Chapter 3. Affected Environment and Environmental Consequences

3.1 Introduction

This chapter describes aspects of the environment likely to be affected by the proposed action and alternatives. Also described are the environmental effects (direct, indirect, and cumulative) that would result from undertaking the proposed action or alternative. Together, these descriptions form the scientific and analytical basis for the comparison of effects in chapter 2.

The following resource specialist analyses are incorporated by reference: Sugarloaf Hazardous Fuels Reduction Project Wildlife Biological Assessment/Biological Evaluation (JoAnna Arroyo) (USDA 2012a); Management Indicator Species Report for the Sugarloaf Hazardous Fuels Reduction Project (Cindy Roberts) (USDA 2012b); Sugarloaf Hazardous Fuels Reduction Project Wildlife Supplemental Information Migratory Birds Report (Cindy Roberts) (USDA 2012c); Sugarloaf Hazardous Fuels Reduction Project: Biological Evaluation of Potential Effects to Threatened, Endangered, and Sensitive Plant Species (Lawrence Janeway) (USDA 2012d), Forest Vegetation Report (Kip Van de Water) (USDA 2012e) and the Aquatic Biological Evaluation (Tina Hopkins) (USDA 2014).

3.2 Past, Present and Reasonably Foreseeable Actions

According to the Council on Environmental Quality (CEQ) *National Environmental Policy Act* (NEPA) regulations, “cumulative impact” is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such actions (40 CFR §1508.7).

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

This cumulative effects analysis does not attempt to quantify the effects of past human actions by adding up all prior actions on an action-by-action basis. There are several reasons for not taking this approach. First, a catalog and analysis of all past actions would be impractical to compile and unduly costly to obtain. Current conditions have been impacted by innumerable actions over the last century (and beyond), and trying to isolate the individual actions that continue to have residual impacts would be nearly impossible. Second, providing the details of past actions on an individual basis would not be useful to predict the cumulative effects of the proposed action or alternatives. In fact, focusing on individual actions would be less accurate than looking at existing conditions, because there is limited information on the environmental impacts of individual past actions, and one cannot reasonably identify each and every action over the last century that has contributed to current conditions.

Public scoping for this project did not identify any public interest or need for detailed information on individual past actions. Finally, the Council on Environmental Quality issued an interpretive memorandum on June 24, 2005 regarding analysis of past actions, which states, "agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions."

The cumulative effects analysis in this EIS is also consistent with Forest Service *National Environmental Policy Act* (NEPA) Regulations (36 CFR §220.4(f)) (July 24, 2008), which state, in part:

> "*CEQ regulations do not require the consideration of the individual effects of all past actions to determine the present effects of past actions. Once the agency has identified those present effects of past actions that warrant consideration, the agency assesses the extent that the effects of the proposal for agency action or its alternatives will add to, modify, or mitigate those effects. The final analysis documents an agency assessment of the cumulative effects of the actions considered (including past, present, and reasonable foreseeable future actions) on the affected environment. With respect to past actions, during the scoping process and subsequent preparation of the analysis, the agency must determine what information regarding past actions is useful and relevant to the required analysis of cumulative effects. Cataloging past actions and specific information about the direct and indirect effects of their design and implementation could in some contexts be useful to predict the cumulative effects of the proposal. The CEQ regulations, however, do not require agencies to catalogue or exhaustively list and analyze all individual past actions. Simply because information about past actions may be available or obtained with reasonable effort does not mean that it is relevant and necessary to inform decision making.*"

Affected environment sections have been divided by resource areas, where as environmental consequence sections have been divided by resource areas and then by alternative, where is some cases, action alternatives are grouped. Further, effects analyses that are required by law are discussed per alternative.

3.3 Fuels and Fire

3.3.1 Introduction

The following section describes the current fuel conditions in the Sugarloaf Project area and the potential effects of NFS land activities aimed at reducing wildfire risk to the community of LaPorte and American House, as it pertains to fire behavior and suppression. The proposed fuel break and fuels reduction treatments are designed to remove surface, ladder, and canopy fuels. Treatments will lead to desired fire-resistant condition, strategically positioned to increase the connectivity between the Bald Onion, Southfork DFPZs, LaPorte HFR project and defensible space established by the private landowners.

Although not designed specifically to achieve fuels reduction, the following section also addresses potential effects to fire behavior and suppression, as a result of establishing dispersed Group Selections—some dispersed within DFPZ treatment units.

Since the 1990s, there have been many changes to national administrative procedures governing the preparation of projects intended to reduce fuel concentrations and restore healthy ecological conditions on public land. The most recent national direction relevant to this environmental analysis process is the *Healthy Forest Restoration Act* (HFRA) of 2003 (16 U.S.C at 1611-6591), which references direction under *A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment: 10-Year Strategy Implementation Plan* (USDA/USDI 2001).

The 2004 Sierra Nevada Forest Plan Amendment (SNFPA) final supplemental EIS Record of Decision (ROD) adopts an integrated strategy for vegetation management that is aggressive enough to reduce the risk of wildfire to communities in the WUI, while modifying fire behavior over the broader landscape.

3.3.2 Analysis Framework: Statute, Regulatory Environment, Forest Plan and Other Direction

The Sugarloaf Project would contribute to fulfilling the long-term goals of the National Fire Plan designed to protect communities at risk from wildfire on federal lands. The Sugarloaf Project would also meet the intent of the 2003 *Healthy Forest Restoration Act* by decreasing the wildfire risk to people, communities, and the environment through the construction of fuel breaks, which provide safer areas to initiate fire suppression activities in the event a fire.

The Sugarloaf Project is designed to fulfill management direction as specified in the 1988 Plumas National Forest Land and Resource Management Plan (LRMP), as amended by the 2004 Record of Decision on the *Sierra Nevada Forest Plan Amendment* (SNFPA) final supplemental EIS. Goals for fire and fuels management from the 1988 Plumas LRMP and the Sierra Nevada Forest Plan Amendment Final Supplement Environmental Impact Statement (SNFPA FSEIS, 2004) for WUI are to:

- create defensible space near communities and provide a safe and effective area for suppressing fire
- design economically efficient treatments to reduce hazardous fuels conditions
- establish and maintain a pattern of area treatments that is effective in modifying wildfire behavior
- treat fuels in a manner that significantly reduces wildland fire intensity and rate of spread, thereby contributing to more effective fire suppression and fewer acres burned
- treat hazardous fuels conditions in a cost-efficient manner to maximize program effectiveness.

These goals also include managing hazardous fuels conditions in and around communities combined with strategic placement of fuels treatments across broad landscapes to modify wildland fire behavior. Goals for fuels treatments include:

- Strategically placing treatment areas across landscapes to interrupt potential fire spread
- Removing sufficient material in treatment areas to cause a fire to burn at lower intensities and slower rates of spread compared to untreated areas.

3.3.3 Effects Analysis Methodology

The dynamics between vegetation and fire and fuels are inherently linked; vegetation treatments (and absence thereof) have profound effects on fuel loading and fuel arrangement. These elements have the greatest influence on fire behavior. Similarly, fire has a profound effect on vegetation establishment and development. For these reasons, the geographic area used to analyze the direct and indirect effects are the treatment area boundaries.

3.3.4 Geographic and Temporal Bounds

The geographic area used to analyze the cumulative effects of the fuels treatments covers approximately 26,000 acres (see DEIS: "Hydrology"). The analysis area is made up of sixteen sub-watersheds that were considered appropriate for this analysis as they encompass all vegetative and fuels treatment areas proposed, along with consequent effects that could occur from the proposed alternatives addressing all land ownerships and administration (i.e., private, federally-administered)

The temporal scale used to analyze the cumulative effects analysis of the fuels treatments, is based on current vegetative landscape features, to aid in characterizing fuel loading and fuel arrangement within the four watersheds. From a broader landscape perspective, the current vegetative structure and composition is assumed to reflect historical management practices (past timber harvests [i.e., plantations composed of various age classes], hazardous fuels reduction treatments, burned areas, road building and urban growth).

3.3.5 Analysis Methodology

The modeling of potential fire behavior was done under 90th percentile weather conditions (table 3-1) that were calculated using Fire Family Plus (Main et al. 1990) and 20 years of weather from the Pike County Remote Automated Weather Station (RAWS). The Fire Management Analyst (FMA) software program (Fire Program Solution 2003) and the Fire and Fuel Extension (FFE) of the Forest Vegetation Simulator model were used to model and assess the effects of different treatments on fire behavior by alternative. Tree and crown fuel data were collected utilizing the Region 5 Common Stand Exam protocol (CSE 2011); information was processed and utilized in the Forest Vegetation Simulator model, whereby tree lists were developed and exported to the FMA program. Fire behavior fuel models were downloaded from the Landfire (2008 1.1.0) website and refined by district fuels personnel. Photo series and ocular observations by District Fuels Officers were used to estimate dead and down woody surface fuel loading.

FMA and FFE were utilized to determine stand level existing and post-treatment surface and crown fuel conditions as well as potential fire behavior and effects associated with each alternative. The different vegetation configurations within the project area were assigned fire behavior fuel models (Scott and Burgan 2005). A general description of the fuel models used in this analysis is summarized in table 3-2. Fire behavior results displayed in this report were based on aspect, slope, environment, and fuel treatment types. Fire behavior data for all stands modeled can be found in the Sugarloaf Analysis File; Fire and Fuels section, available upon request.

Table 3-1. Parameters used for stand-level modeling under 90th percentile weather conditions.

Weather Parameter	Observations
Dry bulb	92°F
1-hour fuel moisture	4 percent
10-hour fuel moisture	5 percent
100-hour fuel moisture	7 percent
20-foot wind speed	7 mph
Herbaceous fuel moisture	33 percent
Live woody fuel moisture	48 percent

Table 3-2. Fuels models used in direct and indirect effects analysis.

Fuel Model*	Fuel Type	Fuel Loading Material <3 in. diameter (tons per acre)	Initial Attack Production Rates (Chains per hour*)		Fuel Model Description
			Type 1 Crew (20 person)	Type 3 Engine (5 person)	
TL1	Low load compact conifer litter	6.8	40	60	Light to moderate load, may be used to represent a recently burned forest. Spread rate is very slow; flame length very low.
TL3	Moderate load, conifer Litter	5.5	7	24	Moderate load of conifer litter, light load of coarse fuels. Spread rate is slow; flame length low.
TL5	High load, conifer litter	8	7	24	Primary carrier of fire is high load conifer litter; light slash or mortality fuel. Spread rate is slow, flame length low.
TU5	Very high load, dry climate timber-shrub	11	6	20	Heavy forest litter with a shrub or small tree understory. Spread rate is moderate; flame length moderate.
SB1	Low load activity fuel	15.5	15	20	Light dead and down activity fuel. Spread rate is moderate; flame length low.
SH2	Moderate Load, dry climate shrub	4.5	6	20	Moderate fuel load, of wood shrubs and shrub litter. Spread rate is low; flame length low.

Note: Chain is a measurement of distance; one chain = 66 feet.

Fuel models are used to predict fire behavior in this analysis. Fuel models TL1, TL3 and TL5 represent desired conditions for forested stands. Timber and slash models that reflect actual Sugarloaf Project conditions were used in the Sugarloaf analysis.

Cumulative effects fire behavior was modeled using 90th percentile weather using Behave Plus 4.0.0. (Andrews 2007). Modeling was done on slopes 0 to 80 percent in order to get a range of expected fire behavior outcomes on various degrees of slope. Although the project area is mildly steep there are steeper pitches in RHCAs and outside the project area that could burn into the proposed DFPZ. Fuel models for cumulative effects modeling were derived from Landfire 1.1.0,

(Scott & Burgan Fire Behavior Fuel Models March 2011) and crossed checked with the personnel observation and the Plumas National Forest fuel model GIS layer then analyzed using ArcMap 9.2 (ESRI 2006). Fuel models were updated in ArcMap based on current and expected fuel and harvest treatments on private and public lands. Refer to table 3-1 for predicted fire behavior across the cumulative effects analysis area. Sources used to identify fuel and harvest treatments were: FACTs (Forest Service Activity Tracking System), Plumas County timber harvest plans and aerial photo interpretation. Predicted fire behavior results were broken into six groups – grasses, grass shrubs, shrubs, timber litter, timber understory and non-combustible (Scott and Burgan 2005). Fire behavior predictions for fuel models TL1 TL3and TL5 (desired condition) were separated from other timber litter and timber understory fuel models to show acre differences in desired condition.

3.3.6 Assumptions Specific to Fire and Fuels Resource Analysis

The output data reflects fire modeling assumptions (weather, fuel model characteristics, and spatial variability) and variability within the Common Stand Exam (CSE) plots. Weather data used in fire modeling were obtained from the Pike County Weather Station, which is approximately 16 miles southwest of the Analysis Area. It is assumed Pike County's Remote Automated Weather Station (RAWS) is maintained to National Fire Danger Rating System (NFDRS) standards and weather data is accurate. Weather conditions at the station reflect the "hottest, driest and windiest" weather conditions on an exposed ridgetop. For stand-level modeling in the Fuels Management Analyst program, wind speeds were adjusted using a wind speed reduction factor (Rothermel 1983).

The Feather River Ranger District has detailed information on fire ignitions less than 5 acres since 1970, but only limited information is available for fires before that time. The history of large fires was derived from the Plumas National Forest Geographic Information System (GIS) database that traced both Forest Service and California Department of Forestry large fires from 1900 to 2009. It is understood that this data does not contain all of the fires that actually occurred due to lack of reporting, differing priorities over the decades, or loss of records. However, there is enough data to demonstrate the continuing influence of wildland fire in and surrounding the approximate 26,000-acre cumulative effects analysis area.

The potential fire behavior and effects of alternatives were modeled pre and post-treatment. Fire behavior predictions are best interpreted relative rather than absolute, research indicates that models used to predict potential fire behavior may, in some instances, under predict potential for crown fire behavior (Cruz and Alexander 2010; Scott and Reinhardt 2001). It is important to note that unanticipated future wildfires, disease outbreaks, or mortality may occur within the project area prior to completion of implementation of this project—these events are not included as part of this analysis.

The BEHAVE model predicts fire behavior only at the flaming front. It assumes that the primary driving force in the flaming front is dead fuel less than one-fourth inch in diameter. It assumes that the residence time of the flame at a given point is a function only of the characteristic surface-area-to-volume ratio of the fuel array. It describes fires that are independent of the source of ignition. Fuel, fuel moisture, wind, and slope are assumed constant.

The Fire and Fuels Extension utilizes stand specific surface fuel and stand inventory data and was used to model and assess the effects of thinning treatments on potential flame length, canopy base

heights and potential fire type. The outputs data reflect fire modeling assumptions (weather, fuel model characteristics, and spatial variability) and variability within the Common Stand Exam plots. Model outputs have unknown variances that may sometimes be large; however, this is normal for modeling efforts, and model outputs are best evaluated in a relative rather than an absolute sense. Fuel model selection logic based on expert opinion of the local Fire and Fuels personnel and time-since-disturbance was developed similar to Collins et al. (in press) to determine fuel model succession post-treatment.

It is assumed that for hand cut and mastication treatments that there would be a 95 percent cutting efficiency and that not all small diameter trees would be cut.

3.3.6.1 Fire and Fuels Measurement Indicators

The measurement indicators for proposed treatment effects on potential fire behavior and severity include flame length, fire type, and canopy base height. These indicators are described below.

Flame length (feet)—Flame lengths greater than 4 feet tend to increase fire intensity and the likelihood of torching events and crown fires. Flame length is influenced in part by fuel type and weather conditions. The upper limit for direct action taken by suppression hand crews is generally considered to be 4 feet. The upper limit for direct action taken by mechanized equipment (dozers) is considered to be 6 feet. Flame lengths in excess of these limits usually result in indirect action taken to contain the fire. Desired flame length post treatment is 4 feet or less.

Fire type (surface, passive crown or active crown fires)—Fire type is described in four ways; only three will be measured in this analysis. The first type is a surface fire, which burns only the fuels at or near the surface without torching the trees above—this is the desired condition. The second type is the passive crown fire, which torches out individual or small groups of trees as the surface fuels burning under them provide the convective heat to ignite the above-ground fuels. The third is an active crown fire in which fire is spread from tree to tree in conjunction with the convective heat of the surface fuels burning under them. The fourth is an independent or running crown fire—this is a very rare occurrence in which the fire is spread from tree to tree independent of the burning surface fuels. This type of crown fire requires extreme weather conditions and contiguous canopy and is not modeled in this analysis.

Canopy Base Height (feet)—For the purpose of this analysis, canopy base height is the lowest height above the ground at which there is sufficient canopy fuel to propagate fire vertically through the canopy (Scott and Reinhardt 2001). Desired canopy base heights are greater than 15 feet.

3.3.7 Affected Environment

Approximately 93 percent of the Sugarloaf Project is in the Wildland Urban Interface (WUI) of the communities of LaPorte and American House. The Little Grass Valley Recreational Area, a high use recreational area in the summer and winter months, is approximately 1 mile north of the project area.

Historically, fires burned with low to moderate intensity, reducing fuel accumulations and vegetation density (Sugihara et al. 2006). Current fire regimes are removed from the historic

reference condition due to fire suppression and past timber management practices. As fire cycles are skipped, fuels accumulate and less fire resistant, shade tolerant tree species grow in forest understory. Effects of fires that burn under moderate to severe conditions in dense forest can be seen in the Moonlight and Antelope Complex on the Plumas National Forest.

Together, the Moonlight and Antelope Complex fires burned over 87,000 acres, with over 54,000 acres (62 percent) of the total area burning under what is classified as high severity (Safford et al. 2007; Miller 2007). Many studies such as Bekker and Taylor (2001), Beaty and Taylor (2001), and Hessburg et al. (2007), Miller et al. (2009), and Collins and Stephens (2010) have discussed the occurrence of moderate, high, and mixed severity occurrences within dry mixed conifer forests of the Cascades and Sierra Nevada ranges. However, fire regime data for the Sugarloaf analysis area indicate that nearly 97 percent of the forested lands are fire regime I, a fire regime characterized by frequent primarily low to mixed severity fire, and the remaining 3 percent of stands are fire regime II, a fire regime characterized by less frequent stand replacing fire.

The primary concern for forest management is the sum of effects with which these extraordinarily severe fires occurred. Concerning high severity patch sizes, recent large wildfires are very different from pre-settlement fires with respect to the average size of patches of high severity fire within the fire perimeter. For those forests with fire regimes classified as fire regime I, high severity patches more than a few acres in size were unusual in fires in the Sierra Nevada before Euroamerican settlement (Show and Kotok 1924; Kilgore 1973; Stephenson et al. 1991; Skinner and Chang 1996; Weatherspoon and Skinner 1996; Safford 2007; Safford pers. comm. 2008a; Safford 2008b). Miller et al. (2008) have also shown trends indicating that the average size of high severity patches in Sierra Nevada wildfires has increased (by about 100 percent) over the last 25 years (Safford pers. comm. 2008a; Safford 2008b).

Historic records pertinent to the cumulative effects analysis area and surroundings indicate fire will continue to influence the landscape. Between 1900 and 2009, four fires greater than 20 acres were recorded that affected the cumulative effects analysis area. These fires ranged from 50 acres to over 1,480 acres in size, with the largest being the Devils Gap fire that burned in 1999. The Devils Gap fire was the convergence of two lightning fires; passive and active crown fire behavior was evident in the fire area suggesting the potential for similar fire behavior (types) in the future. The Devils Gap fire burned for multiple days and cost approximately 3 million dollars to contain.

Fire exclusion, past harvesting practices, and changes in various other land practices have decreased the incidence of historic low intensity fires, allowing for a build-up of surface and canopy fuels (Peterson et al. 2005). Fires burning in dense over-crowded stands, such as the Devils Gap Fire, have greater potential for crown fire. In addition to the potentially larger more intense fire, impassable roads, distance of travel for second alarm resources, and steep inaccessible canyons make rapid access to fires on the Feather River Ranger District a problem for suppression resources. See table 3-3 for a Forest Service history of fires 20 acres or less, listed by fire cause. Lightning is the main cause of all fires in the analysis area, accounting for 34 percent of fires analyzed.

Table 3-3. Fires in analysis area 20 acres or less.

Cause	Number of fires	Cause	Number of fires
Lightning	26	Arson	5
Equipment use	3	Playing with fire	1
Smoking	13	Miscellaneous	16
Campfire	7	**Total**	**77**
Debris	6		

The overall conditions in the analysis area are, in part, also described by the Fire Regime Condition Class (table 3-4). The current conditions in the analysis area as described above are similar to those conditions which could lead to high-severity fires within the vicinity of the analysis area, such as the 1999 Devils Gap fire. Of particular note, 92 percent of the NFS lands within the analysis area are in condition class 3 where "vegetation composition, structure, and fuels have a high departure from the natural fire regime and predispose the system to high risk of loss of key ecosystem components" (Hann and Strohm 2003).

Table 3-4. Fire Regime Condition Classes within the Sugarloaf analysis area.

Fire Regime Condition Class	Acres in the Analysis Area	Description
1	0	Vegetation composition, structure, and fuels are similar to those of the natural regime and do not predispose the system to risk of loss of key ecosystem components. Wildland fires are characteristic of the natural fire regime behavior, severity, and patterns. Disturbance agents, native species habitats, and hydrologic functions are within the natural range of variability.
2	1 (<1%)	Vegetation composition, structure, and fuels have moderate departure from the natural regime and predispose the system to risk of loss of key ecosystem components. Wildland fires are moderately uncharacteristic compared to the natural fire regime behaviors, severity, and patterns. Disturbance agents, native species habitats, and hydrologic functions are outside the natural range of variability.
3	23,931 (92%)	Vegetation composition, structure, and fuels have high departure from the natural regime and predispose the system to high risk of loss of key ecosystem components. Wildland fires are highly uncharacteristic compared to the natural fire regime behaviors, severity, and patterns. Disturbance agents, native species habitats, and hydrologic functions are outside the natural range of variability.
9	2050 (8%)	Agriculture, Barren, Water, or Urban vegetation types.

Due to past fire suppression and the past land management practices, nearly the entire area is currently in Condition Class 3 (table 3-4) and thus in dire need of restoration of fire as an ecosystem process. Extensive developments of residential homes in the Wildland Urban Interface (WUI) around Little Grass Valley Reservoir, LaPorte and American House in addition to the number of camp grounds pose a continued risk of human-caused ignitions throughout dry summer months. This ignition risk puts residences on private lands in the analysis area at risk of wildfires that may occur on adjacent NFS lands; likewise, NFS lands are at risk from fires ignited on these private lands. In addition, large undeveloped areas of the forested wildlife habitat in the analysis area are at continued risk of high-severity fire and drought-related mortality.

Fuel models are mathematical fire behavior models that allow a quantitative basis for rating fire danger and predicting fire behavior (Rothermal 1972). Fuel models are classified into six groups – grasses, grass shrubs, shrubs, timber litter, timber understory and non-combustible (Scott and Burgan 2005). See table 3-1 for fuel models that make up the analysis area and predicted fire behavior, assuming 90th percentile weather conditions.

See table 3-2 for existing fuel models and associated fire behavior in project analysis area. The timber understory (Fuel Model TU05) represents 70 percent of the Sugarloaf analysis area, predicted to sustain moderate flame lengths and spread rates. The Fuel Model TU05 represents forests characterized by heavy litter with a shrub or small tree understory, also having the potential to support moderate flame lengths and spread rates. Timber litter Fuel Models TL2, TL6, TL7 and TL8 represent 15 percent of the project area. These Fuel Models typically burn at lower rates with lower flame lengths, however when modeled using the high fire weather conditions resulted in burn intensities exceeding the desired conditions. Five percent of the project area is made up of grass and shrub fuel models characterized by grass, mixture of grass and shrubs and shrub dominated, likely to sustain fire with low to moderate flame lengths. Seven percent of the project area is represented by non-combustibles, such as roads, a body of water or mine tailings. Two percent of the project area is made up of the fuel models that represent the desired condition of fuel models TL1, TL3 and TL5.

Flame Length. The modeled flame length for the Sugarloaf Project area ranges from 1 to 100 feet. Areas' burning with high flame lengths is primarily due to steepness of slope, heavy surface fuel loads and low canopy base heights which increase potential flame lengths and possible torching (Graham et al. 2004). The slopes in the Sugarloaf Project area vary; the majority of the area is less than 35 percent although there are steeper pitches in the RHCAs and adjacent to project units. The steep Slate Creek and Rabbit Creek drainages south east of LaPorte align with the prevailing wind (southwest) that could funnel a wildfire directly into the community of LaPorte. Predicted flame lengths are highest in the Slate Creek drainage.

Fires burning on steep slopes are problematic for multiple reasons: preheating of fuels increases fire spread; increases spotting from preheated fuels; rolling material may start fire below suppression resources; makes anchor points difficult to establish; and increases probability of injury to fire fighters.

Fire Type. Fire types within the project area vary with topography, elevation, fuel loading and arrangement. Surface fires are generally lower in intensity and easier to suppress—though may still have high mortality rates if fuel accumulations are great. Passive crown fires, which include surface fires that occasional torch individual or clumps of trees, are indicative of higher fire intensity and severity. Active crown fire is spread from tree to tree in conjunction with the convective heat of the surface fuels burning under them. Predicted fire types in the project area range from surface fire to active crown fire, although passive crown fire is most prevalent.

Canopy Base Height. The current canopy base height in the project area ranges from 1 to 69 feet. Lower canopy base heights allow for an easier transition of surface fires into passive or active crown fires. Fire suppression, lack of disturbance, and past practices has created dense multilayered understories known as ladder fuels. There has been an overall shift towards an increased proportion of shade-tolerant, less fire-adapted species (true firs) and decreased proportions of shade-intolerant,

fire-adapted species, such as Jeffery pine. These species tend to have a lower crown base height than more fire resilient species.

Summary. Fire suppression, lack of disturbance, and past practices have created a dense multilayered understory. Heavy dead and down fuel loading and ladder fuels result in high flame lengths. Modeled wildfire is predicted to burn intensely, with higher incidence of passive and active crown fire. Wildfire continues to be a threat to the communities of LaPorte and American House. Under current conditions a high severity wildfire in the project area would have impacts on forest resources such as: loss of certain wildlife habitat, loss of recreational value, degradation of watersheds and decreased timber values.

3.3.8 Environmental Consequences

Table 3-5 summarizes the effects in comparison with the existing condition.

Table-3-5. Comparison of alternatives.

Stands	Alternatives	Fuel Model	Flame Length (feet)	Fire Type	Canopy Base Height (feet)
*542A, 542B, 542C, 542D, 542E, 543, 573	Alt A	TU5	3	Surface	68
	Alt B	TL1/ TL3	1	Surface	68
	Alt C	TL1/ TL3	1	Surface	68
	Alt D	TL1/ TL3/ TU5	1–3	Surface	68
*901A, 901AT, 901AH, 901B, 901GHWK, 900	Alt A	TU5/TL3	1–4	Surface	6
	Alt B	TL1	1	Surface	26
	Alt C	TL1	1	Surface	26
	Alt D	TL1	1	Surface	26
547, 575, 576, 577A, 577B, 577C	Alt A	TU5	3–32	Surface – Passive Crown Fire	4–68
	Alt B	TL1, TL3	1–3	Surface	10–68
	Alt C	TL1, TU5	1–3	Surface Fire	8–68
	Alt D	TL1, TL3, SB1, TU5	1–3	Surface	8–68
002, 003, 37A, 230, 232, 228, 902	Alt A	TU5	4–7	Surface-Active Crown	5–46
	Alt B	TU5, TL3, TL1	1–4	Surface	5–53
	Alt C	TU5, TL1, TL3	1–4	Surface	5–53
	Alt D	TL1, TL3, SB1	1–3	Surface	21–53
14A, 14B, 14C, 14D, 14E, 14F 15A, 15B, 19, 211,	Alt A	TU5	4–13	Surface-Active Crown	1–69
	Alt B	TU5, TL1	1–3	Surface	41–70
	Alt C	TU5, TL1, TL3	1–3	Surface	41–76
	Alt D	TU5, TL1, TL3	1–7	Surface	41–70
21, 221, 222, 224	Alt A	TU5, TL5, TL3, SH2	3–100	Surface-Active Crown	1–65
	Alt B	TL1, TU5	1–41	Surface-Passive Crown	1–83
	Alt C	TL1, TU5	1–41	Surface-Passive Crown	1–83
	Alt D	TL1, TU5, SB1	1–41	Surface-Passive Crown	1–83

Table 3-5. Comparison of alternatives (continued).

Stands	Alternatives	Fuel Model	Flame Length (feet)	Fire Type	Canopy Base Height (feet)
26, 27, 29, 30, 53, 54	Alt A	TU5, TL3	2–73	Surface-Passive Crown	1–65
	Alt B	TL1	1	Surface	4–66
	Alt C	TU5, TL1, SB1	1–50	Surface-Passive Crown	43–69
	Alt D	TL1, TL3, SB1	1–3	Surface	4–70
45, 225, 234, 235, 236, 237, 238, 239, 240	Alt A	TU5, TL3	2–61	Surface-Passive Crown	1–29
	Alt B	TU5, TL1	1–4	Surface	29–57
	Alt C	TU5, TL1	1–4	Surface	21–52
	Alt D	TU5, TL1, TL3	1–3	Surface	27–52
32, 35, 36, 37, 44, 47, 213, 241	Alt A	TU5	6–51	Surface-Active Crown	1–43
	Alt B	TL1	1	Surface	21–83
	Alt C	TU5, TL1, TL3	1–6	Surface	21–83
	Alt D	TU5, TL1, TL3	1–7	Surface	21–83
46, 214, 906, 908	Alt A	TU5	4–27	Surface-Passive Crown	1–36
	Alt B	TL1, TL3	1	Surface	5–46
	Alt C	TL1, TL3	1	Surface	3–53
	Alt D	TL1, TL3	1	Surface	39–46

Note: Predicted modeled outputs were derived using FMA plus using stand level data generated from FVS. **901 stands have received prior treatment (HCPB), but do not meet the canopy base height desired condition due to low hanging branches of remaining trees.

Alternative A – No action

Direct and Indirect Effects

The No-action Alternative would not meet the purpose of modifying fire behavior to aid suppression, as it would not meet the need to reduce potential flame lengths to 4 feet or less. Since the No-action Alternative would not apply fuels reduction activities, surface fuel loading and stand densities (ladder and overstory fuels) would continue to increase over time, as vegetative debris accumulates. For these reasons, predicted flame lengths would continue to reach heights of 100 feet, considered unsafe for direct attack with ground suppression fire fighter modules. Dense overstory canopy decreases the effectiveness of aerial suppression resource.

The No-action Alternative would not meet the purpose of reducing hazardous fuels to modify fire behavior to aid suppression, as it would not expedite the need to reduce wildland fire intensity and rate of spread for fewer acres burned; limiting future fire to surface fire types. Under modeled fire conditions, the project area would continue to be at risk for high intensity passive and active crown fires, typically associated with a higher incidence of mortality of both surface and crown vegetative fuels. Additionally, dense overstocked understories of shade tolerant tree species would persist (refer to DEIS, vegetation section), allowing for easier transition of surface fires into crown fire types. Fuel modeling predicts these vegetative fuel conditions would sustain passive and active crown fire types.

Research conducted by Van Wagtendonk (2004) indicates there are landscapes today where accumulations of dead woody debris and dense stands of shade-tolerant understory trees and shrubs have made the fuel and vegetation complex nearly homogeneous (same vegetation structure or species composition). He indicates inevitably, these conditions facilitate fire behavior that cannot be suppressed due to higher heat intensities, resulting in large burn areas. As Sugarloaf exhibits similar, nearly homogeneous fuels characteristics, is it assumed fire behavior would demonstrate and result in similar undesirable environmental outcomes commonly associated with large size burn areas.

The No-action Alternative would not meet the purpose to modify fire behavior to aid suppression, as it would not meet the need to increase canopy base heights to 15 feet or more. Canopy base heights at the stand level in the Sugarloaf Project area range from 1–68 feet, however in the majority of the project area the average canopy base height is less than 15 feet. Lower canopy base heights, associated with low hanging tree branches, allow for an easier transition from surface fires into passive or active crown fires. There would be a continued shift towards an increased proportion of shade-tolerant, less fire-adapted species (true fir) and decreased proportion of shade-intolerant, fire-adapted species such as ponderosa pine, which generally feature high canopy base heights (refer to DEIS, vegetation section for more description of tree characteristics and species composition).

When passive crown fires occur, fire behavior includes torching, of individual and groups of trees; active crown fire results in fire burning from tree to tree in conjunction with the convective heat of the surface fuels burning under them; both types of crown fire can result in spotting, making control efforts at the fire head ineffective. Indirectly, embers from torching trees and snags could cause spot fires outside the main fire perimeter, which in turn increases risk to firefighters, and contributes to control problems and potential to increase fire size.

Fire suppression would be difficult and control options could be limited to indirect attack as flame lengths would exceed upper limit thresholds. The upper limit for direct action taken by hand crews is generally considered to be 4 feet, 6 feet is considered the upper limit for direct action taken by mechanized equipment (bulldozers). Flame lengths in excess of these limits usually result in indirect action taken, fire resulting in larger fire size. Large fires generally incur more cost and increase potential loss of forest resources. For these reasons, the rural communities of LaPorte and American House would continue to be at risk from wildfire. Based on fuel and fire behavior modeling, the potential for damage to private property and natural resources from wildfire would be high.

3.3.8.1 Cumulative Effects-Alternative A

The No-action Alternative would not meet the intent of the 1988 Plumas National Forest LRMP, as amended by the 2004 ROD on the SNFPA FSEIS. Surface and canopy fuel loading would continue to increase while canopy base heights would remain low, continuing the threat of wildfire to the communities of LaPorte and American House. See table 3-6 for predicted fire behavior by fuel model type in the cumulative effects analysis area.

Table 3-6. Range of predicted fire behavior in Sugarloaf analysis area by fuel model type (alternative A).

Representative Fuel Model	Predicted Flame Lengths	Predicted Fire Type	Public and Private Lands	Percent
GR1 &GR2 (grass)	1–6 feet	Surface	36 acres	<1 percent
GS1&GS2 (grass/shrub)	3–8 feet	Surface-torching	1,251 acres	5 percent
SH1, SH2, SH5 & SH7 (shrubs)	3–20 feet	Surface-torching	726 acres	3 percent
SB1 (Slash)	2–4 feet	Surface	401 acres	2 percent
TL2, TL6, TL7 & TL8 (Timber Litter)	1–7 feet	Surface-torching	3,893 acres	15 percent
TL1, TL3 & TL5 (Timber Litter) Desired Condition	<1–3 feet	Surface	452 acres	2 percent
TU1 & TU5 (Timber understory)	2–12 feet	Surface-torching	17,391 acres	70 percent
Non-combustibles	0	None	1,831 acres	7 percent

NOTE: Outputs were modeled using Behave plus using 90 percentile weather conditions, on slopes 0–80 percent. Ranges in fire behavior vary depending on slope, and characteristics of each fuel model such as fuel loading, surface to volume ratios and fuel bed depths.

Heavy surface fuel loading, low canopy base heights and high canopy cover increase the likelihood that fires could escape initial attack and become large. Larger fires would increase the risk of injuries to both firefighters and the public, as well as increase the potential for residences to be lost or damaged. The potential for high-intensity fire exists in the Sugarloaf Project in those areas where there is little heterogeneity (diversity) in the fuel and vegetation complexes.

Fuelbreaks would not be completed to link DFPZs established by the HFQLG Pilot project, which serve as locations for fire fighters to initiate suppression actions. Stands in the area would not be fire resilient, and the ecological characteristics of high frequency, low to moderate severity fire regimes would not be restored.

The Plumas National Forest has a history of large wildfires including the 1999 Devils Gap fire, which burned within a portion of the project analysis area. The historic record indicates the effects of this fire included damage to critical habitat for threatened and endangered species, timber, plantations and soils, watershed and loss of recreational values.

The financial costs of suppression, emergency rehabilitation and restoration of large fires have been high. There is a cumulative impact from the loss and/or damage to property and natural resources and the associated financial costs mitigating these negative effects under this alternative. In a 2009 publication of case studies evaluating the true cost of wildfires found that the actual suppression/rehab costs are a small fraction of the total cost of a wildfire. True costs were found to be 2 to 30 times the reported suppression costs, (Western Forestry Leadership Coalition 2009).

3.3.8.2 Direct Effects - Alternative B

Flame Length. Predicted flame length is expected to range from 1–4 feet in treated stands. However, 13 percent of the project acres will not receive fuels treatments for various reasons such as; sensitive habitat, exclusion areas and/or areas that meet the desired conditions. These areas will be vulnerable to flame lengths predicted to range from 1–41 feet.

Fire Type-Fire is predicted to burn as a surface fire in treated stands. In untreated areas that are excluded from treatment passive crown fire is possible. The majority of modeled stands are predicted to burn as a surface fire.

Canopy Base Height-is predicted to range from 1–83 feet.

3.3.8.3 Direct Effects - Alternative C

Flame Length—Predicted flame length is expected to range from 1–4 feet in treated stands. However, 20 percent of the project acres will not receive fuels treatments for various reason such as; sensitive habitat, exclusion areas, treatment units outside of the WUI and areas that meet the desired condition. These areas will be vulnerable to flame lengths predicted to range from 1–50 feet.

Fire Type—Fire is predicted to burn as a surface fire in treated stands. In untreated areas that are excluded from treatment passive crown fire is possible. The majority of modeled stands are predicted to burn as a surface fire.

Canopy Base Height—Is predicted to range from 1–83 feet.

3.3.8.4 Direct Effects - Alternative D

Flame Length—Predicted flame length is expected to range from 1–4 feet in treated stands. However, 11 percent of the project acres will not receive fuels treatments for various reasons such as; sensitive habitat, exclusion areas, retention areas and/or areas that meet the desired conditions. These areas will be vulnerable to flame lengths predicted to range from 1–41 feet.

Fire Type—Fire is predicted to burn as a surface fire in treated stands. In untreated areas that are excluded from treatment passive crown fire is possible. The majority of modeled stands are predicted to burn as a surface fire.

Canopy Base Height—Predicted canopy base height to range from 1–83 feet.

3.3.8.5 Indirect Effects-Alternative B, C and D

It is the combined effects of the fuels treatments that would have the greatest effect on fire behavior. Mechanical thinning by itself would reduce intermediate ladder and canopy fuels and reduce the chance of active crown fires; it would not necessarily alter surface fuels or surface fire intensity (Agee and Skinner 2005).

The action alternatives would increase the likelihood that wildland fires occurring in the treatment units could be successfully suppressed by initial attack resources compared to the no action alternative. The action alternatives would also provide a strategic location for fire suppression resource to indirectly attack a wildfire approaching treated areas. This would occur because of 4 factors: (1) opening overstory canopy; (2) reducing ladder fuels; (3) reducing surface fuels, and; (4) strategic location of treatments.

Opening overstory and understory canopy in strategic locations, along roads, ridge tops and near communities would aid fire suppression resources by allowing for a combination of ground and air attack. By reducing the canopy cover, the effectiveness of firefighting aircraft would improve by increasing retardant and water penetration through the canopy to the surface fuels, thereby slowing the fire progression and allowing ground units to be more effective. Aerial suppression methods (retardant or helicopter bucket drops) would be more effective with back up of ground suppression resources (building fire line, back firing or laying hose).

Increasing canopy base height and providing inter-tree crown separation of canopy fuels would decrease the chances of torching and active crown fire (Agee 2005). Increases in canopy base height would require a higher flame length and greater wind speed to carry fire into the canopy of remaining trees. By separating overstory, canopy fires approaching the treated areas would require greater wind speeds and low fuel moisture levels to sustain active crowning. By treating surface and ladder fuels that generate greater flame lengths, passive and active crown fire would be mitigated. As ladder and canopy fuels would be reduced within treatment units, it is predicted approaching crown fires should drop to the ground, providing suppression resources a tactical advantage.

Thinning of canopy and understory vegetation and prescribed fire can modify understory microclimate that was previously buffered by overstory vegetation (Agee 1996, Scott and Reinhardt 2001, Martinson and Omi 2002). However, when all the effects (reductions in surface fuels, flame lengths, and ladder fuels, and an increase in fire suppression production rates) of the treatments are considered together, the fuel treatment activities would mitigate the effects caused by the possible decreased relative humidity and increased temperature (Rothermel 1983; Agee 1996; van Wagtendonk 1996; Agee et al. 2000). Another benefit of thinning dense stands and leaving larger fire tolerant pine species would be altering current trends to re-establish more historical fire adapted ecosystems (North et al. 2009).

Hand cutting ladder fuels, grapple or hand piling and/or prescribe burning would reduce surface fuels to less than 5 tons per acre of dead woody material less than 3 inches diameter and increase canopy base heights to approximately greater than 15 feet. A reduction in ladder fuels and surface fuels would break up horizontal and vertical continuity of flammable fuels. The decrease in live and dead fuel loading and continuity of material would result in lower flame lengths, decreases in potential spotting and increase fire suppression production rates. Based on observations on the 2001 Stream Fire (Beckman 2001), the 2006 Boulder Fire, the 2007 Antelope Complex Fire (Fites et al. 2007), and recent scientific literature (Fule et al. 2006; Safford et al. 2009), lighter intensity, hand thinning treatments may not be as effective as mechanical treatments in modifying ladder and crown fuels and resulting fire behavior or tree mortality, dependent on individual stand conditions. Consequently, hand thinning treatments are prescribed for specific stand conditions where removal of smaller diameter material alone may be effective, for example in riparian areas.

These fuels treatments would reduce the likelihood of structures being destroyed or damaged by wildland fires in the community of LaPorte and American House. Implementing fuel treatments in units that are within 300 feet of structures could prevent intense flaming fronts from reaching structures, in the event of a wildland fire. According to the Structure Ignition Assessment Model (Cohen 1997), intense flame fronts (for example, crown fires) will not ignite wooden walls at distances greater than approximately 130 feet.

Treatments in units that are not immediately adjacent to structures could have an indirect effect on structure protection, by enabling the fire to be controlled at a smaller size, or by requiring fewer resources to work on fire perimeter control, because of the increased fire suppression effectiveness in the treatment areas. This in turn could allow more resources to be committed to structure protection. The action alternatives would also create more strategic locations from which suppression resources could establish control points and safety zones, for initial or extended attacks, because of the reduced number of trees per acre in the treatment units (see EIS; vegetation section). The proposed fuel reduction treatments along roads, as well as the road improvements themselves, would promote safer travel for both the public and firefighters.

As part of the Sugarloaf Project, all action alternatives include prescribed burning during project implementation, including follow-up underburning to other treatments to achieve less than 5 tons per acre of dead woody material less than 3 inch diameter. Existing studies generally agree that mechanical thinning followed by prescribed burning is the most effective at mitigating wildfire severity (Prichard et al. 2010). Prescribed burning is considered effective in mitigating wildfire severity by reducing surface fuels, reducing understory stand densities by killing small diameter trees, and pruning lower limbs of intermediate and large diameter trees through scorch of foliage. Over time, approximately 1–2 years post treatment scorched foliage would drop to the ground, increasing canopy base heights and contributing to surface fuel loading.

Treatment areas that are exclusively treated by understory burning may need additional entries to meet desired conditions. As fire killed trees fall and contribute to surface fuel loading the effectiveness on modifying fire behavior is lessened (Collins et al. 2010). Second prescribed burn entries in underburn only units are expected to occur 5–7 years after initial treatment, to achieve desired fuel conditions.

Prescribed burning is nonselective and may kill some dominant and co-dominant trees, which may have been otherwise retained in more aggressive mechanical treatments. Overall, the overstory canopy would not be affected by underburning, although torching of individual or small groups of trees may occur on up to 10 percent of the burn area where high surface fuel concentrations and ladder fuels occur together. Torching during operations may result in gaps in the canopy typically less than 0.5 acre in size. Localized torching from underburning would occur, thereby creating small openings in the overstory where shade-intolerant species may become established and grow.

Riparian Conservation Habitat Areas (RHCAs) under alternative B and Riparian Conservation Areas (RCAs) under alternatives C and D would be treated with hand cut and pile burning and understory burning, whereby fire is ignited above riparian areas so that only low intensity flames creep downhill to mitigate damage to sensitive riparian related resources resulting in low intensity mosaic burning. Low intensity burning in these designations would result in maintaining higher canopy cover and large logs, if fuels have high moisture content (North et al. 2009). Typically the Feather River RD burns during the late fall (after fire season ending rain) and spring months. Effects of pile burning treatments would be highly localized and dispersed. The effects of pile burning include scorch and subsequent mortality of individual trees; however, this would be a negligible effect due to the relative scale and dispersion associated with the nature of these treatments.

Mastication rearranges hazardous fuel; decreasing ladder fuels while increasing canopy base heights. Surface fuel loading may increase with mastication; however flame lengths and rate of

spreads have been shown to decrease after treatment. In the event of a wildfire, mastication units may still experience higher levels of mortality due to residual soil heating. Burn severity studies in masticated fuels show the burn severity decreases with reduced fuelbed depth and increased soil moisture (Busse et al. 2005).

The Group Selection (alternative B) units would have lower flame lengths after site preparation and replanting than the untreated forested areas. Residual trees greater than 30 inches in diameter within the GS units would have a low chance of mortality during fires, due to their high average canopy base height and relatively low fuel loads in areas that have been prepared for planting. Planted trees would remain vulnerable to scorch-related mortality several years after initial planting due to their small size. Groups in the Sugarloaf Project are imbedded within the DFPZ and would be less vulnerable to damage by wildfire. Over the long-term of 20 to 30 years, regeneration of young trees and shrub species in the Group Selection treatments would be susceptible to higher flame lengths, lower canopy base heights, and higher probabilities of torching which would likely lead to passive crown fire behavior resulting in higher basal area mortality – yet, the potential for this type of fire behavior would be restricted to the 1/2 to 2 acre Group Selection units. Early seral stands, by nature of their inherent structure, are susceptible to these risks (Thompson et al. 2007); however the scattered, disparate arrangement and small scale of Group Selection treatments strategically located within the project area mitigates these risks. In addition, the strategic location of Group Selections within these mechanical fuel treatments would provide greater opportunities for initial attack fire suppression tactics.

Research on GS patches in the Challenge Experimental Forest indicates that in 10 years, there will be significant cover of grasses, herbs, and shrubs, but that the vegetation will have achieved little height growth (McDonald and Abbott 1994; McDonald and Reynolds 1999). That research indicates that small openings, characteristic of Group Selection, suppressed growth of shrubs due to shading from trees adjacent to the opening (McDonald and Abbott 1994; McDonald and Reynolds 1999). The live fuel moisture of the grasses, herbs, and shrubs would play the biggest role in reducing fire behavior (Agee 1996), in addition to the ratio of live to dead vegetation available to burn. The proportion of dead and live material in the units may affect the way regenerated shrub species may burn. With a relatively low amount of dead surface fuels (5 tons or less per acre) remaining post-treatment, the live fuels in the Group Selection units may act more as a heat sink rather than a heat source in the event of a wildland fire.

3.3.8.6 Cumulative Effects - Alternatives B, C and D

The strategic location of units along roads, ridgelines, previous fuels treatments and adjacent to communities increases the overall effectiveness of treatment areas. Both the strategic network of fuelbreaks, along with non-network fuel treatments follow past forest-level (Olson et al. 1995) and more recent scientific recommendations for fuel treatments (Hessburg et al. 2005; Agee et al. 2000). Specifically, Hessburg et al. (2005) note:

> Currently, dry forest landscapes of the Inland Northwest exhibit high landscape connectivity of conditions that support large and severe fires. To buy time for more thoughtful and carefully planned forest restoration, it makes sense to begin restoration by designing and developing networks of shaded fuel breaks throughout the dry forests (Agee et al. 2000; Arno and

Allison-Bunnell 2002). These networks would provide the advantage of breaking large fire-prone landscapes into smaller and more manageable pieces, which would be of significant benefit, both for restoration and fire suppression efforts. It would be useful to position fuelbreaks adjacent to existing roads so that the fuelbreaks could be revisited at regular intervals, and re-treated to maintain a widely scattered cover of medium and large-sized ponderosa pine (where available) with only light fuels (p. 132).

At the landscape level, these treatments would provide connectivity between the existing fuel treatments of Bald Onion, Southfork DFPZs Poverty Hill and LaPorte HFR projects. Table 3-7 shows the changes in predicted fire behavior across the landscape following the Sugarloaf Project.

Modifying forest structure and treating surface fuels will create fire resilient stands (Pollet and Omi 2002, Graham et al. 2004) and restore the ecological characteristics associated with high frequency, low to moderate severity fire regimes (Kilgore 1976).

