICS AND SOCIAL

## Introduction

This section describes the affected economic and social environment and estimates the effects associated with the No Action and action alternatives. The focus of this section is the relationship of the Flathead National Forest to the economy within and around the forest, emphasizing how forest goods and services influence the local economy. Additionally, this section assesses the potential environmental justice from proposed activities.

## Information sources

Information for this section was gathered primarily from the U.S. Census Bureau, the U.S. Bureau of Economic Analysis, the Research and Analysis Bureau of the Montana Department of Labor and Industry, and the Bureau of Business and Economic Research (BBER) at the University of Montana.

## Scope of Analysis and Analysis Methods

The geographic scope of the economic and social analysis includes Flathead, Lake, Lincoln, and Sanders Counties, Montana. This is an appropriate scope of analysis because the project may have economic impact on all four counties, with the greatest impact expected for Flathead and Lincoln counties. The temporal scope of the analysis is the duration of the proposed activities, which is estimated at 10 years (2009-2018).

Part of the Purpose and Need for this project, as stated in Chapter 1 of this document:

> *"…is to salvage harvest burned trees and recover merchantable wood fiber while it is still economically feasible to do so. Timely recovery of wood fiber would support the economies of local and regional communities."*

The measures of success and analysis methods listed in Table 3-95 assess how effectively the proposed activities under each alternative meet this element of the project's purpose and need. These methods of analysis are described in detail in this section prior to the reporting of the results.

**Table 3-95. Effectiveness of Meeting the Purpose and Need and Analysis Methods.**

| Measures of Success | Analysis Method | Analysis Tool |
|---|---|---|
| Financial Feasibility | Transaction Evidence Timber Appraisal | R1 TEA Equation, Q4 2007 |
| Financial Efficiency | Present Net Value Analysis | Quick-Silver |
| Employment & Labor Income Impacts | Input-Output Analysis | IMPLAN, 2004 |

## Project Feasibility

Financial feasibility analysis is used to determine if a timber sale project is viable (will it sell, given current market conditions). It relies on the Region 1 Transaction Evidence Appraisal (TEA) system. The TEA uses regression analysis of recently sold timber sales to predict bid prices given the specifics of the proposed project. The most recent appraisal model for the area of interest was used to estimate the stumpage value (expected high bid resulting from the timber sale auction) for the salvage project. The estimated stumpage value for each alternative was compared to the base rates (revenues considered essential to cover regeneration plus minimum return to the federal treasury) for that alternative. The project is considered to be feasible if the estimated stumpage value exceeds the base rates. If the feasibility analysis indicates that the project is not feasible (estimated stumpage value is less than the base rates), the project may need to be modified. Any infeasibility detected by this analysis indicates an increased risk that the project may not attract bids and may not be implemented (36 CFR 223.61 and FSM 2430.2).

## Financial Efficiency

Financial efficiency provides information relevant to the future financial position of the government if the project is implemented. Financial efficiency considers anticipated costs and revenues that are part of Forest Service monetary transactions. Present net value (PNV) is used as an indicator of financial efficiency and represents one tool to be used in conjunction with many other factors in the decision making process. A PNV combines benefits and costs that occur at different times and discounts them into an amount that is equivalent to the net of revenue and expenditures if all financial transactions occurred a single year. A positive PNV indicates that the alternative is financially efficient. Financial efficiency analysis is not intended to be a comprehensive analysis that incorporates monetary expressions of all known market and non-market benefits and costs. Many of the values associated with natural resource management are best handled apart from, but in conjunction with, a more limited financial efficiency framework. These non-market benefits and costs associated with the project are discussed throughout the document.

## Economic Impacts (Jobs and Labor Income)

Economic impacts are used to evaluate potential direct, indirect, and induced effects on the economy. The analytical technique used by the Forest Service to estimate employment and income impacts is "input-output" analysis using the IMPLAN Pro software system (MIG 2003). Input-output analysis (Miernyk 1965) is a means of examining relationships within an economy both between businesses and between businesses and final consumers. It captures all monetary market transactions for consumption in a given time period. The resulting mathematical representation allows one to examine the effect of a change in one or several economic activities on an entire economy, all else constant. This examination is called economic impact analysis. IMPLAN translates changes in final demand for goods and services into resulting changes in economic effects, such as labor income and employment of the affected area's economy. The IMPLAN modeling system requires one to build regional economic models of one or more counties for a particular year. The regional model for this analysis uses 2004 IMPLAN data.