Table 3-7. Predicted fire behavior in Sugarloaf Project analysis area post treatment (alternative B).

Representative Fuel Model	Predicted Flame Lengths	Predicted Fire Type	Public and Private Lands	Percent
Alternative B				
GR1 &GR2 (grass)	1–6 feet	Surface	36 acres	<1
GS1&GS2 (grass/shrub)	3–8 feet	Surface-torching	1,251 acres	5
SH1, SH2, SH5 & SH7 (shrubs)	3–20 feet	Surface-torching	643 acres	2
SB1 (Slash)	2–4 feet	Surface	216 acres	<1
TL2, TL6, TL7 & TL8 (Timber Litter)	1–7 feet	Surface-torching	3,511 acres	14
TL1, TL3 & TL5 (Timber Litter) Desired Condition	<1–3 feet	Surface	4,214 acres	16
TU1 & TU5 (Timber understory)	2–12 feet	Surface-torching	14,280 acres	55
Non-combustibles	0	None	1,831 acres	7

NOTE: Outputs were modeled using Behave plus using 90 percentile weather conditions, on slopes 0–80 percent.

Table 3-8. Predicted Fire Behavior in Sugarloaf Project analysis area post treatment (alternative C).

Representative Fuel Model	Predicted Flame Lengths	Predicted Fire Type	Public and Private Lands	Percent
GR1 &GR2 (grass)	1–6 feet	Surface	36 acres	<1
GS1&GS2 (grass/shrub)	3–8 feet	Surface-torching	1,251 acres	5
SH1, SH2, SH5 & SH7 (shrubs)	3–20 feet	Surface-torching	663 acres	3
SB1 (Slash)	2–4 feet	Surface	368 acres	1
TL2, TL6, TL7 & TL8 (Timber Litter)	1–7 feet	Surface-torching	3,522 acres	14
TL1, TL3 & TL5 (Timber Litter) Desired Condition	<1–3 feet	Surface	3,936 acres	15
TU1 & TU5 (Timber understory)	2–12 feet	Surface-torching	14,371 acres	55
Non-combustibles	0	None	1,831 acres	7

Table 3-9. Predicted Fire Behavior in Sugarloaf Project analysis area post treatment (alternative D).

Representative Fuel Model	Predicted Flame Lengths	Predicted Fire Type	Public and Private Lands	Percent
GR1 &GR2 (grass)	1–6 feet	Surface	36 acres	<1
GS1&GS2 (grass/shrub)	3–8 feet	Surface-torching	1,251 acres	5
SH1, SH2, SH5 & SH7 (shrubs)	3–20 feet	Surface-torching	646 acres	2
SB1 (Slash)	2–4 feet	Surface	244 acres	1
TL2, TL6, TL7 & TL8 (Timber Litter)	1–7 feet	Surface-torching	3,501 acres	13
TL1, TL3 & TL5 (Timber Litter) Desired Condition	<1–3 feet	Surface	4,250 acres	16
TU1, TU2 & TU5 (Timber understory)	2–12 feet	Surface-torching	14,220 acres	54
Non-combustibles	0	None	1,831 acres	7

3.3.8.7 Cumulative Effects to all Alternatives

Present and foreseeable proposed fuels and vegetation management projects on NFS lands in the analysis area include the St. Louis Hazardous Fuels Reduction project and Grass Flat DFPZ. Collectively, these projects represent less than 10 percent of the analysis area, and Forest Service projects represent less than 10 percent of National Forest System Lands.

Small hazardous fuels projects occurring on private lands such as the Plumas Fire Safe Council Projects include hazardous fuels reduction in the form of commercial and non-commercial mechanical thinning, hand thinning, piling and burning, or underburning. These activities would have a beneficial effect on the stand level by maintaining an open understory in these stands, thereby reducing high stand densities of small trees, ladder fuels, and fuel loading, fire risk, and potential fire behavior and effects. These projects are generally small in scale and highly dispersed through the analysis area.

Large hazardous fuels reduction projects occurring on National Forest System lands such as the St. Louis project also employ hazardous fuels reduction in the form of commercial and non-commercial mechanical thinning, hand thinning, piling and burning, or underburning. These activities would also have a beneficial effect on the stand level by maintaining an open understory in these stands, thereby reducing high stand densities of small trees, ladder fuels, and fuel loading, fire risk, and potential fire behavior and effects. These projects are typically large in scale and have greater capacity to affect overstory tree density.

The present and proposed future foreseeable projects in the analysis area include wildlife, botanical, watershed, recreation, lands, minerals, and special use projects. These projects would not be expected to have a measurable effect on forest structure in the analysis area due to the localized and dispersed nature of scale and intensity of such projects. However, the primary minor adverse effect of these projects, particularly recreation activities, with respect to fire, is increased ignition sources from campfires, vehicles, and other intentional or unintentional ignitions from forest users during summer months.

3.3.9 Summary and Comparison of Alternatives

In conclusion, treatments proposed under the action alternatives in the Sugarloaf Project area would decrease the risk of wildfire to the rural community of LaPorte, American House and forest resources by altering the hazardous fuel conditions and aiding fire suppression. These treatments would increase the ability of fire management personnel to suppress and contain wildfires during initial attack and extended attack operations, while increasing firefighter and public safety (table 3-10).

Table 3-10. Changes in fire behavior; Existing Condition and Action Alternatives.

Indicator	Existing Condition	Alternatives B, C, and D	Change
Canopy Base Height (ft)	1–68	1–83	0–18% increase
Fire Type	Surface/Passive/Active	Surface/Passive	Less risk of Active fire behavior
Flame Length (ft)	1–100	1–41	0–59% decrease

NOTE: modeled using FMA and FFE with stand level data.

All action alternatives would provide for some canopy separation. Canopy separation would make aerial retardant penetration more efficient and help reduce an approaching crown fire to a surface fire. Alternatives B and D meet the desired condition of fuel models TL1, TL3 and TL5 on 1 percent more of the project area than alternative C.

Treating the dense understory canopy would break up vertical and horizontal continuity by removing ladder fuels. Average canopy base heights would be raised to greater than 15 feet. Surface fuel treatments would result in desired flame lengths less than 4 feet in most stands. Increases in canopy base height and decreases in predicted flame length would decrease the probability of crown fire.

3.3.10 Compliance with the Forest Plan and Other Direction

Alternative A would not meet the fuels management goals and objectives of the 1988 Plumas LMP, as amended by the 2004 HFQLG Act FEIS or the SNFPA FSEIS. Alternative A would not allow for the Plumas National Forest to strategically reduce hazardous fuels to protect communities and forest resources at risk from wildfire.

Alternative B would contribute to reaching the HFQLG Pilot Project goal of designing a landscape network of DFPZs. At the landscape level, these treatments would provide connectivity between the existing Bald Onion, Southfork DFPZs and LaPorte HFR project. The proposed treatments are designed to:

- Decrease surface fuel loading (small diameter material less than 3 inches) to 5 tons per acre or less.
- Maintain where available 10–15 tons per acre of the largest logs ≥20 inches dbh, 10 feet or greater in length (approximately 8–12 logs).

- Leave 4–6 of the largest snags larger than 15 inches dbh. Consider leaving fewer snags strategically located in treatment areas within the WUI and DFPZ.
- Flame lengths less than 4 feet at head of fire burning under high fire weather conditions.
- Increase canopy base heights by removing ladder fuels resulting in minimal canopy base height of 15 feet.
- Canopy separation to limit crown fire spread.

Alternatives C and D would contribute to decreasing the risk of wildfire to the communities of LaPorte and American House by implementing the standards and guidelines set by the 2004 Record of Decision on the Sierra Nevada Forest Plan Amendment (SNFPA) final supplemental EIS. The proposed treatments are designed to:

- Create defensible space near communities and provide a safe and effective area for suppressing fire
- Design economically efficient treatments to reduce hazardous fuels conditions
- Establish and maintain a pattern of area treatments that is effective in modifying wildfire behavior.

Treating fuels in a manner that significantly reduces wildland fire intensity and rate of spread, thereby contributing to more effective fire suppression and fewer acres burned.

3.4 Forest Vegetation

3.4.1 Introduction

This section includes complete discussions of possible effects of the proposed project and alternatives on vegetative resources, characterized by pine and fir-dominated Sierra mixed conifer forests with some true fir forests and plantations established over the last 40 years in clear-cut timber, seed-tree and shelterwood harvest units. The Sugarloaf Project area lies just west of the crest of the Northern reach of the Sierra Nevada, from 4,000 feet to 5,800 feet in elevation, with an annual precipitation ranging from 67 to 75 inches. Much of these forests are typical of the wet productive westside forests of the Sierra Nevada (USDA 1999a, b), but the forests in the project area tend to be a mosaic of dry, less productive sites and wet, more productive sites.

The Forest Survey Site Class (FSSC) in the project area ranges from 2 to 7 (based on an index where FSSC 7 represents the least productive site class); however nearly three quarters of the project area is classified as Forest Survey Site Class 5 or 6 (medium to low site quality) which represents a mean annual increment – growth rate – of 20 to 85 cubic feet per acre per year (USDA SCS 1988).

3.4.2 Analysis Framework: Statute, Regulatory Environment, Forest Plan and Other Direction

The Sugarloaf Hazardous Fuels Reduction Project is designed to fulfill the management direction specified in the 1988 Plumas National Forest Land and Resource Management Plan (PNF LRMP) (USDA 1988), as amended by the Sierra Nevada Forest Plan Amendment (SNFPA) FSEIS and ROD (USDA 2004a,b). Fuel and vegetation management activities are designed to comply with the standards and guidelines as described in the SNFPA FSEIS and ROD (USDA 2004a,b).

3.4.2.1 National Forest Management Act

The *National Forest Management Act* (NFMA) of 1976, including its amendments to the *Forest and Rangeland Renewable Resources Planning Act of 1974* state that it is the policy of the Congress that all forested lands in the National Forest System be maintained in appropriate forest cover with species of trees, degree of stocking, rate of growth, and conditions of stand designed to secure the maximum benefits of multiple use sustained yield management in accordance with land management plans. Both acts also state "insure that timber will be harvested from National Forest System land only where – (i) there is assurance that such lands can be adequately restocked within five years of harvest; (ii) that soil, slope, or other watershed conditions will not be irreversibly damaged; (iii) that protection is provided for streams, streambanks, shorelines, lakes, wetlands, and other bodies of water from detrimental changes in water temperatures, blockages of water courses, and deposits of sediment, where harvests are likely to seriously and adversely affect water conditions or fish habitat; and (iv) that the harvesting system to be used is not selected primarily because it will give the greatest dollar return or the greatest unit output of timber (16 U.S.C. 1604 (g)(3)(E)).

National Forest Management Act findings for the Sugarloaf Project are discussed in the Sugarloaf Project "Silviculture Report" Appendix (on file at the Feather River Ranger District).

3.4.2.2 Plumas National Forest Land Management Plan (1988) as amended by the Sierra Nevada Forest Plan Amendment FSEIS and ROD (2004)

The standards and guidelines for fuels and vegetation management projects include direction for the various land allocations inside the Sugarloaf project area.

3.4.3 Effects Analysis Methodology

3.4.3.1 Geographic and Temporal Bounds

The approximate 26,000-acre boundary of the subwatersheds in the Sugarloaf Project area forms the geographic boundary of the analysis area used to analyze the direct, indirect, and cumulative effects on forest vegetation. The analysis area is comprised of sixteen subwatersheds: Little Grass Valley Reservoir, Wallace Creek, Clarks Ravine, Slate Creek Canyon 6, Wisconsin Ravine, East Branch Rabbit Creek, Slate Creek Canyon 4 – Lucky Hill, Valley Creek, Onion Creek, American House Ravine, Slate Creek Canyon 5, Slate Creek Canyon 2 – St. Louis, Unnamed Tributary to Rabbit Creek, Rabbit Creek, Slate Creek Canyon 3 – French Camp, and Upper Lost Creek.

The analysis area includes the vegetation occurring within the treatment areas as well as the vegetation outside of the treatment areas within the affected watersheds. The analysis considers the

sixteen subwatersheds because, when combined, they represent the furthest measurable extent that effects on forest vegetation would occur as a result of implementing any of the proposed alternatives.

The direct, indirect, and cumulative effects analyses are based on a temporal scale. Documented past projects including timber harvesting, wildfires, watershed improvements, and other activities described in EIS; Appendix A ranging as far back as 1980 were considered past actions within the analysis area. In a broader sense, current vegetation structure and composition reflects the historical management regimes prior to 1980. This vegetation structure and composition includes attributes of the current landscape including existing vegetation types, fuel treatments, burned areas, past sanitation harvest, and plantations.

For the purpose of the vegetation analysis, the temporal bounds include a 20 to 30-year horizon for future effects. Within 20 to 30 years, the treated stands would approach current levels of stocking and would approach the typical entry cycle for managed stands. This timeframe allows for examining general trends and trajectories of stand development.

Fuel treatments are expected to remain effective for at least 10 to 20 to years—this is based on experience with existing fuel treatments on the Feather River Ranger District. Fuel treatments would likely require entry for burning and other maintenance prior to the 20 to 30-year horizon modeled for tree stand growth (USDA 2004a).

3.4.4 Analysis Methodology

Field inventories were conducted to measure attributes of existing vegetation in the analysis area. Stands in the analysis area were inventoried using the Common Stand Exam protocols for the Pacific Southwest Region (U.S. Department of Agriculture [USDA] Forest Service Region 5). These stands are representative of the analysis area and the areas to be treated in all action alternatives. Data was collected on live and dead trees.

For analysis purposes, the stand data was loaded into the Forest Vegetation Simulator, a forest growth model that predicts forest stand development (Dixon 2002). The model was used to quantify existing stand conditions and to predict the effect of alternative treatments on forest development. Stand growth, mortality, regeneration, and development by stand were simulated to predict the effects of treatments over time. The FVS model output predicts average stand conditions and attributes by stand. The stand attributes analyzed included trees per acre, basal area, quadratic mean diameter, stand density index, canopy cover, and species composition. Model outputs by stand were utilized to examine the effects of treatment over the larger landscape scale. Model outputs have unknown variances that may sometimes be large; however, this is normal for modeling efforts, and model outputs are best evaluated in a relative rather than an absolute sense. In addition, model simulations have limited capacity to predict mortality due to drought or insect and disease outbreaks. Considering this, model outputs such as stand density and basal area provide useful metrics for determining relative risk of these effects. This further underscores that interpretation of model outputs is best evaluated in a relative sense in conjunction with professional judgment, firsthand knowledge of stand conditions, forest health evaluations, and pertinent scientific research, studies, and literature. For more information regarding FVS modeling by alternative, please refer to the Forest Vegetation Report, appendix C.

A Geographic Information System (GIS) was used to analyze forest vegetation on the landscape scale for the analysis area. Forest-wide vegetation typing into California Wildlife Habitat Relationships (CWHR) classifications (Mayer and Laudenslayer 1988) was done for the Plumas-Lassen Administrative Study in 2002 (Vestra 2002). The HFQLG 2005 Vegetation Mapping Project mapped areas on the Plumas National Forest not covered by Vestra. These data were combined in a GIS to provide a complete map of the existing vegetation within the analysis area. All vegetation information is displayed using CWHR vegetation typing and serves as the baseline acres for analysis. The distribution of CWHR size class and density was analyzed relative to the stand-level effects modeled by CWHR size class (table 3-11). Other sources of information used in the assessment of effects were aerial photos, data generated from common stand exam plots, and field reconnaissance.

Table 3-11. Diameter class and tree size by forest product.

CWHR Tree Size	Sapling to Pole Size Trees	Small-sized Trees	Intermediate-sized Trees (small to medium)	Medium to Large-sized Trees
Forest Product	**Biomass Trees**	**Sawlog Trees**		**Reserve Trees**
Diameter Class	0–10 inches dbh	10–20 inches	20–30 inches	30+ inches
CWHR Size Class	1, 2, 3	4	5	5 (Reserve)
Diameter Class	0–11 inches dbh	11–24 inches	24–30 inches	30+ inches

NOTE: dbh = diameter at breast height, CWHR = California Wildlife Habitat Relationships.

3.4.4.1 Measurement Indicators

Environmental indicators and measures are used to describe the effects of the action alternatives on the vegetative resource. Environmental indicators that will be analyzed in this section are: (1) stand structure measured by trees per acre, basal area per acre, and relative stand density; (2) composition measured by percent change in shade-intolerant species; and (3) landscape heterogeneity measured by percent change in CWHR size and density classes. Indicators are assessed for each alternative (no action and action), and are compared across alternatives for each treatment type.

3.4.4.2 Forest Vegetation: Stand Structure, Composition and Landscape Heterogeneity

The effects of treatment on stand structure, compositional structure, and landscape structure of forest vegetation are evaluated for each alternative. These measurement indicators focus on residual post-treatment attributes (forest vegetation structure, density, species composition, and landscape diversity and heterogeneity) as residual post-treatment conditions are the best indicator of how well desired conditions as described in chapter 1 would be met for the project purposes and needs.

Stand Structure—Stand structure is analyzed using three measures of stocking and density: (1) trees per acre and their distribution by diameter class, (2) basal area per acre, and (3) relative stand density.

Trees per Acre and Their Distribution by Diameter Class. The number and distribution of trees per acre by diameter class (table 3-11) is an important unit of measure because it shows the effect of

treatments on different size trees. High density stands also slow the rate of fire line construction by hand crews and mechanical equipment. The four diameter classes are based on diameter classes for forest products (biomass and sawlog products), ecological importance for fire behavior and wildlife habitat, and guidelines for reserve trees upon which silvicultural prescriptions are based. The sawlog-sized trees are split into two diameter classes to track the effect of treatments on the intermediate-sized tree class as described in the GTR 220 (North 2012; North et al. 2009). The percent reduction of trees per acre is used to show the effects of treatments on reducing stocking, and the percent retention of trees greater than 24 inches in diameter is used to show the effects of treatments on the intermediate and large tree size classes which are valued for ecological structure and function for wildlife habitat.

Basal area per acre. Basal area per acre is "the cross-sectional area of all stems in a stand measured at breast height and expressed per unit land area" (in this case, per acre) (Helms 1998). Basal area per acre is commonly used as a measure of stand density. This measure has been used by Oliver (1995) to describe the threshold for ponderosa pine (150 square feet per acre), above which bark beetle related mortality is expected to occur. This threshold is related to Sartwell's work (Sartwell 1971; Sartwell and Stevens 1975; Sartwell and Dolph 1976) with mountain pine beetle outbreaks as described by Powell (1999) where these "outbreaks could be attributed to two primary factors: second-growth ponderosa pine stands were even-aged and ecologically simplified when compared with the uneven 'virgin' forest; and man's intentional suppression of wildfire effectively removed an important landscape-level thinning agent, which in turn caused an unnatural accumulation of stand density (basal area) as compared to virgin conditions." Both of these conditions occur within the Sugarloaf Project landscape as described in the affected environment.

For true fir stands, Oliver's research (1988) found that "plots with 200 square feet per acre or more basal area suffered the bulk of the mortality." This may allow for leaving slightly higher densities in pure true fir stands, however, Powell (1999) recommends for mixed species stands (which are prevalent in the analysis area) that the "lowest stocking-level recommendations could be selected" because other species (such true fir species) would develop acceptably under the lower densities established for the limiting species (pine species). "This is the strategy recommended by Cochran and others (1994)," (Powell 1999).

In addition, basal area per acre has also been used by Landram (2004) to develop insect risk thinning guidelines for the eastside, transition, and westside zones of the Plumas National Forest. For the westside zone (where the Sugarloaf Project is primarily located) the insect risk thinning guides for the Plumas suggest thinning to 200 square feet per acre. For more information regarding basal area and forest health, please refer to the Forest Vegetation Report, appendix A.

Relative stand density. The concept of a stand density index was first developed for even-aged stands by Reinecke (1933) to compare "the density of stocking of various stands." The relative density concept describes a stand's density relative to the maximum possible density and may serve as a proxy for a stand density relative to its carrying capacity. In general, the concept of stand density as a measure has been further developed for forest management applications for both even-aged and uneven-aged stands (Curtis 1970; Drew and Flewelling 1977, 1979; Long 1985; Long and Daniel 1990; Helms and Tappeiner 1996; Jack and Long 1996; Powell 1999; Woodall et al. 2002).

A relative density between 55 and 60 percent has been described as the lower limit of the "Zone of Imminent Competition Mortality" above which trees begin to die due to competition related stress (Drew and Flewelling 1977, 1979; Long 1985; Long and Daniel 1990; Smith et al. 1997; Powell 1999; Long and Shaw 2005). For the purpose of this analysis, 60 percent was used as a measure of the onset of competition-related mortality because stress induced by competition increases tree susceptibility to drought, insects, disease, and fire. This threshold serves as an appropriate measure for forest health because stands managed below this threshold are less likely to incur mortality due to the agents mentioned above.

The desired relative densities immediately after post-treatment are between 25 and 40 percent, the lower bounds of which correspond with the onset of competition and crown closure. These levels are substantially below the threshold of imminent competition mortality, and treatments within the desired range should have a reasonable "lifetime" before reaching densities at which mortality is expected to occur. Desired relative densities within 20 to 30 years would be below the 60 percent threshold of imminent competition mortality (Blackwell 2004) as this longer time frame would be representative of a reasonable cutting or entry cycle.

Reinecke (1933) described a maximum stand density of 750 for mixed conifer stands in California. The calculation of this maximum stand density is largely dependent on the mix of species. A more site-specific maximum stand density was calculated for each stand using the Forest Vegetation Simulator (FVS), which calculates maximum stand density weighted by the "proportion of basal area each individual species represents in the stand" (Dixon 2002). This may be a more appropriate measure of maximum stand density as it considers site-specific species composition reflected in the existing condition. For the purpose of this analysis, relative density based on the maximum stand density index as calculated by FVS is used. For more information regarding relative stand density, please refer to the Forest Vegetation Report, appendix A.

Compositional Structure. Compositional structure is measured by calculating the percent of species composition pre and post-treatment. Species composition is analyzed because silvicultural prescriptions, particularly Group Selection treatments, may have an effect at the stand level on differing species dependent on shade tolerance and species biology. Residual species composition post-treatment is an important measure because these trees represent the seed bank of the future, which is one factor that affects species diversity over time. The shift in species composition in the northern Sierra Nevada forests from shade-intolerant species (i.e., ponderosa pine, Jeffrey pine, sugar pine, black oak) to shade-tolerant species (white fir, red fir, incense-cedar, Douglas-fir) has been well documented in scientific literature (McKelvey and Johnston 1992; Skinner and Chang 1996; Ansley and Battles 1998). Therefore, treatments that improve the percentage of pine and oak species in forested stands would be beneficial. Percent change in shade-intolerant species composition is used to show the effects that treatments within the alternatives would have on species composition. For more information regarding desired species composition, please refer to the Forest Vegetation Report, appendix A.

Landscape Structure. For the purpose of this analysis, landscape structure refers to the distribution of relative successional (seral) stages on the landscape, and the relative distribution of closed-canopy and open canopy stands. This is an important indicator because it may be used as a measure of landscape heterogeneity and diversity, and as a measure of cumulative effects to forest

vegetation on the landscape scale. Landscape structure is measured by calculating the distribution of these seral stages within the vegetation analysis area. The relative distribution of seral stages within the landscape is measured by using CWHR size class as a proxy for seral stage. Table 12 displays the CWHR tree size and density class categories. CWHR size class serves as an effective proxy for seral stage because it classifies forest vegetation by ranges of average tree size which represent discrete developmental stages of tree growth. Quadratic mean diameter (QMD) is used to determine the CWHR size class, and the percent change in QMD is used to show trends in changing landscape structure. CWHR density class serves an effective proxy for open and closed-canopy conditions because it classifies canopy cover. In addition, this allows for a congruent analysis of effects on forest vegetation and wildlife habitat. Forest stands were aggregated by CWHR size class because the proposed treatments, stand structure, and effects of treatments on stand structure would not substantially vary by forest vegetation type (as classified by CWHR habitat type.

Table 3-12. CWHR tree size and density class crosswalk with seral stage and canopy closure condition.

CWHR Tree Size Categories				CWHR Density Class Categories			
CWHR Size Class	**Tree Sizes (average)**	**Description**	**Seral Stage**	**CWHR Density Class**	**Tree Canopy cover**	**Description**	**Canopy Conditions**
1	<1 in. dbh	Seedlings, but definite forest habitat	Early Seral	n/a	<10%		Open canopy Stands
2	1–6 in. dbh	Sapling		S	10–24%	Sparse	
3	6–11 in. dbh	Pole-sized tree		P	25–39%	Open	
4	11–24 in. dbh	Small Tree	Mid-seral	M	40–60%	Moderate	Closed-canopy Stands
5	>24 in. dbh	Medium/Large tree	Later Seral	D	>60%	Dense	
6	>24 in. dbh	Multilayered canopy with dense cover		n/a	>60%		

3.4.4.3 Types and Duration of Effects

Direct effects to vegetation are caused by treatment implementation or, as with alternative A (no action), a lack of treatment. Indirect effects to vegetation are those occurring in response to the direct effects of treatment implementation or, as with alternative A (no action), a lack of treatment.

Direct effects would likely be limited to the project implementation phase. Indirect effects would last beyond the implementation period and occur within the temporal bound of the cumulative effects analysis described above in “Geographic and Temporal bounds.” In order to understand the contribution of past actions to the cumulative effects of the proposed action and alternatives, this analysis relies on current environmental conditions as a proxy for the impacts of past actions. This is because existing conditions reflect the aggregate impact of all prior human actions and natural events that have affected the environment and might contribute to cumulative effects.

3.4.5 Affected Environment

3.4.5.1 Forest Structure and Composition

As with many areas in the Sierra Nevada, the landscape in the analysis area has been heavily influenced over the last 150 years by past management activities that include mining, grazing, timber harvesting, fire exclusion, large high-severity fires (Young 2003; Beesley 1996; McKelvey and Johnston 1992), and more recent drought-related mortality during the late 1980s and early 1990s (Guarin and Taylor 2005; Ferrell 1996; Macomber and Woodcock 1994).

Past harvest activities on the Sugarloaf Project landscape were primarily focused on overstory removal and sanitation or salvage harvest, with a shift toward even-aged systems in the 1980s. Past use of these harvest systems is consistent with well-documented overall management practices that occurred over vast areas of the Sierra Nevada during the 20th century (UC 1996; Leiberg 1902). With respect to the removal of ponderosa and Jeffrey pine, and the resulting increase in the occurrence of white fir in the watershed of the South Fork of the Feather River and North Fork of the Yuba River, John Leiberg (1902) noted:

> "Some red and white fir has been taken, together with most of the yellow and sugar pine which grew on these tracts (south of the South Fork of the Feather River") (page 91) and "The cutting has been largely selective (in the North Fork of the Yuba River Basin), the yellow and sugar pine being taken, while most of the red and white fir remains" (page 102).

Currently, shade-tolerant species dominate most of the analysis area stands; however conditions range by stand which have varying levels of shade-tolerant versus shade-intolerant species. Those stands on lower elevation south and west facing slopes have greater amounts of shade-intolerant species, yet many mixed species stands have very high proportions of shade-tolerant species. Currently, shade-tolerant species including white fir, red fir, Douglas-fir, and incense cedar account for 81 percent of tree species present in project area stands. Desired shade-intolerant tree species such as black oak, ponderosa pine, Jeffrey pine, and sugar pine only account for 19 percent of the trees species present in project area stands (figure 3-1).

Past harvest activities described above have resulted in (1) the reduction of large dominant and codominant overstory trees, (2) the retention of smaller diameter intermediate and suppressed trees and (3) a shift in species composition from shade-intolerant pine dominated stands to shade-tolerant, white fir dominated stands; all of which have largely decreased landscape level forest heterogeneity (diversity) (McKelvey and Johnston 1992). In addition, a near absence of landscape level, low-intensity surface fires has contributed to increased stand densities in smaller diameter classes, particularly in shade-tolerant species (Skinner and Chang 1996).

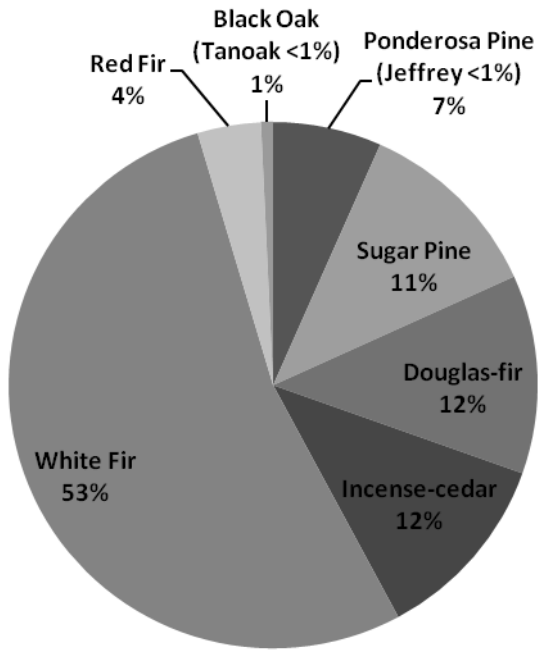


Figure 3-1. Existing average species composition of all stands in the Sugarloaf Project area, as a percentage of total basal area.

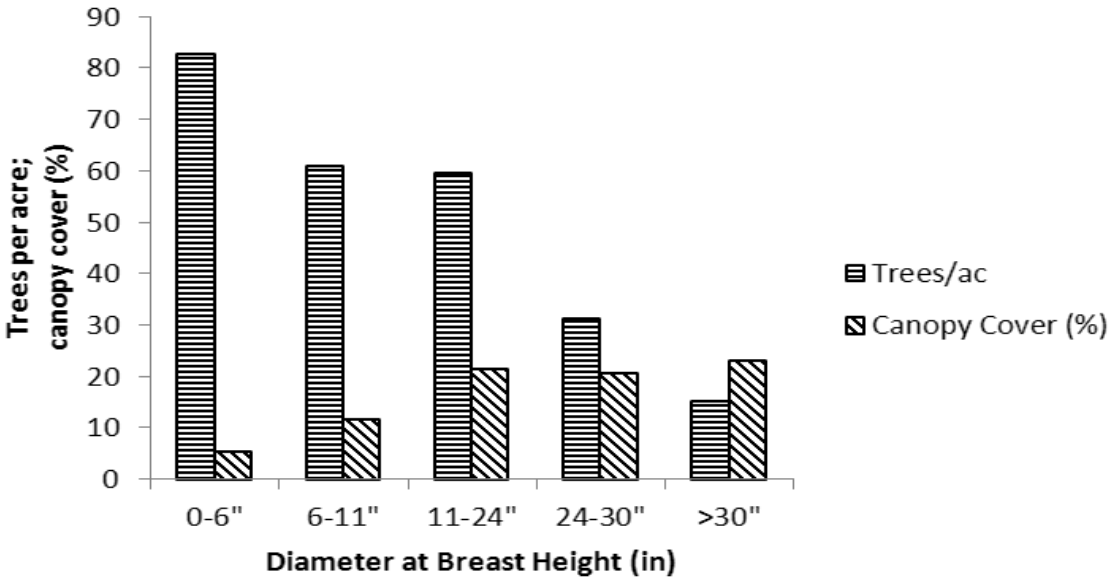


Figure 3-2. Existing average trees per acre and canopy cover by diameter class.

At the stand level, similar to what has occurred at the landscape level, the combination of past management activities, fire exclusion, and extensive drought-related mortality has created relatively homogeneous areas typified by small even-aged trees existing at high densities (Oliver et al. 1996). High-density stands are also more susceptible to density-dependent mortality driven by drought and insect and disease infestations (Cochran et al.1994; Guarin and Taylor 2005; Macomber and Woodcock 1994, Powell 1999). Extensive drought in the late 1980s and early 1990s, combined with high stand density, resulted in extensive mortality of white fir (Guarin and Taylor 2005; Ferrell 1996; Macomber and Woodcock 1994). Much of this material has fallen over in the last 20 years and become dead and down fuel. The high densities of small trees and high fuel loads contribute to:

- overstocked stand conditions in which trees become stressed due to competition for water, light, and nutrients; this can lead to a higher potential for mortality due to drought, insects, or disease (Powell 1999; Ferrell 1996; Guarin and Taylor 2005; Fettig et al. 2007)

- conditions that favor the recruitment of shade-tolerant species such as white fir, which promotes a shift in species composition from pine-dominated to fir-dominated forests (Oliver et al. 1996; McKelvey and Johnston 1992)

- large accumulations of ground fuels, ladder fuels, and canopy fuels which increase the potential for stand-replacing, high-severity fire events (Weatherspoon and Skinner 1996).

As a result of past management activities described above, conditions across the Sierra Nevada have been described as “generally younger, denser, smaller in diameter, and more homogeneous” (McKelvey et al. 1996); this condition is typical of forests in the analysis area. Such conditions are best characterized by California Wildlife Habitat Relationship (CWHR) size class 4 where diameter at breast height (dbh) ranges between 11 and 24 inches. Analysis of CWHR size class distribution for forest types in the analysis area shows a relative overabundance of CWHR size class 4, indicating a departure from desired distributions of seral stages (figure 3-3). Taylor (2004) observed in his study of the Lake Tahoe Basin that “pre-settlement forests were more structurally diverse than contemporary forests” and consisted of larger trees at lower densities — these would be more characteristic of open canopy, later seral stands such as CWHR 5P. In contrast, the relative dominance of CWHR size class 4 likely developed as a result of overstory removal and salvage harvest systems in concert with fire suppression policies.

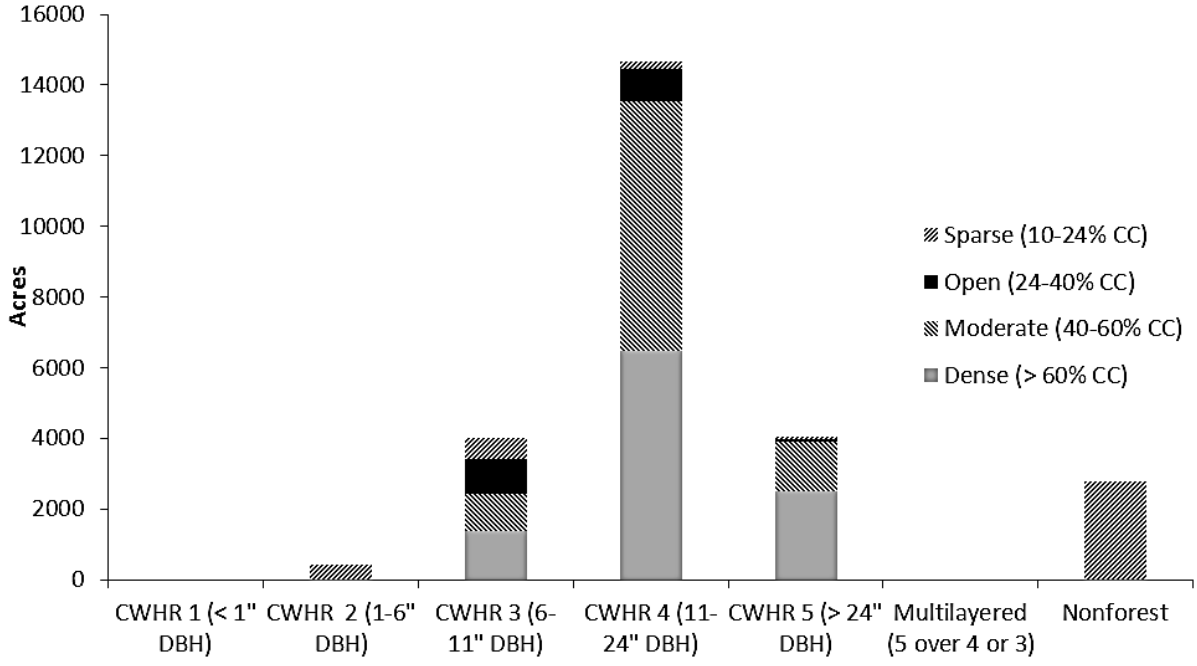


Figure 3-3. Distribution of California Wildlife Habitat Relationship tree size and density classes within the analysis area.

Because such stand structure has increased vulnerability to high-severity fires, insect outbreaks, and landscape level drought-induced mortality, a homogenous (same species or structure) occurrence of this seral stage across the landscape is unstable (McKelvey and Johnston 1992; Millar et al. 2007). A more diverse distribution of seral stages, characterized by heterogeneous stand structures, may be more resilient to disturbance events such as fire, drought, and insect and disease infestations and more characteristic of desired conditions (Stephens and Fule 2005; Millar et al. 2007; Collins and Stephens 2010).

3.4.5.2 Forest Insects and Disease

Forest insects and disease currently occur in many stands in the analysis area. With the exception of white pine blister rust (*Cronartium ribicola*), an introduced disease, forest pathogens are endemic to forests as part of the natural disturbance regime. However, due to the interaction of past management activities (such as fire exclusion, unnaturally high stocking levels of shade-tolerant species, and drought) as well as climate change trends, populations of insects and disease may increase beyond endemic levels associated with forest health.

Bark beetles are the primary insects of concern found in the analysis area and are associated primarily with ponderosa and Jeffrey pines and true fir. Ponderosa and Jeffrey pines are susceptible to the western pine beetle, *Dendroctonus brevicomis*, and *Ips* species. The western pine beetle is the most aggressive and contributes to direct tree mortality, particularly in moisture-stressed trees within high-density stands where density driven competition is greatest. The primary prevention measure for this species is to maintain healthy vigorous trees in low stand densities where competition for water, light, and nutrients is minimized. The *Ips* species breed in accumulated slash and may grow beyond

endemic levels in areas where logging slash is not properly treated. When populations build to sufficient numbers, the *Ips* beetle can attack mature trees.

The fir engraver bark beetle also occurs within the analysis area. The fir engraver bark beetle attacks true fir species and is associated with direct and indirect tree mortality, in combination with drought and disease occurrences in high-density stands (Ferrell 1996).

The primary pathogen of concern found in the analysis area is *Heterobasidion* root disease, caused by *Heterobasidion occidentale* and *Heterobasidion irregulare*. *Heterobasidion* root disease is known to occur throughout the forests of northern California and southern Oregon (Schmitt et al. 2000) and there are well-documented occurrences in both pine and fir species on the Plumas National Forest and neighboring Lassen National Forest (Kliejunas 1989; Woodruff 2006). The occurrence of *Heterobasidion* root disease has been confirmed in true fir and is suspected to occur in pine stands in the analysis area (Woodruff and Kliejunas 2005). There is the potential for new infection in any harvest area because spores can travel up to 100 miles (Goheen and Otrosina 1998).

While all western conifers are susceptible to this pathogen, ponderosa and Jeffrey pines and true fir tend to be most susceptible to adverse effects from the disease. This root disease is spread via spores infecting fresh wounds or stumps and from root-to-root contact (Sinclair et al. 1987). Stands with repeated entry in the analysis area have a higher incidence of the disease than un-entered stands. The effects of this disease range from reduced individual tree vigor, root and bole decay, windthrow, root mortality, and in the worst-case scenario, tree mortality.

Existing conditions of forested stands within the analysis area vary depending on factors such as ownership, past management activities, and CWHR size class and density. In general, forested stands proposed for thinning treatments within the Sugarloaf Project are primarily CWHR 3, CWHR 4 and CWHR 5 size class stands. The average existing conditions and the range for each attribute are shown in table 3-13.

These stands have high densities of trees, particularly in the 1–11 inch diameter class range, and some stands have high densities in the 11–24 inch range. These stands have high accumulations of ladder fuels and vertical continuity with canopy fuels, which in combination with the high surface fuel loads, are predicted to have large flame lengths, high amounts of tree torching, and primarily passive crown fire behavior resulting in large amounts of mortality under 90th percentile weather conditions. These high stand densities also increase stresses on larger more desirable retention trees due to increased inter-tree competition for finite site resources – particularly water during extended drought periods – which is connected to increases in bark beetle populations and subsequent tree mortality. For more information regarding forest health, existing conditions, and desired conditions, please refer to the Forest Vegetation Report, appendix A and B.

Table 3-13. Existing conditions of forested stands.

Stand	CWHR 2			CWHR 3			CWHR 4			CWHR 5		
Attributes	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max
Total trees/ac	232	100	300	569	200	1101	234	60	491	58	50	92
Trees/ac 1-6 in. dbh	199	100	250	353	50	900	60	0	350	0	0	0
Trees/ac 6-11 in. dbh	33	0	100	113	34	200	62	0	233	0	0	0
Trees/ac 11-24 in. dbh	0	0	0	80	0	205	63	0	237	12	0	50
Trees/ac 24-30 in. dbh	0	0	0	19	0	42	34	0	83	22	21	42
Trees/ac >30 in. dbh	0	0	0	4	0	11	15	0	33	24	7	30
Snags/ac >15 in. dbh	0	0	0	2	0	6	7	0	23	12	0	14
Snags/ac >30 in. dbh	0	0	0	0.3	0.0	2.0	2.3	0.0	9.1	4.1	0.0	5.6
Basal area (ft^2/ac)	18	1	33	223	47	301	325	44	422	291	270	360
Relative density (%)	8	1	14	65	19	78	71	10	99	50	46	62
Quadratic mean diameter (in.)	3.4	1.3	4.9	8.6	6.3	10.7	16.7	11.2	23.5	30.8	25.1	32.8
Total canopy cover (%)	23	3	37	62	36	74	62	10	76	47	45	59

3.4.6 Environmental Consequences

3.4.6.1 Alternative A – No Action

Direct and Indirect Effects

Stand Structure: Trees per Acre, Basal Area per Acre, and Relative Stand Density—Under alternative A, current stand conditions would persist and develop unaltered by active management, with the exception of continued fire suppression activities. Wildfire, drought, disease, and insect-related mortality and recruitment would continue to occur. Table 3-14 displays average stand attributes by alternative and prescription. *Under alternative A, there would be no reduction in trees per acre, basal area per acre or relative stand density. Under alternative A, stands would have, on average, 309 square feet of basal area and a relative stand density of 68 percent.* Stands would remain dense, particularly in the smaller diameter classes in terms of trees per acre and basal area.

Table 3-14. Average stand attributes by alternative and prescription, values in parentheses are (min-max). TFB=thinning from below, VDT=variable density thinning, DL=upper diameter limit, CC=canopy cover target.

Alternative	Prescription	Post-Treatment Trees/ac	Average Reduction Trees/ac (%)	Post-Treatment Retention Trees >24" dbh (%)	Post-Treatment Basal Area (ft^2/ac)	Average Reduction Basal Area (%)	Post-Treatment Relative Density (%)	Post-Treatment Quadratic Mean Diameter (in)	Average Change Quadratic Mean Diameter (%)
A (No Action)	NA	249 (50-1101)	0	100	309 (1-422)	0	68 (1-99)	17.0 (1.3-32.8)	0
B (HFQLG)	TFB, 30" DL, 40% CC	77 (48-143)	73 (64-85)	69 (58-100)	176 (155-221)	46 (33-52)	36 (32-42)	21.0 (14.1-29.2)	47 (17-82)
	VDT, 30" DL, 40% CC	65 (33-118)	70 (19-91)	73 (49-100)	207 (106-240)	38 (3-57)	38 (25-43)	24.8 (13.2-33.9)	51 (9-174)
	GS	17 (4-30)	73 (41-99)	63 (18-100)	140 (30-222)	51 (24-88)	21 (6-33)	40.0 (32.6-61.0)	127 (13-335)
	HCPB/HCGP	135 (50-349)	63 (36-80)	100	228 (1-420)	28 (2-89)	48 (1-86)	15.4 (0.8-22.2)	-10 (-37-123)
	MAST	130 (59-259)	50 (17-80)	100	152 (2-420)	32 (2-88)	36 (1-86)	11.9 (2-26.8)	1 (-22-26)
	Average	83 (4-349)	69 (17-99)	76 (18-100)	195 (1-420)	39 (2-89)	37 (1-86)	22.0 (0.8-61.0)	39 (-37-335)
C (Non-commercial)	TFB, 30" DL, 40% CC	75 (34-143)	70 (58-89)	72 (51-100)	188 (111-237)	41 (26-60)	36 (26-42)	22.1 (14.1-33.9)	46 (17-116)
	TFB, 30" DL, 50% CC	138 (57-270)	42 (20-88)	89 (65-100)	262 (190-294)	22 (10-43)	53 (44-64)	20.8 (14.1-28.6)	31 (6-145)
	HCPB/HCGP	178 (59-408)	34 (20-81)	100	275 (1-420)	9 (2-89)	57 (1-86)	16.8 (0.8-22.2)	8 (-37-123)
	MAST	134 (59-259)	46 (17-80)	100	186 (2-420)	29 (2-88)	41 (1-86)	14.0 (2.4-26.8)	-4 (-32-26)
	Average	129 (34-408)	55 (17-89)	87 (51-100)	231 (1-420)	28 (2-89)	47 (1-86)	19.0 (0.8-33.9)	21 (-57-146)

Table 3-12. Average stand attributes by alternative and prescription, values in parentheses are (min-max) (continued).

Alternative	Prescription	Post-Treatment Trees/ac	Average Reduction Trees/ac (%)	Post-Treatment Retention Trees >24" dbh (%)	Post-Treatment Basal Area (ft^2/ac)	Average Reduction Basal Area (%)	Post-Treatment Relative Density (%)	Post-Treatment Quadratic Mean Diameter (in)	Average Change Quadratic Mean Diameter (%)
D (SNFPA 2004)	TFB, 30" DL, 40% CC	105 (48-143)	68 (64-75)	94 (78-100)	177 (155-221)	42 (33-51)	35 (34-39)	19.1 (14.1-29.2)	36 (17-64)
	TFB, 30" DL, 40-50% CC	92 (65-113)	55 (48-64)	81 (60-100)	241 (171-296)	30 (18-46)	44 (32-53)	22.0 (21.9-22.1)	25 (23-27)
	VDT, 30" DL, 40% CC	74 (48-118)	63 (58-76)	91 (52-100)	220 (136-237)	29 (26-43)	40 (32-42)	23.6 (16.7-29.2)	39 (27-64)
	VDT, 30" DL, 40-50% CC	95 (34-167)	74 (48-89)	77 (51-100)	178 (111-296)	43 (18-60)	36 (26-53)	19.3 (14.3-33.9)	58 (16-116)
	VDT, 30" DL, 50% CC	86 (57-93)	67 (62-88)	94 (72-100)	270 (254-274)	22 (20-28)	52 (48-53)	24.3 (23.3-28.6)	65 (44-146)
	VDT, 24" DL, 40% CC	67	19	100	203	3	36	23.6	9
	VDT, 24" DL, 50% CC	82 (57-157)	57 (54-68)	100	265 (236-275)	25 (22-27)	49 (48-50)	26.4 (16.6-29.6)	34 (26-56)
	VDT, 24" DL, 50-60% CC	90 (75-105)	42 (32-51)	100	303 (258-349)	28 (17-38)	56 (48-65)	24.8 (24.6-25.1)	11 (11-12)
	VDT, 20" DL, 50-60% CC	106 (87-127)	59 (48-82)	100	273 (190-311)	39 (14-43)	57 (45-50)	21.8 (20.1-22.8)	39 (29-82)
	HCPB/HCGP	175 (59-408)	32 (20-81)	100	287 (1-420)	8 (2-89)	60 (1-86)	17.4 (0.8-22.2)	0 (-37-123)
	MAST	130 (59-259)	31 (17-80)	100	172 (2-420)	25 (2-88)	38 (1-86)	13.4 (2.4-26.8)	-5 (-32-26)
	Average	129 (34-408)	53 (17-89)	94 (51-100)	248 (1-420)	23 (2-89)	50 (1-86)	19.4 (2.4-33.9)	21 (-37-146)

Oliver (1995) observed that northern California even-aged ponderosa pine stands whose densities exceeded Sartwell's (1971) basal area threshold of 150 square feet per acre were susceptible to *Dendroctonus* bark beetle attack. The basal area threshold for western Sierra Nevada mixed conifer is 200 square feet per acre (Landram 2004*). Under alternative A, 83 percent of the stands are over this basal area threshold and pine species within these stands are at elevated risk of bark beetle mortality* (Fiddler 1989; Oliver 1995). True fir species (white and red fir) may exist at higher stand densities. However, at high stand densities, root disease and drought increase the susceptibility of true fir species to mortality caused by the Scolytus fir-engraver beetle (Oliver et al. 1996; Guarin and Taylor 2005; Ferrell 1996; Macomber and Woodcock 1994).These high tree densities would persist under alternative A, thereby reducing growth rates and tree vigor, and increasing risk of mortality due to inter-tree competition and increased incidence of insect activity (Ferrell 1996; Oliver et al. 1996; Oliver 1995). High densities of small trees may cause competition for soil moisture and nutrients, which could contribute to increased stress on larger, older trees (Dolph et al. 1995*). Under alternative A, 65 percent of the stands have relative stand densities that are at or greater than the "lower limit of the zone of imminent competition mortality"* (Drew and Flewelling 1977; Drew and Flewelling 1979; Smith et al. 1977).