The economic impacts to the local economy affected by the treatments proposed are measured by estimating the employment (full- and part-time jobs) and labor income generated by the 1) harvesting and processing of the timber volume from the project, and 2) all restoration activities included in the project. Additional mill survey data used to estimate the direct effects from the timber harvest and processing was provided by the Bureau of Business and Economic Research at the University of Montana,. The direct employment and labor income benefits employees and their families and therefore directly affects the local economy. Additional indirect and induced multiplier effects (ripple effects) are generated by the direct activities. Together the direct and multiplier effects comprise the total economic impacts to the local economy. The multiplier effects tied to the timber harvest and processing were estimated using IMPLAN. Potential limitations of these estimates are the time lag in IMPLAN data and the data intensive nature of the input-output model.

### Environmental Justice

Environmental justice effects would report what, if any, effects might occur to ethnic or disadvantaged peoples. Of particular concern is whether job or income discrimination might occur to ethnic or disadvantaged citizens in the area during or resulting from the proposed project.

## Affected Environment

### County Level Demographics

According to the 2000 Census (U.S. Dept. of Commerce 2000), Flathead County had the highest population of the four counties identified as the economic impact area, with Lake County ranking second. The combined population of the four counties in 2000 was 130,042, which was 14 percent of the population of the state of Montana. All four counties have experienced population growth since the 1990 Census, and according to Census population projections, this growth is expected to continue in the future.

**Table 3-96. Demographics Indicators for Counties in the Economic Impact Zone.**

| Year | Flathead | Lake | Lincoln | Sanders |
|---|---|---|---|---|
| 1990 | 59,218 | 21,041 | 17,481 | 8,669 |
| 2000 | 74,471 | 26,507 | 18,837 | 10,227 |

Source: 1990 Census, 2000 Census

The percentage of Montana families below the poverty level dropped from 12 percent in the 1990 census to 10.5 percent in the 2000 census. The percent of families below the poverty level also decreased between the 1990 and 2000 censuses for Flathead, Lake, and Sanders Counties; Lincoln County saw an increase in families below the poverty level. During 2000, none of the four counties contained low-income or minority populations as defined by Executive Order 12898 (20 percent below the poverty level or 50 percent minority).

**Table 3-97. Families Below Poverty Level.**

| Unit | 1990 | 2000 |
|---|---|---|
| State of Montana | 12.0% | 10.5% |
| Flathead | 11.7% | 9.4% |
| Lake | 16.6% | 14.0% |
| Lincoln | 11.7% | 14.2% |
| Sanders | 14.1% | 13.3% |

Source: 1990 Census, 2000 Census

## County Level Economic Indicators

Part and full-time employment in the four counties grew rapidly from 1973 to 2003 (Table 3-97). The total employment in the four counties increased from 35,136 in 1973 to 81,166 in 2003 (U.S. Dept of Commerce 2005). This is an average annual growth rate of approximately 7.7 percent. Flathead County in particular has consistently been one of the counties in the state with rapid employment growth in the last 30 years. The 2006 average annual unemployment rate in all four counties was higher than the statewide Montana rate of 3.2 percent (Table 3-98).

**Table 3-97. Total Full-time and Part-time Employment.**

| County | 1973 | 1993 | 2003 |
|---|---|---|---|
| Flathead | 18,925 | 39,107 | 52,939 |
| Lake | 5,827 | 10,306 | 13,704 |
| Lincoln | 6,927 | 8,461 | 8,989 |
| Sanders | 3,457 | 3,303 | 5,534 |
| Total | 35,136 | 61,177 | 81,166 |

Source: U.S. Department of Commerce, BEA, Regional Economic Information System

**Table 3-98. Average annual unemployment rate in 2006.**

| Unit | Unemployment Rate |
|---|---|
| Montana | 3.2% |
| Flathead | 3.6% |
| Lake | 4.5% |
| Lincoln | 6.4% |
| Sanders | 4.8% |

Source: U.S. Department of Commerce, BEA, Regional Economic Information System

Several economic indicators show that although Flathead County has been leading in all statistics, all four counties have seen increases in real (inflation adjusted) earnings and income in most recent years. Total real earnings for the four counties grew substantially each decade from 1970 until 2000. Real earnings in Flathead and Lake Counties at the start of each decade overwhelmed small decreases in real earnings for Lincoln County between 1980 and 1990, and for Sanders County between 1990 to 2000. Similar trends can be seen in more recent data from 2001 to 2003, where real earnings growth in Flathead, Lake, and Sanders counties continued to increase each year, whereas real earnings were slightly less during 2002 than during 2001 in Lincoln County. However, Lincoln County resumed real earnings growth in 2003, the final year with reported data.