The increasing stand density and consequent mortality due to inter-tree competition and increased incidence of insect activity may have a major adverse effect on forest health by decreasing tree vigor and growth; increasing susceptibility to insects, disease, and drought; and increasing susceptibility to intense fire behavior. The resulting stand structure would be characterized by a dense understory and midstory with interlocking crowns.

Compositional Structure: Species Composition

Under alternative A there would be no change in species composition. The existing stand structure promotes a low light environment, which strongly influences species composition by favoring the regeneration, growth, and development of shade-tolerant species such as white fir, incense-cedar, and, to a lesser degree, Douglas fir. Overall, shade-tolerant species collectively account for 81 percent of trees in project area and shade-intolerant tree species such as ponderosa pine, sugar pine, and black oak, account for only 19 percent, on average; however, this varies by stand, aspect, and elevation. Shade-tolerant species currently exist at high densities, particularly in trees less than 24 inches dbh, while pine species (ponderosa and sugar pines) generally occur as overstory trees (greater than 20 inches dbh); the amount of pine regeneration in the understory is much lower than shade-tolerant species. These large dominant overstory pines are "legacy" trees that may be indicative of species composition in historical reference conditions. However, existing stand structure and high densities clearly favor the regeneration, growth, and development of shade-tolerant species. Currently, most mixed species stands in the analysis area are becoming more occupied by the shade-tolerant species mentioned above, and this trend would be expected to continue.

Such high densities of shade-tolerant species compete with shade-intolerant species for resources (nutrients, light, and water), increase shade in the understory, and discourage the regeneration of shade-intolerant pine species (Oliver et al. 1996). Consequently, over the longer temporal scale, a shift in species composition would be expected to occur, giving preference to regeneration of shade-tolerant species over shade-intolerant species (Minnich et al. 1995; Ansley and Battles 1998; Oliver et al. 1996; McKelvey and Johnston 1992). Shade-tolerant species, white fir in particular, can be more susceptible to fire-related scorch mortality than shade-intolerant species such as ponderosa pine and Jeffrey pine

(Skinner 2005; Stephens and Finney 2002; Mutch and Parsons 1998; Leiberg 1902). This susceptibility to mortality can lead to more trees being killed by wildfire-related scorch and damage to the cambium.

Landscape Structure and Heterogeneity: Tree Size and Canopy Cover

Currently, relative stand densities in CWHR size classes 3 and 4 are 65 and 74 percent, respectively, while 60 percent represents the threshold for competition-related mortality. Over time, diameter growth and an increase in trees per acre due to ingrowth would contribute to an increase in stand density. In the absence of treatment or naturally occurring disturbance, such as fire, stand density would continue to increase beyond the threshold of 60 percent relative stand density into the "zone of imminent mortality." This would have an adverse effect on tree growth and vigor and resistance to insects, disease, drought, fire behavior, and fire-related tree mortality.

The analysis area would continue to be dominated by closed-canopy mid-seral forested stands. These stands, best characterized by CWHR size class 4 and canopy density classes of Moderate (M) and Dense (D), contribute to landscape homogeneity due to its ubiquitous abundance and connected arrangement. Because such stand structure has increased vulnerability to high-severity fires, insect outbreaks, and landscape level drought-induced mortality, a homogenous (same species or structure) occurrence of these closed-canopy, mid-seral stages across the landscape is unstable and less resilient to the aforementioned forest disturbances (McKelvey and Johnston 1992).

Cumulative Effects Common to All Alternatives

The cumulative effects of past management practices, fire exclusion, and high-mortality fires (as detailed in Appendix A) have largely shaped the forest that exists in the analysis area today. These factors have influenced vast areas of the Sierra Nevada mountain range and are well documented in the scientific literature as noted in this chapter. These past projects and events are reflected in the vegetation layer used to characterize the existing conditions (the baselines for analysis) in the analysis area. Changes in vegetation structure as a result of recent fires and past projects since the baseline data were collected have been incorporated into the Sugarloaf Project's existing conditions. Such activities have had major impacts at the stand level by converting mid to later seral forest to early seral structure; however, on the landscape scale, this has had a negligible impact due to the dispersed nature of these projects and their size relative to the analysis area.

On National Forest System lands and private lands, past harvest activities focused on selection and sanitation harvests; resulting in overstory removal of dominant and codominant trees and retention of midstory and understory trees. These harvest systems often used lop and scatter techniques for limb wood and tree tops. These practices resulted in promoting closed-canopy, high-density stands of small trees with relatively high surface fuel loads. Many of these stands continue to be conducive to high-mortality fire today.

Since the mid to late 1990s, commercial and non-commercial thinning from below, with and without prescribed fire, has been the principal silvicultural treatment implemented on NFS lands within and adjacent to the analysis area. This silvicultural treatment has been used to establish fuel treatments on NFS lands within the analysis area (LaPorte Hazardous Fuels Reduction project, South Fork Service Contract, Poverty Hill Hazardous Fuels Reduction project, Howland Flat Thinning project). These treated areas currently meet desired conditions in terms of potential fire behavior and tree mortality. Other silvicultural activities on NFS lands within the analysis area have consisted primarily of roadside hazard

tree removal (Lexington Hill and American House Roadside Hazard). Silvicultural activities on private lands within the analysis area have included clear cutting, Group Selection, sanitation/salvage, rehabilitation, shelterwood removal, individual tree selection, and a variety of alternative prescriptions.

Herbicides have been used to control competing brush in conifer plantations and noxious weeds on private lands within the analysis area. A reduction of competing brush generally reduces stand-level flammability in plantations and increases rates of tree growth. These factors can shorten the length of time that planted trees remain vulnerable to scorch-related mortality.

Watershed and wildlife projects are not generally implemented at a scale or location to have an influence on landscape level vegetation or fire behavior and related tree mortality. In general, wildlife and watershed projects listed in Appendix A: Past, Present, and Reasonably Foreseeable Future Actions, have a negligible effect on stand development and landscape level fire behavior and related tree mortality. These small projects that improve riparian areas or improve wildlife habitat have a minor beneficial effect by enhancing vegetation diversity and decreasing fire behavior. In general, current road conditions and past road closures to benefit wildlife have had a negligible impact on vegetation management within the analysis area.

Other present and proposed future projects in the analysis area include wildlife, botanical, watershed, grazing, recreation, lands, minerals, and special use projects. These projects would not be expected to have a measurable effect on forest structure in the analysis area due to the localized and dispersed nature of scale and intensity of such projects. However, the primary minor adverse effect of these projects, particularly recreation activities, with respect to fire, is increased ignition sources from campfires.

Present and proposed future fuels and vegetation management projects on NFS lands in the analysis area include the St. Louis Hazardous Fuels Reduction project and Grass Flat DFPZ. Present and proposed future silvicultural activities on private lands in the analysis area include Group Selection, shelterwood removal, clearcut, and a variety of alternative prescriptions. Collectively, these projects represent less than 10 percent of the analysis area, and Forest Service projects represent less than 10 percent of National Forest System Lands.

Small hazardous fuels projects occurring on private lands such as the Plumas Fire Safe Council Projects, and Natural Resource Conservation Service Projects, include hazardous fuels reduction in the form of commercial and non-commercial mechanical thinning, hand thinning, piling and burning, or underburning. These activities would have a beneficial effect on the stand level by maintaining an open understory in these stands, thereby reducing high stand densities of small trees, ladder fuels, and fuel loading, fire risk, and potential fire behavior and effects. These projects are generally smaller in scale and highly dispersed through the analysis area. In addition, the treatments employed in these projects would not notably affect the overstory trees. Consequently these projects would result in a negligible impact on overall landscape structure because they are not likely to affect seral stage (as represented by CWHR size class) or overstory canopy (as represented by CWHR density class).

Larger hazardous fuels reduction projects occurring on National Forest System lands such as the St. Louis project also employ hazardous fuels reduction in the form of commercial and non-commercial mechanical thinning, hand thinning, piling and burning, or underburning. These activities would also have a beneficial effect on the stand level by maintaining an open understory in these stands are and have greater capacity to affect overstory tree density.

3.4.6.2 Cumulative Effects of Alternative A

Alternative A would not meet the purpose and needs discussed in chapter 1. With regards to Forest Vegetation, alternative A would not reduce hazardous fuel accumulations to improve forest health. Forest structure, species composition, landscape heterogeneity, fuel loadings, and potential fire behavior would remain unchanged. Overall, the existing forest and landscape structure and predicted fire behavior for this alternative could lead to a greater potential for large, high-severity fires in forested areas, including Wildland Urban Interface, riparian habitat conservation areas, protected activity centers, and home range core areas in the analysis area during a wildfire under 90th percentile or worse weather conditions.

The no action alternative would rely on density-dependent mortality, wildfires, and continued fire exclusion, to shape overall landscape structure. The maintenance of early seral stand structure would rely on areas of disturbance. The current landscape is dominated by mid-seral closed forests as represented by CWHR size classes 4M and 4D. No treatments would occur to enhance the development of mid-seral open-canopy forests. Stand densities would be expected to increase with time and would result in overall landscape homogeneity.

Maintaining high stand densities across the landscape would result in the potential for adverse major impacts such as beetle outbreaks beyond endemic levels, widespread susceptibility to drought, and increased risk for high-mortality fire. These high stand densities and closed-canopy forests would favor a gradual shift in species composition toward shade-tolerant species, which would have an adverse effect on species diversity across the landscape. Such high-density stand structure is susceptible to forest health and fire hazard issues, and a homogeneous occurrence of these mid-seral closed-canopy forests across the landscape would be unstable (McKelvey and Johnston 1992). Alternative A would not provide for spatially variable, diverse stand structures across the landscape as described by Skinner (2005), Skinner and Chang (1996) and Weatherspoon (1996), and it would not meet the desired conditions identified in the purpose and need sections in chapter 1 of this document.

3.4.7 Summary and Comparison of Alternatives

Throughout all treatments, regardless of silvicultural prescription, trees greater than 30 inches in diameter would be retained in accordance with the 2004 Record of Decision on the SNFPA Final Supplemental EIS (USDA 2004b). In general, trees in the 24- to 30-inch diameter classes and the greater than 30-inch diameter classes would be the favored tree sizes to retain. These larger trees have favorable attributes in terms of fire resistance, desired stand structure, and wildlife habitat. In pine-dominated mixed conifer forest types, shade-tolerant species (such as white fir, incense-cedar, and to a lesser degree, Douglas-fir) would be targeted for removal, particularly in the smaller diameter classes. Shade-intolerant species such as black oak, Jeffrey pine, ponderosa pine, and sugar pine would be retained. In true fir-dominated forest types, species preference would be weighted towards maintaining naturally occurring shade-intolerant species such as Jeffrey pine; however, species composition would be maintained at levels appropriate for that ecological forest type.

In general, the direct and indirect effects described below would be common to all action alternatives that propose mechanical harvesting as a treatment regardless of silvicultural prescription. All treatments involving mechanical harvesting would share similar effects that include the potential for damage to residual trees; incidental removal of snags and trees greater than 30 inches in diameter; the construction of skid trails, landings, and temporary roads to facilitate logging operations; and the creation of

activity-generated slash. Implementation of mechanical treatments is expected to maintain near-current total volume of snags and woody debris greater than 10 inches in diameter (Stephens and Moghaddas 2005b).

Damage to residual trees may occur during harvesting operations including damage to stems, bark scraping, wrenched stems, broken branches, broken tops, and crushed foliage (McIver et al. 2003). These effects are typical in logging operations, but care would be taken to minimize the potential for damage to residual trees. The Forest Service would inspect timber sales during harvesting to ensure that damage to residual trees is within reasonable tolerances.

Direct and Indirect Effects: Hand thinning Treatments

Hand thinning treatments (HCPB and HCGP) would be similar in intensity for all action alternatives, but the scale of these treatments would vary by alternative. Alternative B would implement 159 acres of hand thinning, while alternatives C and D would implement 961 and 1,037 acres, respectively. Under Alternative A, hand thinning treatments would not occur. Table 3-13 displays the comparison of average post-treatment stand attributes for hand thinning treatments by alternative. Under alternatives B, C, and D, hand thinning treatments would remove most trees up to 9.9 inches in diameter, resulting in similar effects across all action alternatives. Differences among alternatives are a result of the existing stand conditions in the different groups of stands that would be treated under each alternative. For example, more stands are treated under alternatives C and D than alternative B, many of which have a higher density of trees greater than 9.9 inches in diameter. As a result, hand thinning treatments under alternatives C and D result in greater trees per acre, basal area, and relative density than under alternative B. Similarly, post-treatment stands under alternative C and D have a higher QMD than those under alternative B.

Direct and Indirect Effects: Mechanical Thinning Treatments

Mechanical thinning treatments would be implemented in all action alternatives, but the scale and intensity of these treatments would vary by alternative. Alternatives B, C, and D would implement similar amounts of mechanical thinning, but diversity of prescriptions would vary significantly among alternatives. Alternative C would implement the most acres of mechanical thinning because it prescribes thinning in some units that were designated as Group Selection under alternative B; while alternative D would implement the least amount of mechanical thinning treatments of all the action alternatives because thinning is not economically feasible in some stands under the higher canopy cover and smaller diameter limit restrictions. Alternative A would not implement any mechanical treatments.

Mechanical thinning treatments would also vary in intensity between action alternatives. Table 3-1 displays the comparison of average post-treatment stand attributes for mechanical thinning treatments by alternative. Alternative D would generally retain more intermediate-sized trees, and remove smaller diameter trees than the other action alternatives. Alternative C would include slightly more removal of intermediate-sized trees and correspondingly slightly more retention of small diameter-sized trees. Alternative B would remove the most intermediate-sized trees and some large trees (less than 30 inches in diameter), but would also result in the largest increase in QMD.

Under alternative B, average post-treatment stand conditions would meet desired conditions for stand structure and density, create open-canopy stands, and enhance growth of residual trees into larger diameter classes, thereby promoting the development of later seral stand conditions. Due to canopy cover

restrictions, however, desired conditions for basal area less than the 200 ft^2 per acre would not be met in many stands.

Alternatives C and D would result in relatively less reduction in stand densities, and average post-treatment conditions would not meet desired basal area or relative stand density conditions under some prescriptions, although this would vary by individual stand conditions. Diameter limits and canopy cover constraints associated with these alternatives limit the capacity and efficacy of these alternatives in meeting the purposes and needs for forest health. As a result, on average, these alternatives maintain more closed-canopy conditions.

Under alternative A, stands would develop untreated which would result in increasing densities and increased risk for tree mortality and high severity effects from potential disturbances such as drought, fire, and insect and disease occurrences.

These changes in density would also have an effect on species composition. Table 3-17 displays the percent change in shade-intolerant species composition as a result of hand thinning and mechanical thinning treatments. Alternative B would provide for the greatest overall increase in shade-intolerant species composition as a result of the removal of most shade-tolerant trees in Group Selection units (Figure 3-4a). Alternatives C and D would also provide a notable increase in shade-intolerant species composition as canopy cover retention and upper diameter limits in mechanical thinning treatments provide the greatest opportunity to preferentially remove relatively larger amounts of shade-tolerant species in order to retain desired shade-intolerant species (Figures 3-4b, 3-4c). Alternative A would not provide opportunities to improve species composition.

In general, the greatest difference in vegetation treatments between alternatives lies in the mechanical thinning treatments. Amounts of prescribed fire treatments and mastication treatments are similar among action alternatives, and amounts of hand thinning treatments between alternatives C and D are similar.

Table 3-15. Comparison of average post-treatment percent change in desired shade-intolerant species composition by alternative and treatment.

Alternative	Average Post-Treatment Percent Change in desired Shade-Intolerant Species Composition			
	Hand thinning Treatments	Mechanical Thinning Treatments	Group Selection Treatments	Total
A	0%	0%	0%	0%
B	-3%	42%	99%	6%
C	3%	50%	0.0%	5%
D	3%	52%	0.0%	5%

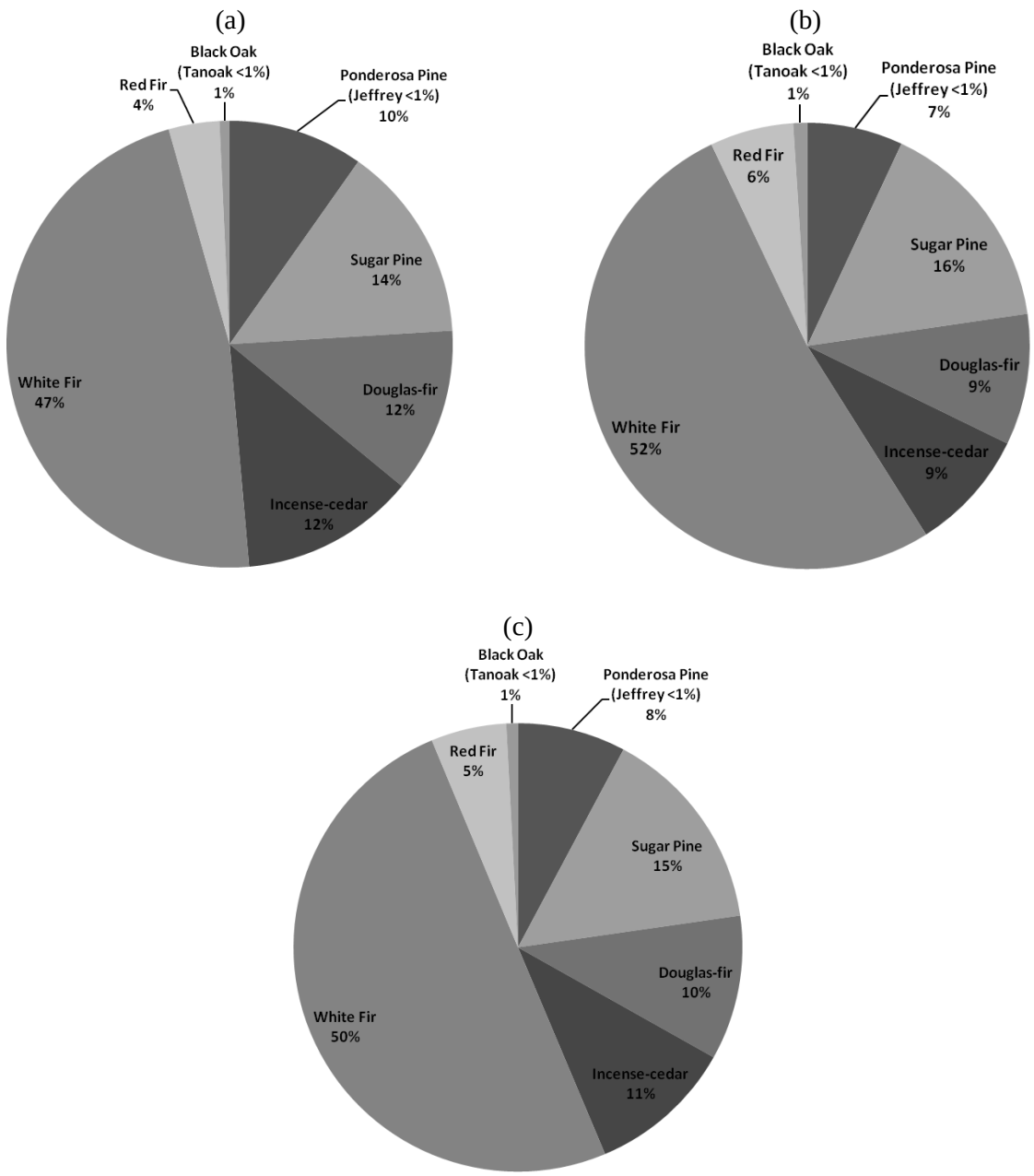


Figure 3-4. Species composition under: (a) alternative B, (b) alternative C, and (c) alternative D as a percentage of total basal area.

Direct and Indirect Effects: Mastication Treatments

Mastication treatments would be similar in scale and intensity for all action alternatives. As with hand thinning, differences among action alternatives are primarily due to the existing conditions of the different groups of stands being treated under each alternative. Mastication treatments would not occur under alternative D and would reduce the risk of wildfire hazards the least of the three alternatives (excluding the no action), as it removes fuel loads to a lesser degree due to less mechanical thinning (Fuels and Fire).

Direct and Indirect Effects: Prescribed Fire Treatments

Prescribed fire treatments would be similar in scale and intensity for all action alternatives. Prescribed fire treatments would not occur under alternative A, the no action alternative.

Direct and Indirect Effects: Group Selection Treatments

Group Selection treatments would only occur under action alternative B. Alternative B would implement 71 acres of Group Selection (within an 850 acre area comprised of Group Selection units). Group Selection units would be located primarily in CWHR 4M stands and would be used to enhance shade-intolerant species composition and promote regeneration of a new age class within areas dominated by shade-tolerant species such as white fir. Group Selection treatments would enhance landscape structure, heterogeneity and species composition by creating early seral conditions (characterized by CWHR 1 and 2) that are favorable for the establishment, growth, and development of a new age class of shade-intolerant species. Under alternatives A, C and D, Group Selection treatments would not occur and these benefits would not be realized.

Direct and Indirect Effects: Borax Treatments

Borax treatments would occur in similar scale and intensities under alternatives B, C, and D. These treatments would limit the spread of *Heterobasidion* root disease. These treatments would result in beneficial effects to forest vegetation by reducing tree mortality and shift in species composition of forested stands.

Alternative A would not implement borax treatments and would not implement site disturbing activities. However, the potential for *Heterobasidion* root disease would be negligible since stump surfaces suitable for *Heterobasidion* infection would not be created.

For further information regarding *Heterobasidion* root disease and treatments, please refer to the Forest Vegetation Report, Appendix D.

Direct and Indirect Effects: Watershed Improvements

Watershed improvement treatments would be similar in scale and intensity for all action alternatives. Watershed improvement treatments would not occur under alternative A, the no action alternative, displayed Table 3-16.

Table 3-16. Comparison of alternatives by measurement indicators.

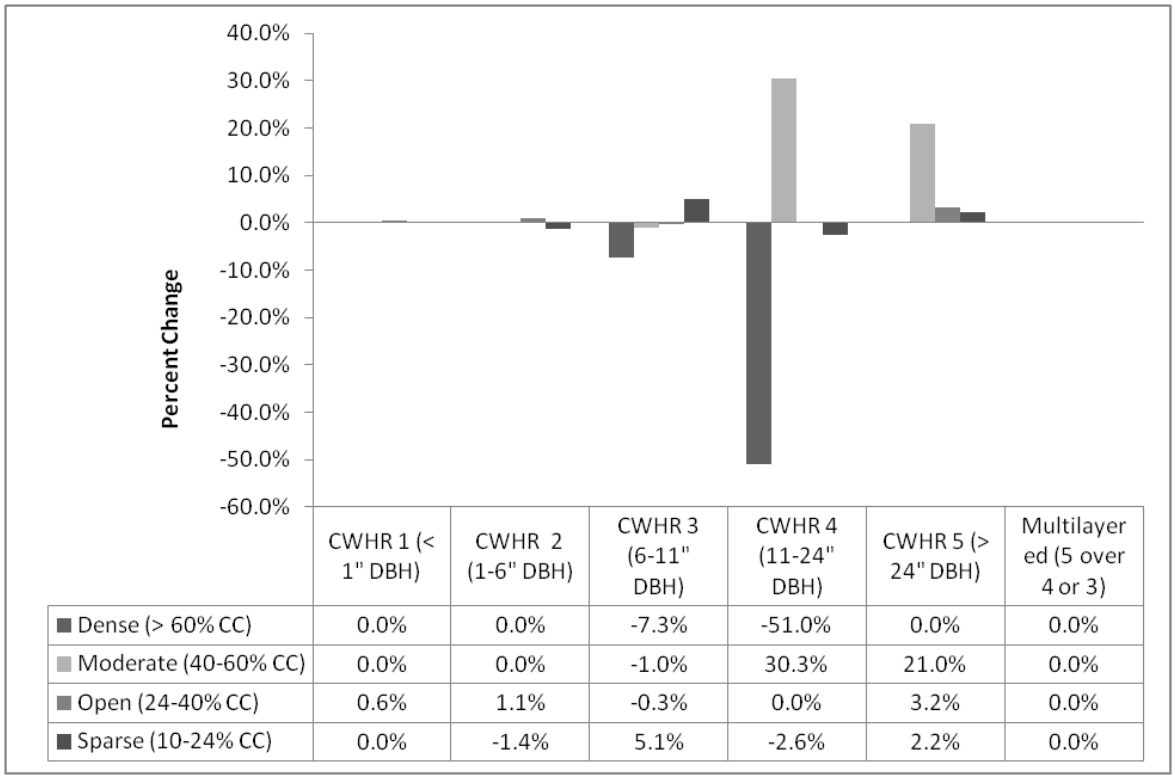
Alternative	% Stands Retaining All Trees >24 in. dbh	% Stands With <200 ft^2 Basal Area	% Stands With 25-40% Relative Density	% Stands With >60% Relative Density	% Stands With Quadratic Mean Diameter >24"	% Stands With >50% Canopy Cover	% Stands With Increased Shade Intolerant Species
A	100	17	5	65	9	71	0
B	43	50	44	12	37	19	75
C	77	36	24	22	10	40	81
D	87	36	29	25	12	42	83

Cumulative Effects

The cumulative effects of all alternatives on vegetation diversity as examined through changes in CWHR size class and density are displayed in figures 3-5, 3-6, and 3-7. While existing conditions serve as the baseline for cumulative effects of past activities within the analysis area, present and future projects would have a minor cumulative effect on change in vegetation throughout the analysis area. These effects are best represented by the no action alternative, alternative A, which would not implement any of the treatments proposed under the action alternatives. Alternative A would largely maintain existing conditions of dense, closed-canopy, mid-seral stands which are susceptible to (1) extreme potential fire behavior due to heavy accumulations of surface fuels in combination with a homogeneous continuity of ladder and canopy fuels, and (2) drought, insect and disease driven tree mortality as a result of high stand densities and increased inter-tree competition. It is important to recognize that while alternative A maintains existing conditions, forested landscapes are dynamic, and maintenance of such homogenous conditions would be relatively unstable and pre-dispose this landscape to rapid change due to high severity disturbance events such as fire, drought, and insect and disease occurrences. Such events like the Bucks and Devils Gap Fires of 1999, and the Moonlight and Antelope Fires of 2007 underscore the scale and severity of disturbances which can occur.

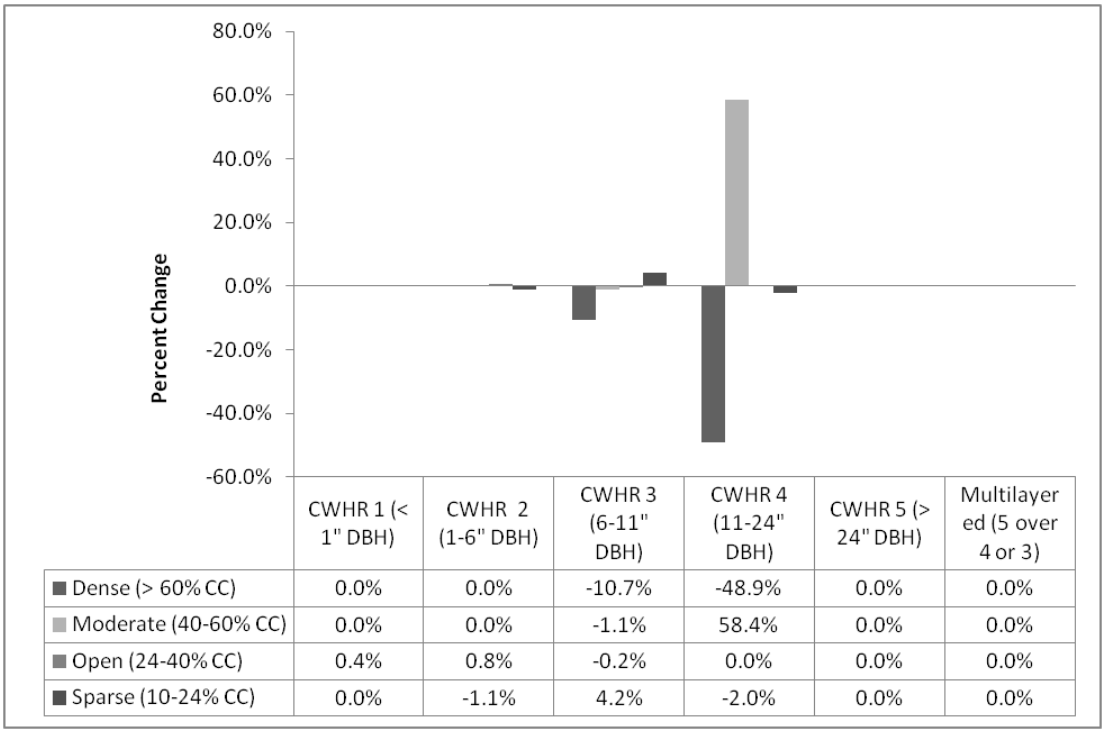
Action alternatives would implement proposed treatments which would further alter the diversity of vegetation on National Forest System lands within the analysis area, and these cumulative effects would vary in intensity and scale dependent on alternative. Alternatives B and D implement treatments and prescriptions which, in general, allow greater opportunity to create more moderate and open canopy, mid-seral stands while maintaining closed-canopy, late seral stands which serve as habitat for late seral dependent species. These effects are displayed by the greater reductions in CWHR 4D, the greater increase in CWHR 4M, and in the case of alternative B, the greater increase in CWHR 5M. Alternative B also provides for the creation of early seral habitat as displayed by the greater increases in CWHR 1 and 2 size classes, and sparse canopy cover. The creation of early seral habitat would provide favorable conditions for the establishment, growth, and development of a new age class of shade-intolerant species which would enhance landscape diversity; however, this effect would come from the conversion of primarily mid-seral stands (CWHR 3 and 4) and a minor portion of late-seral stands in CWHR size class 5. Approximately 41 percent of Group Selection treatments (53 acres) would occur in CWHR size class 5 under alternative B.

The treatments employed under alternatives B and D would best meet desired conditions for the Forest Health purposes and needs as described in chapter 1. The diverse prescriptions that would be implemented under alternative D would enhance heterogeneity at multiple scales - both the stand and landscape scale – while reducing fuels and potential fire behavior and improving forest stand structure, species composition, and forest health, in general. However, alternative B would best meet desired conditions for forest health objectives as described in chapter 1 and would re-align forest structure, composition, and heterogeneity with an active fire disturbance regime which would enhance forest resiliency to trends presented by climate change.



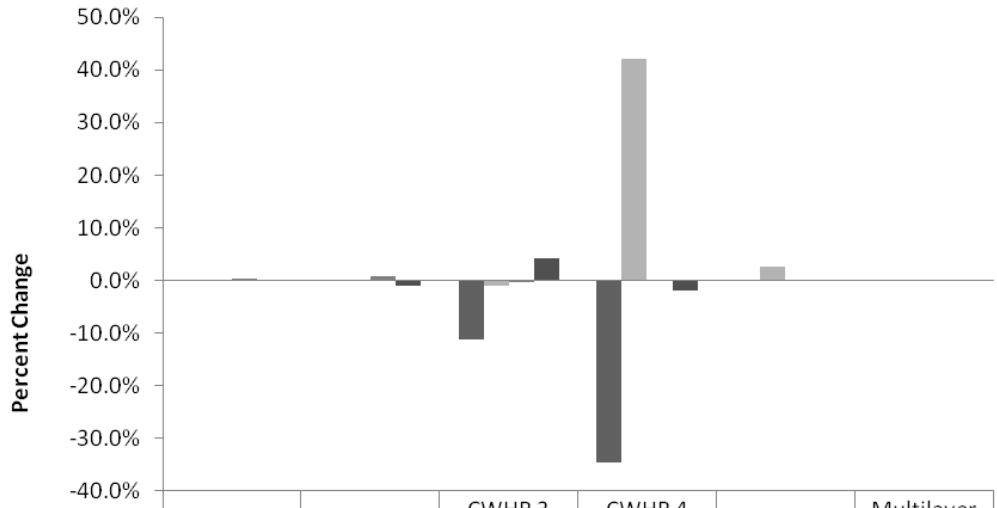
	CWHR 1 (< 1" DBH)	CWHR 2 (1-6" DBH)	CWHR 3 (6-11" DBH)	CWHR 4 (11-24" DBH)	CWHR 5 (> 24" DBH)	Multilayered (5 over 4 or 3)
Dense (> 60% CC)	0.0%	0.0%	-7.3%	-51.0%	0.0%	0.0%
Moderate (40-60% CC)	0.0%	0.0%	-1.0%	30.3%	21.0%	0.0%
Open (24-40% CC)	0.6%	1.1%	-0.3%	0.0%	3.2%	0.0%
Sparse (10-24% CC)	0.0%	-1.4%	5.1%	-2.6%	2.2%	0.0%

Figure 3-5. Percentage change in CWHR size and density classes for alternative B.



	CWHR 1 (< 1" DBH)	CWHR 2 (1-6" DBH)	CWHR 3 (6-11" DBH)	CWHR 4 (11-24" DBH)	CWHR 5 (> 24" DBH)	Multilayered (5 over 4 or 3)
Dense (> 60% CC)	0.0%	0.0%	-10.7%	-48.9%	0.0%	0.0%
Moderate (40-60% CC)	0.0%	0.0%	-1.1%	58.4%	0.0%	0.0%
Open (24-40% CC)	0.4%	0.8%	-0.2%	0.0%	0.0%	0.0%
Sparse (10-24% CC)	0.0%	-1.1%	4.2%	-2.0%	0.0%	0.0%

Figure 3-6. Percentage change in CWHR size and density classes for alternative C.



	CWHR 1 (< 1" DBH)	CWHR 2 (1-6" DBH)	CWHR 3 (6-11" DBH)	CWHR 4 (11-24" DBH)	CWHR 5 (> 24" DBH)	Multilayered (5 over 4 or 3)
Dense (> 60% CC)	0.0%	0.0%	-11.3%	-34.7%	0.0%	0.0%
Moderate (40-60% CC)	0.0%	0.0%	-0.9%	42.2%	2.6%	0.0%
Open (24-40% CC)	0.4%	0.8%	-0.2%	0.0%	0.0%	0.0%
Sparse (10-24% CC)	0.0%	-1.1%	4.2%	-2.0%	0.0%	0.0%

Figure 3-7. Percentage change in CWHR size and density classes for alternative D.

Alternative C implements treatments and prescriptions which, in general, maintain relatively closed-canopy conditions in mid-seral and late seral stands. These effects are displayed by the maintenance of dense canopy cover in CWHR size classes 4 and 5, and the relatively smaller increases in moderate and open canopy stands in CWHR size classes 4 and 5. In addition, there would be no cumulative addition in early seral conditions as displayed by CWHR size classes 1 and 2 and sparse canopy cover. Alternative C would meet fuel reduction purposes and needs to varying degrees. While treatments under alternative C could enhance structural diversity at the stand level depending on individual stand conditions, the capacity of these treatments to enhance heterogeneity and improve species composition are limited by the canopy cover restrictions associated with thinning treatments outside the WUI defense zone, and the strict thinning from below prescriptions. This tempers the efficacy of alternative C to enhance heterogeneity and species composition at the landscape scale. Consequently, this also reduces the effectiveness of alternatives C to meet desired conditions under the forest health purpose and need.

3.4.8 Compliance with the Forest Plan and Other Direction

Alternatives C and D were designed to fully comply with the Plumas National Forest LRMP (USDA 1988a) as amended by the Sierra Nevada Forest Plan Amendment FSEIS and ROD (USDA 2004c, d). Alternative B was designed to comply with table 2 (page 69) of the Sierra Nevada Forest Plan Amendment ROD (USDA 2004d), which provides the standards and guidelines applicable to the HFQLG pilot project area for the life of the pilot project. In addition, prescriptions under all action alternatives are designed to comply with the *National Forest Management Act* (NFMA) of 1976.

3.5 Wildlife – Terrestrial

3.5.1 Introduction

Management of species habitat, and maintenance of a diversity of animal communities, is an important part of the mission of the Forest Service (*Resource Planning Act of 1974, National Forest Management Act of 1976*). Management activities on National Forest System (NFS) land are planned and implemented so that they do not jeopardize the continued existence of Threatened, Endangered or Proposed species: a trend toward listing or loss of viability of Forest Service Sensitive or Candidate species or effects to Management Indicator Species (MIS), as specified in the 1982 Planning Rule (36 CFR 219).

In preparation for the Environmental Impact Statement, the Wildlife Biological Evaluation/Biological Assessment, Management Indicator Species Report, and the Migratory Bird Report were prepared to determine the effects of proposed projects on species listed by the United States Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) in accordance with Section 7 of the *Endangered Species Act* (19 U.S.C. 1536 {c}), 50 CFR 402, and the MIS standards established in Forest Service Manual (FSM) direction FSM 2672.42, for possible effects on regionally listed Forest Service Sensitive species (including invertebrates, amphibians, reptiles, birds and mammals).

There are no Endangered, Threatened or Proposed species in the Sugarloaf project area. There would be no interrelated or interdependent actions to Endangered, Threatened or Proposed species 50 CFR 402:02. The list of Region 5 Forest Service sensitive species found in table 3-17 were analyzed for Sugarloaf Project.

Table 3-17. List of Region 5 Forest Service sensitive species within the wildlife analysis area.

BIRDS	
Northern goshawk	Sensitive
California spotted owl	Sensitive
MAMMALS	
American marten	Sensitive
Pacific fisher*	Sensitive (USFW Candidate)
Pallid bat	Sensitive
Townsend's big-eared bat	Sensitive

NOTE: The West Coast population of the Fisher designated as a candidate species by USFWS (USDI 2004), but listing under the *Endangered Species Act* is precluded by other, higher priority listing actions.

3.5.1.1 Threatened, Endangered, Proposed, Candidate, and Region 5 Forest Service Sensitive Species

The following species are found on the Plumas National Forest, but are not found on the Feather River Ranger District: Swainson's hawk, Sierra Nevada red fox, California wolverine, and Greater sandhill crane will not be discussed further.

Although the following species are found on the Feather River Ranger District of the Plumas National Forest, there is no known habitat and/or no observations (or incidental), or it is out of the elevational range for these reasons, these species will not be discussed further on in this document. Bald eagle, Peregrine falcon, Willow flycatcher, California wolverine, Great gray owl, Western red-bat and Valley elderberry longhorn beetle.

The following species either are known to occur and/or there is suitable habitat in the analysis area and are discussed below: California spotted owl, Northern Goshawk, Fisher, Pacific Marten, Townsend big-eared bat, Pallid bat, Fringe-tailed myotis and the Western bumble bee.

3.5.1.2 Management Indicator Species

Of the twelve Management Indicator Species (MIS) species listed for the Plumas NF, four were identified as "Category 3," species whose habitat would be either directly or indirectly affected by the Sugarloaf Project (USDA 2012b). Habitat effects for the California spotted owl and the Northern flying squirrel for "Late Seral Closed Canopy Coniferous" forest will be addressed under the affected environment and environmental consequences sections for the California spotted owl. Habitat effects for "Snags in Green Forest", for the Hairy woodpecker are addressed under the section for Snags. Habitat effects for "Riparian Forest," for the Yellow Warbler are discussed in the Aquatics section.

3.5.1.3 Migratory Birds

The Plumas utilizes the USFWS 2008 Birds of Conservation Concern for the Sierra Nevada as its framework for analyzing effects to migratory birds. Of this list of eleven birds, project level reports address nine of the species either directly or by using a surrogate species that utilize the same or similar habitat attributes (USDA 2012c). There is potential habitat within the Sugarloaf Project analysis area for the remaining two species, the Peregrine falcon and the Black swift. However, there are no known occupied sites and it is not expected that these species would be directly or indirectly affected.

3.5.2 Analysis Framework: Statute, Regulation, Forest Plan, and Other Direction

Management Area specific and species-specific direction and prescriptions will be included in the species discussions below. Direction is also found under other areas (e.g., timber management) that directly or indirectly affect animal species and/or their habitats. Direction relevant to the proposed action as it affects terrestrial and avian species includes the following:

National Environmental Policy Act (NEPA 1969) The National Environmental Policy Act is a United States environmental law that established policy (e.g. environmental effects of proposed federal actions) and the President's Council on Environmental Quality (CEQ).

Endangered Species Act (ESA 1976) Biological Assessment is prepared in accordance with legal requirements set forth under Section 7 of the *Endangered Species Act* (19 U.S.C. 1536 {c}), 50 CFR 402, and standards established in Forest Service Manual (FSM) direction FSM 2672.42.

National Forest Management Act (NFMA 1976) and Code of Federal Regulations (Titles 36, 40, and 50 CFR) The *National Forest Management Act* (NFMA 1976) includes direction to preserve and enhance the diversity of plant and animal communities, including endemic and desirable naturalized plant and animal species, so that the diversity is at least as great as that which would be expected in a natural forest and the diversity of tree species is similar to that existing in the planning area (36 CFR 219.26 and 219.27). One of the key ways this direction is implemented is through the NFMA regulations concerning species viability, (36 CFR 219.19).

Forest Service Manual and Handbooks (FSM/H 2670) Forest Service direction for Threatened, Endangered, or Sensitive species incorporated in this BA/BE can be found in the Forest Service Manual (FSM 2670.31, FSM 2670.32). Information regarding threatened, endangered, proposed and sensitive animals is also obtained through the cooperation of the USFWS and the California Department of Fish and Game (CDFG).

Plumas National Forest Land and Resource Management Plan (LRMP) and Plumas National Forest FEIS/ROD for the LRMP (USDA 1988a, b):

- Forest Service specific information on how Threatened, Endangered and Sensitive species (TES) will be managed is in the Land Resource Management Plan (LRMP 1988). These include forest wide goals and policies for Wildlife, Fish and Sensitive Plants (p. 4-4) and Riparian Areas (p. 4-7), Wildlife objectives (p. 4-14, 4-15, and 4-19), forest wide direction and standards and guidelines for Wildlife, Fish and Sensitive Plants (p. 4-29 through 4-32).

- The LRMP (1988) is amended by SNFPA FSEIS ROD (2004) for Wildlife, Fish, Riparian Ecosystems and riparian-dependent wildlife species.

Alternative B only: *Herger-Feinstein Quincy Library Group Forest Recovery Act* (HFQLGFRA), and the Final Environmental Impact Statement (FEIS), Record of Decision (ROD), August 1999. *Herger-Feinstein Quincy Library Group Forest Recovery Act* (HFQLGFRA) states–

> "(c) Exclusion of certain lands, riparian protection and compliance. 1. Exclusion– All spotted owl habitat areas (SOHAs) and protected activity centers (PACs) located within the pilot project area designated under subsection (b) (2) will be deferred from resource management activities required under subsection (d) and timber harvesting during the term of the pilot project."

Alternatives C and D: 2004 Sierra Nevada Forest Plan Amendment: Final Supplemental Environmental Impact Statement Record of Decision (SNFPA FSEIS ROD).

3.5.3 Effects Analysis Methodology

3.5.3.1 Geographic Boundary

The wildlife analysis area for determining direct, indirect and cumulative effects on wildlife species includes 4,790 acres of National Forest System land. Refer to the pre-existing broader wildlife analysis conducted for the Sugarberry Project BA/BE 2008 within the Slate Creek watershed. Sugarloaf is a small area within the watershed.

The wildlife analysis area was used for the California spotted owl, Northern goshawk, Fisher, Pacific Marten, Pallid bat, Townsends bat, Fringe-tail myotis and Western bumble bee. The analysis area for wildlife species analyzed was chosen based on the project treatment locations, the amount and intensity of treatments, survey requirements and the natural topography. Based on these factors a ½ mile buffer of the proposed treatment areas was considered adequate to analyze effects. If the analysis area is made too large relative to the proposed action size and intensity, the effects can be diluted and therefore not meaningful. Relative to the broad ranging species discussed in this document, their breeding, nesting, foraging and home ranges can vary in extent depending on the species.

The Region 5 Protocol surveys for all Threatened, Endangered, and Sensitive (TES) species of concern were conducted in potentially suitable habitat for TES species. The wildlife analysis area included National Forest System (NFS) lands surveyed to protocol for California spotted owls, Northern goshawks, carnivores, bats and other target species.

The cumulative effects analysis area includes past, present, and reasonably foreseeable future projects occurring within the Sugarloaf Project wildlife analysis area. Past actions include those that occurred in and around the proposed Sugarloaf Project treatments, such as timber sales and fuel reduction projects on NFS and private lands. Limitations of the analysis include future activities on private land. Past activities are considered part of the existing condition and are discussed in the Affected Environment section for each resource.

Time Frame

The temporal bounds will vary between species since some wildlife, such as the California spotted owl, require areas with mature, multi-canopy forests and diverse habitat components such as snags and large woody material while others species, such as the Townsend's big-eared bat, a require smaller home range area and simpler habitats such as caves with riparian foraging habitat. Consequently, the analysis timeframe would vary for each species and would be dependent in part on current actions. The district silviculturist believes it would only take 60–80 years to grow a 30 inch dbh tree based on growing conditions for the project area.

For the purpose of the fuel treatments being considered, the temporal bounds consist of a 20–25 year horizon. Modeling indicates within this timeframe the treated stands approach stocking levels corresponding with forest growth (i.e., that young forested stands could develop within this timeframe).

3.5.3.2 Analysis Methodology

Landscape Analysis

The effects of the wildlife analysis is comprised of data compiled to provide the basis for understanding the nature and extent of effects and the potential effects that the proposed fuels reduction vegetative treatments would have on wildlife species. Analysis included archival and literature sources, as well as collected data from the National Forest Service resource records, surveys, maps, vegetation layers, aerial photographs and geographic information. Information was compiled to provide a historic overview of the project area.

National Forest Service past and present timber activities were derived from two sources, FACTS (Forest Service Activity Tracking System) database and Timber Harvest Plans (THPs) attained from the California Department of Forestry and Fire Protection (CALFIRE). Canopy change detection imagery was used to determine areas that had past timber activities in the Cumulative Watershed Effects (CWE) analysis area that are not covered by the FACTS database and THP shape files.

Canopy change detection imagery and aerial photos help to determine the year, spatial extent, and general harvest activity. The acres and timber harvest activities (prescriptions) reflected are as accurate as possible given that the canopy change detection imagery and aerial photos filled in the missing data gaps. Supplementary data reported by other resources and used to measure effects for the analysis is found in the list below:

- California Wildlife Relationship habitat layers for specific species for the tree stand data provided by the Silviculturist
- California Wildlife Relationship habitat layers for specific species for the analysis areas provided by the GIS Specialist
- Fire and Fuels Specialist predicted fire severity provided by Fire and Fuels
- Roads analysis provided by Logging Systems Specialist.

Indicators and Measures

Indicators include habitat components that typify the typical requirements for a species to thrive and sustain populations (e.g., canopy cover, tree size, and snags). Habitat requirements are defined as those providing nesting habitat and foraging opportunities with an adequate prey base that help maintain populations over time.

Direct Effects. Include immediate changes in habitat conditions and disturbance or harassment of individual animals, including direct mortality, during project activities.

Indirect Effects. Include changes that occur later in time, such as long-term changes in habitat structure, or changes in human uses within the project area. Indirect effects can also include effects to a species' prey base.

Cumulative Effects. "The impact on the environment which results from the incremental impact of the action when added to other past, present, and foreseeable future actions regardless of what agency (Federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively substantial actions taking place over a period of time" (40 CFR 1508.6).

Refer to table 3-18 for the indicators and associated measures used to evaluate effects to species for the proposed project.

Table 3-18. Wildlife Species and their associated Indicators and Measures.

Species	Indicators	Measures
California Spotted Owl	**Nesting Habitat**	Acres
	CWHR 5M and 5D	
	Large trees	
	Moderate-dense canopy	
	Foraging habitat	Acres
	CWHR 4M and 4D	
	Medium-large trees	
	Moderate-dense canopy	
Northern Goshawk	**Nesting habitat**	Acres
	CWHR 4M, 4D, 5M, and 5D	
	Medium-large trees	
	Moderate-dense canopy	
	Foraging habitat	Acres
	CWHR 3M, 3P, 4P, and 5P	
	Small-large trees	
	Moderate-dense canopy	
American Martin/Pacific Fisher	**Denning/Resting habitat**	Acres
	CWHR 5D and 4D	
	Medium-large trees, dense canopy	
	Foraging/Travel habitat	Acres
	CWR 5M and 4M	
	Medium-large trees, moderate canopy	
Pallid Bat/Townsend big-eared bat	**Roosting**	Number of trees 20 in. dbh and greater
	Large trees	
	Snags	Number of snags 15 in. dbh and greater
	Oaks	Number of 12 in. dbh trees (average 25–35 ft basal area)
	Foraging	Acres
	Riparian	
	Large Down Wood	10–15 tons per acre (10 ft length and 20 ft diameter)
Yellow warbler	**Riparian Forest**	Acres
Hairy Woodpecker	**Snags in Green Forest**	Number of snags 15 in. dbh and greater

Assumptions

The following assumptions are Specific to the wildlife analysis:

- ***Assumption 1***: Retaining the integrity of the 300-acre PACs for spotted owls and 200-acre PAC for goshawks is adequate to maintain current populations.