Total personal income also rose more rapidly for Flathead County than the other three counties between 1973 and 2003 (Table 3-100). However, all counties showed marked growth during each of the decades during those 30 years. Total real earnings for the four counties increased from $2.03 billion in 2001 to $2.15 billion in 2003. This an average annual growth rate of roughly three percent.

**Table 3-99. Recent total (farm and non-farm) earnings by county for the years 1970 to 2000 using SIC* Sectors and 2001 to 2003 using NAICS** sectors (thousands of 2003 dollars).**

| County | 1970 | 1980 | 1990 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|
| Flathead | 413,553 | 696,035 | 837,733 | D/N | 1,412,004 | 1,442,291 | 1,505,574 |
| Lake | 89,174 | 138,322 | 188,081 | 293,450 | 300,579 | 304,251 | 311,811 |
| Lincoln | 232,404 | 201,849 | 231,151 | 212,663 | 219,996 | 219,346 | 223,407 |
| Sanders | 57,128 | 85,952 | 74,100 | 95,431 | 102,100 | 107,544 | 111,650 |
| Total | 792,259 | 1,122,158 | 1,331,065 | D/N | 2,034,679 | 2,073,432 | 2,152,442 |

Source: U.S. Department of Commerce, BEA, Regional Economic Information System

**Table 3-100. Total Personal Income for 1973, 1983, 1993 and 2003 (2003 dollars).**

| County | 1973 | 1983 | 1993 | 2003 |
|---|---|---|---|---|
| Flathead | 661,277 | 976,782 | 1,440,453 | 2,164,975 |
| Lake | 205,803 | 286,474 | 414,764 | 555,083 |
| Lincoln | 245,450 | 274,742 | 318,700 | 381,913 |
| Sanders | 105,263 | 125,064 | 148,937 | 202,655 |
| Total | 1,217,793 | 1,663,062 | 2,322,854 | 3,304,626 |

Source: Pacific Northwest Regional Economic Analysis Project (PNREAP), Bureau of Economic Analysis
* Standard Industrial Classification
** North American Industry Classification System

The per capita personal income (PCPI) economic indicator conveys information about the average personal income for each county. This is what each citizen would receive if the total personal income generated by all residents (over age 15) in that country were divided equally among all residents. Although Flathead County had the highest PCPI of the four counties for 1995, all four counties were below the State of Montana average that year. In 2003, Flathead County was higher than the State of Montana for PCPI while the three other counties remained below the state PCPI.

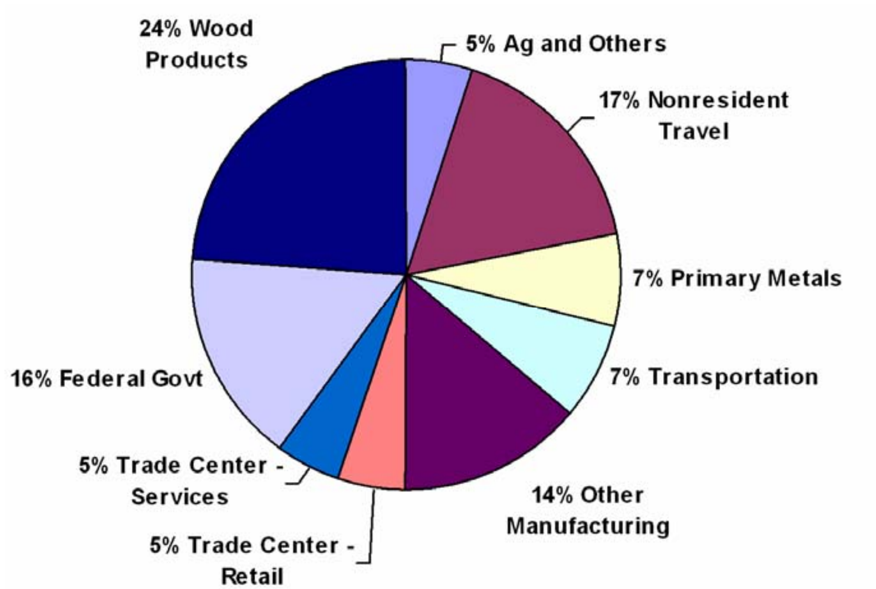
**Table 3-101. Per Capita Personal Income (2003 dollars).**