- ***Assumption 2***: Spotted owls would have adequate foraging areas around their PAC based on preliminary findings; California spotted owls forage much closer to their site center (within the PAC) than expected by chance (Plumas-Lassen Administrative Study 2010, California spotted owl Annual Report).

- ***Assumption 3***: Proposed activities have the potential to affect Region 5 Forest Service sensitive species directly by the modification of habitat or by loss of habitat, but rarely from direct mortality.

- ***Assumption 4***: Fragmentation at this scale would not obstruct a species movement across the landscape or reduce current populations due to separation.

- ***Assumption 5***: Treatments such as prescribed burns, hand-cut pile then burn, or grapple pile and mastication have lower impacts on habitat suitability for wildlife than would mechanical thinning or Group Selections.

Data Sources

Within the wildlife analysis area, data compiled through surveys provided the basis for understanding the nature and extent of the potential effects that the proposed fuels reduction vegetative treatments would have on wildlife species. Site-specific surveys for sensitive wildlife species includes current as well as historical surveys conducted within the project boundary. Additional data by expert field reconnaissance and observations were factored into the analysis.

***California spotted owl*:** Surveys follow the "Protocol For Surveying For Spotted Owls In Proposed Management Activity Areas And Habitat Conservation Areas"; Region 5; March 12, 1991 (revised February 1993)(USDA 1993b).

***Northern Goshawk*:** Surveys follow the "Survey Methodology for Northern Goshawks in the Pacific Southwest Region," U.S. Forest Service, draft 14 May 2002 (USDA 2002b).

***Fisher and Pacific Marten*:** Surveys follow the "American Marten, Fisher, Lynx, and Wolverine: Survey Methods for their Detection"; Zielinski/Kucera; PSW-GTR-157; August 1995 (USDA 1995a).

***Pallid Bat, Townsend's big-eared bat and Fringe-tailed myotis*:** There is no formal protocol adopted by Region 5 for bat surveys. Survey protocol follows an Interim protocol approved by Linda Angerer, program manager for bats, US Forest Service in Region 5. Surveys are conducted by bat biologists certified to conduct bat surveys. All survey plans are approved prior to implementation.

3.5.4 Affected Environment

As described in the EIS Forest Vegetation section, the Sugarloaf Project area and surrounding lands are described as having "a high departure from the natural fire regime and predispose the system to high risk of loss of key ecosystems components" (Hann and Strohm 2003). Forested stands within the analysis area in general, are primarily overstocked CWHR 3, CWHR 4 and CWHR 5 size class stands.

Large Trees

The SNFPA FSEIS/ROD 2004 includes management direction for retention of large trees, 30 inches dbh and greater. These documents each discuss the importance of large tree retention for mature/old forest associated species. Large trees are an important habitat component and necessary also as recruitment for large snags and large down wood. Forest Inventory Analysis (FIA), based on stand data, for the Sugarloaf project area show that the area consists of an average of **34** trees per acre (TPA) in CWHR size class 4 stands and an average of **24** TPA in CWHR size class 4 stands. Trees

30 inches dbh and greater would be retained for the Sugarloaf Project unless a hazard or r operability concern. Across the landscape the large tree standards and guidelines would be met.

Snags

Forest Inventory Analysis (FIA) based on stand data for the Sugarloaf project area indicates an average of 5.2 snags per acre that are 15 inches dbh or greater, of these 1.7 snags per acre are greater than 30 inches dbh. Snag retention levels would be evaluated on a 10-acre basis and snags should be clumped and irregularly distributed across all treatment units as consistent with the 2004 SNFPA ROD. Refer to the wildlife mitigations in the appendices and the Forest silviculturist vegetation report.

Large Down Wood (LDW)

By default, LDW is removed by operational procedures. Such as the large trees removed for operability and or safety hazards which would have eventually fallen and contributed to the tons per acre. The SNFPA ROD 2004 standard and guideline for large down woody material is *not* met within the Sugarloaf project area. Analysis based on stand data and fuels exams show that the units within the project area consist of an average of **2.4 tons per acre**. High quantities of downed large woody material are not expected to exist equally across the landscape. Overall, less productive sites, such as ridge tops or south-facing slopes are expected to have less downed large woody material due to less forest cover.

Oak

The SNFPA FSEIS/ROD 2004 includes management direction for retention of hardwoods. Page 52 of SNFPA ROD 2004 states "During mechanical vegetation treatments, prescribed fire, and salvage operations, retain all large hardwoods on the westside except where: (1) large trees pose an immediate threat to human life or property or (2) losses of large trees are incurred due to prescribed or wildland fire. Large montane hardwoods are trees with a dbh of 12 inches or greater".

Black oak is a critical habitat type for wildlife. Oaks (*Quercus* spp.) may be the single most important genus used by wildlife for food and cover in California forests and rangelands, and black oak occupies more total area in California than any other hardwood species. The physical structure of oak communities determines the availability of shelter, nesting sites, and corridors for travel. Wildlife use oaks as places to hide, shade, and escape from predators and from fires (Pavlik et al. 1991). Large diameter black oak is lacking in the greater than 15 inch diameter classes. This species provides wildlife habitat and contributes to vegetative species diversity. California black oak is shade-tolerant in early life, but as the oak tree ages, it becomes more shade intolerant. If overtopped, the oak either dies outright or dies back successively each year. With continued overtopping, death is inevitable (Burns and Honkala 1990). Retention of oaks includes oaks eight inches in diameter and greater, especially those areas where the basal area is not met.

Forest Inventory Analysis (FIA), based on stand data, for the Sugarloaf project area show that the average area contains one percent black oak.

California spotted owl

***Status*:** The California spotted owl (CSO) is a USFS Region 5 Sensitive Species. On May 23, 2006 the U.S. Fish and Wildlife Service provided a news release stating "Listing of California spotted

owl Found Not Warranted - Service finds most owl populations stable or increasing in the Sierra Nevada" (USDI 2006c).

***Surveys*:** Specific to the project area, two-year protocol level surveys were completed in 2011. Surveys began in April and were finished by August. During survey efforts no CSOs were found within the project treatment areas. The owls that were located during surveys were within established owl PACs. The project and the surrounding area have been surveyed seasonally from 1990 through 2006 (not in consecutive years). During that time owl PACs were established.

***Analysis Area Occurrence Potential*:** There is suitable habitat within the treatment units that is favorable for owls to nest and forage. Suitable nesting habitat consists of CWHR size classes 5 (greater than 24 inch dbh) and canopy cover that is Moderate (40-59 percent) to Dense (50-100 percent). Suitable foraging habitat consists of CWHR size classes 4 (11-24 inch dbh) and canopy cover Moderate (40-59 percent) to Dense (50-100 percent).

Owls are managed through the establishment of Protected Activity Centers (PACs) and Home Range Core Areas (HRCAs). The PACs are 300 acres in size and designated for owl activity centers based on criteria described in California spotted owl (CASPO) technical report (Verner et al. 1992). The HRCAs on the Plumas National Forest are 1,000 acres in size, comprised of the 300-acre PACs and 700 acres of the best available habitat around or adjacent to the PAC (USDA 2001b; USDA 2004c).

The California spotted owl Module: 2010 Annual Report for the Plumas-Lassen Administrative Study (PLAS) area notes that: (1) approximately 53 percent of the nest sites were located within CWHR 5M, 5D; (2) of the nests located in CWHR size class 4 stands included large tree component (i.e., presence of greater than 24 inches dbh trees); (3) overall, 90 percent of the nest sites were located in CWHR 4M,4D,5M,5D and 6 size classes; and (4) the remaining 10 percent sites were in more open, smaller-tree sizes with nests or roosts located within remnant, scattered larger trees (USDA 2010).

The analysis area is **4,790** acres of National Forest System (NFS) land. Of the 4,790 acres, there are **4,245** acres classified as suitable habitat: **422** acres as suitable nesting habitat (5M, 5D) and **3,823** acres as suitable foraging habitat (4M, 4D). There are also approximately **545** acres of unsuitable habitat within the analysis area.

Northern Goshawk (NOGO)

***Status*:** The Northern goshawk is listed by the U.S. Forest Service as a sensitive species and is protected under the *Migratory Bird Treaty Act*. The latest published information regarding the Northern goshawk in terms of population status, distribution, population, habitat trends, and species requirements can be found in the 2001 Sierra Nevada Forest Plan Amendment Final Environmental Impact Statement (USDA 2001b, chapter 3, part 4.4.2.2), and in part 3.2.2.4 of the 2004 Sierra Nevada Forest Plan Amendment Final Supplement Environmental Impact Statement (USDA 2004c).

Based on numerous studies outside of the Plumas National Forest (Bloom et al. 1986; Reynolds et al. 1992; Kennedy 1997; Smallwood 1998; DeStefano 1998 – all referenced in USDA 2001b), there is concern that goshawk populations and reproduction may be declining in North America and California due to changes in the amount and distribution of habitat or reductions in habitat quality.

***Surveys*:** Survey areas were chosen based on suitability that consisted of mature open stands with an average canopy cover greater than 65 percent. During survey efforts there were no detections within treatment units. Goshawks that were located were within already established PACs. Protocol surveys will continue in 2012.

***Area Occurrence Potential*:** The Northern goshawk is found throughout the Plumas. Suitable nesting habitat consists of CWHR size classes 5 (greater than 24 inch dbh) and 4 (11-24 inch dbh) and canopy cover that is Moderate (40-59 percent) to Dense (50-100 percent). Suitable foraging habitat consists of CWHR size classes 3 (6-11 inch dbh), 4 (11-24 inch dbh), 5 (greater than 24 inch dbh), 6 (size class over 5) and canopy cover that is Moderate (40-59 percent), Dense (50-100 percent), and open (P, 20-39 percent). A total of 588 Northern goshawk breeding territories have been reported from National Forests in the Sierra Nevada. The Plumas National Forest maintains 110 goshawk territories. This is approximately 15 percent of the total in the Sierra Nevada. These numbers represent goshawks that have been found as a result of both individual project inventories to standardized protocols, as well as nest locations found by other incidental methods.

The analysis area is **4,790** acres of National Forest System (NFS) land. Of the 4,790 acres, there are **4,638** acres classified as suitable habitat: **4,245** acres classified as suitable nesting habitat (5D, 5M, 4D and 4M) and **393** acres as suitable foraging habitat (3M, 3D, 4P, 5P and 6). There are also approximately **152** acres of unsuitable habitat within the analysis area.

Fisher

***Status*:** The Fisher has been included on the National Forest Service Sensitive Species list since 1984 (Macfarlane 1984) and the state of California has listed the Fisher as a Species of Concern since 1986. The Plumas LRMP does not provide specific management guidelines for forest carnivores, but does instruct the National Forest Service to maintain viability of State-listed and National Forest Service Sensitive species. Appendix C in the SNFPA (2004) summarizes the standards and guidelines relating to Marten and Fisher.

In July 2003, the U.S. Fish and Wildlife Service (USFWS) announced the initiation of a 12-month status review to determine if listing of the Fisher was warranted (USDI 2003a). They concluded that listing under the *Endangered Species Act* was warranted, but precluded by higher priority actions to amend the Lists of Endangered and Threatened Wildlife and Plants (USDI 2004).

***Surveys*:** In 2001, potential sites were surveyed using on-the-ground habitat typing or topographical maps and aerial photos. The surveyed area included the Sugarloaf Project which resulted in no sightings of the carnivores.

As part of the Slate Creek Landscape Assessment on the Feather Ranger District, (USDA 1999c) surveys were completed in the winter of 1999 in what is now the Sugarloaf project area. The surveys resulted in no sightings of detection of the carnivore species during either spring or fall camera surveys.

***Analysis Area Occurrence Potential*:** Across the Plumas National Forest, several thousand acres of potential carnivore habitat have been surveyed over the last decade. Based on grids and transects approximately 60 percent of the Plumas NF has been surveyed for carnivores. Based on those surveys

no Fishers (or Marten) have been detected on the Feather River Ranger District. Extensive trapping and logging practices are a few reasons given for the absence of the Fisher.

Suitable denning or resting habitat consists of CWHR size classes 5 (greater than 24 inch dbh) and 4 (11-24 inch dbh) and canopy cover that is Dense (50-100 percent). Suitable foraging or traveling habitat consists of CWHR size classes 4 and 5 and canopy cover that is Moderate (40-59 percent).

In the Pacific States, Fishers were historically more likely to be found in low to mid-elevation forests up to 8,200 feet (USDA 1995b). In the southern Sierra Nevada, Fisher most often occur at elevations between 4000-8000 feet (Freely 1991, USDA 2004c). The current distribution within California suggests that the once continuous distribution of the Fisher is now apparently fragmented into two areas and is separated by a distance. The distance greatly exceeds reported Fisher dispersal ability (USDA 1995b).

The analysis area is **4,790** acres of National Forest System (NFS) land. Of the 4,790 acres, there are **4,245** acres classified as suitable habitat. Of the **4,245** acres, there are **2,460** acres classified as denning or resting (5D,4D) habitat and **1,785** acres as suitable foraging or traveling habitat (5M, 4M).

Pacific Marten

***Status*:** The Pacific Marten is a U.S. Forest Service Region 5 California and designated as a sensitive species by the California Department of Fish and Game and (MacFarlane 2007). In northeastern California, the Marten has experienced an apparent loss of occupied range over the last 75 years (Zielinski et al. 2005). In northeastern California, ongoing studies based on known historical Marten (and Fisher) distributions continue (Grinnell et al. 1937). This includes portions of Siskiyou, Shasta, Tehema, Lassen, Plumas, Butte, Nevada, Sierra and Yuba counties (Zielinski et al. 2005). Marten were found in clusters in three distinct areas: near Mt. Shasta, on the Lassen Plateau, and more scattered groups on the southern Plumas and northern Tahoe National Forest (Kirk et al. 2009).

***Surveys*:** The same carnivore survey efforts in 2001 and 1999 for the Fisher also surveyed for Marten. The survey resulted in no Marten detections in the Sugarloaf Project area.

***Analysis Area Occurrence Potential*:** The Pacific Marten occurs within the Plumas National Forest in limited areas. During approximately the last 10 years, several thousand acres of suitable carnivore habitat across the Forest (approximately 60 percent of the forest) have been systematically surveyed to protocol using track plates and camera stations.

Suitable denning or resting habitat consists of CWHR size classes 5 (greater than 24 inch dbh) and 4 (11-24 inch dbh) and canopy cover that is Dense (50-100 percent). Suitable foraging or traveling habitat consists of CWHR size classes 4 (11-24 inch dbh) and 5 (greater than 24 inch dbh) and canopy cover that is Moderate (40-59 percent). The CWHR estimates are based on the most recent vegetation data available for Sugarloaf, which is from aerial photo interpretation and Plumas National Forest “e-veg” timber type coverages (based on 1997 aerial photographs) in the Geographic Information System (GIS). The photographs were used to determine timber strata, CWHR size, and densities. Land classifications and allocations were determined using GIS.

The analysis area is **4,790** acres. Of the 4,790 acres of National Forest System (NFS) land there are **4,245** acres classified as suitable habitat: Of the **4,245** acres of NFS lands there are **2,460** acres classified as suitable denning or resting (5D, 4D) habitat and **1,785** acres as suitable foraging or traveling habitat (5M,4M).

Pallid Bat

***Status*:** The Pallid bat, listed as a Forest Service Sensitive species in California Region 5, is not state or regionally listed by the Fish and Wildlife Service. Current distribution outside of California is from southern British Columbia, Montana to central Mexico, and east to Texas, Oklahoma and Kansas. An isolated population also occurs in Cuba. They are most abundant in the arid Sonoran life zones below 6,000 feet, but have been located up to 10,000 feet in the Sierra Nevada.

***Surveys*:** During 2006 and 2007, surveys occurred near the proposed project along Mooreville Ridge, approximately 4 miles northwest, with a few surveyed areas being adjacent to treatment units in the project area. Surveyed areas require suitable habitat (i.e. vegetation and open-water) and favorable structures (i.e., snags, mines, and rock crevices) particular to the bat species. Sixty-nine Pallid bats were recorded during the 2006-2007 surveys.

***Analysis Area Occurrence Potential*:** There is suitable habitat for Pallid bats to roost and forage in many areas across the forest, including the project area. Recent surveys in northern California showed that while Pallid bats are documented as using rock crevices (Rambaldini 2006 *in* Baker et al. 2007) the majority of roosts found pallid bats in live trees or snags that were large in diameter, tall in height, and located in stands of mature trees (Baker et al. 2007). Roost results for surveys conducted on the Plumas National Forest found bats in incense cedar, Jeffery pine and in a bridge; all day roosts within an open forest canopy, with large size trees greater than 20 inch dbh.

Townsend big-eared bat

***Status**:* The Townsend big-eared bat is listed as a Forest Service Sensitive species in California Region 5. It is listed as a Species of Concern by the Department of Fish and Wildlife. There is no state or regional listing by the Fish and Wildlife Service. Regionally, the Townsend's big-eared bats are a Species of Special Concern in the states of Texas, Montana and California; a Sensitive species in Oregon, and listed as an endangered species in Washington.

***Surveys*:** Townsend big-eared bats where located during the 2006 and 2007 surveys for pallid bats. See pallid bat surveys to see where areas were surveyed. Outside the project area, several bat surveys have been conducted across the Feather River District to determine the presence, absence and relative abundance of bats. In 2002, Townsend bats were detected in a variety of habitat settings. Acoustical sites were north of the project area along creeks, at seeps, and in forest settings with mixed hardwood and conifer trees. The elevation for these observations ranged from 4,000 to 6,000 feet.

Several survey techniques where used during those surveys. First, natural roosting features and water source areas were located, then (for Townsend's) surveys incorporated areas with structures such as caves, mines, and riparian areas specific to bats. Mist nets are not generally a good source to located Townsend big-eared bats, as they tend to have a low capture rate. Instead, bats were detected using acoustic sampling methods. Acoustic sampling was used to detect bat ultrasound echolocation calls.

***Analysis Area Occurrence Potential*:** There is suitable habitat for Townsend big-eared bats to roost and forage in many areas across the forest, including the project area. The project falls within the historic range of Townsend's big-eared bats. Townsend's big-eared bats occupy a wide variety of habitats (older forest, desert, grasslands/plains, riparian, coastal). Roosting habitat requires caves, mines, abandoned human structures, rock crevices, and water for drinking. They forage in a variety of habitats, including riparian areas, old forests, and mixed hardwood-conifer forest. They feed primarily on flying insects, specializing in moths, and they usually capture prey in flight, or by gleaning from foliage of brush or trees.

Fringe-tailed Myotis

Status: There is little information on size and trend of Fringe-tailed myotis (*Myotis thysanodes*) populations. Although it may be locally abundant, this widespread species (western North America from British Columbia south to Mexico) also may be locally rare (Keinath 2004). In California, *M. thysanodes* is distributed statewide except the Central Valley and the Colorado and Mojave Deserts (CWHR 2008).

Surveys: Bat distribution data on 16 species has been collected (using mist nets, acoustic sampling, and visual inspection of suitable roosting sites) to address project specific needs for more than two decades across the Plumas National Forest (1991–2013, 206 forest-wide survey locations with bat detections). *M. thysanodes* has been detected at multiple locations within each ranger district on the Plumas National Forest, but our survey data are too patchily distributed, both spatially and temporally, to accurately estimate population size or trend for bat species on Plumas National Forest. The California Department of Fish and Game (2005) recorded occurrences of the Fringe-tailed myotis from the Plumas as well as the Angeles, Cleveland, El Dorado, Lassen, San Bernardino, Sequoia, Sierra, Six Rivers, Stanislaus, Tahoe National Forests, and the Lake Tahoe Basin Management Unit.

Analysis Area Occurrence Potential: There is suitable habitat for Fringe-tailed myotis to roost and forage in many areas across the forest, including areas in the project area. *M. thysanodes* most frequently is observed at middle elevations (3,900–7,050 feet) in desert, grassland, and woodland habitats, but ranges between coastal areas along the Pacific Ocean to 9,350 feet in spruce-fir habitat in New Mexico (Keinath 2005). The Fringe-tailed myotis is known to roost in caves, mines, buildings, crevices in rocks, and snags with nearby access to drinking water (Ibid). Oak and pinyon woodlands appear to be the most commonly used habitat. Nursery colonies occur in caves, mines, and sometimes buildings (Ibid). Individuals are known to move up to five miles between roosting and foraging areas (Ibid). Roost sites were characterized by having more snags ≥12 inches diameter at breast height, less canopy cover, and were closer to streams than random sites (USDA 2005). Although the Fringe-tailed myotis roost in a wide variety of structures, they have only been recorded to hibernate in mines and buildings (CDFG 2005). In Douglas-fir forests of northern California, Fringe-tailed myotis day roosts were found exclusively in snags of early to medium stages of decay (USDA Forest Service 2005). Roost snags were taller and larger in diameter than random snags and other snags near the roost (USDA 2005).

The Fringe-tailed myotis roosts in a wide variety of structures and has been recorded hibernating in mines, buildings, (CDFG 2005), oak and pinyon woodlands (Bradley et al. 2005), and snags (Keinath 2005). The likelihood of occurrence for Fringe-tailed myotis increases as the number of snags >12 inches dbh increases and percent canopy cover decreases (Keinath 2005). The Fringe-tailed

myotis roost under bark and in tree hollows, and bats exclusively used snags for day roost sites in Douglas-fir (*Pseudotsuga menziesii*) forest in Northwestern California. All roost trees were snags in early to medium stages of decay, and bats switched roosts often varying between 1-88 (Six Rivers National Forest, Weller and Zabel 2001).

Thermoregulatory requirements result in bats periodically shifting the specific roost site occupied within a colony to adapt to fluctuations in climatic conditions (e.g., clusters of bats move in response to temperature changes in different parts of the roost (Ibid). Fringed bats are known to migrate, but little is known about the magnitude of movements. Their diet includes beetles and moths.

Bumble bee

Status: *Bombus occidentalis* currently occurs in all states adjacent to California. Historically, the species was broadly distributed across western North America along the Pacific Coast and westward from Alaska to the Colorado Rocky Mountains (Thorp and Shepard 2005, Koch et al. 2012). Historically, *B. occidentalis* was one of the most broadly distributed bumble bee species in North America (Cameron et al. 2011). Currently, the western bumble bee is experiencing severe declines in distribution and abundance due to a variety of factors including diseases and loss of genetic diversity (Tommasi et al. 2004, Cameron et al. 2011, Koch et al. 2012).

Bumble bees introduced from Europe for commercial pollination apparently carried a microsporidian parasite, *Nosema bombi*, which has been introduced into native bumble bee populations. Highest incidences of declining *B. occidentalis* populations are associated with highest infection rates with the *Nosema* parasite, and the incidence of Nosema infection is significantly higher in the vicinity of greenhouses that use imported bumble bees for pollination of commercial crops (Cameron et al. 2011). Although the general distribution trend is steeply downward, especially in the west coast states, some isolated populations in Oregon and the Rocky Mountains appear stable (Rao et al. 2011, Koch et al. 2012). The overall status of populations in the west is largely dependent on geographic region: populations west of the Cascade and Sierra Nevada mountains are experiencing dire circumstances with steeply declining numbers, while those to the east of this dividing line are more secure with relatively unchanged population sizes. The reasons for these differences are not known.

Surveys: Surveys for *B. occidentalis* have not been conducted in the analysis area. However, botanical surveys across the Sugarloaf project area and analysis area routinely reported numerous occurrences of flowering plant species known to be used by *B. occidentalis* which are listed below.

Analysis Area Occurrence Potential: Western bumble bees have a short proboscis or tongue length relative to other co-occurring bumble bee species, which restricts nectar gathering to flowers with short corolla lengths and limits the variety of flower species it is able to exploit. Western bumble bees have been observed taking nectar from a variety of flowering plants, including *Aster* spp., *Brassica* spp., *Centaurea* spp., *Cimicifuga arizonica*, *Corydalis caseana*, *Chrysothamnus* spp., *Cirsium* spp., *Cosmos* spp., *Dahlia* spp., *Delphinium nuttallianum*, *Erica carnea*, *Erythronium grandiflorum*, *Foeniculum* spp., *Gaultheria shallon*, *Geranium* spp., *Gladiolus* spp., *Grindelia* spp., *Haplopappus* spp., *Hedysarum alpinum*, *Hypochoeris* spp., *Ipomopsis aggregata*, *Lathyrus* spp., *Linaria vulgaris*, *Lotus* spp., *Lupinus monticola*, *Mentha* spp., *Medicago* spp., *Melilotus* spp., *Mertensia ciliata*, *Monardella* spp., *Nama* spp., *Origanum* spp., *Orthocarpus* spp., *Pedicularis capitata*, *P. kanei*, and *P. langsdorfii*, *P. groenlandica*, *Penstemon procerus*, *Phacelia* spp., *Prunus*

spp., *Raphanus* spp., *Rhododendron* spp., *Salix* spp., *Salvia* spp., *Solidago* spp., *Symphoricarpos* spp., *Tanacetum* spp., *Taraxacum* spp., *Trifolium dasyphyllum*, *Trichostema* spp., *Trifolium* spp. and *Zea* spp. (Evans et al. 2008).

3.5.5 Environmental Consequences

Alternatives range in difference by the amount of acres treated under differing canopy cover retention guidelines. Alternative D would implement the least amount of mechanical thinning treatments of all the action alternatives and no Group Selection. Alternative D was designed with considerations to the Home Range Core Areas (HRCA), creating a diverse range in canopy covers that vary by topographical characteristics.

Alternative A – No Action

Direct and Indirect Effects: Alternative A states that the proposed activity would not take place, and compares the environmental effects of no action with the effects of the proposed activity or an alternative activity. Excluding natural occurrences or disasters, the no-action has no direct or indirect impact to the wildlife species. Alternative A, the no action alternative, would not directly or indirectly affect the following species: California spotted owl, Northern goshawk, Fisher, Pacific Marten, Pallid bat, Townsend big-eared bat and Fringed-tailed myotis and the Western bumble bee.

The effects of the no action alternative on wildlife habitat and species are related to natural and human-caused disturbance trends to forest structure. Since habitat conditions and wildlife populations are not static, but in continuous fluctuation due to a variety of factors such as tree mortality, weather events or wildfires, land management, predation, etc., wildlife species survival, reproduction rates and distribution would persist dependent on the intensity of future events.

According to predicted fuels modeling and field observations, trends linked to increasing fuel loading if left untreated under the no action alternative, would likely increase wildfire suppression difficulty with a high probability for considerable tree mortality (DEIS; section Fuels and Fire). Although animal occupancy may persist despite extensive tree mortality in suitable habitats, degraded or lost features (i.e., mistletoe brooms used for nesting, down log prey habitats, etc.) may reduce habitat quality for the long term.

As indicated in the DEIS section, Forest Vegetation, the current trend in forest tree species composition and structure in the Sugarloaf Project area, as well as surrounding the National Forest System (NFS) lands, is favoring regeneration and over stocking of shade-tolerant trees such as white fir, incense-cedar and Douglas-fir. Shade-tolerant species tend to out-compete ponderosa pine, sugar pine, and black oak, causing a shift in landscape forest structure and corresponding loss of open forest habitats. Consequently under the no action alternative, this trend is expected to continue favoring wildlife species preferring closed canopy forest habitats.

Action Alternatives (Alternatives B, C and D)

Refer to tables 3-19 through 3-21 which summarizes the proposed acres of treatment type by each action alternative. *No treatments are proposed in 5D stands for all action alternatives.*

Table 3-19. Alternative B: acres of treatment by CWHR size class and density.

Treatment	CWHR Size and Density Classes (acres)										
	2O	**2P**	**2S**	**3D**	**3M**	**3P**	**4D**	**4M**	**4S**	**5M**	**Total**
GS				20			20	8		52	100
Mechanical Thin				59			697	236			992
TFB, 40% CC, 30" DL				*12*			*217*				229
VDT, 40% CC, 30" DL				*47*			*480*	236			763
MAST		6	25	28	33	32	43	9	32	15	223
HCGP								27			27
HCPB	10	18		9	10	4	71	53	16	65	255
UB*			3	129	59		845	708	0	195	1938
Unit NT				5			486	128		7	626
RHCA Buffer NT		2	2	55	6	3	310	200	1	122	700
Group Unit Matrix NT										10	10
Total	**10**	**25**	**30**	**305**	**108**	**38**	**2471**	**1369**	**48**	**466**	**4870**

NOTES: Eighty acres of GS will be treated using UB after harvest as part of larger first entry UB treatments outside the groups

GS = Group Selection
TFB = Thin From Below
CC = Canopy Cover
VDT = Variable Density Thin
MAST = Mastication
HCGP = Handcut/Grapple pile
HCPB = Handcut/Pile/Burn
UB = Underburn
NT = No Treatment
RHCA = Riparian Habitat Conservation Areas.

Table 3-20. Alternative C: acres of treatment by CWHR size class and density.

Treatment	CWHR Size and Density Classes (acres)										Total
	2O	**2P**	**2S**	**3D**	**3M**	**3P**	**4D**	**4M**	**4S**	**5M**	
MECHANICAL THIN				194			560	209		110	1073
TFB, 40% CC, 30" DL				*177*			*325*	*186*			*688*
TFB, 50% CC, 30" DL				*17*			*235*	*23*		*110*	*385*
MAST		6	25	28	36	32	68	18	32	64	309
HCGP				19			49	27		36	131
HCPB	10	18		9	10	4	454	171	16	49	740
UB					52		551	480		31	1114
Unit NT			3	5	4		531	285		106	935
RHCA Buffer NT		2	2	30	6	3	246	173	1	26	489
Total	10	25	30	285	108	38	2460	1363	48	422	4790

NOTES:

TFB = Thin From Below
VDT = Variable Density Thin
MAST = Mastication
HCGP = Handcut/Grapple pile
HCPB = Handcut/Pile/Burn
UB = Underburn
NT = No Treatment
RHCA = Riparian Habitat Conservation Areas.

Table 3-21. Alternative D: acres of treatment by CWHR size class and density.

Treatment	CWHR Size and Density Classes (acres)										Total
	2O	2P	2S	3D	3M	3P	4D	4M	4S	5M	
Mechanical Thin				193			562	179			935
TFB, 40% CC, 30" DL				*12*			*22*				*34*
TFB, 40-50% CC, 30" DL							*42*				*42*
VDT, 40% CC, 30" DL				*16*			*46*	*166*			*229*
VDT, 40% CC, 24" DL								*13*			*13*
VDT, 40-50% CC, 30" DL				*148*			*93*				*241*
VDT, 50% CC, 30" DL							*145*				*145*
VDT, 50% CC, 24" DL				*17*			*45*				*62*
VDT, 50-60% CC, 24" DL							*95*				*95*
VDT, 50-60% CC, 20" DL							*74*				*74*
MAST		6	25	28	40	32	43	9	32	64	278
HCGP								97		156	254
HCPB	10	18		9	10	4	487	34	16	107	656
UB			3	25	52		754	719			1553
Unit NT				5			318	188		69	580
RCA Buffer NT		2	2	25	6	3	305	117	1	26	486
Retention Area NT							28	20			48
Total	10	25	30	285	108	38	2459	1363	48	422	4790

NOTES:

TFB = Thin From Below
VDT = Variable Density Thin
MAST = Mastication
HCGP = Handcut/Grapple pile
HCPB = Handcut/Pile/Burn
UB = Underburn
NT = No Treatment

Large Trees

Direct and Indirect Effects: Across the landscape, the large tree standards and guidelines would be met. Trees 30 inches dbh or greater are not proposed for removal under all of the action alternatives. However, trees 30 inches dbh or greater could be removed for operability or if they pose a safety hazard on the mechanical thin treatments. The loss of large trees is directly related to the intensity of the action: alternative B would have the greatest effect through removing trees over 30 inches, because of more acres treated and more intensive treatment with large equipment (mechanical thin and Group Selection), additional new landings and temporary road construction. Alternative D would have the least effect due to fewer acres treated by large equipment.

Snags

Direct and Indirect Effects: Post-treatment the snag numbers are expected to be lower but still meet the minimum snag retention requirements. It is estimated that half of the snags within the mechanical thin area would be removed, and no snags within the Group Selection would be retained due to operability or as hazard trees. Snags would be retained along the unit perimeters or within clumps in the units, where available. Alternative B is expected to have a higher snag reduction, because of the increased acres of mechanical thin, Group Selection, and additional new landings and temporary road construction. Alternative D includes retention areas to protect high quality old-forest habitat that includes snags and trees with character (broken-top/bayonet limb/cavities etc.) on 48 acres.

Large Down Wood (LDW)

Direct and Indirect Effects: To mitigate the loss of LWM during project implementation, the contractor would be directed under C clause, C6.7 to not Yard Un-merchantable Material (YUM) (logs 20 inches in diameter and 10 feet in length). YUM is defined as yarding of cull, rotten, small, or otherwise unsalable wood material to a designated area for disposal. The C clause when used requires the contractor to leave the cull logs to meet the large down wood standard, where feasible.

Oak

Direct and Indirect Effects: The prescription for all action alternatives is to retain all black oaks greater than 3 inches dbh. Thin conifers from around individuals and clumps of oaks and remove tan oak if it is in direct competition with black oak. The heavier mechanical thin, harvesting predominately fir, under alternative B would likely enhance existing black oak and increase recruitment of additional oaks by opening up the forest. Within a predominately conifer forest, black oaks provide diversity and create a healthier forest.

California spotted owl

Indicators and measures are acres of Nesting Habitat (5D, 5M) and Foraging Habitat (4D, 4M).

Direct Effects: The California spotted owl (CSO) is not expected to be directly affected based on the following direction, standard and guidelines, protection measures and design features. Refer to “Mitigations” in DEIS, Appendix A.

- CSO PACs have been established to encompass all known activity centers.
- No treatments are proposed in CSO PACs.
- Protocol level surveys were conducted over a 4-year period in 2007–2008 and 2010–2011 within the Sugarloaf project wildlife analysis area.
- Protocol level surveys were conducted for the Bald Mountain (2004–2005) and Bald Onion (2002–2003) project wildlife analysis area, which overlap the Sugarloaf project wildlife analysis area.
- If new activity centers are located, PACs would be adjusted to include the activity centers or a new CSO PAC created.

- Protection measures such as Limited Operating Periods (LOPs), no activity between March 1 and August 15 would be in place to prevent disturbances to nesting owls.
- No mechanical thin treatments are proposed within Northern goshawk PACs, which may also provide suitable CSO nesting habitat.

Under the SNFPA FEIS 2004, entries into PACs for mechanical treatments are allowed when necessary to ensure the overall effectiveness of the landscape of fire and fuel strategy within the WUI zone. In PACs outside of Wildland Urban Interface (WUI), prescribed fire is the only option.

The effect to potentially suitable nesting habitat outside of established PACs was considered under indirect effects based on the assumption that the extensive surveys, following Region 5 protocol, would have detected activity centers. Operations shall be evaluated within ¼ mile of activity centers to prevent disturbance to species during the breeding season. If nesting status is determined, the Limiting Operating Period (LOP) will be applied to ¼ mile around the nest stand, or as determined by the District Biologist. In addition, if any new owl activity centers are detected during implementation of the project, the District Biologist will be notified for further evaluation before continuing operation.

Any activity with the potential for disturbance would be limited to individual treatment units and would last a few days to two weeks in any location. Impacts from disturbance are not expected to substantially affect habitat use or reproductive capacity of this species.

Indirect Effects: Indirect effects to the California spotted owl habitat are expected to be low. Refer to the list of direction, standard and guidelines, protection measures and design features that are listed under direct effects above as these avoid and minimize indirect effects as well. Refer to "Mitigations" in DEIS; appendix A.

Home Range Core Areas: The amount of private land and non-suitable habitat on FS lands (water, rock, etc.) limits the land available to establish HRCAs around the CSO PACs within the project area. Therefore, the majority of the proposed treatments are within HRCAs. Refer to the discussion below for direct and indirect effects on nesting (5D/5M) and foraging (4D/4M) habitat. Based on the number of acres treated and the level of effect that is proposed in individual HRCAs, it is difficult to predict if there would be a shift in owl use due to habitat alteration. In addition, due to the large amount of private land adjacent to the PACs in some cases there are not enough National Forest System (NFS) lands surrounding PACs to provide for 700 acres of foraging habitat for each owl PAC. In addition, some of the FS lands that do surround PACs are not classified as suitable foraging habitat. Because of the limited habitat available to designate as HRCA some of the HRCAs are very close together and suitable foraging acres overlap.

Group Selection (GS): Alternative B proposes to implement 100 acres of GS, of these acres there are 80 acres classified as suitable nesting and foraging habitat, which is 2 percent of the total suitable habitat within the analysis area. Alternatives C and D do not propose Group Selection treatments.

Nesting Habitat (5D, 5M)

Alternative B	—	removal of **52** acres of 5M	**34** acres are in HRCAs.

Foraging Habitat (4D, 4M)

Alternative B	—	removal of **28** acres: 20 acres of 4D and 8 acres of 4M	**16** acres are in HRCAs

For wildlife, GSs across the landscape increase edge effects, reduce forest interior habitat, and create a condition in which otherwise suitable owl habitat becomes less suitable. It is unknown at what threshold the amount of edge to interior habitat results in use, marginal use or non-use by spotted owls. Forest interior is a sheltered environment away from the influence of forest edges and open habitat. Edges tend to be sunnier, warmer, windier, and drier and experience more dramatic environmental changes than the forest interior. Edges are also prone to more disturbance and support a larger variety and higher density of predators. California spotted owls will use edge habitat for foraging, but overall they prefer forest interior to edge habitat. However, Franklin et al. (2000) found a positive relationship with habitat patches intermixed with non-habitat areas. They found that habitat and Northern spotted owls showed higher reproductive success in sites where the landscape is intermixed with suitable and not-suitable habitat.

Group Selection treatments are designed to convert a mid-seral, closed canopy forest dominated by shade-tolerant species to early seral, open canopy gaps, which would create favorable conditions for the establishment, growth and development of shade-intolerant species. However, for owls GSs are small openings that do not provide suitable nesting habitat. True openings would eventually over-time become forested, but would not provide habitat now for the owls. Where GS are placed at a higher density, have the greatest habitat change effect.

Group Selections within DFPZs reduce the canopy cover and habitat components well below suitability. In DFPZ units the canopy cover is averaged across the unit; however, Group Selections do not have canopy restrictions. Canopy cover averaged in a DFPZ unit, and would not include Group Selections as part of the overall canopy cover. Therefore, the canopy cover would fall below the minimum. California spotted owls spend less time in areas with less than 40 percent canopy cover than expected if habitat were selected randomly (Keane et al. 2011).

Gallagher (2010) reported that radio-tagged owls in the Meadow Valley Project area appeared to select against DFPZs when foraging. This is the first and only study to evaluate owl use of DFPZs after a fully implemented project. This research was referenced to acknowledge uncertainty regarding potential impacts of the proposed treatment to California spotted owls. This study highlights the need for additional monitoring of spotted owl foraging behavior in and around DFPZ treatments, at multiple sites, to adequately evaluate the impacts of DFPZ projects on spotted owl foraging behavior.

Owls selected against clear-cuts and other openings, less than expected based on availability, and chose trees with a 20-35 inch dbh significantly over open areas (Call 1990). Also, there are supportive studies for owls tending not to forage in open areas, but instead foraging near the core nest-site. Edges created by group may increase use by Great horned owls, an effective competitor and predator of the

spotted owl. Despite preliminary finding, Keane et al. (2011) and Gallagher (2010), caution that owl use of Group Selection is inconclusive and requires further study.

***Mechanical Thinning (MT)*:** The action alternatives propose mechanical thin on a similar number of acres, the major difference is the intensity of the treatment. Alternative B would have the greatest effect on the suitability of the habitat for nesting and foraging due to the number of acres thinned and the level of reduction of canopy cover and layering. Alternative D would have the least adverse effect on suitable habitat while still reducing the fuels, resulting in a net benefit to the land. Alternative B proposes to implement MT on **993** acres of suitable habitat, which is **23 percent** of the total suitable habitat within the analysis area. Alternative C proposes to implement MT on **879** acres of suitable habitat, which is **21 percent** of the total suitable habitat within the analysis area. Alternative D proposes to implement MT on **741** acres of suitable habitat, which is **17 percent** of the total suitable habitat within the analysis area.

Nesting Habitat (5D, 5M)

- **Alternative B** – 0 acres
- **Alternative C** – 110 acres
  - **5M**: 110 acres reduced to 50 percent CC, remains 5M – 108 acres in HRCA
- **Alternative D** – 0 acres

Foraging Habitat (4D, 4M)

Table 1. **Alternative B** – 933 acres

1. 4D: 697 acres reduced to 40 percent CC, reclassified as 4M (300 acres in HRCA)
2. 4M: 236 acres reduced to 40 percent CC, remains 4M (192 acres in HRCA)

Table 2. **Alternative C** – 769 acres

1. 4D: 325 acres reduced to 40 percent CC, reclassified as 4M (155 acres in HRCA)
2. 4D: 235 acres reduced to 50 percent CC, reclassified as 4M (98 acres in HRCA)
3. 4M: 186 acres reduced to 40 percent CC, remains 4M (175 acres in HRCA)
4. 4M: 23 acres reduced to 50 percent CC, remains 4M (0 acres in HRCA)

Table 3. **Alternative D** – 741 acres

1. 4D: 203 acres reduced to 40 percent CC, reclassified as 4M (177 acres in HRCA)
2. 4D: 359 acres reduced to 50 percent CC, reclassified as 4M (86 acres in HRCA)
3. 4M: 179 acres reduced to 40 percent CC, remains 4M (157 acres in HRCA)

Removing more trees in the intermediate and co-dominant size classes (20 to 30 inches in diameter) would reduce stand vertical heterogeneity. Refer to the “Vegetation, and Fire and Fuels” sections within this document.

Not actively treating within CSO PACs, with the exception of allowing prescribed fire, no mechanical thin or GS treatments in goshawk PACs, no treatments in retention areas, and limited treatments within Riparian Habitat Conservation Areas (RHCAs) would contribute to higher tree density and vertical and horizontal diversity within larger stand treatment areas. Alternative D addresses the fuels concerns and root disease but at the same time mechanically thins fewer acres and reduces the effect on habitat by limiting the level of treatments within five stands.

Mechanical thinned areas are maintained long term, this means that the habitat would remain below suitability. If allowed to regrow it would take years to reestablish with the tree sizes removed. More trees removed in the intermediate and co-dominant size classes (20 to 30 inches in diameter) increases the reduction of stand vertical heterogeneity. Retention of black oak greater than 3 inches dbh to meet future recruitment needs, where feasible, would assist in maintaining some vertical and horizontal diversity within treated stands. Additionally, not actively or less intensively treating Riparian Habitat Conservation Areas (RHCAs), with the exception of allowing prescribed fire, would contribute to higher tree density and vertical and horizontal diversity within larger stand treatment areas.

Mechanical thin and radial thin prescriptions leave a less desirable habitat structure, particularly for owl nesting needs. Trees that remain would be 30 inches dbh and greater, and they would provide some structure. Lower canopy cover and open understory are not typical spotted owl habitat.

Based on acres and the level of effect that is proposed in individual HRCAs, it is difficult to predict if there would be a shift in owl use due to habitat alteration. The majority of the habitat in the 700-acre HRCAs would not be affected by treatments. Thus, the potential risk of reduced PAC/HRCA occupancy resulting from project implementation would be low. The fuels treatments proposed under the action alternatives could decrease the risk of losing owl habitat to high-intensity wildfire. Despite, the low risk, a reduction in suitable habitat because of treatments could result in a risk to owl occupancy.

***Handcut/Grapple Pile, Handcut/Pile/Burn, Mastication and Underburn*:** Overall the canopy cover and layering would not be reduced. There could be a short-term disturbance for owls utilizing the area for foraging. The California spotted owl Module: 2010 Annual Report for the Plumas-Lassen Administrative Study (PLAS) area notes that “Spotted owls selected against DFPZ landscape fuelbreak thins, but not for other fuels treatments (removal of less than 10 inches dbh trees; understory thins), for nocturnal activities “(USDA 2010). Indirect effects are considered short-term land disturbance created by the proposed mastication, handcut/pile/burn, handcut/grapple pile/burn and underburning treatments. Secondary treatments are proposed for the hand-cut/pile/burn and underburn. Suitable habitat proposed to be treated is **2,031** acres under alternative B, **1,998** acres under alternative C and **2,432** acres under alternative D.

Nesting Habitat (5D and 5M)

1. ***Alternative B*:** proposes to treat **275** acres of 5M – 2 acres in HRCA
2. ***Alternative C*:** proposes to treat **180** acres of 5M – 82 acres in HRCA
3. ***Alternative D*:** proposes to treat **327** acres of 5M – 174 acres in HRCA

Foraging Habitat (4D and 4M)

1. ***Alternative B*:** proposes to treat **1,756** acres of 4D/4M – 576 acres in HRCA
2. ***Alternative C*:** proposes to treat **1,818** acres of 4D/4M – 629 acres in HRCA
3. ***Alternative D*:** proposes to treat **2,105** acres of 4D/4M – 644 acres in HRCA

These treatments have much less of an impact on habitat than GS or Mechanical Thin treatments. This is because these prescriptions are designed to reduce surface and some ladder fuels (0-9 inches dbh). Treatments would not change the habitat CWHR classification (canopy cover or density) or modify the suitability of the habitat. Those types of prescriptions leave enough habitat structure so that owls could forage or nest if desired.

Treatments would remove most ground cover and some understory, and potentially affect prey species for the spotted owl in the short term. However, the short-term disturbance should not hinder an owls' ability to find prey in non-treated areas such as in their PACs. According to Keane et al. (2011), owls selected against using DFPZs (down to 40 percent canopy cover) for foraging but not for other DFPZ fuels treatments such as understory thinning less than 10 inches dbh and underburns.

Implementation of fuels treatments could decrease the likelihood of active crown fires and increase ability of fire management to suppress, control, and contain fires. The goal is to reduce the potential risk of increased large-scale habitat fragmentation, and loss of species habitat as a result of high intensity wildfire. This alternative would decrease the risk of PAC loss caused by large stand-replacing wildfire immediately adjacent to, and upslope, of fuels treatments. It is expected prescribed underburns would enhance habitat and create a mosaic landscape beneficial to wildlife.

A low to moderate prescribed fire can be an effective tool in restoring habitat to a natural condition with minimal short-term impact on resident spotted owls (Bond et. al 2002). Prescribed burns are expected to enhance habitat and create a mosaic landscape beneficial to wildlife. Burns are designed to retain large pieces of down wood and maintain adequate ground cover to reduce erosion. Burns would primarily remove shrubs and trees that are 0–8.9 inches dbh. The retention of snags and large down wood would aid in minimizing effects on the spotted owl and their prey species.

The ideal prescribed burn leaves a mosaic landscape, retaining shrubs to provide cover for prey species. However, there are risks involved, for example: Fire is nonselective and could scorch trees reducing the incidental numbers of snags, on the other hand, fire may also induce snag recruitment through incidental tree mortality. Smoke can be a problem for wildlife; inhalation can kill or affect the health of animals.

***Landings and Temporary Road Construction*:** Landings and roads do not provide suitable habitat. The action alternatives vary in the number of acres of new landings and skylines proposed, and new temporary road construction and the amount of suitable habitat removed. The discussion of effects for these activities is similar to the discussion for Group Selection above. Roads, particularly landings are considered as a loss of trees in all size classes. Existing skid trails, landings, and temporary roads would be used, when available, to facilitate the harvesting and removal of forest products (biomass and saw logs). Skid trails, landings, and temporary roads could be constructed under all action alternatives to facilitate the removal of forest products when existing infrastructure does not exist.

Throughout the project area, approximately 10.5 miles of temporary roads would be obliterated and 0.7 miles of system road would be decommissioned, supporting the mitigation of the numerous negative consequences to the habitat because of roads. The benefit to removing the 11.2 miles of roads are numerous such as but not limited to: (1) Rejoining the habitat promotes natural hydrological functions, (2) reduces non-native vegetation; (3) reducing fragmentation, therefore reducing threats wildlife have when crossing roads by mortality from cars or hunting; and (4) disturbance to nesting/roosting/denning wildlife. The action alternative does not have to occur in order to pursue funding to decommissioned egregious roads.

Landings would be about 1/2 acre in size. Skylines would be about 1/4 acre in size and along roads. Suitable habitat removed under alternative B would be **48** acres, alternative C would be **21** acres and alternative D would be **17** acres. These acres are all within 4D and 4M habitat.

Cumulative Effects: Direct effects are not expected. Indirect effects are expected to be low. It is uncertain exactly what the California spotted owl cumulative impact will be from these actions but some level of effects is expected. Proposed treatments for the Sugarloaf Project are expected to result in low incremental impact. Of the total **61,939** acres of suitable habitat potentially entered during the life of the HFQLG pilot project: Sugarloaf Project proposes to implement GS on **80** acres of suitable habitat which is **0.1 percent** of the total acres, Mechanical Thin on **993** acres of suitable habitat which is **1.6 percent** of the total acres and new road construction and landings on **48** acres which is **0.08 percent** of the total acres (USDA 1999a, p3-103).

The Sugarloaf Project proposes construction of DFPZs units designed to provide an area from which fire fighters can take a stand to reduce the spread of a forest fire. While there is no guaranteed method of protecting lands from a wildfire, the DFPZs create areas where firefighters could more effectively fight fires and could reduce the wildfires impacts to habitat. On the National Forest System (NFS) lands, short-term habitat suitability reductions within the project area will be offset by fuel treatments that in the long-term would reduce the potential risk of loss of wildlife habitat to wildfire. Wildfire can add to large-scale habitat

***Past, Present and Foreseeable Future*:** The cumulative effect of the Sugarloaf Project and other vegetation management activities in the Sierra Nevada was assessed in the Sierra Nevada Forest Plan Amendment Final Supplement Environmental Impact Statement (SNFPA FSEIS), to which this Sugarloaf Project EIS is tiered. The habitat modeling used for the FSEIS was intended to indicate the direction, magnitude, and time frames (general trends) of change and was not intended to provide precise information. That assessment (USDA 2004c, pages 260–280) acknowledged that suitable foraging habitat provided by CWHR 4 stands would diminish in early decades under the Sierra Nevada Forest Plan Amendment but would be offset by increases in acreage of CWHR 5 and 6 stands. According to projections (USDA 2004c, table 4.3.2.3g), 20 years after implementation of the Sierra Nevada Forest Plan Amendment there would be an 11 percent increase of total spotted owl habitat (classes 4M, 4D, 5M, and 5D) in the HFQLG Pilot Project planning area. By project year 50, there would be a drop in net gain of 6 percent; by year 130, there would be a net reduction of 7 percent. However, in the Sierra Nevada bioregion as a whole, there would be a 13 percent increase in total habitat by project year 20, 18 percent by year 50, and 20 percent by year 130.

***Private*:** The nature of the private lands is that they are urbanized or managed for industrial timber such as by Sierra Pacific Industries. In general, these private lands are treated with different

objectives compared to National Forest lands and therefore are minimally or not suitable as habitat for mature/older-forest dependent species. Urban areas, such as LaPorte and American House, and immediate surrounding areas are not now or ever expected to be suitable habitat for the owl. Sierra Pacific Industries, the largest private landowners in the analysis area, has outlined strategies that provide certain owl protections on their land. The company implements such activities such as conducting surveys for spotted owls before timber harvests, and/or buffer nest centers from disturbances, and/or protect forest units with nesting spotted owls from harvest altogether.

***Wildfires*:** The treatments are designed to provide an area from which fire fighters can take a stand to reduce the spread of wildfires. These wildfires could pose a threat to California spotted owl habitat. Large scale changes in owl habitat as a result of past wildfires and anticipated future fires in spotted owl habitat has been identified as a potential threat affecting spotted owl distribution (USDA 2005, USDI 2006a). Habitat effects from wildfires cannot be fully measured immediately following wildfire, because direct and indirect tree mortality may not become evident for several years. It is unknown, therefore, how much burning of PACs resulted in sufficient loss of live mature trees and changed stand structure to eliminate or significantly diminish habitat suitability for spotted owls.

Excerpt from the *"*California spotted owl Module: 2010 Annual Report,*"* (Keane et al. 2011). A primary source of uncertainty regarding the effect of fuels treatments is an assessment of risk to the CSOs and their habitat from treatments versus the risk from wildfire that occurs across untreated landscapes. Results of 2 years of survey work for the Moonlight-Antelope Complex Wildfires, primarily high-severity, suggest that the primarily high-severity wildfire does not support CSOs other than a single pair that is using the landscape. First year results of the Cub-Onion Complex wildfire, (primarily low-moderate severity) suggests that CSOs were able to persist in the post-fire landscape with similar abundance and spacing as has been observed in unburned forests outside the burned areas. It is important to determine both the acute and chronic responses of CSOs and their habitat to wildfires as it is unknown if CSOs can persist over both the short-term and long-term in these areas.

***Barred owl*:** The U.S. Fish and Wildlife Service concluded that Barred owls constitute a threat to site occupancy, reproduction and survival of the California spotted owl, but that there currently is not enough information to conclude that hybridization with Barred owls poses a threat (USDI 2005).

The *"*California spotted owl Module: 2010 Annual Report*"* states: "Barred and Sparred owl detections were the highest during 2010 surveys within the Plumas-Lassen Study area then any that were detected in any year during the study from 2003–2010. The pattern of records suggest that barred/sparred owls have been increasing in the northern Sierra Nevada from 1989–2010 and are now present in low, stable numbers over the 4–5 years on our study area. Results indicate that Barred owls are increasing in the northern Sierra Nevada and may become an increasing risk factor to CSOs." The potential for the Barred owl to become established and compete with California spotted owls within the Sugarloaf Project area is a possible additional cumulative effect, but at this point, it is unknown as to what the extent this effect will be. The treatments are primarily on ridge-tops and not preferred habitat for the California spotted owl but could be suitable for Barred owls.

It is likely that spotted owl behavioral and competitive interactions with other species such as the Barred owl could affect owl activity and occupancy of PACs/HRCAs that are already low in suitable habitat. Although the HRCAs are well distributed across the wildlife analysis area, they are also confined across the Sugarloaf Project area by large blocks of unsuitable habitat and private lands.

Effects of the action alternatives could possibly cause a shift in owl home range use and increase the potential for intraspecific (single species) competition between neighbors. The increased competition associated with using the same restricted habitat parcels could directly influence owl behavior, possibly affecting nesting and reproduction. This is especially true if the directly affected HRCA overlaps with another HRCA, and increases as the percent of the overlap increases.

***Plumas-Lassen Administrative Study*:** "California spotted owl Module: 2010 Annual Report": (1) The Lassen Demographic Study results suggest a decline in the CSO population within the Lassen study area over a 20-year study period; (2) The Plumas NF Survey Areas crude density estimates within individual Survey Areas indicate similar densities and number of territorial single sites between 2004–2010 for the survey areas on the Plumas NF; (3) California spotted owls selected against DFPZs, but not other fuel treatments (Group Selection), for nocturnal activities: hypothesized that the habitat character of DFPZs may be unfavorable for common spotted owl prey species. Spotted owls foraged much closer to their site center than expected because fuel treatments are not permitted within PACs. One owl strongly selected underburn treatments over untreated forest for foraging; limited availability of underburn within the study are prevents further extrapolation of the result: (4) Overall, about 90 percent of the 103 CSO territorial sites were located within CWHR 4M, 4D,5M,5D and 6 size classes. The remaining 10 percent of sites were located in greater openings, smaller-tree size polygons, with nests or roosts located within remnant, scattered larger trees.

The most current research regarding California spotted owl populations on the Eldorado, Sierra, and Lassen National Forest was considered in the determination process. Gutiérrez (2011) most recently estimated population rate of change (λ_t) on the Eldorado Density Study Area using capture-mark-recapture techniques. Model results indicated the average λ over the study period was not significantly different from one, the value for a stable population (λ_t = 0.989, SE = 0.016, Gutiérrez 2011, Figure 4). Estimates of realized population change (which show the proportion of the initial population size remaining each year) also suggested that the number of territorial owls in 2009 was similar to that at the beginning of the study (Gutiérrez 2011, Figure 5). Results may suggest a gradual decline in realized population change on the Eldorado Density Study Area during the past 10 years; however, further monitoring is required to adequately assess the validity of such a trend (Gutiérrez 2011).

Blakesley et al. (2010) evaluated California spotted owl population dynamics from four study areas in the Sierra Nevada (Sierra, Eldorado and Lassen National Forests; Sequoia and Kings Canyon National Parks) using capture-mark-recapture data from 1990–2005. These analyses did not find evidence for decreasing linear trends in λ_t on any of the study areas. In general, λ_t was either stationary (Lassen and Sierra National Forests) or increasing after an initial decrease (Eldorado National Forest and Sequoia and Kings Canyon National Parks). Estimates of realized population change (proportion of the population size in the first year that remained in each subsequent year) showed no strong evidence of population change on the Eldorado and Sierra National Forests or in Sequoia or Kings Canyon National Parks (Blakesley et al. 2010). Blakesley et al. (2010) reported that the population on the Lassen National forest was the only population in their analysis to have an ending population size that was lower than the starting population, based on realized changed.

Scherer et al. (2011) evaluated California spotted owl demographics on the Lassen National Forest using capture-mark-recapture data (1990–2010). These analyses found no evidence for a linear

trend in λ_t across time or a quadratic or pseudo-threshold relationship between λ_t and year (Scherer et al. 2011). Results indicated that λ_t varied randomly around a mean value of 0.979 (95 percent CI ranged from 0.959–0.999) across time (annual estimates of λ ranged from 0.87 to 1.13). Although their estimated mean value of lambda ($\bar{\lambda}$ = 0.979) across years was below 1.0, indicating an average annual decline in the number of territory-holding owls on the Lassen National Forest, annual estimates of population growth rate (λ_t) all had 95 percent confidence intervals that overlapped 1.0 with the exception of one time period (2004–2005). Further monitoring is required to adequately assess the California spotted owl population's rate of change on the Lassen National Forest.

***Uncertainty*:** Potential effects from the proposed GS, mechanical thin treatments are the reduction in the quality of suitable habitat. The key uncertainties related to viability in the Sierra Nevada include (1) factors driving population trends; (2) habitat relationships and habitat quality; (3) current distribution, amount, and quality of habitat; (4) treatment effects, including fuels and Silviculture treatments, on habitat and populations at multiple scales; and (5) increase in barred/sparred owl detections. There is a degree of uncertainty as to risk of potential wildfire and disease if treatments were implemented to a lesser degree, thereby retaining habitat that is more suitable in terms of canopy cover and layering.

Northern Goshawk

Indicators and measures are acres of Nesting Habitat (5D, 5M, 4D, 4M) and Foraging Habitat (3M, 3D, 4P, and 5P).

Direct Effects: The Northern Goshawk is not expected to be directly affected based on the following direction, standard and guidelines, protection measures and design features. (Refer to "Mitigations" in Appendix A. These refer to the discussion under direct effects for the California spotted owl above for more information.)

- NOGO PACs have been established to encompass all known activity centers;
- no Group Selection and mechanical thin treatments are proposed in NOGO PACs;
- no new landings or road construction are proposed in NOGO PACs;
- protocol level surveys were conducted in 2011 and 2012 within the analysis area;
- if new activity centers are located, PACs would be adjusted to include the activity centers or a new NOGO PAC created;
- design features such as Limited Operating Periods (LOPs), would be in place to prevent disturbances to nesting goshawks located within 1/4 mile of treatments (harvest, road construction, log hauling, etc.);
- proposed fuels reduction would improve habitat available for foraging outside of NOGO PACs.

Indirect Effects: Indirect effects to the Northern goshawk habitat are expected to be low. Refer to the list of directions, standards and guidelines, protection measures and design features that are

listed under direct effects above as these avoid and minimize indirect effects as well. Refer to "Mitigations" in Appendix A. Refer to the discussion under indirect effects for the California spotted owl above.

The action alternatives assume a risk because they remove suitable habitat, and decrease NOGO habitat suitability and could reduce the use of the treated areas at least for the short-term. However, the proposed action is intended to reduce the long-term risk of the loss of habitat due to fire and disease. Refer to the Fire and Fuels and Vegetation sections within this document.

Group Selection retains very little overstory, trees 30 inches dbh and greater. Mechanical thin treatments propose to predominately remove surface (0–9.9 inches dbh) and ladder (10-16 inches dbh) fuels: (1) none of the trees 0–6 inches dbh would be retained; and (2) few of the trees 6–11 inches dbh would be retained. Some of the understory canopy cover of size class 4 (trees 11–24 inches dbh) would be retained. The overstory would be retained 1) the size class trees 24–30 inches dbh would actually increase; and the 30 inches and greater trees would only decrease slightly. Other fuels treatments, such as HCGP and HCPB, would remove surface fuels and retain most existing canopy cover.

Refer to the discussion above for the CSO for nesting (5D, 5M) and foraging (4D, 4M) habitat. The discussion would be similar. Northern goshawks use 4D and 4M stands for nesting as well as the 5D and 5M used for nesting by the CSO. A major difference between the CSO and the NOGO is that the Northern goshawks will utilize a more open understory for foraging, so treatments outside of NOGO PACs may benefit this species in the long-term.

***Group Selection*:** Alternative B proposes **100** acres of GS, all **100** acres are classified as suitable nesting habitat. The 100 acres is **2 percent** of the total suitable habitat within the analysis area. Alternatives C and D do not propose any Group Selection treatments.

***Mechanical Thin*:** Alternative B proposes to treat **992** acres, which is **21 percent** of the total suitable habitat within the analysis area. Alternative C proposes to treat **1,073** acres, which is **23 percent** of the total suitable habitat within the analysis area. Alternative D proposes to treat **934** acres of suitable habitat, which is **20 percent** of the total suitable habitat within the analysis area.

Nesting Habitat (5D, 5M, 4D, 4M)

1. ***Alternative B*** – **933** acres
   - 4D: 697 acres reduced to 40 percent CC, reclassified as 4M
   - 4M: 236 acres reduced to 40 percent CC, remains 4M
2. ***Alternative C*** – **879** acres
   - 5M: 110 acres reduced to 50 percent CC, remains 5M
   - 4D: 325 acres reduced to 40 percent CC, reclassified as 4M.
   - 4D: 235 acres reduced to 50 percent CC, reclassified as 4M.
   - 4M: 186 acres reduced to 40 percent CC, remains 4M.
   - 4M: 23 acres reduced to 50 percent CC, remains 4M.

3. ***Alternative D*** – **741** acres
   - 4D: 203 acres reduced to 40 percent CC, reclassified as 4M
   - 4D: 359 acres reduced to 50 percent CC, reclassified as 4M
   - 4M: 179 acres reduced to 40 percent CC, remains 4M

Foraging Habitat (3M, 3D, 4P, 5P)

1. ***Alternative B*** – **59 acres**
   - 3D: 59 acres reduced to 40 percent CC, reclassified as 3M
2. ***Alternative C*** – **194 acres**
   - 3D: 177 acres reduced to 40 percent CC, reclassified as 4M
   - 3D: 17 acres reduced to 50 percent CC, reclassified as 4M
3. ***Alternative D*** – **193 acres**
   - 3D: 176 acres reduced to 40 percent CC, reclassified as 4M
   - 3D: 17 acres reduced to 50 percent CC, reclassified as 4M

Handcut/Grapple Pile, Mastication, Handcut/Pile/Burn and Underburn: Alternative B proposes to treat **2,197** acres, alternative C proposes to treat **2,054** acres and alternative D proposes to treat **2,494** acres of suitable habitat.

Nesting Habitat (5D, 5M, 4D, 4M)

1. ***Alternative B*:** – **2,031 acres** – 275 acres of 5M – 1,756 acres of 4D/4M
2. ***Alternative C*:** – **1,998 acres** – 180 acres of 5M – 1,818 acres of 4D/4M
3. ***Alternative D*:** – **2,432 acres** – 27 acres of 5M – 2,105 acres of 4D/4M

Foraging Habitat (3M, 3D, 4P, 5P)

1. ***Alternative B*:** – **166 acres** of 3D
2. ***Alternative C*:** – **56 acres** of 3D
3. ***Alternative D*:** – **62 acres** of 3D

Landings and Road Construction: Existing or new landings and roads would not provide suitable habitat in the short-term and potentially long-term. Refer to the discussion under the CSO above.

Cumulative Effects: Direct effects are not expected and indirect effects are likely to be very low. Cumulative effects from the Sugarloaf Project for the Northern goshawk are expected to be minimal when added to other actions. This reasoning is based on not entering goshawk PACs, surveys, protection measures, project design features and retaining suitable habitat.

It is uncertain as to what influence this reduction in habitat would have on goshawk activity and occupancy in the wildlife analysis area, but it is not anticipated that the cumulative habitat reduction would result in loss of occupancy and productivity of known goshawk PACs. This is based on the location of project activities in relation to known PACs, no habitat alteration in PACs, and

distribution of known PACs. Proposed treatments for the Sugarloaf Project are expected to result in low incremental impact. Of the total **101,154** acres of suitable habitat potentially entered during the HFQLG pilot project: Sugarloaf Project proposes to implement GS on **100** acres of suitable habitat which is **0.1 percent** of the total acres, Mechanical Thin on **1,073** acres of suitable habitat which is **1 percent** of the total acres and new road construction and landings on **48** acres which is **0.08 percent** of the total acres (USDA 1999a, p3-106 and 3-107).

Cumulative effects on the goshawk could occur with the incremental loss of the quality of habitat for this species. Overall, increases in recreational use of National Forest lands, and the use of natural resources on state, private, and federal lands, may contribute to habitat loss for this species. High-intensity stand-replacing fires, and the means by which land managers control them, have contributed and may continue to contribute to loss of habitat for this species.

The analysis of cumulative actions focuses on past timber sales as they related to impacts on suitable owl habitat, more specifically CWHR size 4M, 4D, 5M, and 5D. These same CWHR types are considered suitable goshawk nesting habitat. Generally, the average tree size in the nest stands found on the project ranged from 25 to 40 inches. That translates to CWHR size 5M and 5D. Through analysis, all of these actions often translated into a projected decrease in habitat suitability for goshawks.

Fisher and Pacific Marten

Indicators and measures are acres of Denning/Resting Habitat (5D and 4D) and Travel/Foraging Habitat (5M and 4M).

Direct and Indirect Effects: Direct and indirect effects are expected to be low based on the following direction, standard and guidelines, protection measures and design features. Refer to “Mitigations” in Appendix A.

- There are no known den/rest sites in the analysis area
- Protocol level surveys were conducted within the analysis area in 2001/2002 for the Bald Mountain Project
- Protection measures such as LOPs are included to protect any den or rest sites if they are located
- Many acres of suitable mature/older forest habitat will be avoided because there will be no treatments in CSO PACs and no GS or mechanical thin treatments within NOGO PACs
- The treatments are within or around higher levels of human disturbance or along ridge-tops, which are not considered preferred nesting habitat
- Overall, treatments are not entering RHCAs except for understory burning and handcut/pile/burn, retaining riparian vegetation
- Retention of large trees 30 inches dbh or greater

- Retention of important habitat components, where available, such as 4 snags (15 inches dbh and greater) per acre on the landscape, and 10–15 tons (8–12 logs, 20 inches diameter and 10 foot length minimum) per acre of large down wood
- Any treatments within riparian areas would be to maintain or restore habitat
- Buffers are applied to protect riparian/aquatic zones following 2004 SNFPA guidelines.

The 2004 SNFPA ROD identifies higher than average canopy closure as habitat attributes important to the Marten, stating a minimum of 40 percent canopy cover. Forest carnivores primarily travel and forage along rivers and streams, whereas they den and forage within mature/old forest habitat. CSO PACs and the NOGO PACs within Sugarloaf analysis area predominately encompass the mature/old forest blocks. In addition, riparian zones, used as travel corridors, in general would be maintained or improved.

Size class 4 trees stands that are thinned would grow into size class 5 stands. Size class 5 stands are retaining at least the minimum level of suitability. It is predominately the surface fuels that would be removed: (1) none of the trees 0–6 inches dbh would be retained; and (2) very few of the trees 6–11 inches dbh would be retained. Some of the understory canopy cover of size class 4 (trees 11–24 inches dbh) would be retained. The overstory would be retained (1) the size class trees 24–30 inches dbh would actually increase;(2)and the 30 inches and greater trees would only decrease slightly. The discussion for the effects of mechanical thinning, Group Selection, new landing and road construction is similar to the discussion for mechanical thinning and Group Selection above for the California spotted owl.

***Group Selection*:** Alternative B proposes to implement **100** acres of GS, of these acres there are **80** acres classified as suitable denning and foraging habitat, which is 2 percent of the total suitable habitat within the analysis area. Alternatives C and D do not propose Group Selection treatments.

Denning/Resting Habitat (5D and 4D)

- ***AlternativeB*** proposes removal of **20** acres: 20 acres of 4D

Travel/Foraging Habitat (5M and 4M)

- ***Alternative B*** proposes removal of **60** acres: 52 acre of 5M and 8 acres of 4M

Group Selection was considered in the overall percent canopy cover reductions. The majority of trees would be removed but retain an estimate of 6-8 trees per acre that are 30 inches or greater. It is expected that since the quantity of proposed GS is comparatively low and that they are fairly well dispersed, within the analysis area that the overall affects on suitable habitat would be low.

***Mechanical Thin (MT)*:** The action alternatives propose mechanical thin on a similar number of acres, the major difference is the intensity of the treatment. Alternative B would have the greatest effect on the suitability of the habitat for denning/resting and foraging/travel due to the number of acres thinned and the level of reduction of canopy cover and layering. Alternative D would have the least adverse effect on suitable habitat while still reducing the fuels, resulting in a net benefit to the land. No treatments are proposed for 5D stands. Alternative B proposes to implement MT on **993** acres of suitable habitat, which is **23 percent** of the total suitable habitat within the analysis area.

Alternative C proposes to implement MT on **879** acres of suitable habitat, which is **21 percent** of the total suitable habitat within the analysis area. Alternative D proposes to implement MT on **741** acres of suitable habitat, which is **17 percent** of the total suitable habitat within the analysis area.

Nesting Habitat (5D, 4D)

- **Alternative B** - 697 acres
  - 4D: 697 acres reduced to 40 percent CC, reclassified as 4M
- **Alternative C** – 560 acres
  - 4D: 325 acres reduced to 40 percent CC, reclassified as 4M
  - 4D: 235 acres reduced to 50 percent CC, reclassified as 4M
- **Alternative D** – 562 acres
  - 4D: 203 acres reduced to 40 percent CC, reclassified as 4M
  - 4D: 359 acres reduced to 50 percent CC, reclassified as 4M

Foraging Habitat (5M, 4M)

- **Alternative B** – 236 acres
  - 4M: 236 acres reduced to 40 percent CC, remains 4M
- **Alternative C** – 319acres
  - 5M: 110 acres reduced to 50 percent CC, remains 5M.
  - 4M: 186 acres reduced to 40 percent CC, remains 4M.
  - 4M: 23 acres reduced to 50 percent CC, remains 4M
- **Alternative D** – 179 acres
  - 4M: 179 acres reduced to 40 percent CC, remains 4M.

***Handcut/Grapple Pile, Mastication, Handcut/Pile/Burn and Underburn*:** Suitable habitat proposed to be treated is **2,031** acres under alternative B, **1,998** acres under alternative C and **2,432** acres under alternative D.

Nesting Habitat (5D and 5M)

- ***Alternative B*:** proposes to treat **275** acres of 5M
- ***Alternative C*:** proposes to treat **180** acres of 5M
- ***Alternative D*:** proposes to treat **327** acres of 5M

Foraging Habitat (4D and 4M)

- ***Alternative B*:** proposes to treat **1,756** acres
- ***Alternative C*:** proposes to treat **1,818** acres

- ***Alternative D*:** proposes to treat **2,105** acres

Handcut/grapplepile, handcut/pile/burn, mastication and underburn treatments would be removing surface and some ladder, fuels up to 9.9 inches dbh. These treatments have less of an impact on Fisher and Marten habitat than thinning and Group Selection. Treatments would not change the habitat CWHR classification or modify the suitability of the habitat, overall canopy covers and layers would not be reduced. Mastication and grapple/pile, which uses heavy equipment, would be more of a disturbance then handcut/pile/burn or underburn treatments. The short-term disturbance should not hinder the Fisher or Marten's ability to find prey in non-treated areas.

Analysis indicates that prescribed burning would result in 60 to 80 percent mortality of conifers, hardwoods (8.9 inches or less), and most shrubs. Burns will be conducted to retain large trees, snags and large down wood. Prescribed burns leave a mosaic of burned and unburned areas, so some shrubs will remain to provide cover for carnivores and prey species using these areas. Habitat modification by these treatments would not affect the over story of mature forest stands in RHCA, used by carnivores as travel corridors.

It is unknown how some of the important prey species (small mammals and birds) preferred by the Fisher/Marten would respond to the DFPZ treatments, but it is expected that the disturbance would be short-term disturbance. Small mammal availability is a subject being monitored by the Plumas-Lassen Administrative Study, but results are not available.

Landings and Road Construction

Denning/Resting Habitat (5D and 4D): refer to the discussion under the CSO above.

Travel/Forage Habitat (5M and 4M): refer to the discussion under the CSO above.

The existing heavily traveled roads around the Sugarloaf area fragment habitat, yet suitable habitat does exists between roads. Management strategies to fill the gaps between suitable habitats could promote species richness and biodiversity for wide-ranging mammals (Scott et al. 1983) such as the Fisher and Marten. The approximately 10.5 miles of temporary road, that would be obliterated supports reducing some of the fragmentation in the area, even though the road density would remain high for this area.

The potential direct effects on forest carnivores from vegetation management activities consist of modification of habitat or habitat components, in regards to denning/resting habitat and foraging/travel habitat. There are no known den sites of forest carnivores in the analysis area. However, there is suitable habitat within the project area and the lack of detections because of surveys does not mean species absence. If a Fisher or Marten den site is found in the future, the site will be protected and a LOP would be implemented within 1/2 mile of the den site (USDA 1999a, b; USDA 2004c, d).

Although surveys were conducted to protocols, the Fisher and Marten are very elusive species and are not as easily detected as the CSO or goshawk. In addition, there are no land allocations such as there are for the CSO and goshawk with PAC land allocations. Therefore, direct effects are based on the loss, modification or fragmentation of suitable habitat and habitat components. Whereas,

indirect effects are road density and new construction, and disturbances such as equipment noise as a result of the activity.

Powell (USDI 2004) states that forest type is probably not as important to Fishers (and Martens) as the vegetative and structural aspects, and Fishers (and Martens) may select forests that have low and closed canopies. The Marten's need for overhead cover was well documented in the April 8, 2004, Federal Register. Numerous studies (as referenced in the 2004 SNFPA final supplemental EIS) indicate that canopy closure over 60 percent is important, and these species preferentially select home ranges to include high proportions of dense forested habitat.

The discussion for the effects of mechanical thinning, Group Selection, new landing and road construction is similar to the discussion for mechanical thinning and Group Selection above for the California spotted owl. Suitable denning/resting habitat would be reduced to forage/travel habitat as a result of treatments.

Because Martens avoid openings and are less abundant in landscapes with 65 percent forest cover (Potvin et al. 2000 *in* Moriarty et al. 2011), we predicted that loss of high-quality habitat in SEF would negatively affect Marten occupancy (Moriarty et al. 2011). Martens may be associated with such forests because they can forage most effectively in dense forests with complex structure (Andruskiw et al. 2008 *in* Moriarty et al. 2011), and because forests with complex structure and large trees and snags provide resting and denning sites (Slauson and Zielinski 2009 *in* Moriarty et al. 2011), as well as escape and thermal cover (Drew 1995 *in* Moriarty et al. 2011).

Cumulative Effects: Cumulative effects are expected to be low. There are no known unavoidable adverse effects. Cumulative effects on the Pacific Marten or Fisher habitat could occur with the incremental reduction of the quantity and/or quality of habitat for these species. Historic fires, timber harvests, recreational use and fire suppressions have extensively modified habitat of the Marten. Overall, increases in urbanization, increases in recreational use of Forest Service system lands, and the utilization of natural resources on state, private and federal lands may contribute to habitat loss for this species. High intensity stand replacement fires, and the methods land managers utilize to control them, have contributed and may continue to contribute to loss of habitat for this species. Cumulative effects on the Pacific Marten habitat could occur if incremental amounts of habitat are lost through a variety of activities over time.

It is uncertain exactly what the cumulative impact on Fisher and Marten will be from these actions but some level of effects is expected. Proposed treatments for the Sugarloaf Project are expected to result in low incremental impact. Of the total **65,395** acres of suitable habitat potentially entered during the HFQLG pilot project: Sugarloaf Project proposes to implement GS on **80** acres of suitable habitat which is **0.1 percent** of the total acres, Mechanical Thin on **993** acres of suitable habitat which is **1.5 percent** of the total acres and new road construction and landings on **48** acres which is **0.07 percent** of the total acres.

The proposed Action Alternative would not increase any large-scale, high-contrast fragmentation above existing levels. The treatment design features would retain habitat elements within the range of those used by the Marten for foraging and dispersal, such that these areas would likely note create large barriers to further expansion and connectivity to Fisher habitat. In 2001, potential sites surveyed

used on-the-ground habitat typing or the used topographical maps and aerial photos. The surveyed area included the Sugarloaf Project, which resulted in no findings of the carnivores.

The retention of nesting habitat within California spotted owl PACs, Northern goshawk habitat PACs and RHCAs and will provide connectivity between large blocks of suitable habitat for the Fisher and Marten. In addition, implementation of Riparian Conservation Areas (RCAs) and Alternative B: Riparian Management Objectives (RMOs) (refer to the Hydrology and Aquatic sections) would also improve habitat conditions.

***Wildfire*:** The Sugarloaf project has the potential to reduce wildfire risk to Fisher and Marten habitat. Implementation of fuels treatments could decrease the likelihood of active crown fires and increase ability of fire management to suppress, control, and contain fires. Refer to the discussion above under CSO. The Truex/Zielinski 2005 paper "Short-term Effects of Fire and Fire Surrogate Treatments on Fisher Habitat in the Sierra Nevada" was reviewed. Measures to mitigate short-term effects, as suggested in the paper, where considered and applied were feasible and applicable. SNFPA ROD 2004 "Standards and Guidelines" were applied to retain large trees, snags, large woody material and large oaks, thereby reducing effects of implementing fuels-reduction ("Fire and Fire Surrogate") treatments such as mechanical harvest, mechanical harvest followed by burn and fire (underburn) only treatments. The paper also states, "The short-term effects of treatments may be mitigated by the beneficial effects of the treatments on subsequent stand development". Prescribed underburns could affect Marten if they are utilizing an area. They could be directly affected by the fire or by smoke inhalation. The size of the burned area will be small and adults could escape. However, if there were den sites the young could perish since they would not be able to escape.

***Fisher Translocation*:** The ongoing release efforts by Department of Fish and Game (DFG) continue with the release of several more Fisher individuals on Sierra Pacific Industry (SPI) land in 2011. The Fishers are being tracked via radio transmitter collars (for the males) and surgically implanted radio transmitters (in females). The Forest Service remains informed as to where and how the Fishers are moving across the landscape. The most current update (March 28, 2011) map locations showed Fisher males traveling a distance of 26 km (16 miles) from the original release point. All the male Fishers released have traveled in cardinal directions except towards the valley (Magalia, Paradise, Chico or Oroville). Transient locations varied from Lassen National Park, Lassen National Forest and Plumas National Forest. However, the males are considered transient, returning to the areas where the females are located. The females have remained on SPI land where they were released and some have nested successfully (per. com Aaron Facka 2011).

***Habitat Fragmentation*:** The greatest concern for Fisher and the Marten habitat in the Sierra Nevada range is the risk of further fragmentation due to large stand replacing fire (USDA 2004c, page 244). Species most sensitive to habitat fragmentation and loss are usually those that have large land base requirements (Wilcox 1980), are sedentary specialist (Opdam 1990), occupy late successional stages (Gotelli and Graves 1990) and have low dispersal ability (Primm et al. 1988 and Bolger et al. 1991). For the purposes of this analysis, prescriptions using thinning, including Group Selections, are considered likely to reduce canopy cover and alter stand structure sufficiently to have the potential for effects that could linger beyond the immediate treatment and affect overall habitat quality. Habitat excluded from the project based on protection from activities such as the California

spotted owl, goshawk PACs and riparian areas would provide habitat for Fishers and Martens to den, hunt and travel.

***Studies/Reports*:** The HFQLG Independent Science Panel "Red Flag" Issue Monitoring Report-2008 recommended that the following question be addressed: "Does DFPZ implementation present a risk to Marten movement or Marten habitat connectivity?" The publication "Decline in Pacific Marten Occupancy Rates at Sagehen Experimental Forest, California" states "Marten detections in 2007–2008 were 60 percent lower than in surveys in the 1980s. No Martens were detected at lower elevations where most of the recent forest management activity occurred. We suggest that the Marten population at SEF has been negatively affected by the loss and fragmentation of habitat. We recommend that future management of forests in the Sagehen basin focus on restoring and connecting residual Marten habitat to improve habitat quality for Marten" (Moriarty et al. 2011). Also of concern is the mortality of radio-collared Marten in the study area on the Lassen NF (pers. communication Moriarty 2012).

***Connectivity*:** In 2009 a "least-cost path (corridor)" analysis for the Plumas NF was modeled connecting the Lassen NF to the Tahoe NF for the Marten. This form of GIS modeling uses a cost/risk surface to evaluate potential animal movement pathways by increasing 'travel costs' in vegetation types they are not commonly associated with (Kirk and Zielinski 2009). The Marten "path" runs directly across the Grass Flat area above the Sugarloaf Project area, which also contains the best habitat that provides the "least-cost" pathway. Grass Flat is at the lower end of the Marten range. Outside of private lands (timber industry and homeowners) in the Sugarloaf, area there is a very limited "path" for Marten or Fisher.

***Uncertainty*:** A potential effect from the proposed fuels and forest health treatments is the reduction in the quality of suitable habitat. The key uncertainties related to viability in the Sierra Nevada include (1) factors driving population trends; (2) habitat relationships and habitat quality; (3) current distribution, amount, and quality of habitat; and (4) treatment effects, including fuels and Silviculture treatments, on habitat and populations at multiple scales.

Pallid Bat, Townsend Big-Eared Bat, and Fringe-tailed myotis

Direct and Indirect Effects: Direct and indirect effects are expected to be low based on the following:

- There are no known roost sites in the analysis area
- Limited historical surveys were conducted within the analysis area
- Limited Operating Periods are included to protect any roost sites if they are located
- Many acres of suitable mature/older forest will be avoided because there will be no treatments in CSO PACs and only no canopy affecting treatments in NOGO PACs
- Treatments are staying out of RCAs and RHCAs except for understory burning and some handcut/pile/burn
- Retention of large trees 30 inches dbh or greater

- Retention of important habitat components such as 4 snags (15 inches dbh and greater) per acre on the landscape, and 10–15 tons per acre of large down wood (8–12 logs, 20 inches diameter and 10 foot length minimum)
- Retention and enhancement of cottonwood trees
- Best Management Practices would be applied (refer to hydrology section).

If the sensitive bat species are found at additional locations during project implementation or roosting habitat, showing recent activity is located, the district biologist will be notified and will develop and implement mitigations to protect roosting individuals, thereby further reducing any effects to individuals or breeding populations from disturbance during project activities.

The project is designed to retain and promote hardwoods within the Sugarloaf Project area. Destruction of active roosts through felling and/or removal of large trees, or small trees with hollows, or mature oaks could displace or harm individual bats. Snags removed for safety reasons, could result in direct mortality of bat species that may be roosting within the tree or snag. Adults may be able to flee from the destruction of their roost tree. For the Fringe-tailed myotis the most important factor that discriminated roost sites from random sites at this study site was 5.4 or more snags ≥12 inches dbh at roost sites. Roost snags were 85 feet taller and had diameters 17 inches larger than random snags in the surrounding watershed, and roost sites had 11% less canopy cover and were 135 feet closer to stream channels than random sites (Weller and Zabel 2001). However, if activities were to take place during the spring and early summer, juvenile bats, prior to initiation of flight skills, would have no means of escaping direct disturbance and would be killed if roost trees were felled. In addition, bats primarily forage at dusk or night when project activities would be minimal or not occurring.

Chain saw activity or the use of heavy equipment causing ground vibrations may cause noise and tremor disturbance significant enough to cause temporary or permanent roost abandonment. However, machinery used for mechanized treatment would disturb most tree-roosting bats prior to tree removal activities, and therefore reduce the potential for direct mortality of these species. However, if activities were to take place during the spring and early summer, juvenile bats would have no means of escaping direct disturbance and would perish if maternity roosts were abandoned. If bats are roosting in trees that are not felled or trees adjacent to the treatment area, temporary or permanent roost abandonment could also result in lowered reproductive success or possibly, total maternity roost abandonment and death of the young of the year.

Analysis indicates that prescribed burning would result in 60 to 80 percent mortality in conifers (8.9 inches dbh or less) and most shrubs. Burns will be conducted to retain snags and large down wood. Prescribed burns leave a mosaic of burned and unburned areas, so some shrubs will remain to provide cover for carnivores and prey species using these areas. Habitat modification by these treatments would not affect the over story of mature forest stands in RCAs and RHCA. However, fires could kill some larger trees that could be utilized as roosts. Smoke inhalation could kill bats. Adults could fly away from the burn but if young cannot fly, they would perish. Prescribed burns done in the spring could affect Pallid bats, due to their habitat preferences. Conducting prescribed burns during fall months will minimize the risk of mortality to bats. By fall, the young can fly, and hibernation has not yet begun.

Cumulative Effects: Cumulative effects are expected to be low. Cumulative effects to these species within the project area occur predominately from potential loss of roost tree, disturbance during roosting attempts and of prey base. Overall, increases in urbanization, increases in recreational use of National Forest System lands, and the utilization of natural resources on state, private and federal lands may contribute to habitat loss for this species. Proposed treatments may reduce the threat of high intensity, stand replacing fires, thus providing some protection to residual habitat attributes such as large trees, snags, large down wood and mature hardwoods.

Western Bumble bee

Direct and Indirect Effects: Direct and indirect effects are expected to be low. Based on results within Sugarloaf, there are many opportunities for bees to cope adequately. Flowering plant species (nectar sources) known to be used by *B. occidentalis* occur throughout the analysis area (see Sugarloaf Project botany specialist report 2013). Ground disturbing activities associated with the Sugarloaf Project likely will reduce foraging opportunities for *B. occidentalis* in the project footprint (treatment units) through trampling; however, this reduction in foraging habitat likely will be ephemeral as flowering plants will sprout and regenerate post-project. Ground disturbing activities also may destroy suitable nesting and overwintering sites for *B. occidentalis* within treatment units. However, snag retention areas within salvage treatment units and equipment exclusion zones within riparian areas will not experience ground disturbing activities and will provide foraging, nesting, and over wintering opportunities throughout the Sugarloaf Project area.

Cumulative Effects: The existing condition reflects the changes of all activities that have occurred in the past. Cumulative effects on *B. occidentalis* could occur with the incremental loss of the quantity and/or quality of habitat for this species. Overall, increases in urbanization, increases in recreational use of National Forest System lands, and the utilization of natural resources on state, private and federal lands may contribute to habitat loss for this species. Although the general distribution trend is steeply declining, especially in the west coast states, some isolated populations in Oregon and the Rocky Mountains appear stable (Rao et al. 2011, Koch et al. 2012). The overall status of populations in the west is largely dependent on geographic region: populations west of the Cascade and Sierra Nevada mountains are experiencing dire circumstances with steeply declining numbers, while those to the east of this dividing line are more secure with relatively unchanged population sizes. The reasons for these differences are not known.

Bumble bees are threatened by many kinds of habitat alterations that may fragment or reduce the availability of flowers that produce the nectar and pollen they require, and decrease the number of abandoned rodent burrows that provide nest and hibernation sites for queens. Major threats that alter landscapes and habitat required by bumble bees include agricultural and urban development. Exposure to organophosphate, carbonate, parathyroid and particularly neonicotinoid insecticides has recently been identified as a major contributor to the decline of many pollinating bees, including honey bees and bumble bees (Henry et al. 2012, Hopwood et al. 2012). In the absence of fire, native conifers encroach upon meadows, and decrease foraging and nesting habitat available for bumble bees.

3.5.6 Summary and Comparison of Alternatives

Table 3-22 provides a summary of effect determinations for wildlife species that potentially occur in and could be affected by implementation of the Sugarloaf Project.

Although there is suitable habitat that would not be affected within the project boundary, the may affect determination is based on the unsuitable habitat expected from group selects, mechanical thinning, landings and roads. The affect is less in alternative D, where there are no group select and mechanical thinning is 109 acres.

If any federally listed species are found later, or if any new information relevant to potential effects of the project on these species becomes available, the project would be stopped and the Section 7 Consultation process would be initiated.

Table 3-22. Summary of effects of the Proposed Action for wildlife species that could be affected by the Sugarloaf Project.

Species	Alternatives	
	A	B, C, D
Northern goshawk (*Accipiter gentilis*)	Will not affect	May affect individuals
California spotted owl (*Strix occidentalis occidentalis*)	Will not affect	May affect individuals
Pacific Marten (*Martes caurina*)	Will not affect	May affect individuals
Fisher (*Pekania pennanti*)	Will not affect	May affect individuals
Pallid bat (*Antrozous pallidus*)	Will not affect	May affect individuals
Townsend's big-eared bat (*Corynorhinus townsendii*)	Will not affect	May affect individuals
Fringe-tailed myotis (*Myotis thysanodes*)	Will not affect	May affect individuals
Western Bumble bee (*Bombus occidentails*)	Will not affect	May affect individuals

Alternative A - No Action

The determination for the No Action Alternative is with the understanding that the existing environment is not static. Landscape conditions would continue to change in response to natural and human factors.

Region 5 Forest Service Sensitive Species with a “Will Not Effect” determination

It is my determination that the proposed project will not affect the California spotted owl and Northern Goshawk, Pacific Marten, Townsend big-eared bat and Pallid bat.

Candidate species and Region 5 Forest Service Sensitive Species with a “Will Not Effect” determination

It is my determination that the proposed project will not affect the Fisher in the planning area.

Alternatives B, C and D

Forest Service Species with a May Affect Determination

It is my determination that the proposed activities within the Sugarloaf Project analysis area may affect individuals, but are not likely to result in a trend toward Federal listing or loss of viability for the following Forest Service Sensitive species: California spotted owl, Northern Goshawk, Pacific Marten, Townsend big-eared bat, Pallid bat, Fringe-tailed myotis, and the Western bumble bee.

Candidate species and Region 5 Forest Service Sensitive Species with a will not affect Determination

It is my determination that the proposed project may affect individuals, but is not likely to contribute to the need for Federal listing or result in loss of viability for the Fisher in the planning area.

General key points for all species for the determination

- Construction of a network of fuel reduction areas designed to reduce the loss of habitat caused by large stand-replacing wildfire.
- Prescriptions such as the proposed mastication, hand-cut and pile, grapple pile and underburn are less impactful to habitat than thinning or Group Selection treatments. There could be short-term disturbances for a long-term habitat gain by reducing fuels and therefore potentially large stand replacing wildfires.
- Riparian habitat is critical roosting/nesting and foraging habitat for many species and is protected within RCAs and RCHAs. Direction requires that any proposed treatments within RHCAs maintain or improve habitat. There are no Group Selection treatments within RHCAs. For other treatments, design features such as buffers, LOPs, and limited treatments would protect and/or enhance riparian habitat.

California spotted owl

- Surveys of suitable habitat were conducted and based on protocol level surveys (2010–2011).
- Protected Activity Centers (PACs) are excluded from management activities (SNFPA FSEIS ROD HFQLG 2004). Owl PACs remain intact and protected riparian areas help maintain habitat connectivity reducing fragmentation within the surrounding area.
- PACs maintain nesting and foraging habitat for spotted owls within their 300-acre PAC and the majority of landscape bordering the PAC remains intact for foraging.
- Limited Operating Periods (LOP) (March 1 through August 15) are a 1/4-mile circle around known spotted owl nests or pairs, and are intended to eliminate or deflect low disturbances associated with implementation of treatments or crossing routes near the PAC.

Northern Goshawk

- Surveys included areas of suitable habitat based on protocol surveys (2011–2012).
- PACs maintain nesting and foraging habitat for goshawks within their 200-acre PAC and the majority of landscape bordering the PAC remains intact.
- Limited Operating Periods (LOP) (March 1 through September 15) are a 1/4-mile circle around known spotted owl nests or pairs, and are intended to eliminate or deflect low disturbances associated with implementation of treatments or crossing routes near the PAC.

Pacific Marten and Fisher

- Based on protocol level surveys; there has not been a documented Fisher or Marten or den site within the project area
- Habitat excluded from the project based on protection from activities such as the California spotted owl and goshawk PACs, and riparian areas would provide habitat for Fishers and Martens to den, forage and travel.

Pallid bat, Townsend big-eared bat, and Fringe-tailed myotis

- Townsend's big-eared bats are tightly associated with mines, caves or abandoned structures for resting or roosting and riparian water sources for foraging.
- Pallid bats commonly day roost in caves, crevices, mines, and occasionally in hollow trees/snags, crevices in oaks, and snags. They prefer rocky outcrops, cliffs, and crevices with access to open habitats for foraging. Philpott (1997) emphasizes the importance of oak woodlands for foraging for pallid bats. Oaks, 3 inches dbh and greater, would be retained.
- Fringed tailed-myotis roost in snags in early to medium stages of decay (Weller 2001). Snags are protected, plus equipment operators generally avoid snags for two reasons, no economic value and two it requires equipment and time to remove a snag. Management direction is to retain four of the largest snags per acre (SNFPA ROD 2004). To avoid limiting snag retention opportunities, the mitigation is to retain all snags in the project. Myotis are also known to roost in caves, mines, rock crevices, and buildings. Nursery colonies occur in caves and mines and sometimes buildings (Jones et al. 1983) areas where the project is not located.

Bumble bee

- There are opportunities for bees to cope adequately because there are flowering plant species (nectar sources) known to be used by *B. occidentalis* that occur throughout the analysis area.
- Habitats areas with potential habitat not entered are PACs for the California spotted owl and Northern goshawk, and riparian conservation areas.
- Snag retention areas within salvage treatment units and equipment exclusion zones within riparian areas will not experience ground disturbing activities and will provide foraging, nesting, and over wintering opportunities throughout the Sugarloaf Project area.

3.6 Wildlife – Aquatics

3.6.1 Introduction

Important characteristics that influence habitat quality for aquatic species include channel and floodplain configuration, amount of fine sediment in stream substrate, riparian condition, amount and distribution of woody debris, stream flow, water quality, and temperature regime (Furnis and others 1991). Smaller streams, such as many of those found in the Sugarloaf Hazardous Fuels Reduction Project provide important habitat for resident and migratory aquatic species and also influence the quality of habitat in larger, downstream reaches (Chamberlin and others 1991). Waters with little anthropogenic disturbances have been shown to function as biological strong holds and refuges for many fish species. The extent of an area; landscape complexity; the variety and intensity of management-induced and natural disturbances that have occurred in the past, all affect the quality, distribution, and extent of these habitats. Some of these waters may now play a much greater role in supporting aquatic species viability and biodiversity than in the past due to cumulative degradation and loss of other, potentially more biologically rich habitat within associated drainages.

In order to maintain species richness in our forest streams an Aquatic Biological Assessment (BA) was prepared to determine if any species listed by the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service as Endangered, Threatened or Proposed for listing would be affected by the proposed project and would require a BA (table 3-23). The results of the BA showed no listed species and its habitat within the project boundary. Habitat Suitability Criteria (HSC) models were used to determine if available habitat existed in the project boundary.

Table 3-23. Species protection category.

USFWS and NMFS (TES)	USFWS Candidate	Forest Service Sensitive
Those species listed under the Federal *Endangered Species Act*. Threatened species are likely to become endangered throughout all or a significant portion of their range (16 United States Code [USC] 1532). (16 USC 1532). Requires a Biological Assessment (BA) along with consultation with USFWS	A Candidate species is a species for which the service has enough information on file to warrant or propose listing the species as Endangered or Threatened. **Requires Biological Evaluation (BE) no consultation required with USFWS**	Species designated by the Forest Service as needing special management attention because of viability concerns. The Forest Service manages for these species to ensure they will not require listing as Threatened or Endangered. **Requires Biological Evaluation (BE) no consultation required**

USFWS list of species protected by the Endangered Species act can be found in Appendix A of the Sugarloaf Hazardous Fuels Reduction Project's Biological Assessment and Biological Evaluation (BA/BE) for Fish and Wildlife.