| Unit | 1973 | 1983 | 1993 | 2003 |
|---|---|---|---|---|
| State of Montana | $16,763 | $18,146 | $21,339 | $26,360 |
| Flathead | $15,818 | $18,133 | $22,022 | $27,277 |
| Lake | $12,931 | $14,454 | $18,034 | $20,285 |
| Lincoln | $13,855 | $15,026 | $17,435 | $20,198 |
| Sanders | $13,949 | $13,652 | $16,135 | $19,289 |

Source: Pacific Northwest Regional Economic Analysis Project (PNREAP), Bureau of Economic Analysis

The project area is mainly located in Flathead County, where wood and paper products are an important component of the economic base (which represent the export portion of the economy and includes among other sectors: manufacturing, transportation, nonresident travel, and the federal government). The Bureau of Business and Economic Research at the University of Montana, reports that in 2005 wood and paper products accounted for 24 percent of the labor income (Figure 3-21) in basic Industries in Flathead County (Bureau of Business and Economic Research 2005).

**Figure 3-21. Labor Income in Basic Industries, Flathead County, (2003-2005).**




(Sources: Bureau of Business and Economic Research, the University if Montana – Missoula; Bureau of Economic Analysis, U.S. Department of Commerce)

## Flathead National Forest Timber Program

Table 3-102 and Figure 3-22 display information regarding the Flathead National Forest timber program from 1985 to 2005. These displays offer a time-series perspective for the last twenty years. Generally, the size of the timber program on the Flathead National Forest has declined over the last twenty years. Some of the decline can be attributed to reduced Congressional allocations and litigation involving projects with a commercial timber component.

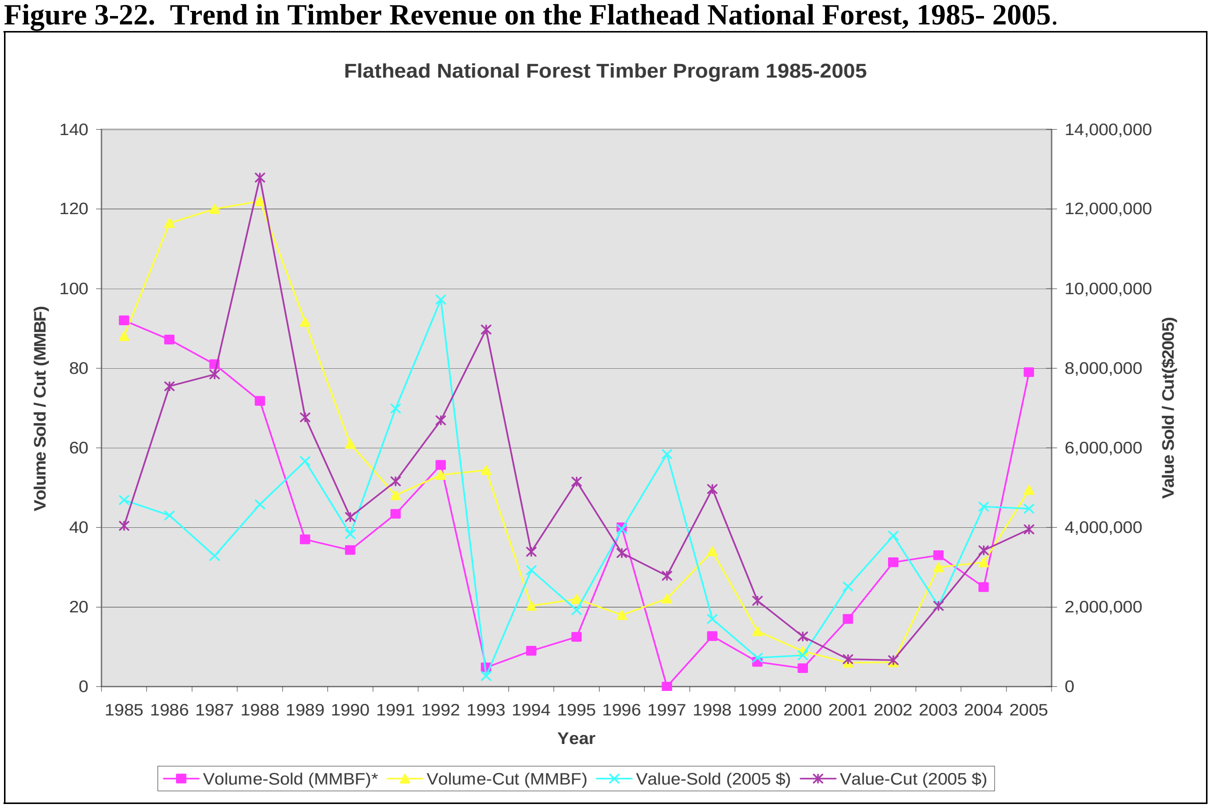
Since 1985, when the Flathead National forest offered for sale a high of 92 million board feet and the lowest volume offered for sale, 4.6 million board feet, was in 2000. The Proposed Action would offer 27 million board feet of timber to be sold in fiscal year 2009.