The Biological Evaluation (BE) provides a process to review all Forest Service planned, funded, executed, or permitted programs and activities for possible effects on regionally listed Forest Service Sensitive species (FSM 2672.42). The results of the BE found three Forest Service Sensitive species. The Aquatic BA/BE report can be found in the Sugarloaf Hazardous Fuels Reduction Project EIS project folder. No Critical Red-legged frog (CRLF) habitat was in the project but because a nearby population in Oregon creek exists in habitat which is atypical, CRLF habitat site assessments were conducted to ensure no habitat or frogs were present in the Sugarloaf project area (USDA 2012a).

Threatened, endangered, or sensitive aquatic species that may be present based on their preferred habitat and elevation range, and their potential to reside in the Sugarloaf Hazardous Fuels Reduction Project are listed on table 3-24.

Table 3-24. Threatened, endangered, or sensitive aquatic species that may be present in the Plumas National forest, their preferred habitat and elevation range, and their potential to reside in the Sugarloaf Hazardous Fuels Reduction Project.

Species	TES Status	Elevation Range of Habitat	Preferred Habitat	Potential for Project to Affect this Species
California red-legged frog (Rana *draytonia)* CRLF	Threatened	Below 1,525 m (5,000 ft)	Ponds and slow-moving streams	The proposed project is not within critical habitat for the California red-legged frog. An HSC model analyzed for any potential A typical habitat in the project resulted no potential affects. Refer to BA_BE
Central Valley spring-run Chinook salmon (*Oncorhynchus tshawaytsha*)	Threatened	N/A	Central Valley delta and up rivers to man-made and natural barriers	None.
Central Valley steelhead (*Oncorhynchus mykiss*)	Threatened	N/A	Central Valley delta and up rivers to man-made and natural barriers	None.
Foothill yellow-legged frog (Rana *boylii*) FYLF	FS sensitive	Below 1,830 m (6,000 ft)	High gradient streams with cobbles, riffles, and open areas	Project Located within the suitable range of this species and with individual detections in treatment units 235C 221D 44
Pacific pond turtle (Actmemys *marmorata*) PPT	FS sensitive	Below 1,525 m (5,000 ft)	Ponds and slow moving streams	Suitable habitat exists within the project area. No western pond turtle have been sighted in the project area.
Hardhead minnow (*Mylopharodon conocephalus*)	FS sensitive	9-1,465 m (30-4,800 ft)	Sacramento-San Joaquin delta, S. Fork American River	None.
Sierra Nevada yellow-legged frog (Rana *sierra*) SNYLF	Proposed Endangered, Proposed Critical Habitat	Above 1,525 m (5,000 ft)	High elevation lakes, streams, small ponds and meadows	Small populations exists in Dark ravine and individual sightings have been reported in all of its tributaries
Northern leopard frog (*Rana pipiens*)	FS sensitive	From sea level-2,135 m (7,000 ft)	Perennial streams and ponds	None. Incidental historical occurrence for this species on Forest at Riverton and off-Forest in the Lake Tahoe Basin.
Winter-run Chinook Salmon (*Oncorhynchus tshawaytsha*)	Endangered	N/A	Central Valley delta and up rivers to man-made and natural barriers	None.

The following listed fish species are not known to be located on the Plumas National Forest: winter-run Chinook salmon, Central Valley spring-run Chinook salmon, Delta smelt and Central Valley steelhead. The Hardhead minnow and the California red-legged frog are found on the Plumas National Forest. Some areas of the project are in the species elevation range but suitable habitat

required for all life cycle stages is absent within the Sugarloaf project treatment units, therefore, these species, will not be discussed further in this FEIS.

One Proposed Endangered Species, the Sierra Nevada (Mountain) yellow-legged frog (*Rana sierrae),* is present and suitable habitat, including Proposed Critical Habitat exists within the project area. Two Forest Service Sensitive species, the Foothill yellow-legged frog (*Rana boylii*) and the Pacific pond turtle (Emys *marmorata*), occur and suitable habitat is present in the project area. These three species may potentially be affected by the activities proposed under this project. The major difference between these aquatic/riparian associated species is range in elevation. The SN(M)YLF is predominately above 4,400 feet and the FYLF and PPT are below 4,400 feet within the analysis area; however SN(M) YLF are known to occur as low as 3500 feet on the Plumas National Forest (USDA 2014). The SN(M)YLF and its Critical Habitat were listed as a "proposed" by the USFWS on April 25, 2013. Therefore, this species and its habitat is given additional protection measures. Refer to the Aquatic Biological Assessment and Biological Evaluation for further information concerning the above mentioned species. The aquatic analysis looked at potential direct and indirect effects to these species within the project boundary and cumulative effects within 16 sub-watersheds in and around the project boundary.

3.6.2 Analysis Framework: Statute, Regulatory Environment, Forest Plan and Other Direction

The Sugarloaf Hazardous Fuels Reduction Project is designed to fulfill the management direction specified in the 1988 Plumas National Forest Land and Resource Management Plan (PNF LRMP) (USDA 1988a), as amended by the Sierra Nevada Forest Plan Amendment (SNFPA) FSEIS and ROD (USDA 2004c, d). Aquatic habitat management activities are designed to comply with the standards and guidelines as described in the SNFPA FSEIS and ROD (USDA 2004c, d).

Current management direction for threatened, endangered, proposed and sensitive species on the Plumas National Forest can be found in the following documents:

- Code of Federal Regulations (23, 36, 50 CFR)
- Forest Service Manual and Handbooks (FSM/H 1200, 1500, 1700, 2600)
- *Endangered Species Act* (ESA; 1976)
- *National Environmental Policy Act* (NEPA; 1969)
- *National Forest Management Act* (NFMA; 1976)
- Plumas National Forest Land and Resource Management Plan (PNF LRMP; 1988)
- Bald Eagle and Peregrine Falcon Recovery Plans which establish population goals for recovery of these species
- Regional Forester (Region 5) policy and management direction
- Regional Forester (Region 5) Sensitive Plant and Animal Species List (June 10, 1998), with subsequent updates up through Aug 4, 2004
- USFWS Quarterly Species List (updates through August 11, 2004)

- Sierra Nevada Forest Plan Amendment, Final Supplemental Environmental Impact Statement, Record of Decision, January 2004
- Clean Water Act - *Clean Water Act of 1948* (as amended in 1972 and 1987).

The *National Forest Management Act* includes direction to preserve and enhance the diversity of plant and animal communities, including endemic and desirable naturalized plant and animal species, so that the diversity is at least as great as that which would be expected in a natural forest and the diversity of tree species is similar to that existing in the planning area (36 CFR 219.26 and 219.27). One of the key ways this direction is implemented is through the NFMA regulations concerning species viability, (36 CFR 219.19). The viability requirement, under NFMA, is not limited to species identified by the Regional Forester as sensitive. The consultation process, including determinations made in the BABE, any incidental take statements, and/or mandatory terms and conditions, as well as any conservation recommendations are designed to address viability of threatened, endangered and Forest Service sensitive (TES) species.

Forest Service direction for TES species incorporated in this BA/BE can be found in the Forest Service Manual (FSM 2670.31, FSM 2670.32). Information regarding threatened, endangered, proposed and sensitive animals is also obtained through the cooperation of the USFWS and the California Department of Fish and Wildlife (CDFW).

The Plumas National Forest Land and Resource Management Plan (LRMP) provides Forest specific information on how TES species will be managed. These include forest wide goals and policies for Wildlife, Fish and Sensitive Plants (p. 4-4) and Riparian Areas (p. 4-7), Wildlife objectives (p. 4-14, 4-15, and 4-19), forest wide direction and standards and guidelines for Wildlife, Fish and Sensitive Plants (p. 4-29 through 4-32). Management Area specific and species-specific direction and prescriptions will be included in the species discussions below. Direction is also found under other areas (e.g., Timber management) that directly or indirectly affect animal species and/or their habitats. This direction is incorporated by reference. The PNF-LRMP provides management guidelines that incorporate Regional direction for each species. Current TES and wildlife direction can be found in the PNF-LRMP, as amended by SNFPA FSEIS ROD (2004), for Wildlife, Fish, Riparian Ecosystems and riparian-dependent wildlife species.

The Sierra Nevada Forest Plan Amendment (SNFPA) Record of Decision (ROD) Appendix A of the SNFPA ROD (USDA 2004d) describes management direction applicable to Sierra Nevada Forests and presents broad management goals and strategies for addressing the aquatic, riparian, and meadow ecosystems and associated species (USDA 2004d, pgs 32–34) and Riparian Conservation Area and Critical Aquatic Refuge designation and desired conditions (pgs. 42–44). All Applicable Standards and Guidelines for Riparian Conservation Areas and Critical Aquatic Refuges; and Standards and Guidelines associated with the Riparian Conservation Objectives can be found on pages 62–66 (USDA 2004d).

Management direction under the 2004 Framework presents strategies for desired conditions at watershed and landscape scales for aquatic riparian and meadow ecosystems and associated species along with several other resources. Land allocations, specifically riparian conservation areas and critical aquatic refuges that delineate aquatic, riparian, and meadow habitats, are to be managed consistent with the Riparian Conservation Objectives (RCO). The Riparian Conservation Areas have

delineated specific widths in and around water bodies (tables 3-25 and 3-26). Refer to the design criteria for RHCAs and RCAs under the hydrology section and appendix A5 within this document. Critical Aquatic Refuges are areas that have been set aside for known locations of threatened, endangered, or sensitive species refer to appendix A of this report.

Table 3-25. RHCAs 1999 HFQLG – alternative B

Type	Width
Perennial Streams Fish Bearing	300 feet on each side of the stream's bank
Perennial Streams Non Fish bearing ponds and wetlands greater than 1acre	150 feet on each side of stream's bank
Intermittent and ephemeral streams wetlands less than 1 acre	100 feet

Table 3-26. RCAs 2004 Framework – alternatives C and D

Type	Width
Perennial Streams	300 feet on each side of the stream, measured from the bank full edge of the stream
Seasonally Flowing Streams (includes intermittent and ephemeral streams)	150 feet on each side of the stream, measured from bank full edge of the stream.
Streams in Inner Gorge	Top of inner gorge (adjacent slopes >70%gradient
Special Aquatic Features (lakes, wet meadows, bogs, fens, vernal pools and springs	300 feet from edge of feature or riparian vegetation, whichever is greater
Critical Aquatic Refuges	500 to 40,000 acres

3.6.3 Effects Analysis Methodology

Geographic and Temporal Bounds

The analysis for potential direct, indirect, and cumulative effects to habitat suitability and associated species required consideration of varying spatial scales. For the purpose of this FEIS, the direct and indirect analysis areas are unique to species or groups of species requiring similar habitat features. The scale and location of analysis areas reflect fresh water fish assemblages that require large habitat stream reaches featuring mature, multi-canopy forest cover (stream shading) and diverse habitat components such as down large woody material (shelter). The Pacific pond turtle is opportunistic and will use varying habitats. The Sierra Nevada (Mountain) yellow-legged frog and Foothill yellow-legged frog will vary on elevational range and slightly different habitat conditions. However, they utilize a much smaller areas then the PPT and therefore are more vulnerable to change.

A cumulative effect was analyzed using Sixteen HUC 6 watersheds in and around the Sugarloaf Project consisting of a total of 25,982 acres. Generally effects do not extend beyond the physical boundary of a watershed. The larger geographic analysis was chosen to allow for assessing effects to linkages to surrounding habitats and interactions with associated species. To accurately assess effects to aquatics species for direct and indirect impacts the Sugarloaf Project boundary was used. The analysis spatial scales vary so that effects are not untenably amplified or neutralized.

For the purpose of the commercial mechanical treatment areas, the temporal bounds consist of a 5 year horizon for direct effects and a 20–25 year horizon for indirect and cumulative effects. Modeling indicates within this timeframe the treated stands approach stocking levels corresponding with forest growth (i.e., that young forested stands could develop within this timeframe). The period for determining cumulative effects depends on the length of time past effects continue into the future.

Data Sources

- Archival and literature sources including prior fish, amphibian, reptile, and stream survey data from Forest Service aquatic resource records.
- GIS layers to build Habitat Suitability Criteria (HSC) Models: elevation contours, slope and gradient, vegetation stream and lake, and species detections(National Resource Information System [NRIS] layers)
- Site-specific amphibian surveys conducted in Dark Ravine Creek, Slate, Creek, Valley Creek, Port Wine Pond and tributaries of Dark Ravine and Gold Run Creeks using the Fellers and Freel (1995) protocol.
- Site assessments for potentially suitable habitat following the 2007 USFWS CRLF protocol.
- Expert field reconnaissance and observations conducted in 2009, 2010, and 2011.
- Equivalent Road Area (ERAs) as compared to Threshold of Concern (TOC) calculations at analyzed at a sub watershed scale (Hydrology).

Assumptions

The following assumptions are specific to resource analysis for the SN(M)YLF, FYLF, PPT and aquatic (stream and riparian) habitat:

- Aquatic species spend all or significant portions of their life cycles either in or moving through stream and/or riparian habitats.
- Aquatic habitats and associated stream systems can tolerate certain levels of land disturbance. However, widespread or intense land disturbances applied in sensitive areas such as RHCAs/RCAs can substantially impact the immediate area or downstream channel stability and water quality.
- All sub watersheds currently at or predicted to exceed the Threshold of Concern will have the greatest potential for off-site sediment delivery into streams and water bodies (Hydrology).
- Treatments requiring mechanized ground-based equipment will result in the same amount of disturbance effect on aquatic dependent species and habitats, as measured at a sub watershed scale.

Indicators and Measures

Habitat requirements vary by species, there are habitat components and structures that when altered can have a measureable effect on species. Implementation of an action alternative may affect species differently, positively and negatively, or not at all. One indicator (table 3-27) measured

habitat alteration by comparing the existing riparian acres to treated acres by activity proposed under the three action alternatives. Another indicator measured the risk of increase sedimentation to 16 sub watersheds with a risk value ascribed to it. The water quality indicator was measured by temperature. For direct and indirect effects habitat alteration was measured to indicate the potential to affect individuals. Sedimentation and water quality was measured to indicate any potential cumulative effects by alternative.

Table 3-27. Indicators and Measures for Sugarloaf project aquatic analyses.

Type	Width
Perennial Streams	300 feet on each side of the stream, measured from the bank full edge of the stream
Seasonally Flowing Streams (includes intermittent and ephemeral streams)	150 feet on each side of the stream, measured from bank full edge of the stream.
Streams in Inner Gorge	Top of inner gorge (adjacent slopes >70%gradient
Special Aquatic Features (lakes, wet meadows, bogs, fens, vernal pools and springs	300 feet from edge of feature or riparian vegetation, whichever is greater
CARs	500 to 40,000 acres

Water Quality can be assessed by measuring the temperature. Oxygen is more easily dissolved in cold water. Removal of riparian vegetation may lower oxygen concentrations due to increased water temperature resulting from a lack of canopy shade and increased suspended solids resulting from erosion of bare soil. Temperature can increase due to vegetation removal and water quality for aquatics and fish species could decrease. Stable temperatures are critical for aquatic species (Bury 2001). Treatments allowed in the riparian zones may affect temperature or it may not. Pre-surveys indicate healthy cold water temperatures for aquatic species within the Sugarloaf streams.

Habitat alterations may cause behavior changes to aquatic species. Many reptiles and amphibians are dependent on terrestrial habitats in riparian zones as they are on the aquatic habitats for some parts of their life cycles. Riparian corridors are important linkages to other streams or wetlands to complete species life cycles. Vital activities requiring terrestrial riparian habitat are nesting, hibernating, aestivating, foraging, adult residency, and terrestrial dispersal (Gibbons 2003). Unaltered terrestrial linkages within the riparian buffers will provide aquatic stability decreasing amphibian and reptile changes in behavior. Project treatments were used to measure the habitat alterations which may affect behavior changes in aquatic and terrestrial species.

Sedimentation increases can be detrimental to breeding in aquatic species. Aquatic (stream and riparian habitat) systems are easily affected by management activities. Individual events or cumulative effects can have severe effects on aquatic life, channel condition, riparian habitat and water quality (Menning et al. 1996). The Watershed Threshold of Concern (TOC) was used as measures to analyze the effects based on the percentage of TOC. This upper estimate of watershed "tolerance" to land use is called the threshold of concern (TOC). Refer to the Hydrology section within this FEIS for complete list of all 16 sub-watersheds (SWS), and definitions and discussion regarding TOCs. Riparian Management Objectives (RMOs) and Riparian Conservation Objectives (RCOs) were developed by evaluating the effects of the action alternatives effects to biological and physical attributes of aquatic systems.

A ranking of a risk value was associated with the TOC percentages (table 3-31). If the TOC had above 100 percent was “Over” a value of “3” sedimentation probability was given; if the TOC was 88 percent to 99 percent “Approaching” a value of “2” sedimentation probability was given; and if the TOC was under 88 percent “Under” a value of “1” sedimentation probability was given. Watersheds and their associated stream systems can tolerate given levels of land disturbance, but there is a point when land disturbances begin to substantially impact downstream channel stability and water quality (refer to EIS; section on “Hydrology”).

3.6.4 Affected Environment

The PNF LRMP 1988 has general direction requiring the Plumas to improve habitat capability and provide viable populations for all aquatic (stream and riparian) dependent species. The SNFPA FEIS and ROD 2004 and HFQLG 1999 include direction, and standards and guidelines for surveys, limited operating periods (LOPs), habitat monitoring, Riparian Habitat Conservation Area (RHCA) buffers and Riparian Management Objectives (RMOs), Riparian Conservation Areas (RCA) buffers and Riparian Conservation Objectives (RCOs).

The project boundary and treatment units are between 4,000- 5,800 feet elevation. The Plumas National Forest corporate Geographic Information System (PNF GIS) shows a total of 242 miles of streams (perennial, intermittent) in the Sugarloaf Project aquatic analysis area. The Lower Slate Creek watershed and Lost Creek watershed contain suitable habitat for the FYLF and the PPT. There are detections for the FYLF but not for the PPT. The Upper Slate Creek watershed contains suitable habitat for the SN(M)YLF and there are documented small populations and individual detections. Refer to Figure 2-1, CWE Subwatershed With Proposed Treatment Units.

Pacific pond turtle

Analysis Area Occurrence Potential

No Pacific pond turtles have been observed in the Sugarloaf Project aquatic analysis area. The closest sightings of Pacific pond turtles are in Haphazard Creek approximately 6 miles from the Sugarloaf project boundary and 2 miles from southern boundary of the cumulative watershed boundary.

Pacific pond turtles, one of only two species of freshwater turtle native to west coast of the United States, are habitat generalists, occurring in a wide variety of permanent and intermittent aquatic habitats; however, they prefer to have pools nearby to escape from predators while basking on large logs and boulders.

There are six ponds in the cumulative analysis area and one pond that shares west boundary with private property in the project area 310 meters from unit 221. Habitat needs can be varied and could potentially be found in most streams below 1,525 m (5,000 ft) in elevation. Since Pacific pond turtle nests can be within 500 m (550 yards) of a perennial stream course and are generally found on south and southwest facing slopes with a slope angle of 15 degrees or less, adjacent to perennial stream courses that are dominated by grasses and herbaceous annuals with few shrubs, a GIS analysis was performed using these criteria see Appendix A.

Pacific pond turtle nest have been found as far as 400 m from a perennial water body (Reese and Welsh 1997) in open sunny areas on hill slopes, generally with a south to southwest facing aspect. The majority of nest sites discovered to date have been found on dry, well-drained soils with increased amounts of clay and silt and gentle slope less than 15 degree slope. The nests found were dominated by grasses or annuals with few shrubs or trees in the vicinity thus skid roads or small plantations can be ideal for nesting or estivating. Restoration on the Feather River Ranger District Haphazard creek found an estivating turtle in the road by the engineer crew while excavating road several years ago. Based on the natural history of the Pacific pond turtle, there is a risk for disturbance to individuals or their nests essentially year round (table 3-28).

Table 3-28. Pacific pond turtle seasonal movements and potential disturbance.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Disturbance to:												
Nesting individuals												
Eggs												
Overwintering individuals												

Foothill Yellow-legged frog (FYLF)

Analysis area Occurrence Potential

The elevation range of the FYLF extends from near sea level to about 5,000ft. However specimens catalogued in 1955 at the University of California Museum of Vertebrate Zoology show that species has been recorded at elevations as high as 6,000 ft. in Plumas County. In 1994 Jennings and Hayes reported that FYLFs have disappeared from about 45 percent of their historic range in California and 66 percent of their historic range in the Sierra Nevada Mountains.

Suitable habitat within the Sugarloaf aquatic analysis area is within Lost Creek and Lower Slate Creek watersheds. The nearest known sightings of Foothill yellow-legged frog to Sugarloaf Project are in treatment units 30C, 53C and 46A. Surveys have found various life stages suggesting reproduction is occurring. Streams are on an average 6-15 percent gradient, with 4,176 acres of suitable FYLF habitat. Outside the southern project boundary greater numbers of detections have been recorded at the confluence of Lower Slate Creek and its tributary Onion Creek. Breeding is mostly likely occurring in the confluence vicinity with mature frogs dispersing seasonally up into Onion Creek and its tributaries. There are no detections within the Lost Creek watershed.

Surveys: Galloway and Associates, 2005 Contract to survey for amphibians in the Sugarloaf Project area (23 records) May and Associates, 2001 surveyed for amphibians in the Slate project area (4 records). Tartarian 2008-9 (7 records) and Aquatics Crew FRRD 2010, 2011 (15 records).

Sierra Nevada (Mountain) yellow-legged frog (SN(M)YLF)

Analysis Area Occurrence Potential

The Sierra Nevada (Mountain) yellow-legged frog is a USFS Region 5 Sensitive Species. The SN(M)YLF was listed as a “proposed” species and Critical Habitat designated by the USFWS on

April 25, 2013 (Federal Register Vol. 78, No. 80, pp 24472-24514 and pp 24515-24574. Refer to the following excerpt from the Federal Register:

> "MYLFs currently exist in mountain regions of the Sierra Nevada of California. Throughout their range, these species historically inhabited lakes, ponds, marshes, meadows and streams at elevations ranging from 1,370 to 3,660 meters (4,500-1200 feet) (Ca Department of Fish and Game 2011b, ppA-1-A-5). MYLFs are highly aquatic; they are generally not found more than 1 meter (3.3 feet) from water (Stebbins 1951, p 340; Mullally and Cunningham 1956a, p191; Bradford et al. 1993, p886). Adults typically are found sitting on rocks along shoreline, usually where there is little or no vegetation (Mullally and Cunningham 1956a, p191). Although MYLF use a variety of shoreline habitats, both tadpoles and adults are less common at shorelines that drop abruptly to a depth of 2ft than at open shorelines that gently slope up to shallow waters of only 2-3 inches in depth (Mullally and Cunningham 1956a, p191; Jennings and Hayes 1994, p77).
>
> At lower elevations within their historical range, these species are known to be associated with rocky streambeds and wet meadows surrounded by coniferous forests (Zweifel 1955, p237; Zeiner et al. 1988, p88). Streams utilized by adults vary from streams having high gradients and numerous pools, rapids, and small waterfalls, to streams with low gradients and slow flows, marshy edges, and sod banks (Zweifel 1955, p237). Aquatic substrates vary from bedrock to fine sand, rubble (rock fragments), and boulders (Zweifel 1955, p237). MYLFs appear absent from the smallest creeks, probably because these creeks have insufficient depth for aquatic refuge and overwintering habitat (Jennings and Hayes 1994, p77). SN(M)YLF do use stream habitats, especially the remnant populations in the northern part of their range. The current distributions of the SN(M)YLF are restricted primarily to publicly managed lands at high elevations located within National Forests (including Plumas NF) and National Parks."

On the Feather River RD of the PNF, SN(M)YLFs are found in perennial and intermittent streams and ponds, with suitable habitat components, above 3,500 feet in elevation. All vital life history activities for SN(M)YLF, including breeding, foraging, dispersal, and over-wintering, occur in or adjacent to these habitat types (Stebbins 2003, Wengert et al. 2006). Two major watersheds are within the Sugarloaf aquatic analysis area, Lost Creek and Slate Creek. SN(M)YLFs have been found within Upper Slate Creek in step pools within high gradient Rosgen A and B channel type head water streams. Habitat within the Lost Creek and Lower Slate Creek watersheds is more suited to FYLFs and not SN(M)YLFs. Surveys over the past few years have not detected any SN(M)YLFs within the Lost Creek watershed but have detected FYLFs. Surveys have detected a few individual SN(M)YLF within the Lower Slate Creek watershed but it is believed that these are individual "washouts" from Upper Slate Creek and not distinct populations or possible even miss-identified and were FYLFs. Additional surveys are proposed for spring 2014.

A couple of tributaries on Upper Slate Creek have small populations which has been observed from 1995 to 2012. It is speculated that SN(M)YLF are reproducing because various life stages have been observed. Breeding surveys have not been conducted on the existing population and no egg masses have been found to date. The SN(M)YLF detections have been predominately within the streamcourses. A telemetry study conducted on a tributary of Spanish Creek on the PNF showed

SN(M)YLF stayed within 10 m (33 ft) of the edge of the stream during the summer tracking session and within 25m (82 ft) of the edge of the stream during the winter tracking session (Wengert et al. 2006). SN(M)YLF have used terrestrial corridors in the riparian zone greater than 100 meters while migrating between high mountain lakes (Pope 2010).

Surveys Galloway and Associates, 2005 Contract to survey for amphibians in the Sugarloaf Project area (23 records) May and Associates, 2001 surveyed for amphibians in the Slate project area (4 records). Tartarian 2008-9 (7 records) and Aquatics Crew, FRRD 2010, and 2011 (15 records).

3.6.5 Environmental Consequences

The Feather River Aquatic and Hydrology department identified riparian areas with heavy concentrations of fuels due to legacy fire suppression. Fire suppression has resulted in RHCA/RCA conditions that are no longer consistent with the RMOs/RCOs. Fuels reduction treatments are proposed to be implemented within the RHCAs and RCAs as a result. A buffering system specifically geared towards the proposed treatments of the units surrounding RHCAs (HFQLG 1999) and RCAs (SNFPA 2004). Table 3-29 shows the different riparian habitat areas and associated treatments based on the horizontal buffer width allowances. The Scientific Analysis Team (SAT) guidelines include ten Riparian Management Objectives (RMOs) for RHCAs and 6 Objectives for RCOs for RCAs. To describe how this project's proposed timber harvest and fire and fuel treatments meet these objectives, an RMO and RCO analysis was accomplished and is located in the project file.

Direct and Indirect effects were analyzed by alternative treatments in the Riparian areas adhering to the SAT guidelines in the above table 3-2. Refer to Table 2-5; "Design Criteria for RHCAs and RCAs" and Appendix A5 "RMO Analysis" for modified buffer widths. Table 3-29 compares the treated riparian within each treatment proposed under the three Sugarloaf action alternatives. The action treatments have the potential to cause potential short-term impacts to species habitat and to individuals. However, with consideration for unit placement and proposed treatment, mitigations, and design features the potential short-term impacts are avoided. Riparian acres were calculated and mapped using GIS and GPS, by FRRD hydrology crew. Units with heavy concentrations of fuels were allowed to have treatments within the riparian acres. Short-term impacts from implementation of treatments (such as sedimentation or underburns) had to be weighed against long-term benefits such as reducing road density, increasing water table, reducing fuel loads and fire severity and minimizing any potential for habitat loss.

The Sugarloaf Project alternatives B, C, and D propose various treatments to reduce fuels and improve forest health, within the full Riparian Habitat Conservation Areas (RHCAs) or Riparian Conservation Areas (RCAs). Alternative B proposes the following 3 treatments: 35 acres of hand cut/pile/burn (HCPB); 42 acres of mastication (Mast); and 396 acres of underburn (UB); alternative C proposes the following 5 treatments: 240 acres HCPB; 47 acres Radial thinning (RT); 46 acres Mast; 33 acres Mechanical Thinning (MT) and 5 acres of underburn; and alternative D also proposes the following 5 treatments: 234 acres HCPB; 25 acres of RT; 48 acres of Mast; 19 acres of MT; and 14 acres of UB.

Table 3-29. Treatments in RCA/RHCAs by alternative

Treatments	Alternative B	Alternative C	Alternative D
	Acres proposed		
HCPB	35	240	234
Mastication	42	46	48
Mechanical Thinning	0	33	19
Radial Thinning	0	47	25
Underburn	396	5	14

Alternative A – Direct, Indirect and Cumulative Effects

Sierra Nevada (Mountain) yellow-legged frog, Foothill Yellow-legged Frog and Western Pond Turtle

Alternative A is the No Action alternative, in which no project activities would be proposed. The analysis of the No Action Alternative provides reviewers disclosure of effects of the "No Action" to compare the magnitude of environmental effects of the action alternatives. No project related ground, vegetative, or wildlife disturbance would occur. No road reconstruction or decommissioning in connection with this project would occur. With this alternative, no fuel reduction activities would take place in the Sugarloaf Hazardous Fuels Reduction Project area at this time. Fuels would continue to accumulate and fire hazards would continue to increase. Insect and disease mortality would continue to take toll on trees with low vigor. Trees would continue to compete for necessary resources like water, nutrients, and sunlight creating dead, dying or diseased trees or shrubs as the result of inter-tree competition. Less water will be available for streams as dense forest vegetation continue to grow and expand and utilize water resources. Aquatic habitat may undergo significant disturbance if fuels continue to accumulate over time subjecting species to increased sedimentations, increase turbidity, and solar radiation. Species could individually suffer and burn up due to catastrophic fire events. Aquatic species may not have adequate food supply due to suspended particles in streams causing mortality to macro invertebrates. Habitat alterations would not occur quickly as in the proposed actions and therefore would not result in species behavioral changes but because of fire suppression normal succession will not occur and overtime species behavior will begin respond to its surrounding environment. Refer to the Fuels and Fire, and Forest Vegetation sections within this document.

The existing TOCs in subwatershed (SWS) #5 is "Approaching" and SWS #15 is "Over" threshold of concern (table 3-29). A catastrophic fire event would increase sediment into the streams adding stress to watersheds with existing concerns. If there is a catastrophic fire as a result of not implementing this project, then the cumulative effects would potentially be much greater than with implementation of alternatives B, C, or D depending on fire severity and the number of moist riparian areas affected versus lower order streams which tend to burn hotter, thus increasing adverse effects to aquatic species. Refer to the Fuels and Fire, and Forest Vegetation sections within this document.

Alternatives B, C and D - Direct and Indirect Effects

Riparian and Aquatic Habitat

Land management activities such as fuels reduction and prescribed burning have a greater potential to adversely affect amphibians than other vertebrates because (1) they use both terrestrial

and aquatic habitats with cover requirements often differing by life history stage, (2) their body temperature is not internally regulated, (3) they breathe through their skin extensively, and (4) they have low mobility. The degree to which individuals can be affected by land management activities depends in largely on the intensity of these activities in and immediately adjacent to riparian areas. "The desired condition is to provide sustainable aquatic, riparian, and meadow compositions, structures and functions including processes within desired ranges of variability, well-distributed habitat for desired plant, invertebrate, and vertebrate species and connectivity among watersheds (USDA 2004d)."

"In most habitats, plant communities determine the physical structure of the environment, and therefore, have a considerable influence on the distributions and interaction of animal species (Tews et al. 2004)." Within Riparian zones (RHCAs and RCAs), terrestrial plants provide shade, regulate microclimates, and contribute pieces of large woody debris that create and enhance habitat complexity; riparian plant species also provide organic materials that serve as food for aquatic organisms such macro invertebrates (Welsh et al. 1998). Riparian vegetation reduces influences of solar radiation, precipitation, and wind speed; it has the potential to have an effect on moisture and temperature regimes (Macdonald et al. 2003). Water temperature directly affects dissolved oxygen and pH. Water temperature can influence types, densities and distribution of aquatic species e.g., macro invertebrates and algal assemblages (Berg and Roby 2002). Thus, depending on the amount of alteration, changes in riparian vegetative composition and structure that fall outside of the range of natural variability have the potential to influence water temperature regimes (fluctuations in temperatures in a 24 hour period), affect macro invertebrate assemblages, and effect aquatic species presence and reproduction. Studies show that much of the change in microclimate takes place within about one tree height in distance of the edge (Macdonald et al. 2003).

Handcut/Pile/Burn: Negative direct and indirect effects under alternative B, Hand Cut Pile Burn treatments have the potential to cause direct/indirect effects by increasing mortality to individuals by hand crews by crushing, burning or causing injury with tools to semi-aquatic species. Alternative B would treat 35.2%; alternative C 67% and alternative D 72 %. Alternative D is altering the greatest amount of acres. The risk of negative direct/indirect effects is higher in alternative D.

Mastication: Mastication units have the potential to directly/indirectly increase mortality to frogs and turtles using the riparian areas greater than the treatment buffer. Frogs and turtles may leave riparian areas in response to the vibration of the machinery. Environmental changes can cause stress to individuals. Stressed individuals can lead to behavior changes affecting their reproduction, critical foraging or health. Semi-aquatic and terrestrial species may delay seasonal movements because openings in the riparian corridor can attract predators which increase the risk of injury or death to individuals. Percent treatment by mastication is similar for all action alternatives. Mastication units would treat 66% in alternative B; 65% in alternative C and 68% in alternative D of the existing riparian acres.

Underburn: Underburn units have the potential to directly/indirectly affect semi-aquatic and terrestrial species by hand crews crushing burning individuals. Indirectly the smoke from the underburn can accumulate and linger for days causing mortality. Amphibians use subcutaneous respiration and are very vulnerable to smoke pollution. Alternative B would treat 100% and both alternative C and alternative D treat less than 1% of the existing riparian acres. Alternative B has a

very high negative risk value, whereas alternatives C and D are low negative risk and a high long-term benefit.

Implementation of the Action Alternative treatments would reduce and remove fuel accumulation and decrease fire hazards. Trees with low vigor would be removed creating openings for grasses, forbes, brush species and riparian trees. Aquatic habitat would not be affected by increase of sedimentations, turbidity and solar radiation caused by a catastrophic fire. Semi-aquatic species may not directly suffer from injuries caused by high intensity fires. Riparian vegetation would have added nutrients from the proposed underburns.

Alternatives B, C and D - Direct and Indirect Effects

Pacific pond turtle, Foothill yellow-legged frog and Sierra Nevada yellow-legged frog

Direct effects are not expected based on the following project design features, protection measures and mitigations: (1) Multiple surveys were conducted over the past 5 years to determine location of individual species, populations of species, and suitable habitat; (2) Suitable habitat is protected with RHCAs and RCAs buffers, widths depending on species present and location, and proposed treatments; (3) Full RHCA/RCA buffers are applied for known SN(M)YLF populations; (4) Limited Operating Periods (LOPs) are applied were necessary (no activity March 1 through October 15 or the first wetting rain {continuous rain and not drying out after 72 hours}); (5) Additional surveys will be conducted prior to activities for potential additional protection needs); (6) Mechanical treatments are predominately on ridge-tops which is not suitable habitat; and (7) Best Management Practices (BMPs) will be in place to protect hydrological resources.

Pacific pond turtle

The amount GIS mapped of Pacific pond turtle suitable habitat in the project units resulted in 41 miles of perennial streams; 60 miles of intermittent streams; and 110 miles of ephemeral steams. Turtles using sugarloaf streams are protected by the appropriate stream buffers. Treatments in riparian areas that may result in habitat alteration are very minimal (table 3-30). Direct and indirect effects would be short term. The short term is one to two seasons. The direct and indirect benefits have a greater potential to increase habitat health and resilience. The proposed decommission of roads may provide an increase in nesting habitat. The amount of nesting habitat is very limited and identified in five treatment units. Sugarloaf treatment units 221D and 235C have no treatments proposed in all action alternatives (alternatives B, C, and D), and units 900 and 901 have underburn treatments proposed in alternative B, C, and D and the direct affects have the potential to burn and increase in ground temperature which may affect soil surrounding buried turtle eggs causing embryonic mortality. Alternative B, C, and D have mastication treatments in the riparian area and alternative C and D have Mechanical and Radial thinning these treatments can cause direct mortality by being crushed from the weight of the machinery. The potential to affect PPT habitat indirectly by changing their habitat on the short term can result from all the alternatives.

Table 3-30. Suitable habitat with known or suspected presences with treatment.

Nesting Habitat	Alt B	Alt D	Alt C	Comments
	Treatments			
900 & 901	Under burn	Under burn	Under burn	.5 miles to Barnard Diggings Pond
235 C	No treatment	No treatment	No treatment	.35 miles from valley creek
221 D	No treatment	No treatment	No treatment	310 meters from pond
44	No treatment	No treatment	Mechanical Thin	.3 acres unit

Foothill yellow-legged frog and Sierra Nevada (Mountain) yellow-legged frog

The application of design criteria and mitigation measures would protect the physical structure of the stream channel and the riparian plant communities supporting the extent and habitat complexity for the FYLF and the SN(M)YLF. The potential alterations to current water temperature regimes would be mitigated by restricting all fuels and vegetation treatment to outside Riparian Conservation Areas (RCAs) where historic or known macro invertebrate assemblages are present. This RCA reserve will protect habitats that allow amphibians the ability to complete their entire life stages.

Alternatives B and D propose 10.5 miles of temporary system roads be obliterated and .07 mile of system road to be decommissioned. The roads proposed for restoration are unpaved and unpaved roads are often considered the primary source of sedimentation to stream channels (MacDonald and Coe 2007). Obliterating the proposed roads and decommissioning small sections of two system roads would decrease road density which is extremely high in the Sugarloaf boundary. Mortality of aquatic species using near stream roads for crossings and or linkages to other habitats may decrease.

Alternative B has the probability to increase sediment into the Sugarloaf streams in SWS #5, #6, #8 and # 15. Alternative C has the probability to increase sediment into SWS #1 and shares the same risks as alternative B. Alternative D shares the same sedimentation risks as Alternative B. The impacts of fine sediments have been identified as contributors to the degradation of freshwater habitats and impacts on aquatic biota (Kreutzweiser et al. 2004) (table 3-31). PPT and FYLF may experience direct mortality from increased turbidity causing limited oxygen (table 3-32) exchange which can cause the macro invertebrate assemblage to change or decline affecting the overall health of the stream and the species who consume them. Alterations in the RHCAs and RCO may indirectly affect water temperature (table 3-32). Currently the water temperatures are considered high quality. Our 2011 stream data showed temperatures in the project streams to be healthy. Decreases in canopy cover may cause temperatures to increase which can affect stream health. The above species would have to migrate to reaches of the stream not affected by increased sediment which may cause indirect impacts by increasing the risk of predation or starvation.

Table 3-31. Threshold of Concern and Sediment Increase Probability.

SWS #	% TOC Alternative A		% TOC Alternative B		% TOC Alternative C		% TOC Alternative D		Species Detections	Unit #
	w/sediment value									
1	87%	1	88%	1	92%	2	86%	1		
2	29%	1	35%	1	43%	1	36%	1	SNYLF	577B 223B
3	27%	1	48%	1	48%	1	48%	1		
4	30%	1	55%	1	55%	1	55%	1		
5	95%	2	104%	3	101%	3	101%	3		
6	72%	1	136%	3	135%	3	134%	3	SNYLF	222C
7	83%	1	84%	1	84%	1	84%	1		
8	69%	1	128%	3	126%	3	128%	3		
9	43%	1	44%	1	47%	1	44%	1		
10	34%	1	73%	1	69%	1	69%	1		
11	70%	1	82%	1	84%	1	84%	1		
12	29%	1	31%	1	34%	1	33%	1		
13	33%	1	61%	1	80%	1	64%	1	FYLF	45A
14	41%	1	61%	1	51%	1	53%	1	FYLF	53C
15	136%	3	162%	3	155%	3	159%	3	FYLF	30C
16	24%	1	33%	1	25%	1	29%	1		

Table 3-32. Habitat alterations by species by alternative.

Sugarloaf Streams and Pond	Turbidity Clear = 1 Turbid = 5	Temperature Celsius C	Species Present	RHCA Treatments Alternatives B,C, and D
Dark Ravine	1	9°	**SNYLF**	No Treatments **Aquatic Reserve**
Rabbit Creek	1	11°	ONMY PSRE	Masticate and Under burn
Slate Creek	1	11°	ONMY	Group Selection and Under burn
Pats Gulch	1	11°	ONMY	Under Burn
Tributary into Slate	1	13°	ONMY	No Treatments

***SNYL=Sierra Nevada (Mountain) yellow-legged frog; ONMY=rainbow trout; and PSRE=Pacific tree frog**

Sierra Nevada (Mountain) yellow-legged frog

The streams within Lost Creek and Lower Slate Creek watersheds are not considered suitable habitat for the SN(M)YLF based habitat quality. Upper Slate Creek is suitable habitat for the SN(M)YLF and has documented individuals and populations. Suitable habitat consists of moderate to high gradient and tributaries do not have fine sediment due to high gradient, high cascades and falls and trench pools, and steep pool systems. Bank stability is very high due to bedrock and boulder substrate. Slate Creek is fish-bearing however its tributaries are non-fishbearing due to aquatic

barriers. Upper Slate Creek is within "proposed" Critical Habitat for the SN(M)YLF. In addition to the RHCA/RCA buffers (see table 3-23 and 3-24) established for streams in general, there are wider buffers for known SN(M)YLF populations to avoid direct effects (harm to individuals and adverse modification of Proposed Critical Habitat) and project treatments were modified to avoid indirect effects (sedimentation).

Rabbit creek: Rabbit Creek is located in Sub-watershed #6. Presently it is under TOC, however, all action alternatives bring it over TOC for the short-term. It is expected that the short-term impacts of the proposed treatments, especially for alternative C and D will be "brief" in nature and the proposed treatments reduce the TOC for the long-term (refer to Hydrology section within this document).

Rabbit Creek begins at 5,200 foot elevation and ends at the confluence of Slate Creek at about 4,200 feet. East Branch Creek feeds into Rabbit Creek. The confluence of the two streams is located in the town of LaPorte at an elevation of 5,000 feet. The public use in this area is very high. Off road vehicle use, and recreational mining, as well as the possibility of contaminants reaching the stream may have had negative impacts on the Sierra Nevada (Mountain) yellow-legged frog in this area. Only the confluence of Rabbit Creek with Slate Creek is within "proposed" Critical Habitat (P-CH) for the SN(M)YLF. The East Branch Creek is not within P-CH.

Four historic detections of SN(M)YLF have been found on Rabbit Creek and on small tributaries of Rabbit Creek. One of the four detections occurred on East Branch, 750 feet from the confluence of Rabbit Creek in 1950. The 1950 detection was found on private land in the town of LaPorte. Two detections were recorded on May 14, 1960 on a tributary of Rabbit Creek at 4900 feet elevation. Amphibian surveys conducted in 2005, 2006, 2009, and 2011 did not result in any detection in the Rabbit Creek and East Branch drainages. Some of these detections are greater than 60 years. The most recent detection was 12 years ago. It is expected that any population within Rabbit Creek had been extirpated due to the intensive past and present land use (town site, mining, OHV, logging, etc.) on private and public lands. Stream Condition Inventory (SCI) surveys on Rabbit Creek has shown high sedimentation values. All of the above treatments will have LOP's in place for the remote chance of impacting any amphibian individuals. The small portion of Rabbit Creek, at the confluence of Slate Creek that is within P-CH has a wide buffer with no treatment proposed. To further provide protection for SN(M)YLF surveys would be conducted in the Sugarloaf treatments units listed in table 3-33 before implementation of the Sugarloaf Project. If any SN(M)YLF are found a District Biologist will assess the area and implement a larger buffer, or modify or drop units to ensure the safety of any individuals or populations of SN(M)YLF detected.

Table 3-33. Rabbit Creek-comparison of treatments in RHCAs/RCAs by action alternative.

	Alternative B		Alternative C			Alternative D		
Unit #	Treatment in RHCA	Acres	Unit#	Treatment in RCA	Acres	Unit #	Treatment in RCA	Acres
14 B	HCPB	0	14 B	UB	0	14 B	UB	6.35
14 F	Masticate	2.0	14 F	Masticate	2.0		Masticate	2.00
21C	Masticate	0	21C	Mechanical	0	21C	Masticate	.70
27A	GS	0	27A	HCPB	8.8	27A	HCPB	9.35
27B	HCPB	6.8	27B	UB	6.8		UB	0
27 D	Mechanical thin	0	27 D	Masticate	2.33	27 D	HCBB	3.80
27 E	Group selection	0	27 E	No treatment	0	27 E	HCPB	36.10
221A	Masticate	10.7	221A	Masticate	10.7	221A	Masticate	10.7
221B	HCPB	8.4	221B	HCPB	8.4	221B	HCPB	8.4
221C	HCPB	2.41	221C	HCPB	2.41	221C	HCPB	2.41
222A	UB/only	19.4	222A	UB/only	19.4	222A	HCPB	14.9
222C	Radial thin	0	222C	Mechanical	0	222C	Radial thin	0
224	Masticate	4.6	224	Masticate	4.6	224	Masticate	5.3

***Dark Ravine*:** Dark Ravine is located in subwatersheds #3 and 4. Presently it is under TOC (No action-Alternative A), and they remain under TOC for all action alternatives. Although the TOC does increase slightly under the action alternatives, it is expected that the proposed treatments, especially for alternative C and D for the short-term impacts will be "brief" in nature and the proposed treatments reduce the TOC even further for the long-term (refer to Hydrology section within this document).

The Dark Ravine population of SN(M)YLF will be protected by an Aquatic Reserve. The reserve was established to protect the SN(M)YLF and its breeding and dispersal habitat. The Aquatic Reserve includes full RHCA/RCA buffers, 300 foot for perennial and 150 feet for intermittent, applied to Dark ravine and its tributaries. Since all SN(M)YLF detections have been within the stream course it is determined that these buffers are more than adequate to ensure that there is no effect to individual frogs or frog populations or its habitat. In addition, proposed mechanical treatments are confined to ridge-tops and meet all BMPs.

***Wisconsin Ravine*:** Wisconsin Ravine is located in subwatersheds #3 and 4. Presently it is under TOC (No action-Alternative A), and they will remain under TOC for all action alternatives. Although the TOC does increase slightly under the action alternatives, it is expected that the proposed treatments, especially for alternative C and D for the short-term impacts will be "brief" in nature and the proposed treatments reduce the TOC even further for the long-term (refer to Hydrology section within this document).

A single detection in July of 2001 was made on Wisconsin Ravine, 1,500 feet from the Sugarloaf Project boundary. The elevation of this detection was at 4,800 feet. There is a small amount mechanical treatment for alternative B, and of mastication and underburn for alternative C and D, at the headwaters of the ravine but it is on the opposite side of a moderate-use system road that runs along the ravine and not expected to adversely affect the stream.

No-name Tributary: No-name Tributary is located in subwatersheds #2. Presently it is under TOC (No action-Alternative A), and they will remain under TOC for all action alternatives. Although the TOC does increase slightly under the action alternatives, it is expected that the proposed treatments, especially for alternative C and D for the short-term impacts will be "brief" in nature and the proposed treatments will reduce the TOC even further for the long-term (refer to Hydrology section within this document).

There is a historical detection of a single frog at the confluence of a No-name tributary and Upper Slate Creek, just southwest of Bellevue. However, there were no detections within No-name tributary and the habitat was considered not suitable due to the creek being predominately ephemeral in nature. There are proposed treatments just north of the No-name tributary which vary from Group Selection and mechanical thin under alternative B to Handcut/pile/burn under alternatives C and D. Treatments are on the ridgetop on the other-side of a road from the No-name tributary and two roads upslope from Upper Slate Creek. Therefore the tributary did not require any buffers for treatments. Adverse effects are not expected.

There are handcut/pile/burn and underburn treatments proposed on the ridge-top between Dark Ravine and No-named Tributary. Sedimentation discharge is not expected to be a concern, therefore these treatments are not expected to effect the SN(M)YLF.

To further provide protection for SN(M)YLF surveys would be conducted in the Sugarloaf treatments units in table 3-34 before implementation of the Sugarloaf Project. If any SN(M)YLF are found during implementation a Feather River Ranger District Biologist will assess the area and implement a larger buffer to ensure the safety of the individual or individuals SN(M)YLF found.