**Table 3-102. The Trend in Volume Cut and Sold for the Flathead National Forest and Revenue Received.**

| Year | Volume-Sold (MMBF)* | Volume-Cut (MMBF) | Value-Sold (2005 $) | Value-Cut (2005 $) |
|---|---|---|---|---|
| 1985 | 92.0 | 88.1 | 4,687,640 | 4,039,580 |
| 1986 | 87.2 | 116.5 | 4,299,243 | 7,547,420 |
| 1987 | 81.0 | 120.0 | 3,287,908 | 7,842,910 |
| 1988 | 71.8 | 122.0 | 4,580,417 | 12,792,131 |
| 1989 | 37.0 | 91.7 | 5,666,053 | 6,767,636 |
| 1990 | 34.3 | 61.0 | 3,834,869 | 4,260,929 |
| 1991 | 43.4 | 48.1 | 6,992,040 | 5,158,062 |
| 1992 | 55.7 | 53.2 | 9,722,805 | 6,694,132 |
| 1993 | 4.8 | 54.4 | 269,812 | 8,973,701 |
| 1994 | 9.0 | 20.3 | 2,928,027 | 3,389,405 |
| 1995 | 12.5 | 22.0 | 1,920,406 | 5,152,720 |
| 1996 | 40.0 | 18.0 | 3,955,097 | 3,355,255 |
| 1997 | 32.0 | 22.1 | 5,841,307 | 2,785,606 |
| 1998 | 12.7 | 34.0 | 1,701,905 | 4,965,420 |
| 1999 | 6.2 | 13.9 | 725,245 | 2,157,220 |
| 2000 | 4.6 | 8.9 | 787,255 | 1,264,758 |
| 2001 | 17.0 | 6.0 | 2,515,426 | 689,301 |
| 2002 | 31.2 | 6.1 | 3,791,139 | 664,893 |
| 2003 | 33.0 | 30.0 | 2,035,389 | 2,028,132 |
| 2004 | 25.0 | 31.2 | 4,524,608 | 3,424,582 |
| 2005 | 79.0 | 49.4 | 4,469,652 | 3,953,132 |

*Million board feet

**Figure 3-22. Trend in Timber Revenue on the Flathead National Forest, 1985- 2005.**



# Environmental Consequences

## Project Feasibility

The estimation of project feasibility was based on the Region 1 transaction evidence appraisal model, which took into account logging systems; timber species and quality; volume removed per acre; lumber market trends; and costs for slash treatment, temporary road construction, and road maintenance. The estimated high bid was compared to base rates (revenues considered essential to cover regeneration plus minimum return to the federal treasury). The estimated high bid and base rates for each alternative are displayed in Table 3-103. The estimated high bids for Alternatives B, C, and D indicate that each of the alternatives is feasible (likely to sell). The revenue estimates from the feasibility analysis are used in the financial efficiency analysis discussed below.

Reforestation costs are not included in the financial feasibility nor the PNV analyses because these costs are a result of the Brush Creek Fire and would be incurred whether the no-action or one of the action alternatives are selected. Reforestation needs within the project area are presented in the *Vegetation* section found earlier in this chapter. The cost of all reforestation and subsequent survival exams in the Brush Creek Fire, including areas not proposed for salvage harvest in an action alternative, is approximately 3.5 million dollars.

## Financial Efficiency

The financial efficiency analysis is specific to the timber harvest and restoration activities associated with the alternatives (as directed in Forest Service Manual 2400 and guidance found in the Forest Service Handbook 2409.18). Costs for sale preparation, sale administration, regeneration, and restoration activities are included. All costs, timing, and amounts were developed by the specialists on the project's interdisciplinary team. If exact costs were not known, the maximum of the cost range was used to produce the most conservative PNV result. The expected revenue for each alternative is the corresponding predicted high bid from the transaction evidence appraisal equation. The PNV was calculated using Quicksilver, a program for economic analysis of long-term, on-the-ground resource management projects. A four percent real discount rate was used over the five-year project lifespan (2009 to 2013). Please see Exhibit N-1 for more information on the values or costs.

This analysis is not intended to be a comprehensive benefit-cost (or PNV) analysis that incorporates a monetary expression of all known market and non-market benefits and costs that is generally used when economic efficiency is the sole or primary criterion upon which a decision is made. Many of the values associated with natural resource management are best handled apart from, but in conjunction with, a more limited benefit-cost framework. These values are discussed throughout this document for each resource area.

Changes to resources like fisheries have been measured using expected changes to habitat conditions and would not be described in financial or economic terms for this project. See the resource sections of this document. Recreation levels are not expected to change between any alternative and were not included in the financial efficiency analysis.

Table 3-103 summarizes the project feasibility and financial efficiency, including the base rates, predicted high bid (i.e., estimated stumpage value), total revenue, and PNV for each alternative. The PNV indicates the financial efficiency of the timber sale, including all costs and revenues associated with the timber harvest and required design criteria. The required design criteria, as used here, are the mandatory land management activities (e.g., weed spraying, burning landing piles, seeding and planting of temporary roads after use, and seeding skid and skyline trails). There are also some non-essential restoration costs for monitoring weeds and planting forbs and shrubs along temporary roads after use. These two costs are not in the appraisal but they are captured in the financial efficiency analysis. There are also some sale preparation costs and sale administration costs. The costs of sale preparation ($11.89/CCF) and sale administration ($1.93/CCF) together are approximately $816,278 for Alternative B, $516,218 for Alternative C, and $964,802 for Alternative D.

Table 3-103 indicates all action alternatives are financially efficient for the timber sale, as well as the entire project when timber and all non-timber activities are considered. The No Action Alternative has no costs or revenues associated with it. Of the action alternatives, Alternative C has the highest PNV at $1,062,697.

A reduction of financial PNV in any alternative, as compared to the most efficient solution, is a component of the economic trade-off, or opportunity cost, of implementing an action alternative. The No Action Alternative would not harvest or take other restorative actions and, therefore, incur no costs. As indicated earlier, many of the values associated with natural resource management are either non-market cost and benefits or regional economic impacts. These costs and benefits should be considered in conjunction with the financial efficiency information presented here. The non-market values are discussed in the various resource sections found in this document.

**Table 3–103. Project Feasibility and Financial Efficiency Summary (2007 dollars).**

| Measure | Alternative A | Alternative B | Alternative C | Alternative D |
|---|---|---|---|---|
| Acres Harvested | 0 | 6,346 | 3,902 | 7,465 |
| Volume Harvested (CCF) | 0 | 59,065 | 37,353 | 69,812 |
| Base Rates ($/CCF) | $0 | $6.00 | $6.00 | $6.00 |
| Predicted High Bid ($/CCF) | $0 | $31.26 | $42.79 | $25.22 |
| Present Value of Total Revenue | $0 | $1,827,520 | $1,578,915 | $1,747,164 |
| Present Net Value | $0 | $1,011,242 | $1,062,697 | $782,362 |

When evaluating trade-offs, the use of efficiency measures is one tool used by the decision maker in making the decision. Many things cannot be quantified, such as effects on soils, wildlife, and/or the restoration of watersheds and vegetation. The decision maker considers many factors in making the decision.