Table 3-34. Alternatives – Cumulative Effects

Indicators	Alternative B	Alternative C	Alternative D
Water quality increases due to road improvements	Road drainages will increase water quality	Road improvements would not occur no change water quality	Water quality would increase
Subwatersheds over TOC	SWS 15 5,6,8, over threshold TOC%	5, 6, & 8 over TOC%	6,8,15
Subwatersheds at TOC	SWS 11		
Subwatersheds decrease due to implementation of BMP's and Riparian habitat improvements	5, 11	5	5, 11
Subwatersheds TOC increase but not at risk		13	13
Riparian Conditions improved	yes	yes	
Timber vegetation to reduce catastrophic fires decrease	yes	yes	yes

Cumulative Effects for Alternatives B, C, and D

A cumulative effect is the effect on the environment that results from the incremental consequence of an action when added to the effects of other past, present, and reasonably foreseeable

future actions. The cumulative effects analysis presented here for aquatic dependent species considers the effects of this project when combined with past, present, and foreseeable future actions and events. Past land disturbances within the proposed project area were considered if they had the potential to influence species population dynamics and or potential habitat. Similarly, future land disturbances were considered based on their probability of influencing species populations and or aquatic community components. Due to the uncertainty of future anthropogenic disturbance in the affected watershed, the temporal scale for this analysis is limited to approximately 5 years.

Past Disturbances: Based on historic accounts, one major cause in the decline of Pacific pond turtle populations was due to extensive commercial harvest of the species as a food source. During the 1870s to the 1930s millions of turtles were harvested and sold in San Francisco markets for human consumption (Ashton et al. 1997). 1980 saw a ban on the sale or exhibition of native reptiles and amphibians but illegal collection of turtles occurs. The release of non-native species especially the Red eared slider which can carry detrimental diseases to native turtles caused decreases in populations of Pacific pond turtles. Education on the implications of releasing non-native species is somewhat thwarting the problem but it is still a future concern among biologists. Historic mining activities caused the following (USDA 2013):

- Baren, exposed hillslopes affected by hydraulic mining activities of the late 19th century have not stabilized or re-vegetated
- Hydraulic mine sites within the project area are concentrated in the Rabbit Creek watershed around LaPorte (subwatersheds 5, 6, and 8) and in the area of Secret Diggings (subwatershed 15)
- Historic mining activities caused channel degradation with incised channels, disconnected from the flood plains, increased sediment delivery into streams channels
- Road densities within the project area are well above the desired condition with the some of the highest densities existing in the subwatersheds listed above.

Present Disturbances: As in the past, an anthropogenic disturbance on private and federal lands within the Sugarloaf Hazardous Fuels Reduction Project area presently includes timber harvest. Dispersed camping, hunting, and off highway vehicle use will continue on the Feather River Ranger District which may cause disturbances in SN(M)YLF, FYLF and PPT, life stages resulting in behavior changes or mortality. The district hydrologist found the following (USDA 2013):

- Watersheds and their associated stream systems can absorb some level of land disturbance without causing unacceptable effects to beneficial uses of water. However, there is a point where additive or synergistic effects of land use activities would cause a watershed to become highly susceptible to cumulative effects.
- The threshold of concern is an indicator of increased risk of significant adverse cumulative effects potentially occurring within a watershed.

- This upper estimate of watershed "tolerance" to land use is described as the threshold of concern (TOC). When the sum of disturbances exceeds the TOC, water quality may be impaired for established beneficial uses, such as aquatic habitat.

- Historic hydraulic and in-channel mining activities have degraded channel conditions and have likely resulted in an impact to beneficial uses of water within these watersheds, particularly coldwater aquatic habitat.

Foreseeable Future Disturbances: Pacific pond turtle nests have been found as far as 500 m from the stream (Bondi 2008) far exceeding traditionally protected buffer zones afforded under the provisions of the Riparian Conservation Area widths, established under Record of Decision for the Sierra Nevada Forest Plan Amendment final supplemental Environmental Impact Statement (USDA 2004c). Thus, because Pacific pond turtles travel into upland environs frequently and often times for prolonged periods of time, they are susceptible to ground disturbing activities such as timber harvest, fuels reduction projects, and OHV uses.

Any timber activities being planned in the future by the USDA Forest Service will follow the standards and guidelines established under the Sierra Nevada Forest Plan Amendment (USDA 2004d). Under these standards and guidelines, the effects of future sales in the project area are expected to maintain and restore the species composition and structural diversity of plant and animal communities in riparian areas and promote the growth of larger trees that would eventually contribute large down woody debris to the Riparian Conservation Areas sooner than would have otherwise occurred.

The ERA analysis completed by the district hydrologist found that for alternative B and C, 16 subwatersheds saw increases in TOP percentages, and the same three subwatersheds that went over threshold in alternative B are over threshold in alternative C also due to the proposed activities of this project. In general, the increases in TOC percentage, however, are slightly moderately lower than those of alternative B.

Alternative D has increases in the TOC percentage in fifteen subwatersheds and a decrease in TOC percentage in one subwatershed due to the road density reductions. Proposed treatments within RCAs would follow the same criteria as those utilized in Alternative C and would improve riparian conditions locally if implemented properly. It is less likely that implementation of the Sugarloaf Hazardous Fuels Reduction Project action alternatives would exacerbate past, present, or future affects to Sierra Nevada (Mountain) yellow-legged frog, Foothill yellow-legged frog and Pacific pond turtle populations or habitats.

Determination of Effects for Alternatives A, B, C and D

The proposed activities within the Sugarloaf Hazardous Fuels Reduction Project may impact individuals of Pacific pond turtles and Foothill yellow-legged frog but is not likely to cause a trend toward Federal listing or a loss of viability. Direct effects are expected to be unlikely. Indirect and cumulative effects are expected to be low by adhering to management directions, standards and guidelines such as Riparian Management Objectives (RMOs), Riparian Habitat Conservation Areas (RHCAs)/Riparian Conservation Areas (RCAs), Best Management Practices (BMPs), mitigations, and resource protection and design features. The Sierra Nevada yellow -legged frogs and its known

habitat would be protected by the Aquatic Reserve, therefore the project will not affect the species and there would be no adverse modification of Proposed Critical Habitat. Refer to table 3-35.

- Pacific pond turtles have never been seen in the project units.
- The Protection measures RHCAs and RCAs and assigned buffers would minimize adverse effects to aquatic habitats due to sediment delivery to stream channels, and possible crushing of turtles, and frogs or burning from project treatments.
- All action alternatives propose an aquatic reserve with no treatments allowed, therefor no direct or indirect effects within the RCA to the known population of SN(M)YLF's.
- Rabbit Creek RCA/RHCA treatments would improve SN(M)YLF habitat. Mitigations would be in place if any SN(M)YLF individuals are found before or during implementations.
- The effects of the No Action alternative as compared to alternative B, C, and D would have an increase in long term disturbances than the short term effects from implementation of the other alternatives because hazardous fuels would be removed under the direction of Best Management Practices and adhering to our Standard and Guides.
- If a new population of TES frogs or turtles is found, protection measures would be applied such as LOPS to protect species.

Table 3-35. Effects determinations by species

Species	Alternative A	Alternative B	Alternative C	Alternative D
Sierra Mountain yellow-legged frog Rana *sierrae*	Will not affect	Will not affect	Will not affect	Will not affect
Pacific pond turtle *Actimenys momorata*	Will not affect	May affect individual*	May affect individual*	May affect individual*
Foothill yellow-legged frog	Will not affect	May affect individual*	May affect individual*	May affect individual*

NOTE: *Not likely to result in trend toward Federal listing of viability.

3.7 Hydrology

3.7.1 Introduction

Protection of water quality and quantity is an important part of the Forest Service's mission (Forest Service Strategic Plan for 2007 to 2012, July 2007). Management activities on National Forest System (NFS) lands must be planned and implemented to protect the hydrologic functions of forest watersheds, including the volume, timing, and quality of streamflow. The *Clean Water Act of 1948* (as amended in 1972 and 1987) establishes as federal policy the control of point and non-point source pollution and assigns the States primary responsibility over control of water pollution. The Forest Service is required to protect and enhance existing and potential beneficial uses during water quality planning (California Regional Water Quality Control Board [CRWQCB], 1998). Compliance with the *Clean Water Act* by National Forests in California is achieved under state law (see below). Beneficial uses are defined under California State law in order to protect against degradation of water resources and to meet state water quality objectives. The 1988 Plumas National Forest Land and Resource

Management Plan states: "maintain or, where necessary, improve water quality using Best Management Practices (BMPs)." BMPs are procedures, techniques, and mitigation measures that are incorporated in all Plumas National Forest actions to protect water resources and prevent or diminish adverse effects to water quality. Subsequent Forest Plan standards and guides state: "implement BMPs to meet water quality objectives and improve the quality of surface water on the Forest."

This report utilizes the Equivalent Roaded Acres (ERA) model to assess cumulative watershed effects (USDA 1988a). ERA coefficients are used to estimate the effect of management activities such as timber harvest, pile burning, and underburning comparable to the effect of a road in terms of altering surface runoff patterns and timing. Watersheds and their associated stream systems can absorb some level of land disturbance without causing unacceptable effects to beneficial uses of water. However, there is a point where additive or synergistic effects of land use activities would cause a watershed to become highly susceptible to cumulative effects. For the Forest Service ERA model, the estimated upper limit of watershed tolerance is called the threshold of concern (TOC). The TOC does not represent an exact level of disturbance above which cumulative watershed effects will occur. Rather, it serves as an indicator of increased risk of significant adverse cumulative effects occurring within a watershed. The land management activities proposed under this project have the potential to affect watershed resources in a beneficial, indifferent, or adverse manner, either through direct, indirect, or cumulative effects, as described in detail below.

3.7.2 Analysis Framework: Statute, Regulatory Environment, Forest Plan and Other Direction

The Sugarloaf Hazardous Fuels Reduction Project is designed to fulfill the management direction specified in the 1988 Plumas National Forest Land and Resource Management Plan (PNF LRMP) (USDA 1988a), as amended by Sierra Nevada Forest Plan Amendment (SNFPA) FSEIS and ROD (USDA 2004c, d). Management activities are designed to comply with the standards and guidelines as described in the SNFPA FSEIS and ROD (USDA 2004c, d).

Organic Administration Act of 1897 - This act emphasizes that the Forest Reserves, currently known as National Forests, were created to improve and protect the forests within their boundaries; to secure favorable water flows; and to furnish a continuous supply of timber for the use and necessities of the citizens of the United States.

Clean Water Act - *Clean Water Act of 1948* (as amended in 1972 and 1987) establishes as federal policy the control of both point and non-point pollution and assigns to the States the primary responsibility for control of water pollution.

National Forest Management Act – The *National Forest Management Act* (NFMA) of 1976 amended the *Forest and Rangeland Renewable Resources Planning Act of 1974*. This authority requires the maintenance of productivity of the land and the protection and, where appropriate, the improvement of the quality of soil and water resources. The Act specifies that substantial and permanent impairment of productivity must be avoided.

State Water Quality Management Plan - Non-point source pollution on Plumas National Forest has been managed for the past 12 years through the water quality management program contained in

Water Quality Management for Forest System Lands in California (USDA 2000c). The Best Management Practices (BMPs) contained in that document have recently been improved and replaced by the BMPs presented in a Region 5 amendment to the Forest Service Handbook (see below). The 2000 State Water Quality Management Plan contains the 1981 Management Agency Agreement (MAA) between the California State Water Resources Control Board and the USDA, Forest Service. The State Board has designated the Forest Service as the management agency for all activities on National Forest lands.

Region 5 2011 Amendment to the Forest Service Soil and Water Conservation Handbook - The Pacific Southwest Region (Region 5) of USDA-Forest Service has recently adopted an amendment to the Forest Service Handbook, Section 2509.22, Chapter 10 (Water Quality Management Handbook) (USDA 2011b). This handbook improves and replaces the Best Management Practices presented in Water Quality Management for Forest System Lands in California (see above). The Forest Service water quality protection program relies on implementation of BMPs. Best Management Practices are procedures, techniques, and design features that are incorporated in project actions that have been determined by the State of California to be the most effective, practicable means of preventing or reducing the amount of pollution generated by nonpoint sources to a level compatible with water quality goals. Improvements to Forest Service BMPs, as presented in the 2011 Handbook amendment include more detailed descriptions of individual BMPs (section 12), a requirement that site-specific BMPs be included in timber sale contracts (section 13), and direction that legacy sites (sites disturbed by previous land use that is causing or has potential to cause adverse effects to water quality) within timber project boundaries will be restored or improved. Additionally, the 2011 Handbook amendment establishes an expanded water quality management monitoring program (section 16). BMPs applicable to the Sugarloaf Hazardous Fuels Reduction Project are presented in EIS; Appendix A.

Section 303(d) of the Clean Water Act - The section requires the identification of water bodies that do not meet, or are not expected to meet, water quality standards or are considered impaired. The list of affected water bodies, and associated pollutants or stressors, is provided by the State Water Resources Control Board (SWRCB). The most current list available is the 2010 Integrated Report on the SWRCB website (SWRCB 2010). There are no 303d listed water bodies within the Sugarloaf Hazardous Fuels Reduction Project.

Beneficial Uses Identified by the CA Regional Water Quality Control Board (Central Valley Region) - Beneficial uses are defined under California State law in order to protect against degradation of water resources and to meet state water quality objectives. The Forest Service is required to protect and enhance existing and potential beneficial uses (California Regional Water Quality Control Board [CRWQCB] 1998). Beneficial uses of surface water bodies that may be affected by activities on the Forest are listed in Chapter 2 of the Central Valley Region's Water Quality Control Plan (commonly referred to as the "Basin Plan") for the Sacramento and San Joaquin River basins (CRWQCB 1998). The Basin Plan does not specify beneficial uses for Little Grass Valley Reservoir or South Fork Feather River. The South Fork Feather River flows to Lake Oroville. Beneficial uses for waters of Lake Oroville are specified in the Basin Plan and include contact and noncontact water recreation, wildlife habitat, and coldwater aquatic habitat.

The Sierra Nevada Forest Plan Amendment (SNFPA) Record of Decision (ROD) – The SNFPA ROD (USDA 2004d) describes management direction for riparian areas and water resources located on Plumas National Forest System lands. The ROD includes six riparian conservation objectives (RCOs) and more than thirty standards and guidelines to be implemented for designated Riparian Conservation Areas (RCAs). Designation of appropriate widths of RCAs is an integral element of the riparian area management. The standard and guide for Riparian Conservation Area (RCA) widths suggested by the ROD are described below. RCA widths shown below may be adjusted at the project level if a landscape analysis has been completed and a site-specific Riparian Conservation Objective (RCO) analysis demonstrates a need for different widths which did occur for this project.

- Perennial Streams: 300 feet on each side of the stream, measured from the bank full edge of the stream
- Seasonally Flowing Streams (includes intermittent and ephemeral streams): 150 feet on each side of the stream, measured from the bank full edge of the stream
- Streams in Inner Gorge: top of inner gorge
- Special Aquatic Features or Perennial Streams with Riparian Conditions extending more than 150 feet from edge of streambank or Seasonally Flowing streams with riparian conditions extending more than 50 feet from edge of streambank: 300 feet from edge of feature or riparian vegetation, whichever width is greater
- Special Aquatic Features include: lakes, wet meadows, bogs, fens, wetlands, vernal pools, and springs
- Other hydrological or topographic depressions without a defined channel: RCA width and protection measures determined through project level analysis.

Plumas National Forest Land and Resource Management Plan (LRMP) - Forest Plan standards and guidelines provide the relevant substantive standards to comply with NFMA. The 1988 LRMP (USDA 1988a) establishes standards and guidelines for protection and maintenance of Forest watersheds, water quality, and water supply, including:

- Implementation of BMPs.
- Establishment of Streamside Management Zones (SMZs) per guidelines in Appendix M of the LRMP. These guidelines were mostly replaced by the SAT guideline, RHCA width requirements mandated by the HFQLG ROD. However, ephemeral channels without evidence of annual scour and deposition are not addressed by the SAT guideline buffer widths. Therefore, SMZ widths defined in Appendix M of the LRMP are applied to these channels. Recommended SMZ widths for these ephemeral swales range from 0 to 50 feet, depending upon the stability of the swale channel and side-slope.

- Preparation of an SMZ plan for any activities that will occur within an SMZ, including a description of vegetation management objectives, needed erosion control measures, and an analysis of SMZ areas with over-steepened slopes or very high Erosion Hazard Rating (EHR). The SMZ plan for this project is included in appendix A.

Timber Harvest Activities Waiver Program - On April 28, 2005, the Central Valley Regional Water Quality Board adopted the Conditional Waiver of Waste Discharge Requirements for Discharges Related to Timber Harvest Activities in Resolution R5-2005-0052 (Waiver). The Waiver specifies eligibility criteria and conditions that must be met by dischargers engaged in timber harvest activities on private and National Forest System lands in order to qualify for a waiver of waste discharge requirements. Dischargers submit Waiver Applications prior to commencement of timber harvest activities and Waiver Certifications at the conclusion of those activities. The waiver also imposes conditions and requirements for agency monitoring. Implementation monitoring is required for all projects and consists of non-random pre- and post-winter inspection of project BMPs during the course of timber harvest activities. It should be designed to focus on portions of the project that have the highest risk to water quality. Forensic and effectiveness monitoring are required for Federal projects only if "the discharger's cumulative off-site watershed effects analysis indicates that the project, combined with other Forest Service projects conducted in the watershed over the past 10 years, may cause any watershed or sub-watershed to exceed a threshold of concern" (CRWQCB 2005). Forensic and effectiveness monitoring consist of winter inspection of sediment sources and BMPs to detect significant sources of pollution, to determine whether project-specific BMPs are effective in protecting water quality, and to assist in evaluating the overall effectiveness of the waiver program in protecting water quality and beneficial uses. Additional monitoring may be required if water quality protection measures fail or there are threats to water quality or beneficial uses from project activities.

3.7.3 Effects Analysis Methodology

Geographic and Temporal Bounds

The scope of the Cumulative Watershed Effects (CWE) Analysis includes sixteen subwatersheds ranging from 577 to 7024 acres in size with a total analysis area of 25,982 acres (table 3-36). The South Fork Feather River, Lost Creek and Slate Creek are the three major drainages within the analysis area. The South Fork Feather River drains subwatershed 7 while Lost Creek drains subwatersheds 9 and 10. Slate Creek drains all remaining subwatersheds. The highest point within this area is Gibsonville Ridge at 6320 feet and the lowest elevation is the junction of Slate and Onion Creek at 3560 feet. Figure 3-8 depicts the location of the subwatersheds relative to the landscape and surrounding communities. Figure 3-9 provides a closer look of the subwatersheds and the location of the proposed treatments units. The temporal bounds of direct and indirect effects are two fold, where impacts and improvements would be evident following the first runoff season post project. Depending on the type of treatments, impacts could potentially persist for several years or even decades, but would not be permanent. Improvements, when properly maintained, should persist for decades. For cumulative effects, a standard timeframe of 25 years is assumed for impacts to recover and for improvements to sustain unless overridden with other activity.

Table 3-36. Cumulative watershed effects (CWE) subwatershed description.

Watershed Number	Miles^2	Acres	HFQLG Watershed Number	HUC 6 Watershed Number	HUC 6 Watershed Name
1	2.04	1306	110042	180201250202	Slate Creek
2	3.24	2076	110042	180201250202	Slate Creek
3	2.02	1296	110042	180201250202	Slate Creek
4	0.93	596	110042	180201250202	Slate Creek
5	1.19	760	110041	180201250202	Slate Creek
6	2.20	1408	110041	180201250202	Slate Creek
7	10.98	7024	110040	180201230601	Little Grass Valley Reservoir
8	0.90	577	110041	180201250202	Slate Creek
9	2.74	1755	110024	180201230602	Lewis Flat
10	2.68	1714	110024	180201230602	Lewis Flat
11	2.02	1294	110023	180201250202	Slate Creek
12	1.78	1138	110023	180201250202	Slate Creek
13	1.07	685	110023	180201250202	Slate Creek
14	2.65	1698	110023	180201250202	Slate Creek
15	2.12	1355	110023	180201250202	Slate Creek
16	2.03	1300	110023	180201250202	Slate Creek
Grand Total	**40.60**	**25982**			

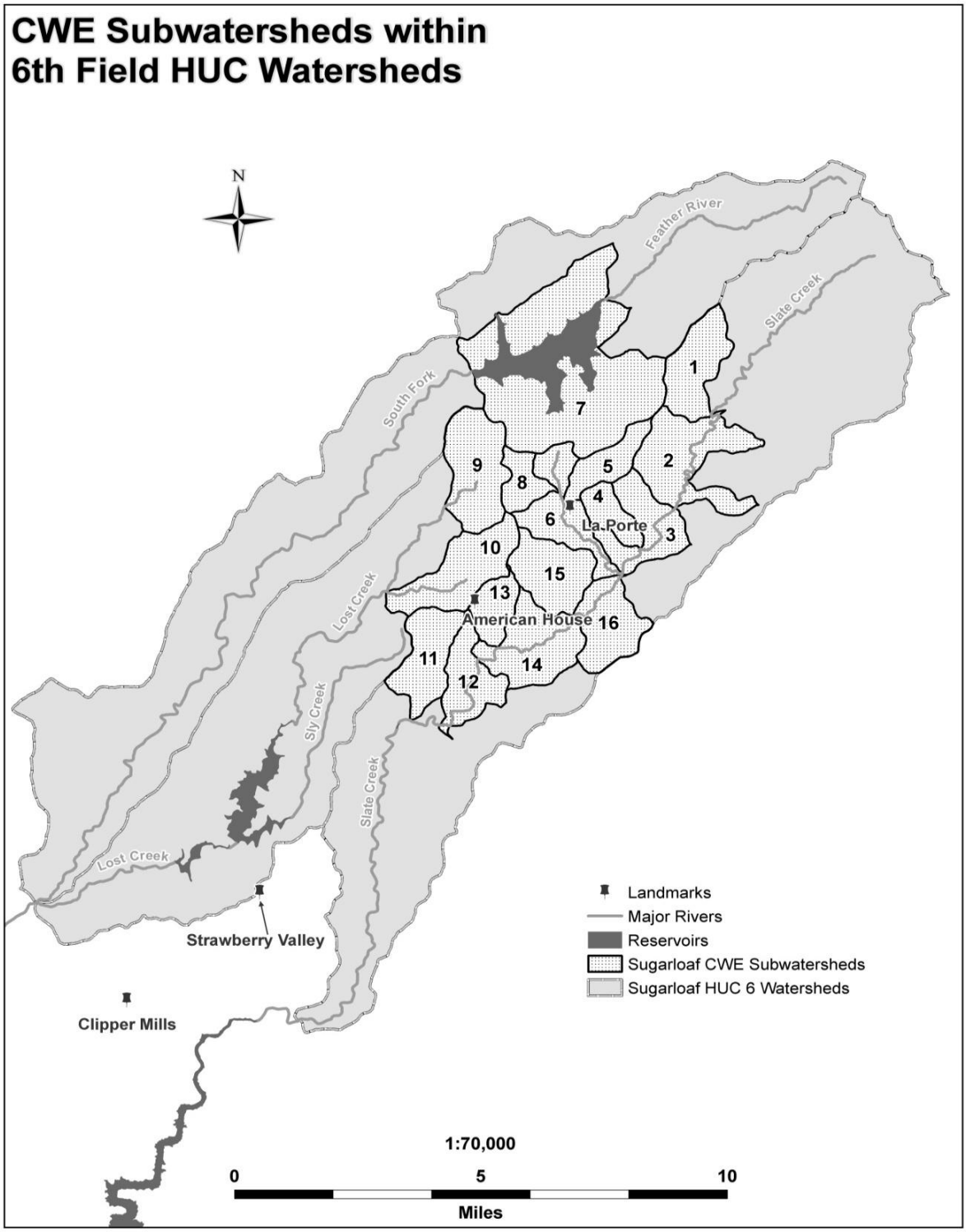


Figure 3-8. Cumulative Watershed Effects analysis area map.

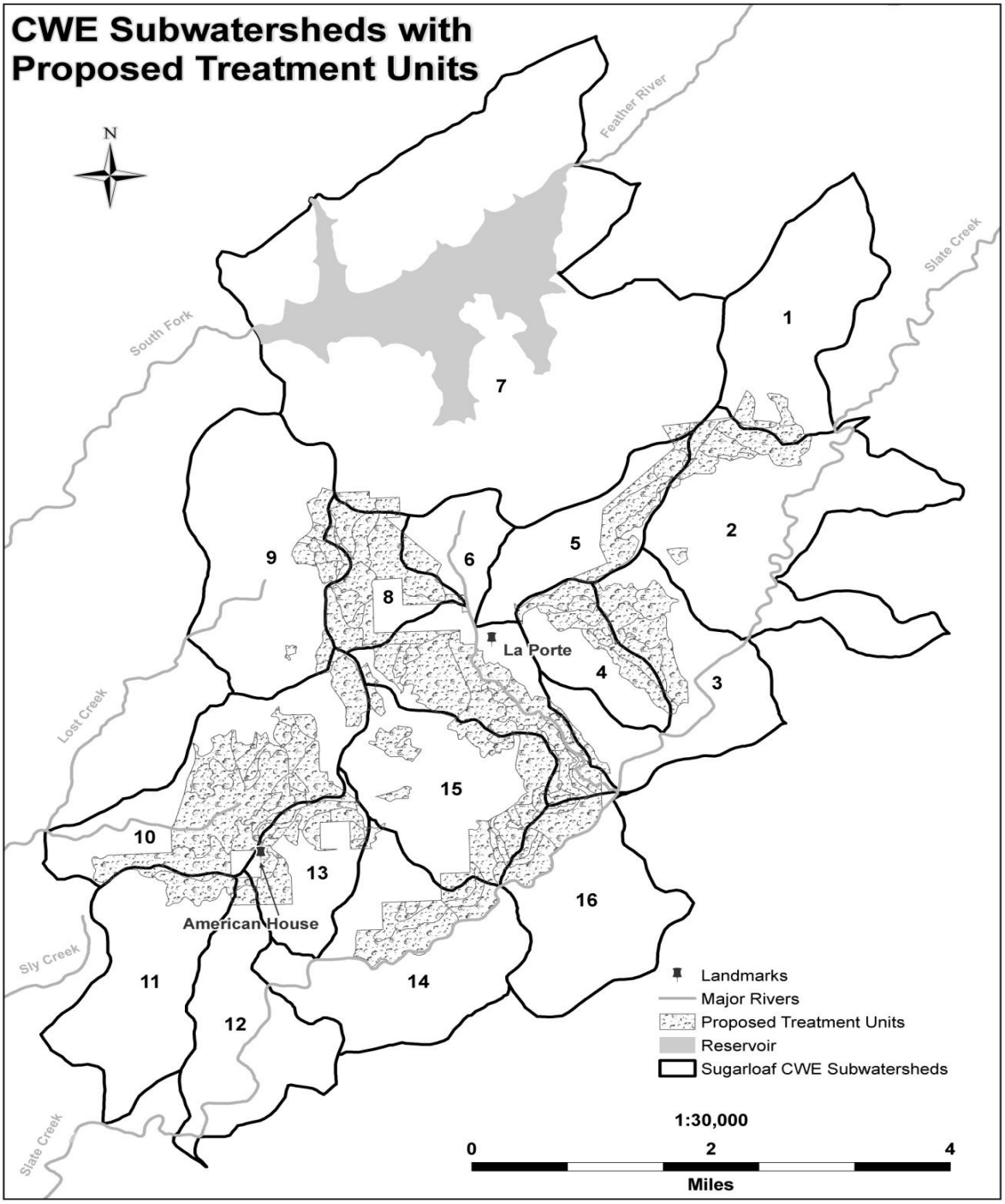


Figure 3-9. Cumulative Watershed Effects analysis area map with proposed treatment units.

3.7.4 Analysis Methodology

The measurement indicator for hydrology is water quality. Road density and the Best Management Practices Evaluation Program (BMPEP) are employed to analyze for direct and indirect effects to water quality. Road density data is backed by existing information and field inventories while the BMPEP is supported by yearly evaluations to its effectiveness, and where and when needed,

improvements to its current parameters. For cumulative effects, the Equivalent Roaded Acres (ERA) model is used. The ERA model is a Geographic Information Systems (GIS) exercise utilizing internal Forest Service and external databases of land management activities to determine the extent of the influence these activities may have on water quality.

Equivalent Roaded Acres (ERA)

The Cumulative Watershed Effects (CWE) analysis is based on the guidance from the Forest Service Handbook FSH 2509.22-Soil and Water Conservation, Region 5 Amendment (USDA 1988a). Effects may be either beneficial or adverse and are a result of combined effects of multiple management activities within a watershed. *Beneficial uses for waters in the project watersheds include water recreation, terrestrial wildlife habitat, and cold freshwater habitat.* Among these beneficial uses, aquatic habitat is the most sensitive to adverse water quality effects that could potentially result from land disturbing activities such as those proposed for this project. Alterations to watershed hydrology are believed to be the most probable mechanism for initiating these effects to aquatic habitat (USDA 1988a). The Region 5 Forest Service Handbook amendment utilizes conceptual site disturbance coefficients called equivalent roaded acres (ERA) to track changes in the hydrologic functioning of watersheds. ERA coefficients are used to compare the effect of management activities (e.g., timber harvest or pile burning) to the effect of a road in terms of altering surface runoff patterns and timing. The sum of these coefficients represents the percentage of watershed in road surface that would produce the same effects as the existing or planned distribution of management activities (Berg et al. 1996). The following land disturbing activities are evaluated in the ERA model for the Sugarloaf Hazardous Fuels Reduction Project: roads, landings, off-highway vehicle (OHV) trails, timber harvesting activities on public and private lands, urbanization, and legacy mining disturbance. These land-disturbing effects are assessed for the past 25 years, the present, and the foreseeable future. The analysis is based on geographic and land use information compiled from the Forest Service, CalFire, county databases, aerial photographic interpretation and field observations.

The response of the landscapes to land disturbances is influenced by climate, physiographic, geologic, and ecologic conditions (USDA 1990). Therefore, recovery coefficients are assigned based on local conditions. The western slope of the Sierra Nevada within the Plumas National Forest has a high rate of vegetative establishment and growth due to high annual precipitation and the presence of highly productive forest soils. On the Feather River Ranger District, 25 years is used as the average recovery period for disturbed sites as vegetation management is assumed to have no effect on hydrologic processes after 25 years. Other disturbances, such as roads, mining or urbanization receive no recovery coefficient as they recover more slowly or not at all.

Watersheds and stream channels have a natural capacity to absorb various levels of land disturbance without major adjustment to their function and condition. However, there is point where additive or synergistic effects of land use activities would cause a watershed to become highly susceptible to cumulative effects. This upper estimate of watershed “tolerance” to land use is described as the threshold of concern (TOC). When the sum of disturbances exceeds the TOC, water quality may be impaired for established beneficial uses, such as aquatic habitat. Stream channels and water quality can deteriorate to the point where adjacent riparian areas and wetlands become severely damaged.

Project level TOCs are estimated by considering the sensitivity of each analyzed watershed. Natural watershed sensitivity is an estimate of a watershed's ability to absorb land use impacts without increasing the effects of cumulative impacts to unacceptably high levels (USDA 1988a). Watershed sensitivity for watersheds 110023, 110024, 110040, 110041 and 110042 was analyzed for the HFQLG Environmental Impact Statement, considering the following factors: (1) soil erosion potential; (2) potential for high intensity and/or long duration precipitation events, including rain-on-snow; (3) potential for landslides and debris flows; and (4) the percentage of alluvial stream channels in the watershed (USDA 1999a). All but one subwatersheds rated as moderate for watershed sensitivity; subwatershed 7 rated high. The TOC generally ranges between 12 percent and 20 percent ERA depending upon the intrinsic sensitivity of the watershed and beneficial uses of water (USDA 1988a). Due to sensitive local conditions, and the fact that the HFQLG FEIS is a pilot project, the TOC for the HFQLG scale watersheds within the Plumas National Forest was set conservatively from 10 percent to 16 percent. For this project, the TOC has been set at 11 percent of the subwatershed area within watershed 110040, 12 percent of the subwatershed areas within watersheds 110024, 110041 and 110042, and 13 percent of the subwatershed areas within watershed 110023. The ERA method for CWE analysis document in the project folder contains details of how these percentage numbers are assigned.

The ERA total of each subwatershed, expressed as a percentage of the subwatershed area, is compared to the TOC and reported as a fraction (percent) of the TOC. ERA totals in the range of 90 to 99 percent of TOC are considered to be approaching TOC, while those that are 100 percent or greater equal or exceed the TOC. The TOC does not represent an exact level of disturbance where cumulative watershed effects will begin to occur. Rather, it serves as an indicator of increased risk of significant adverse cumulative effects occurring within a watershed. If a subwatershed is approaching or above the TOC, a more thorough analysis of the activities planned within the watershed is necessary. Subwatersheds that need a more thorough analysis will look at the impacts to its beneficial uses.

Best Management Practices (BMPs) Effectiveness Evaluations

The Best Management Practices (BMP) Evaluation Program (USDA 2002) was developed to reduce the risk to water quality degradation by assessing the implementation and effectiveness of BMPs. The objective of BMPs is to protect water related beneficial uses from nonpoint source contaminants (USDA 2000c). Results from the BMP Evaluation Program will be used to assess direct and indirect effects of water quality for the proposed actions. Proper application of BMPs minimizes erosion, such as drilling, and sediment delivery to nearby streams. The BMP Evaluation Program rates two components: the effectiveness of the BMPs and whether or not BMPs were properly implemented.

The effectiveness of BMPs are rated as "pass," "at risk," or "fail." BMPs rated as "pass" or "at risk" will count as effective and go towards calculating percent effectiveness of the BMPs. Standard practice on Plumas NF has been to visit all sites where a BMP evaluation indicated substandard effectiveness, correct the practice on the ground at that location, and consider how the practice may be improved during implementation of future projects.

The recent Region 5 amendment to the Forest Service Handbook for water quality management indicates Forests should strive to achieve BMP effectiveness rates of 90 percent to 95 percent (USDA

2011b). The Region 5 amendment states that BMP monitoring frequency may be reduced for evaluation protocols that rate as at least 95 percent effective for 5 consecutive years. Additionally, the Handbook amendment states that the Forest Service will work with the California State Water Resource Control Board to revise and improve particular BMPs if effectiveness rates are less than 90 percent.

Road Density

Roads cause some of the greatest impacts to water quality through sedimentation, stream diversion, and loss of riparian habitat. The more miles of road there are within a watershed, the more impacts to water quality. However, roads are necessary for forest managers to effectively manage the various resources that the forests provide. Finding a balance between the amount of roads and effectively managing for forest resources is thus of utmost importance. Road density is calculated by correlating the miles of road within a watershed to the area in square miles of the watershed. The road density analysis consists of compiling geospatial data on system and non-system roads, system and non-system OHV routes, and county roads into one dataset. The geospatial data is then used to determine the road mileage and road density by subwatershed. Road density numbers are rated as good, fair or poor based on the Washington Office (WO) Forest Service Watershed Condition Classification Assessment (WCA) Guide (USDA 2010). The following are how road densities are rated:

- Good = Road density less than 1 mi/mi^2
- Fair = Road density of 1 – 2.4 mi/mi^2
- Poor = Road density greater than 2.4 mi/mi.^{2}

The analysis will consist of comparing road densities through the alternatives. The mechanism through which road densities would change is through construction of new roads, decommissioning[1] of system roads and obliteration[2] of non-system roads. The same mechanism applies to OHV routes.

3.7.5 Affected Environment

The community of LaPorte serves as a staging area for forest visitors to the surrounding vicinity. Little Grass Valley Reservoir just north of the town is a popular recreation destination for the public. It also supplies municipal and irrigation water to the surrounding communities. The Valley Creek Special Interest Area (SIA) located southwest of LaPorte is an old growth forest ecosystem with valuable hydrologic resources that include approximately 6 miles of streams.

Hydraulic mining activities of the late 19th century stripped large areas of hillside of vegetation and topsoil and left those slopes steeper than the natural angle of repose for the native soils. Many of these raw hillslopes have not stabilized or re-vegetated over the past century and the mine sites continue to cause accelerated runoff and act as chronic sources of sediment to adjacent stream

1. Decommissioning only applies to roads and OHV routes currently in the National Forest System (NFS) roads database. For the purpose of the Sugarloaf project, decommissioning is the system roads equivalent to the non-system road's "obliteration."
2. Obliteration only applies to non-system roads and OHV routes. Please refer to the transportation report for more details on these definitions.

channels. Hydraulic mine sites within the project area are concentrated in the Rabbit Creek watershed around LaPorte (subwatersheds 5, 6, and 8) and in the area of Secret Diggings (subwatershed 15).

Historic land development and resource extraction operations on private and government lands, the fire suppression efforts of the previous century, and recent motorized recreational use have resulted in a sprawling network of roads and trails within the project area, particularly around the community of LaPorte. This concentration of infrastructure poses a threat to the quality of local water resources. Years of fire suppression have altered the natural fire regime, resulting in excessive buildup of fuels within the analysis area and further threatening hydrologic resources in the area should a high-intensity wildfire come to pass.

3.7.6 Environmental Consequences

Alternative A: No-action Alternative – Direct and Indirect Effects

Road Density. Unpaved roads are commonly considered to be the predominant source of sediment in forested watersheds. Sediment delivery to streams occurs primarily at road-stream crossings and secondarily by road-induced gullies (MacDonald 2007). A high concentration of forest roads can cause increased peak runoff rates by two prominent mechanisms: lower infiltration rates and capacities on compacted road surfaces and interception of shallow subsurface flow along road cutbanks (Wemple 1996).

Currently road densities within the analysis area are well above the desired condition threshold of 2.4 mi/mi^2. Table 3-37 below depicts the current road densities of the subwatersheds. The road densities range from 3.22 to 9.59 miles per square mile. The highest existing road densities are located in the Rabbit Creek watersheds (subwatersheds 5, 6, and 8) surrounding the community of LaPorte and in subwatersheds 11 and 15.

Published literature demonstrates that, for a forest road network, a small proportion of road segments typically generate most of the road-related increases in sediment yields (MacDonald 2007). Road sediment deliveries can be greatly decreased by improving road drainage to disconnect the pathways leading between road templates and stream systems. No road drainage improvements or road obliteration would occur under alternative A so localized impacts to water quality due to troublesome road segments would continue.

Table 3-37. Existing miles of road and road density by subwatershed.

Existing Road Conditions			
Subwatershed Number	**Subwatershed Area (Mi^2)**	**Miles of Road (Mi)**	**Road Density (Mi/Mi^2)**
1	2.04	9.53	4.67
2	3.24	16.01	4.94
3	2.02	10.91	5.39
4	0.93	5.70	6.12
5	1.19	11.39	9.59
6	2.20	13.90	6.32
7	10.98	61.24	5.58
8	0.90	6.36	7.06
9	2.74	13.06	4.76
10	2.68	15.37	5.74
11	2.02	15.59	7.71
12	1.78	7.11	4.00
13	1.07	6.55	6.12
14	2.65	9.67	3.64
15	2.12	13.79	6.51
16	2.03	6.55	3.22
Grand Total	40.60	222.72	5.49

Best Management Practices (BMPs) Effectiveness Evaluations. As BMPs are designed to be implemented around management activities, it is not an applicable discussion under the No-action Alternative.

Alternative A: No-action Alternative – Cumulative Effects

Equivalent Roaded Acres (ERA). The ERA model analyzed what the existing condition would be like for 2014, which is the proposed year of project implementation. It takes into account past, present, and future foreseeable management activities.

For the entire CWE analysis area, the general trend (table 3-38) is that infrastructure (roads, trails, landings, mines, and campgrounds) and past private land management activities are the main contributors to the cumulative ERA. The percent of TOC for the subwatersheds range from 24 to 136 (table 3-38) with subwatershed 15 being over threshold at 136 percent. Subwatersheds 5 and 11 are predicted to be approaching threshold respectively at 95 percent and 97 percent. The primary reason why subwatershed 11 is predicted to be approaching TOC is due to Forest Service future foreseeable activities which include the St Louis Fuels Reduction Project and Union Hill Forest Health and Restoration Project that contribute to 62 percent to the total ERAs. The ERA totals for all remaining subwatersheds are below the TOC under alternative A. Detailed past, present and foreseeable future activities by land ownership can be found in the appendices.

Table 3-38. Percent of disturbance activities contributing to the TOC.

Subwatershed Number	Infrastructure	Urban	Forest Service Activities		Private Timber Harvest Activities	
			Past Activities	Present and Future Foreseeable Activities	Past Activities	Present and Future Foreseeable Activities
	Percent of Disturbance Activities Contributing to the TOC					
1	23%	0%	6%	0%	71%	0%
2	66%	0%	11%	0%	22%	0%
3	79%	0%	2%	0%	19%	0%
4	83%	0%	14%	0%	3%	0%
5	39%	4%	11%	0%	47%	0%
6	42%	22%	16%	0%	18%	2%
7	30%	7%	6%	30%	17%	10%
8	36%	11%	50%	0%	3%	1%
9	39%	0%	38%	0%	23%	0%
10	56%	0%	22%	0%	23%	0%
11	24%	0%	0%	62%	14%	0%
12	21%	0%	1%	57%	21%	0%
13	55%	0%	20%	0%	25%	0%
14	64%	0%	8%	1%	27%	0%
15	57%	0%	29%	0%	14%	0%
16	43%	0%	31%	26%	0%	0%
Grand Total	**39%**	**4%**	**14%**	**16%**	**23%**	**4%**

Table 3-39. Percent TOC by subwatershed.

Subwatershed Number	Percent of Watershed Disturbance (In terms of ERA) Required to Reach TOC	Subwatershed Acres	Total ERA (acres)	% Disturbed	% TOC	Under, Over or Approaching TOC
1	12%	1306	136.0	10%	87%	Under
2	12%	2076	72.9	4%	29%	Under
3	12%	1296	42.1	3%	27%	Under
4	12%	596	21.7	4%	30%	Under
5	12%	760	86.6	11%	95%	Approaching
6	12%	1408	122.0	9%	72%	Under
7	11%	7024	643.8	9%	83%	Under
8	12%	577	47.9	8%	69%	Under
9	12%	1755	89.7	5%	43%	Under
10	12%	1714	70.7	4%	34%	Under
11	13%	1294	163.7	13%	97%	Approaching
12	13%	1138	87.4	8%	59%	Under
13	13%	685	29.6	4%	33%	Under
14	13%	1698	91.2	5%	41%	Under
15	13%	1355	240.0	18%	136%	Over
16	13%	1300	41.3	3%	24%	Under

ERA modeling for existing conditions indicate that the cumulative effect of past, present and foreseeable future activities have potentially altered surface runoff patterns and timing enough to affect normal hydrologic functions in subwatersheds 5 and 15. In published literature, it is difficult to separate the effect of roads on peak flows from effects due to logging because intensive road building events in forests in the mid- to late-1900s were usually accompanied by intensive clear-cutting (Grant 2008). A paired watershed study in coastal Oregon documented measurable increases in peak flow for a watershed where roads occupied 12 percent of the basin area but peak flow changes in other watersheds where roads occupied 3–5 percent of the watershed area were much smaller, inconsistent, and statistically non-significant (Harr 1975). Subwatershed 5 has the highest existing road density in the project area at 9.6 miles per square mile, representing roughly 3–4 percent of the watershed area. Nonetheless, increases in peak flow volumes are likely to occur in heavily roaded watersheds, even if those increases are difficult to measure.

Hydraulically mined lands in subwatershed 15 account for nearly 3 times the ERA value as the roads located in that subwatershed. Coarse sediment which erodes from hydraulically mined hillslopes and is delivered to stream channels has likely overloaded the channel carrying capacity and caused stream channel degradation. Historic mining activities within the stream channels of both subwatersheds 5 and 15 have also contributed to channel degradation. Field investigation of mainstem channels in these watersheds revealed incised channels along many stream segments that are disconnected from natural floodplains with raw, undercut or vertical streambanks devoid of stabilizing vegetation.

It is likely that beneficial uses of water in subwatersheds 5 and 15, particularly the use for coldwater aquatic habitat, have been impacted by the extensive road building of the mid- to late-1900s and by historic mining activities. Water quality impacts due to roads likely do not extend beyond the subwatershed scale. Throughout the Slate Creek watershed, isolated areas exist that have been heavily impacted by historic hydraulic mining activity. The resulting stream channel instability issues caused by an overload of sedimentation are evident throughout Slate Creek, both upstream and downstream of subwatersheds 5 and 15. Only a small portion of the total hydraulic mining that occurred along the tributaries to Slate Creek is within the bounds of these two subwatersheds, but they are still substantial in their contribution to water quality impacts.

Alternative B – Direct and Indirect Effects

Alternative B has potential to further affect water quality and hydrologic function of the subwatersheds within and surrounding the Sugarloaf Hazardous Fuels Reduction Project. The HFQLG FEIS and ROD directed the adherence to Scientific Analysis Team (SAT) guidelines while implementing projects. The SAT guidelines include maintaining standard Riparian Habitat Conservation Areas (RHCAs) and observing ten Riparian Management Objectives (RMOs). Heavy concentrations of fuels due to legacy fire suppression have resulted in RHCA conditions that are no longer consistent with the RMOs. Fuels reduction treatments are proposed to be implemented within the RHCAs as a result. The Feather River Ranger District Hydrology Department, in coordination with the Wildlife and Aquatics Department, developed a buffering system specifically geared towards the proposed treatments of the units surrounding RHCAs. Table 3-40 below outlines this system.

Table 3-40. RHCA and SMZ buffers for fuels and timber operations

Riparian Habitat Conservation Areas (RHCAs)—Overall widths, per SAT guidelines, are 150 feet for non-fish bearing and 300 feet for fish bearing on each side of stream. • The following buffers by treatments apply to RHCAs, unless otherwise specified below. • All buffers are no-treatment buffers, unless specified otherwise. • Buffers smaller than RHCAs are prescribed for treatments on slopes less than or equal to 35 percent. These buffers are doubled for slopes greater than 35 percent and where special aquatics concerns exist.
Groups Selection, Mechanical Thinning and Radial Thinning—Maintain standard RHCAs. These treatments by mechanical equipment would not occur within the full width of RHCAs.
Mastication—Apply a 25 foot buffer for SMZs, a 50 foot buffer for all non-fish bearing streams and a 75 foot buffer for fish bearing streams.
Handcut/Pile/Burn (HCPB)—No buffer on all ephemeral streams, but retain at least 50 percent canopy cover and all riparian vegetation post treatment. Piles should be at least 25 feet from edge of stream. Apply a 25 foot buffer to all other non-fish bearing streams and a 50 foot buffer to fish bearing streams.
Handcut/Grapple Pile (HCGP)—50 foot buffer for ephemeral streams, 75 feet for all other non-fish bearing and 100 feet for fish bearing streams.
Underburns (UB)—Use RHCA widths, but buffer is not a no-treatment buffer. Fire ignition would be prohibited within the buffer, but fire would be allowed to back into the buffer.

Road Density. In an effort to reduce the impacts to hydrologic resources from the high density of roads in the area, approximately 10.5 miles of road are proposed to be obliterated, of which, approximately 1 mile of non-system road would be obliterated within the Valley Creek SIA (table 3-41). These road obliterations include 0.7 miles of system road that would be decommissioned, since that road length would be taken off of the Forest's defined transportation system. The remaining 9.8 miles to be obliterated are non-system routes. The proposed reductions to road density would improve current conditions, but due to logistical and fiscal constraints, the road densities remain high. Table 3-41 below outlines the decrease in road densities by subwatershed. Road obliterations would address priority locations of road-generated sediment, resulting in localized improvements to water quality in adjacent stream channels. These water quality improvements would likely only be measureable for streams located immediately adjacent to the obliterated road.

A case study on three northern California watersheds looked at erosion at 42 decommissioned road stream crossings. One objective was to describe the principle erosional processes at work which were channel incision, bank failure, and rill/gully along the channel sideslopes (Flanagan, Fuller, & Morrison, 2012). A second objective was to quantify erosion volumes in the years following treatment. The case study compared its initial erosional volumes to 10 other studies in the region and found that their results were consistent. The average volume of erosion after the first year of treatment for the 10 studies was 19.5 m^3 compared to 21 m^3 and 11m^3 observed in their two study areas. Another objective of the study was to determine the temporal distribution of erosion meaning how long does erosion persist after the initial decommissioning of road stream crossings. In one of their study areas 19 sites were revisited for a second time within 2 to 5 years after treatment and of those sites another 5 sites were visited for a third time. Of the sites that had a third visit only four sites showed evidence of erosion but it was less than 1 m3 per site. The study's "results indicate that 99 percent of the post-treatment erosion occurs in the first winter following treatment" (Flanagan, Fuller,

& Morrison, 2012).The results of the study are consistent with the 10 other studies that were mentioned who noted the bulk of erosion occurring in the first winter season (Flanagan, Fuller, & Morrison, 2012).