## Economic Impacts Effects

The analysis calculated the jobs and labor income associated with the harvesting and processing of the timber products. Timber products harvested from the project, and the non-timber activities, would have direct and indirect effects on local jobs and labor income. In order to estimate jobs and labor income associated with the timber harvest, it was assumed that nearly all (98 percent) of the saw log material would be processed by the sawmill and planing sector.

Table 3-104 displays both direct and total estimates for employment (part and full-time) and labor income that may be contributed to the local economic impact area from each alternative. Since the expenditures occur over a five-year period, the estimated impacts of jobs and labor income would be spread out over the life of the project. Of these, most of the timber harvest and wood processing jobs would occur over the first two years of the project. It is important to note that these are not new jobs or income, but rather jobs and income that can be attributed to this project.

**Table 3-104. Total Employment and Labor Income (2007 dollars) Over the Life of the Project.**

| Analysis Item | Alternative A | Alternative B | Alternative C | Alternative D |
|---|---|---|---|---|
| Direct Employment | 0 | 290 | 185 | 337 |
| Total Employment | 0 | 568 | 362 | 663 |
| Direct Labor Income | 0 | $9,623,000 | $6,158,000 | $11,206,000 |
| Total Labor Income | 0 | $16,339,000 | $10,434,000 | $19,084,000 |

1. Employment is the total full- and part-time wage, salaried, and self-employed jobs in the region.
2. Labor income includes the wages, salaries and benefits of workers who are paid by employers and income paid to proprietors.

Estimates in Table 3-104 indicate that Alternative A maintains no jobs nor income because there are no activities associated with this alternative. Alternatives B and D are similar in terms of their overall employment and labor income effects, with Alternative C contributing substantially less to the local economy. The range of total jobs contributed from non-essential design criteria is 21 to 32 part and full-time jobs spread over five years. Looking at the essential activities for the timber sale, the difference between alternatives becomes more noticeable. For Alternative B, harvesting and processing of the timber products is expected to contribute approximately 568 total jobs and $16.3 million of total labor income between 2009 and 2013. For Alternative C, harvesting and processing of the timber products is expected to contribute approximately 362 total part and full-time jobs and $10.4 million of total labor income between 2009 and 2013. The total part and full-time jobs and total labor income associated with harvesting and processing of the timber products for Alternative D are somewhat larger at 663 part and full-time jobs, and approximately $19 million of labor income, between 2009 and 2013.

## REGULATORY FRAMEWORK AND CONSISTENCY

The Flathead National Forest Plan directs managers to provide a sustained yield of timber products that is cost effective and responsive to the needs of the local economy.

Forest-wide standards supplementing National and Regional policies, standards, and guidelines found in Forest Service Manuals, Handbooks, and the Northern Region Guide relevant to timber harvesting include:

- Providing well designed timber sales to be affordable under average market condition at time of sale.
- Increasing the use of available wood fiber consistent with management objectives and economic principles.

Section 16 USC 1604(g)(3)(E)(iv) requires that timber would be harvested from National Forest lands only where the harvest system to be used is not selected primarily because it would give the greatest dollar return or the greatest unit output of timber.

Alternative A would not be consistent with Forest Plan direction. The three action alternatives offer varying levels of timber harvest and are consistent with being responsive to the needs of the local economy. Action alternatives were not designed to exclusively give the greatest dollar return or the greatest output of timber.

### Environmental Justice and Civil Rights

Executive Order 12898, issued in 1994, orders federal agencies to identify and address any adverse human health and environmental effects of agency programs that disproportionately impact minority and low-income populations. The Order also directs agencies to consider patterns of subsistence hunting and fishing when an agency action may affect fish or wildlife.

The Civil Rights Act of 1964 provides for nondiscrimination in voting, public accommodations, public facilities, public education, federally assisted programs, and equal employment opportunity. Title VI of the Act, Nondiscrimination in Federally Assisted Programs, as amended (42 U.S. C. 2000d through 2000d-6) prohibits discrimination based on race, color, or national origin.

None of the alternatives restricts or alters opportunities for subsistence hunting and fishing by Native American tribes. Tribes holding treaty rights for hunting and fishing on the Flathead National Forest are included on the project mailing list and have the opportunity to provide comments on this project.

Table 3-104 above, predicts more employment and income opportunities would be created by Alternatives B and D than by Alternative A or C, with Alternative D providing the highest level of opportunity. Implementation of any action alternative would not likely adversely affect minority or low-income populations.

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