The short term effects of the proposed activities identified under this alternative are that decommissioned road stream crossings may produce erosion post treatment and the bulk of the erosion occurs in the first winter season. The fact that erosion occurs within the first winter season results in short term water quality issues because in subsequent years, erosion is minimal to none, which is a long term benefit to water quality. Reasons why the removal of roads off the landscape long term is good for water quality are because the road no longer acts as a conduit for surface runoff, and stream crossing are not subjected to erosion through surface runoff and overtopping due to undersized culverts.

Four priority roads within the project area (PC511A, 22N53, 21N18A, and 21N42Y), with a combined length of approximately 5 miles, are proposed to be reconstructed and improved with additional cross-drains to address current water quality concerns. Adding road drainage features would reduce the lengths of road that are hydrologically connected to stream channels, eliminating or substantially reducing fine sediment impacts at a localized scale.

Table 3-41. Proposed reduction in road density.

Subwatershed Number	Subwatershed Area in Square Miles (Mi2)	Proposed Miles of Road Obliteration (Mi)	Post Project Miles of Road (Mi)	Post Project Road Density (Mi/Mi2)	% Decrease in Density
	Post Project Road Condition				
1	2.04	1.68	7.84	3.84	17.7%
2	3.24	0.26	15.76	4.86	1.6%
3	2.02	0.35	10.55	5.21	3.2%
4	0.93	0.00	5.70	6.12	0.0%
5	1.19	0.00	11.39	9.59	0.0%
6	2.20	0.52	13.37	6.08	3.8%
7	10.98	0.00	61.24	5.58	0.0%
8	0.90	0.53	5.83	6.47	8.4%
9	2.74	2.91	10.15	3.70	22.3%
10	2.68	2.66	12.71	4.75	17.3%
11	2.02	0.05	15.54	7.68	0.3%
12	1.78	0.00	7.11	4.00	0.0%
13	1.07	0.59	5.96	5.57	9.0%
14	2.65	0.00	9.67	3.64	0.0%
15	2.12	0.98	12.81	6.05	7.1%
16	2.03	0.00	6.55	3.22	0.0%
Grand Total	**40.60**	**10.54**	**212.18**	**5.23**	**4.7%**

Best Management Practices (BMPs) Effectiveness Evaluations. Alternative B has the potential to directly and/or indirectly affect water quality and associated beneficial uses. Providing adequate protection buffers to streams, as well as use of effective nonpoint source pollution prevention measures, would greatly reduce the potential of sediment reaching stream channels within and downstream of proposed treatment units. The BMPs are evaluated annually by the BMP Evaluation Program (BMPEP) to assess their effectiveness.

BMP evaluations conducted on the Plumas National Forest for activities that are pertinent to alternative B are evaluations T01, T02, T04, E08, E09, E11, E12 and F25 (table 3-42). Of these, 88 percent were rated as "effective" between 2007 and 2009 (table 3-43) (USDA 2009). The 2010 and 2011 data are currently under evaluation and not yet available. In most cases, BMP evaluations rate a "fail" when sediment is introduced into a stream channel adjacent to a project activity. Of the 12 percent rated as "fail" between 2007 and 2009, the majority were due to legacy factors associated with the original design or location of Forest roads constructed prior to the development of the 2000 Best Management Practices guide: Water Quality Management for Forest System Lands in California. While correction of all of these legacy factors is currently not feasible due to temporal and fiscal constraints, proposed decommissioning, obliteration, reconstruction and maintenance of roads under alternative B would correct the worst of the observed legacy factors contributing to water quality impacts in the project area. As stated above, it is likely that past activities, particularly hydraulic mining operations, have impacted beneficial uses of water by degrading stream channel conditions, leaving impacted areas that continue to be sources of fine and coarse sediment delivery to streams. Project design features and BMPs for would minimize further impacts to water quality and prevent further impairment of beneficial uses in impacted watersheds.

Under alternative B, approximately 1057 acres of RHCAs and SMZs would be treated. Potential negative direct and indirect effects to water quality would be prevented through implementation of BMPs and project design features for treatments within RHCAs. All units post treatment would have to meet a minimum requirement for areal extent of effective soil cover ranging between 50-70 percent, as it is the minimum required to successfully offset the effects and transport of sediment reaching streams or bodies of water due to surface runoff.

Table 3-42. BMP onsite evaluation protocols.

BMPEP Onsite Evaluation Protocols	BMP subjects Evaluated
T01: Streamside Management Zones (SMZs)	SMZ Designation Stream Course and Aquatic Protection Slash Treatment in Sensitive Areas
T02: Skid Trails	Tractor Skidding Design Erosion Control on Skid Trails
T04: Landings	Log Landing Location Log Landing Erosion Control
E08: Road Surface, Drainage and Slope Protection	Erosion Control Plan Stabilization of Road Slope Surfaces and Spoil Disposal Areas Road Slope Stabilization Construction Practices Control of Drainage Construction of Stable Embankments Maintenance of Roads Road Surface Treatments to Prevent Loss of Materials
E09: Stream Crossings	General Guidelines for Location and Design of Roads Stabilization of Road Slope Surfaces and Spoil Disposal Areas Road Slope Stabilization Construction Practices Control of Road Drainage Construction of Stable Embankments (Fills) Stabilization of Road Slope Surfaces and Spoil Disposal Areas
E11: Control of Sidecast Material	Control of Sidecast Material During Construction and Maintenance
E12: Servicing and Refueling	Servicing and Refueling of Equipment
F25: Prescribed Fire	Consideration of Water Quality in Formulating Fire Prescriptions Protection of Water Quality from Prescribed Burning Effects

Table 3-43. BMPEP summary of ratings, 2007–2009. BMPs for timber activities only.

	Implementation				Effectiveness			
Form	**Pass**	**At-Risk**	**Fail**	**Total**	**Pass**	**At-Risk**	**Fail**	**Total**
T01	23	1	0	24	20	3	1	24
T02	27	2	3	32	26	3	3	32
T04	31	1	1	33	31	1	1	33
E08	22	1	1	24	14	4	8	26
E09	21	1	0	22	11	5	7	23
E11	16	0	1	17	16	1	1	18
E12	2	0	0	2	2	0	0	2
F25	25	3	0	28	24	3	1	28
Total	**167**	**9**	**6**	**182**	**144**	**20**	**22**	**186**
No. of fails, Implementation =				6	No. of fails, Effectiveness =			22
Percent Implemented =				**96.7%**	**Percent Effective =**			**88.2%**

Alternative B: Proposed Action – Cumulative Effects

Equivalent Roaded Acres (ERA). For alternative B, the ERA model analyzed what conditions would be like upon completion of the project. It adds the effects of the proposed actions onto the existing condition. The model's assumption is that all the proposed actions would occur within one year. But reality is that not all the proposed actions would occur within the same year. The model looks at a worst case scenario that is used to identify watersheds that may need a closer look at for cumulative watershed effects that may have a negative or adverse effect to beneficial uses. The beneficial uses for the project are identified in the Riparian Conservation Objective (RCO) Analysis in the appendices of the document. Implementation of proposed activities may take up to 10 years due to various factors. One factor is funding. For example Forest Service may have limited funding to cruise and layout units in any given year. Restoration work is dependent on Knutson Vandenberg (KV) funding, grants, and Forest Service funds. Another factor is that the purchaser of timber contract determines when they work and complete the treatments. The market influences the contract purchaser actions too. Weather and politics determine if and when prescribed pile burning and underburning occur. Chapter 2 discusses anticipated phases of the treatments.

For the entire CWE analysis area, contributions to the TOC score by the alternative B prescriptions are varied between the sixteen subwatersheds (table 3-44). The contributions towards TOC are largest in subwatershed 10 (50 percent), and smallest in subwatershed 7 (1 percent). The overall percent of TOC under alternative B now ranges from 31 to 160 (table 3-45) as a result of the proposed action, with subwatersheds 5, 6, and 8 being pushed over their TOC, subwatershed 15 still over TOC, subwatershed 11 at TOC and subwatershed 1 approaching TOC.

Although there are 6 subwatersheds approaching, at or over TOC no cumulative effects to water quality are anticipated for any of the subwatersheds. There are various reasons for this assessment. First, the road decommissioning, obliteration, reconstruction, improvements and maintenance identified in chapter 2 and road density section above is intended to improve the water quality and its beneficial uses. Short-term effects of these actions are increased sedimentation after the first rains and winters but long-term benefit is improved water quality. These water quality improvements would likely only be measureable for streams located immediately adjacent to the roads discussed. Subwatershed 15 (0.26 miles of decommissioning, 0.72 miles of obliteration, 1.34 miles of road improvements), 8 (0.53 miles of obliteration), 6 (0.52 miles of obliteration, 0.90 miles of road improvement) and 1(0.29 miles of decommissioning, 1.4 miles of obliteration) all have proposed activities to improve water quality.

The second reason why there are no anticipated cumulative effects to water quality is the treatment of RHCAs are designed to reduce the fuel using various vegetation management tools such as mastication, hand thinning, hand piling/mechanical (grapple) piling and burning, and underburning that should not affect water quality. Mastication within RHCAs will improve the size and health of stands therefore providing more shade for streams in the future while making them more fire resilient. The long term improvement of increased tree size along the riparian corridor means better recruitment for future large woody debris in streams. Underburning as a primary or secondary prescription within RHCAs will reduce the amount of vegetation and surface fuel while making the RHCAs more fire resilient. Underburning is not anticipated to cause cumulative effects to water quality because the prescribed underburns will occur when conditions are right for a light intensity burn that it will leave

a mosaic pattern due to the higher moisture content. See the Riparian Management Objectives (RMOs) section in the appendices for more details in how the treatments within RHCAs will maintain or improve riparian habitat.

Based on the proposed road activities and treatments along with design features, LOPs, and BMPs coupled with the fact that all the activities will not occur within the same year, that no significant impacts are anticipated for water quality and its beneficial uses.

Table 3-44. Percent of disturbance activities contributing to the TOC (for alternative B).

Percent of Disturbance Activities Contributing to the TOC							
Subwatershed Number	Infrastructure	Urban	Private Timber Harvest Activities		Forest Service Activities		
			Past Activities	Present and Future Foreseeable Activities	Past Activities	Present and Future Foreseeable Activities	Alternative B Prescriptions
1	22%	0%	68%	0%	6%	0%	4%
2	58%	0%	19%	0%	10%	0%	13%
3	47%	0%	11%	0%	1%	0%	41%
4	46%	0%	2%	0%	8%	0%	45%
5	35%	3%	43%	0%	9%	0%	10%
6	23%	12%	10%	1%	9%	0%	46%
7	29%	7%	17%	10%	6%	30%	1%
8	20%	6%	2%	1%	28%	0%	44%
9	35%	0%	21%	0%	34%	0%	10%
10	28%	0%	11%	0%	11%	0%	50%
11	24%	0%	13%	0%	0%	60%	2%
12	20%	0%	20%	0%	1%	56%	2%
13	31%	0%	14%	0%	11%	0%	44%
14	48%	0%	20%	0%	6%	1%	25%
15	48%	0%	12%	0%	24%	0%	15%
16	34%	0%	0%	0%	24%	21%	21%
Grand Total	32%	3%	19%	3%	11%	13%	18%

Table 3-45. Percent TOC by subwatershed.

Subwatershed Number	Percent of Watershed Disturbance (In terms of ERA) Required to Reach TOC	Subwatershed Acres	Total ERA (Acres)	% Disturbed	% TOC	Under, Over or Approaching TOC
1	12%	1306	141.2	11%	90%	Approaching
2	12%	2076	83.7	4%	34%	Under
3	12%	1296	71.5	6%	46%	Under
4	12%	596	39.1	7%	55%	Under
5	12%	760	95.9	13%	105%	Over
6	12%	1408	224.9	16%	133%	Over
7	11%	7024	648.9	9%	84%	Under
8	12%	577	86.2	15%	125%	Over
9	12%	1755	99.6	6%	47%	Under
10	12%	1714	140.7	8%	68%	Under
11	13%	1294	167.7	13%	100%	At
12	13%	1138	89.4	8%	60%	Under
13	13%	685	52.4	8%	59%	Under
14	13%	1698	122.2	7%	55%	Under
15	13%	1355	281.5	21%	160%	Over
16	13%	1300	52.3	4%	31%	Under

Alternative C: Hazardous Fuels Reduction Only-Direct and Indirect Effects

Alternative C is the Hazardous Fuels Reduction only alternative that is based on the 2004 Sierra Nevada Forest Plan Amendment Final Supplemental EIS. Road decommissioning and obliteration is not proposed in this action alternative. The reconstruction of approximately 5 miles of road on four roads would still happen, as would the proposed road maintenance work. The number of units and spatial extent is the same across all the action alternatives; the only difference is that prescription for a given unit may vary depending on alternative. The primary difference between alternative B and C is that the aquatic, riparian, meadow and associated species have different land allocated to them (i.e., protection buffers/widths) these areas are identified as RCA's in the SNFPA ROD (USDA 2004).

Road Density. No road decommissioning or obliteration is proposed under alternative C, so the existing road densities presented in table 3-43 would remain the same. The localized improvements in water quality predicted for alternative B due to obliteration of road drainage issues would not occur under alternative C.

Best Management Practices (BMPs) Effectiveness Evaluations. The analysis conducted under alternative B applies here. Under alternative C, approximately 998 acres of RCAs and SMZs would be treated. Potential negative direct and indirect effects to water quality would be prevented through implementation of BMPs and project design features for treatments within RCAs. All units post treatment would have to meet a minimum requirement for areal extent of effective soil cover ranging

between 50-70 percent, as it is the minimum required to successfully offset the effects and transportation of sediment reaching streams or bodies of water from surface runoff.

Alternative C: Hazardous Fuels Reduction Only– Cumulative Effects

Equivalent Roaded Acres (ERA). For the non-commercial alternative, the ERA model analyzed for what conditions would be like upon completion of the project. It adds the effects of alternative C onto the existing condition. As discussed in alternative B, the ERA model looks at a worst case scenario where all the proposed actions occur within the same year. But, reality is that not all the proposed actions occur within the same year. The model's assumptions discussed in alternative B apply to this alternative and alternative D.

For the entire CWE analysis area, contributions to the TOC score by alternative C prescriptions are varied between the sixteen subwatersheds (table 3-46). Similar to alternative B, the contributions towards TOC are largest in subwatershed 10 (50 percent), and smallest in subwatershed 7 (1 percent). The overall percent of TOC under alternative C ranges from 25 to 154 (table 3-47) as a result, with subwatershed 1 now approaching its TOC, subwatershed 11 still approaching TOC, subwatersheds 5, 6, and 8 being pushed over their TOC and subwatershed 15 increasing further in percent TOC.

Although there are 6 subwatersheds that are approaching or over TOC, no cumulative effects to water quality are anticipated or to the rest of the subwatersheds. Treatment of RCAs are designed to reduce the fuel using various vegetation management tools such as mastication, hand thinning, hand piling/mechanical (grapple) piling and burning, and underburning that should not affect water quality. Mastication within RCAs will improve the size and health of stands therefore provide more shade for streams in the future while making them more fire resilient. The long term improvement of increased tree size along the riparian corridor means better recruitment for future large woody debris for streams. Underburning as a primary or secondary prescription within RCAs will reduce the amount of vegetation and surface fuel while making the RCAs more fire resilient. Underburning is not anticipated to cause cumulative effects to water quality because the prescribed underburns will occur when conditions are right for a light intensity burn that it will leave a mosaic pattern due to the higher moisture content. See the Riparian Conservation Objectives (RCOs) section in the appendices for more details in how the treatments within RCAs will maintain or improve riparian habitat. The beneficial uses as described in the RCOs section of the appendices do occur in this alternative but to a lesser degree than alternatives B and D because it does not include all the long term improvements to water quality that are associated with the road decommissioning and obliteration.

Based on the proposed road improvements and treatments along with design features, LOPs, and BMPs coupled with the fact that all the activities will not occur within the same year, no significant impacts are anticipated for water quality and its beneficial uses.

Table 3-46. Percent of disturbance activities contributing to the TOC (for alternative C).

Percent of Disturbance Activities Contributing to the TOC							
Subwatershed Number	Infrastructure	Urban	Private Timber Harvest Activities		Forest Service Activities		
			Past Activities	Present and Future Foreseeable Activities	Past Activities	Present and Future Foreseeable Activities	Alternative C Prescriptions
1	22%	0%	67%	0%	5%	0%	7%
2	45%	0%	15%	0%	7%	0%	33%
3	44%	0%	11%	0%	1%	0%	44%
4	46%	0%	2%	0%	6%	0%	47%
5	36%	3%	44%	0%	7%	0%	10%
6	22%	12%	9%	1%	8%	0%	48%
7	31%	7%	17%	10%	6%	28%	1%
8	20%	6%	1%	1%	27%	0%	45%
9	35%	0%	21%	0%	34%	0%	10%
10	28%	0%	11%	0%	9%	0%	52%
11	28%	0%	32%	9%	11%	0%	19%
12	37%	0%	44%	0%	4%	0%	15%
13	23%	0%	10%	0%	5%	0%	62%
14	52%	0%	22%	0%	6%	1%	19%
15	50%	0%	13%	0%	25%	0%	12%
16	41%	0%	0%	0%	30%	25%	4%
Grand Total	**34%**	**3%**	**20%**	**3%**	**11%**	**8%**	**20%**

Table 3-47. Percent TOC by subwatershed (for alternative C).

Subwatershed Number	Percent of Watershed Disturbance (In terms of ERA) Required to Reach TOC	Subwatershed Acres	Total ERA (Acres)	% Disturbed	% TOC	Under, Over or Approaching TOC
1	12%	1306	144.6	11%	92%	Approaching
2	12%	2076	108.1	5%	43%	Under
3	12%	1296	74.9	6%	48%	Under
4	12%	596	39.3	7%	55%	Under
5	12%	760	92.4	12%	101%	Over
6	12%	1408	227.6	16%	135%	Over
7	11%	7024	649.8	9%	84%	Under
8	12%	577	87.0	15%	126%	Over
9	12%	1755	99.0	6%	47%	Under
10	12%	1714	142.1	8%	69%	Under
11	13%	1294	141.8	11%	84%	Under
12	13%	1138	49.7	4%	34%	Under
13	13%	685	71.5	10%	80%	Under
14	13%	1698	113.1	7%	51%	Under
15	13%	1355	273.6	20%	155%	Over
16	13%	1300	43.0	3%	25%	Under

Alternative D: 2004 Framework Alternative – Direct and Indirect Effects

Alternative D is based on the 2004 Sierra Nevada Forest Plan Amendment (SNFPA) Final Supplemental EIS, commonly referred to as the 2004 Framework. Under Alternative D, there would be no Group Selection treatments. The number of units and spatial extent is the same across all the action alternatives; the only difference is that prescription for a given unit may vary depending on alternative. With respect to hydrologic resources, the land allocation assigned to RCAs will remain the same as described in alternative C. The treatment matrix within RCA and SMZ discussed in alternative C will apply to this alternative too, as described in Table 3-48.

Table 3-48. RCA widths.

Type	Width
Perennial Streams.	300 feet on each side of the stream's bank.
Seasonally Flowing Streams (includes intermittent and ephemeral streams).	150 feet on each side of the stream's bank.
Streams in Inner Gorge.	Buffer width begins from the top of inner gorge.
Special Aquatic Features or Perennial Streams with Riparian Conditions extending more than 150 feet from edge of streambank or Seasonally Flowing Streams with riparian conditions extending more than 50 feet from edge of streambank.	300 feet from edge of feature or riparian vegetation, whichever is greater.
Other Hydrological or Topographic Depressions without a defined channel.	RCA width and protection measures determined through project level analysis. For this project, The original SMZ standards of 0 to 50 feet set forth by the 1988 LRMP (which the 2004 framework amended) is utilized.

Road Density. The same reductions to road density in alternative B are proposed here in alternative D, and the effects would be the same. Table-3-48 above outlines the details. The analysis conducted under alternative B applies here.

Best Management Practices (BMPs) Effectiveness Evaluations. The analysis conducted under alternative B applies here.

Under alternative D, approximately 1158 acres of RCAs would be treated. This is due to the more stringent RCA widths where more stream types have larger buffers compared to RHCA widths under HFQLG. Potential negative direct and indirect effects to water quality would be prevented through implementation of BMPs and project design features. All units post treatment would have to meet a minimum requirement for areal extent of effective soil cover ranging between 50–70 percent, as it is the minimum required to successfully offset the effects and transport of sediment reaching streams or bodies of water due to surface runoff.

Alternative D: 2004 Framework Alternative – Cumulative Effects

Equivalent Roaded Acres (ERA). For the 2004 framework alternative, the ERA model analyzed for what conditions would be like upon completion of the project. It adds the effects of alternative D onto the existing condition. The model's assumptions discussed in the other action alternatives applies to this alternative.

For the entire CWE analysis area, contributions to the TOC score by the alternative D prescriptions are varied between the sixteen subwatersheds (table 3-47). Similar to alternative B and C, the contributions towards TOC are largest in subwatershed 10 (52 percent), and smallest in subwatershed 7 (percent). The overall percent of TOC under alternative D now ranges from 29 to 155 (table 3-48) with subwatersheds 5, 6, and 8 being pushed over their TOC, subwatershed 11 at TOC and subwatershed 15 increasing further in percent TOC.

Table 3-47. Percent of disturbance activities contributing to the TOC (for alternative D).

Percent of Disturbance Activities Contributing to the TOC							
Subwatershed Number	Infrastructure	Urban	Private Timber Harvest Activities		Forest Service Activities		
			Past Activities	Present and Future Foreseeable Activities	Past Activities	Present and Future Foreseeable Activities	Alternative D Prescriptions
1	24%	0%	72%	0%	5%	0%	-1%
2	53%	0%	18%	0%	8%	0%	21%
3	45%	0%	11%	0%	1%	0%	43%
4	46%	0%	2%	0%	6%	0%	47%
5	36%	3%	44%	0%	7%	0%	10%
6	22%	12%	10%	1%	8%	0%	47%
7	31%	7%	17%	10%	6%	28%	1%
8	19%	6%	1%	1%	26%	0%	47%
9	37%	0%	23%	0%	36%	0%	4%
10	28%	0%	11%	0%	9%	0%	52%
11	28%	0%	32%	9%	11%	0%	19%
12	37%	0%	45%	0%	4%	0%	14%
13	28%	0%	13%	0%	6%	0%	52%
14	50%	0%	21%	0%	6%	1%	22%
15	49%	0%	12%	0%	25%	0%	14%
16	36%	0%	0%	0%	26%	22%	16%
Grand Total	**34%**	**4%**	**20%**	**3%**	**11%**	**8%**	**19%**

Table 3-48. Percent TOC by subwatershed (for alternate D).

Subwatershed Number	Percent of Watershed Disturbance (In terms of ERA) Required to Reach TOC	Subwatershed Acres	Total ERA (Acres)	% Disturbed	% TOC	Under, Over or Approaching TOC
1	12%	1306	134.1	10%	86%	Under
2	12%	2076	90.9	4%	36%	Under
3	12%	1296	74.1	6%	48%	Under
4	12%	596	39.3	7%	55%	Under
5	12%	760	92.5	12%	101%	Over
6	12%	1408	226.0	16%	134%	Over
7	11%	7024	649.8	9%	84%	Under
8	12%	577	88.4	15%	128%	Over
9	12%	1755	92.5	5%	44%	Under
10	12%	1714	142.3	8%	69%	Under
11	13%	1294	141.6	11%	84%	Under
12	13%	1138	49.0	4%	33%	Under
13	13%	685	56.7	8%	64%	Under
14	13%	1698	116.2	7%	53%	Under
15	13%	1355	280.2	21%	159%	Over
16	13%	1300	49.4	4%	29%	Under

Although there are 5 subwatersheds that are approaching, at or over TOC no cumulative effects to water quality are anticipated for any of the subwatersheds. Treatment of RCAs are designed to reduce fuel using various vegetation management tools such as mastication, hand thinning, hand piling/mechanical (grapple) piling and burning, and underburning which should not affect water quality. The discussion in alternative C of short term and long term effects of these treatments within RCAs applies to this alternative. The difference is the type of treatment and the acres between the two alternatives. Another difference between alternatives C and D is that alternative D has road decommissioning and obliteration. The road decommissioning and obliteration for this alternative is the same as proposed in alternative B. The short term and long term effects discussion in alternative B apply to this alternative too.

Based on the proposed road activities and treatments, design features, LOPs, and BMPs coupled with the fact that all the activities will not occur within the same year, no significant impacts are anticipated for water quality and its beneficial uses.

Summary and Comparison of Alternatives

Alternative A. Within the project area, many of the raw hillslopes affected by hydraulic mining activities of the late 19th century have not stabilized or re-vegetated. Hydraulic mine sites within the project area are concentrated in the Rabbit Creek watershed around LaPorte (subwatersheds 5, 6, and 8) and in the area of Secret Diggings (subwatershed 15). Historic mining activities of the same era within the stream channels of these watersheds also caused channel degradation. Recent field

investigation of mainstem channels in these watersheds revealed incised channels along many stream segments that are disconnected from natural floodplains with raw, undercut or vertical streambanks devoid of stabilizing vegetation. Coarse and fine sediment which continues to erode from hydraulically mined hillslopes is delivered to stream channels and has likely overloaded the channel carrying capacity, inhibiting the healing of historic stream channel degradation. Road densities within the project area are well above the desired condition with the some of the highest densities existing in the subwatersheds listed above.

ERA model results for the No-action Alternative (i.e., the existing condition) indicate that subwatersheds 5 and 15 are at risk of cumulative watershed effects. It is likely that beneficial uses of water in these subwatersheds, particularly the use for coldwater aquatic habitat, have been impacted by the extensive road building of the mid- to late-1900s and by historic mining activities. Water quality impacts due to roads likely do not extend beyond the subwatershed scale. No road drainage improvements or road obliteration would occur under alternative A so localized impacts to water quality due to troublesome road segments would continue. The selection of alternative A would result in the continued degradation of beneficial uses due to the deterioration of water quality associated with identified roads and the none treatment of riparian corridors. Years of fire suppression has altered the natural fire regime, resulting in excessive buildup of fuels within the project area. If a high-intensity wildfire came to pass, hillslope erosion and sediment delivery potential would increase by several orders of magnitude in the burned watersheds, posing a significant threat to water quality and aquatic habitat resulting in a negative impact on its beneficial uses.

Alternative B. The overall percent of TOC under alternative B now ranges from 31 to 160 as a result of the proposed action, with subwatersheds 5, 6, and 8 being pushed over their TOC, subwatershed 15 still over TOC, subwatershed 11 at TOC and subwatershed 1 approaching TOC. Although there are 6 subwatersheds approaching, at, or over TOC no cumulative effects to water quality are anticipated or to the rest of the subwatersheds. There are various reasons for this assessment. First, the road decommissioning, obliteration, reconstruction, improvements and maintenance identified in chapter 2 and road density section above is intended to improve the water quality and its beneficial uses. Short-term effects of these actions are increased sedimentation after the first rains and winters but long-term benefit is improved water quality. These water quality improvements would likely only be measureable for streams located immediately adjacent to the roads discussed.

The second reason why there are no anticipated cumulative effects to water quality is the treatment of RHCAs are designed to reduce the fuel using various vegetation management tools such as mastication, hand thinning, hand piling/mechanical (grapple) piling and burning, and underburning that should not affect water quality. Mastication within RHCAs will improve the size and health of stands therefore provide more shade for streams in the future while making them more fire resilient. The long term improvement of increased tree size along the riparian corridor means better recruitment for future large woody debris for streams. Underburning as a primary or secondary prescription within RHCAs will reduce the amount of vegetation and surface fuel while making the RHCAs more fire resilient. Underburning is not anticipated to cause cumulative effects to water quality because the prescribed underburns will occur when conditions are right for a light intensity burn that it will leave a mosaic pattern due to the higher moisture content. See the Riparian Management Objectives

(RMOs) section in the appendices for more details in how the treatments within RHCAs will maintain or improve riparian habitat which is tied to improved beneficial uses.

Based on the proposed road activities and treatments along with design features, LOPs, and BMPs coupled with the fact that all the activities will not occur within the same year, no significant impacts are anticipated for water quality and its beneficial uses.

Alternative C. This alternative was designed to meet a different set of criteria under the 2004 SNFPA FSEIS. Alternative C does not propose any road decommissioning or obliteration and does not have Group Selection treatments. Since there are no roads proposed for decommissioning or obliteration no road density reductions result from this alternative when compared to alternatives B and D. Similar to alternative B, the contributions towards TOC are largest in subwatershed 10 (50%), and smallest in subwatershed 7 (1%). The overall percent of TOC under alternative C ranges from 25 to 154 as a result, subwatershed 1is now approaching TOC, subwatershed 11 is still approaching TOC, subwatersheds 5, 6, and 8 are being pushed over their TOC and subwatershed 15 is increasing further in percent TOC.

Although there are 6 subwatersheds that are approaching or over TOC, no cumulative effects to water quality are anticipated or to the rest of the subwatersheds. Treatment of RCAs are designed to reduce the fuel using various vegetation management tools such as mastication, hand thinning, hand piling/mechanical (grapple) piling and burning, and underburning that should not affect water quality. Mastication within RCAs will improve the size and health of stands therefore provide more shade for streams in the future while making them more fire resilient. The long term improvement of increased tree size along the riparian corridor means better recruitment for future large woody debris for streams. Underburning as a primary or secondary prescription within RCAs will reduce the amount of vegetation and surface fuel while making the RCAs more fire resilient. Underburning is not anticipated to cause cumulative effects to water quality because the prescribed underburns will occur when conditions are right for a light intensity burn that it will leave a mosaic pattern due to the higher moisture content. See the Riparian Conservation Objectives (RCOs) section in the appendices for more details in how the treatments within RCAs will maintain or improve riparian habitat. The beneficial uses as described in the RCOs section of the appendices do occur in this alternative but its degree is less when compared to alternatives B and D because it does not include all the long term improvements to water quality that are associated with the road decommissioning and obliteration.

Based on the proposed road improvements and treatments along with design features, LOPs, and BMPs coupled with the fact that all the activities would not occur within the same year, no significant impacts are anticipated for water quality and its beneficial uses.

Alternative D. This alternative was designed to meet a different set of criteria set under the 2004 SNFPA FSEIS. It does not include the Group Selections of alternative B but would include the proposed road density reductions. The ERA analysis completed for alternative D saw increases in TOC percentage in fifteen subwatersheds and a decrease in TOC percentage in one subwatershed due to the road density reductions. Proposed treatments within RCAs would follow the same criteria as those utilized in alternative C and would improve riparian conditions locally if implemented properly.

For the entire CWE analysis area, contributions to the TOC score by the alternative D prescriptions are varied between the sixteen subwatersheds. Similar to alternative B and C, the

contributions towards TOC are largest in subwatershed 10 (52%), and smallest in subwatershed 7 (1%). The overall percent of TOC under alternative D now ranges from 29 to 155 as a result, with subwatersheds 5, 6, and 8 being pushed over their TOC, subwatershed 11 at TOC and subwatershed 15 increasing further in percent TOC.

Although there are 5 subwatersheds that are approaching, at or over TOC no cumulative effects to water quality are anticipated or to the rest of the subwatersheds. Treatment of RCAs are designed to reduce the fuel using various vegetation management tools such as mastication, hand thinning, hand piling/mechanical (grapple) piling and burning, and underburning that should not affect water quality. The discussion in alternative C of the short term and long term effects of these treatments within RCAs applies to this alternative. The difference is the type of treatment and the acres between the two alternatives. Another difference between alternatives C and D is that alternative D has road decommissioning and obliteration. The road decommissioning and obliteration is for this alternative is the same as proposed in alternative B. The short term and long term effects discussion in alternative B applies to this alternative too.

Based on the proposed road activities and treatments along with design features, LOPs, and BMPs coupled with the fact that all the activities will not occur within the same year, no significant impacts are anticipated for water quality and its beneficial uses.

3.7.7 Compliance with the Forest Plan and Other Direction

The project will be in compliance with the conditional waiver of waste discharge as directed by the California Regional Water Quality Control Board. The waiver also imposes conditions and requirements for agency monitoring. Implementation monitoring is required for all projects and consists of non-random pre- and post-winter inspection of project Best Management Practices (BMPs) during the course of timber harvest activities. The use of BMPs is consistent with the state's water quality management program for non-point source pollution as described in the Water Quality Management for Forest System Lands in California (USDA 2000c). The use of BMPs reduces the potential of pollution reaching a stream and degrading water quality, and therefore protects the beneficial uses identified by the California Regional Water Quality Control, in compliance with California State law. Under alternatives B and D, road density reductions identified in the analysis would occur and mitigate some of the existing hydrologic issues. Under alternatives B and C the riparian protection buffers are consistent with the HFQLG FEIS ROD and LRMP and they are consistent with the SNFPA FSEIS under alternative D. Proposed treatments within the riparian protection buffers are consistent with the RMOs and RCOs.

3.8 Soils

3.8.1 Introduction

The purpose of the soils effects analysis is to determine the direct, indirect, and cumulative effects of the Sugarloaf Hazardous Fuels Reduction Project on the soil resource, specifically productivity for plant growth and soil hydrologic function. The land management activities proposed under this project have the potential to affect the soil resource in a beneficial, indifferent, or adverse manner.

3.8.2 Analysis Framework: Statute, Regulatory Environment, Forest Plan and Other Direction

The Multiple-Use, Sustained Yield Act of 1960

This act states that the National Forests are to be administered for outdoor recreation, range, timber, watershed, wildlife and fish purposes. The Act directs the Secretary of Agriculture to manage these resources in the combination that will best meet the needs of the American people. Sustained yield is defined as achieving and maintaining into perpetuity a high-level periodic output of renewable resources without impairment of the productivity of the land.

National Forest Management Act

The *National Forest Management Act* (NFMA) of 1976 amended The *Forest and Rangeland Renewable Resources Planning Act of 1974*. As described in Forest Service Manual chapter 2550.1 (USDA 2010a), this authority requires the maintenance of productivity of the land and the protection and, where appropriate, the improvement of the quality of soil and water resources. The Act specifies that substantial and permanent impairment of productivity must be avoided.

Plumas National Forest Land and Resource Management Plan (LRMP)

Forest Plan standards and guidelines provide the relevant substantive standards to comply with NFMA. Soil management standards and guidelines are not applied to administrative sites or dedicated use areas, such as roads or recreation sites (USDA 2010a). The 1988 LRMP (USDA 1988a) establishes standards and guidelines to prevent significant or permanent impairment of soil productivity, including:

- During project activities, minimize excessive loss of fine organic matter and limit soil disturbance according to Erosion Hazard Rating (EHR):
  - Low to Moderate EHR, conduct normal activities;
  - High EHR, minimize or modify use of soil disturbing activities;
  - Very high EHR, severely limit soil-disturbing activities.
- Determine adequate ground cover for disturbed sites during project planning on a case-by-case basis. Suggested levels of minimum effective cover are (these suggested levels have been selected as the ground cover standard for the Sugarloaf Project):
  1. Low EHR, 40 percent;
  2. Moderate EHR, 50 percent;
  3. High EHR, 60 percent;
  4. Very high EHR, 70 percent.
- To avoid land base productivity loss due to soil compaction, dedicate no more than 15 percent of timber stands to landings and permanent skid trails.

Permanent landings and skid trails do not exist within the project area and the Sugarloaf Project does not propose such permanent features.

Sierra Nevada Forest Plan Amendment FSEIS and ROD

The 2004 Sierra Nevada Forest Plan Amendment (SNFPA) Final Supplemental Environmental Impact Statement and Record of Decision amend the Plumas National Forest LRMP but do not add additional standards and guidelines for soil management beyond the standards and guidelines described above for the LRMP.

National Forest Service Manual for Soil Management

Forest Service Manual 2550 (USDA 2010a) establishes the management framework for sustaining soil quality and hydrologic function while providing goods and services outlined in Forest land and resource management plans. Primary objectives of this framework are to inform managers of the effects of land management activities on soil quality and to determine if adjustments to activities and practices are necessary to sustain and restore soil quality. Soil quality analysis and monitoring processes are to be used to determine if soil quality conditions and objectives have been achieved.

Forest staff determine soil quality indicators and measures that are appropriate for the proposed activities. Most soil quality indicators are observations and measurements taken at the soil surface and in the upper mineral soil since this region of the soil profile strongly influences soil hydrology and long term soil productivity. Forest staff is directed to estimate the type, amount, and degree of change to soil indicators that the proposed activity may produce by using appropriate analysis methods, scientific literature, past monitoring results, and knowledge of local site and soil characteristics. In most cases, qualitative estimates of the effects of management activities on soils are considered sufficient to meet analysis objectives.

The major objective of soil quality monitoring is to ensure that ecologically sustainable soil management practices are being applied. Soil quality monitoring is to be used to validate and refine management decisions. The focus of project level monitoring is observation and documentation of the implementation of soil protection prescriptions.

Region Five National FSM Supplement for Soil Management

Region 5 FSM 2500 chapter 2550 Supplement (pgs. 13–18) establishes soil functions (support for plant growth function, soil hydrologic function, and filtering and buffering function) that the region will use to assess soil conditions. The analysis standards are to be used for areas dedicated to growing vegetation. They are not applied to lands with other dedicated uses, such as system roads and trails or developed campgrounds.

3.8.3 Methodology of Effects Analysis

One hundred and thirteen discrete treatment units exist within the Sugarloaf Hazardous Fuels Reduction Project. Field surveys of existing soil conditions occurred in 101 of these units. Since several treatment units are situated adjacent to each other, many of the field survey transects traversed more than one treatment unit. The survey results for each transect are considered representative for

each of the treatment units (table 3-49). Field surveys did not occur within 12 of the proposed treatment units. Eighty-nine percent of the proposed units were surveyed and results from the surveyed units are used to generally estimate existing condition in the 12 units that were not surveyed.

Management Indicators and Measurements

The two soil quality indicators with measurements developed for this project are soil productivity and soil hydrologic function. Soil productivity is the inherent capacity of the soil resource to support appropriate growth of plants, plant communities, or a sequence of plant communities to support multiple land uses (USDA 2010a). Soil hydrologic function is the capability of the soil to absorb, store, and transmit water, both vertically and horizontally. Soil capacity to buffer and filter chemical compounds and excess nutrients is not analyzed because this project does not involve significant application of chemicals such as herbicides, pesticides or other amendments.

Indicators 1 and 2: Productivity for Plant Growth and Soil Hydrologic Function

Measure 1: Percent effective soil cover

Short-term timeframe: 0-2 years after implementation.

Long-term timeframe: 2-10 years after implementation.

Data Sources:

- Field Data: Soils surveys were conducted in 2011
- Plumas National Forest Soil Resource Inventory and its associated Geographic Information System (GIS) component
- Annual HFQLG Soil Monitoring Reports.

Spatial Boundary: Proposed Treatment Units

Assumptions:

- Duff and litter greater than ½ inch in depth, surface gravels greater than ¾ inch in diameter, woody debris greater than ¼ inch in diameter, and living vegetation count as effective soil cover
- Units with low and moderate EHRs require a minimum of 50 percent effective soil cover
- Units with high and very high EHRs require a minimum of 60 percent and 70 percent effective soil cover, respectively.

Methodology:

Data collection included point sampling in proposed treatment units along systematic randomized transects, which were designed to sample the geographic and topographic extent and variation of those proposed treatment units. Transects were randomly located using a topographic map and modified in the field to ensure collection of the necessary information. The data was collected systematically along each transect. Each survey had a minimum of two transects and a total of 30

sample points. Information on slope, soil texture, detrimental soil compaction, soil cover, and soil disturbance was recorded at each sample point.

The Plumas National Forest Soil Resource Inventory (USDA 1989) and its associated GIS component were used to pre-determine a unit's Erosion Hazard Rating (EHR) for the proposed treatment units that were surveyed. Units with moderate, high, and very high EHRs respectively require a minimum of 50 percent, 60 percent, and 70 percent for effective soil cover to prevent significant or permanent impairment of soil productivity (USDA 1988a). Based on the soil textures collected and the range of soil map units within the proposed surveyed treatment units the higher EHR was selected to minimize the effect of erosion. For the units that were not surveyed, the process of selecting the appropriate EHR was the same for the surveyed units except for soil texture could not be used to modify an EHR.

Measure 2: Fine organic matter on top of the mineral soil

Short-term timeframe: 0–2 years after implementation.

Long-term timeframe: 2–10 years after implementation.

Data Sources:

- Field Data: Soils surveys were conducted in 2011
- Annual HFQLG Soil Monitoring Reports
- The North American long-term soil productivity experiment: Findings from the first decade of research.

Spatial Boundary: Proposed treatment units

Assumptions:

- Duff and litter greater than ½ inch in depth and woody debris between 1/4 to 3 inches in diameter will count as fine organic matter on top of the mineral soil.
- Desired condition for fine organic matter on top of the mineral soil is 50 percent or greater and will be rated as good.
- Fine organic matter on top of the mineral soil ranging from 30 percent to 49 percent will be rated as fair condition while anything less than 30 percent will be considered poor condition.

Methodology:

The data that was used for the analysis is the same data that was collected for effective soil cover except for woody debris greater than 3 inches, gravel and living vegetation did not count for fine organic matter on top of the mineral soil. If living vegetation was recorded at a sample point then whatever feature (duff and litter, woody debris, surface gravels or bare soil) adjacent to it was recorded.

Measure 3: Percent detrimental compaction

Short-term timeframe: 0–5 years

Long-term timeframe: 5–30 years

Data Sources:

- Field Data: Soils surveys were conducted in 2011.
- Annual HFQLG Soil Monitoring Reports.
- The North American long-term soil productivity experiment: Findings from the first decade of research.

Spatial Boundary: Proposed treatment units

Assumptions:

- Platy or massive soil structure indicates compaction.
- Rock Refusal (FR): Very low (0–9 percent), Low (10–29 percent), Moderate (30–39 percent), High (40–49 percent), and Very high (50 percent greater than).

Methodology:

Soil hydrologic function is the ability of soil to intake, retain, and transmit water that is influenced by soil texture and soil porosity. Timber management activities in particular treatments that involve mechanical equipment have the potential to compact the soil by changing the soil structure and soil porosity. Depending on the degree and extent of compaction it can change the hydrologic function of an area (i.e., unit).

Each soil survey consisted of 30 sample points and soil compaction was determined at a depth of 4 to 8 inches at every sample point by inserting a spade or shovel into the soil. If the spade was inserted without difficulty the soil was considered to be non-compacted. If the soil was resistant to insertion of spade or shovel, a shovel-full of soil was removed and soil structure examined for indications of compaction (platy or massive soil structure). If the spade could not penetrate the soil down to the depth of 4 to 8 inches after 3 separate times within a square foot of the sample point then the location was considered to be impervious and not susceptible to compaction. These locations were recorded as rock refusal.

3.8.4 Known Soils Types

Based on the Plumas National Forest Soil Resource Inventory (USDA 1989) there are 28 different soil map units identified within the soil effects analysis area (table 3-49). The PNF Soil Resource Inventory is an Order 3 soil survey that provides general soil map units but does not delineate the exact location of each soil type. The map units typically consist of a group of soils that occupy particular portions of the landscape. A soil map unit is an association or complex of soil components and does not necessarily consist of similar soil types. Map units consist of geographically associated soils that are typically different in soil characteristics and suitability for use and management. Soil textures were determined in proposed treatment units surveyed to aid in soil type detection and interpreting expected effects.

Table 3-49. Known soil types within proposed treatment units.

Soils Map Unit	Soil Map Unit Name	General Texture of Soil Surface Layer (and depth)	Management Concerns
102	Aiken family	Gravelly loam (17 in.)	Highly susceptible to deformation by heavy equipment.
126	Clallam family	Gravelly loam (6 in.)	Somewhat unstable in relation to road construction.
127	Clallam family	Sam as soils map unit 126	Same as soils map unit 126 just found at greater slopes.
128	Clallam family	Extremely gravelly loam (7 in.)	Dust production is especially high on roads.
132	Clallam family (40%), Rock outcrops (25%), and Holland family (20%).	Very gravelly loam (6 in. gravelly loam or clay loam (9 in.)	Management activities are highly restricted and some mass instability is evident.
135	Deadwood family (55%), Clallam family (30%)	Gravelly or very gravelly silt loam or loam (4 in.), extremely gravelly loam (7 in.)	Mass instability is a problem in many areas even on slopes of less than 35% slopes.
137	Deadwood family (35%), Clallam family (30%), Rock outcrops (20%)	Gravelly or very gravelly silt loam or loam (4 in.), very gravelly loam (6 in.)	Surface raveling of surface stones, cobbles and boulders is common. This process can be accelerated by clear cutting and poses a direct threat to seedling survival.
138	Deadwood family (55%), Josephine family (30%)	Gravelly or very gravelly silt loam or loam (4 in. gravelly or cobbly loam (21 in.)	Mass instability is not widespread except on slopes exceeding 50%.
140	Deadwood family (55%), Kistirn family (30%)	Gravelly or very gravelly silt loam or loam (4 in.), very gravelly loam or silt loam (5 in.)	Mass instability is apparent on slopes greater than 50 percent.
151	Dystric Lithic Xerochrepts (60%), Smokey family (25%)	Gravelly or cobbly sandy loam (4 in.) very gravelly sandy loam (5 in.)	Mass instability is apparent on slopes greater than 50 percent.
177	Gibsonville family (55%), Rock outcrops (30%)	Gravelly loam (8 in.)	Mass instability is apparent on slopes greater than 50 percent.
179	Gibsonville family (60%) and Waca family (25%)	Gravelly loam (8 in.) gravelly sandy loam (10 in.)	Soils are highly erosive and prone to mass wasting. Ground cover retention and low road density are essential standards that should be applied in this map unit.
180	Gibsonville family (60%) and Waca family (25%)	Same as soils map unit 179	Same as soils map unit 179 just found at greater slopes.
199	Holland family	Gravelly loam or clay loam (9 in.)	Limit mechanical operation during web periods.
200	Holland family	Same as soils map unit 199	Same as soils map unit 199 just found at greater slopes.
208	Holland family (60%), Clallam family (25%)	Gravelly loam or clay loam (9 in.), very gravelly loam (6 in.)	Regeneration potential begins to decline rapidly on slopes over 50 percent.

Table 3-49. Existing condition of soil indicators (continued).

Soils Map Unit	Soil Map Unit Name	General Texture of Soil Surface Layer (and depth)	Management Concerns
209	Holland family (60%), Clallam family (25%)	Same as soils map unit 208	Same as soils map unit 208 just found at greater slopes.
211	Hurlbut family	Gravelly loam (14 in.)	Ground cover maintenance is essential due to the erosive nature of these soils.
212	Hurlbut family	Same as soils map units 211	Same as soils map unit 211 just found at greater slopes.
231	Pits, quarry	NA	NA
243	Rock outcrop-Rubble land complex	NA	NA
265	Smokey family	Gravelly sandy loam (5 in.)	Some mass instability is evident, primarily along roaded areas and slopes greater than 50 percent.
266	Smokey family	Same as soils map unit 265	Same as soils map unit 265 just found at greater slopes.
284	Urban land	NA	NA
286	Uvi (50%)-Smokey (35%) families complex	Very gravelly loam (8 in.), gravelly sandy loam (5 in.)	Some areas of mass wasting can be seen, especially where road construction is involved. Most soils in this map unit are fairly erosive, therefore, ground cover retention is essential.
287	Uvi (50%)-Smokey (35%) families complex	Same as soils map unit 287	Same as soils map unit 286 just found at greater slopes.
293	Waca (50%)-Woodseye (35%) families complex	Gravelly sandy loam (10 in.), very gravelly loam (10 in.)	Mass instability is common place and a consistent problem on slopes greater than 50 percent. Surface erosion is considerable especially after soil disturbing events. Groundcover maintenance is essential with 40-60% cover.
294	Waca (50%)-Woodseye (35%) families complex	Same as soils map unit 293	Same as soils map unit 293 just found at greater slopes.

3.8.5 Affected Environment

Indicator 1 and 2: Productivity for Plant Growth and Soil Hydrologic Function

Measure 1: Percent effective soil cover

All proposed treatment units that were surveyed meet the minimum standard for effective soil cover and table 3-50 indicates what those levels are. The soil survey data indicates that the average, median, and mode for effective soil cover are 89 percent, 93 percent, and 90 percent respectively. The range of measured values is 57 percent to 100 percent. There are 113 units proposed for the project and 101 were surveyed for 89 percent soil survey coverage. Twelve units do not have any kind of survey coverage but it is highly probable that those units currently meet the standard for effective soil cover because all the units that were surveyed met the standard.

Measure 2: Fine organic matter on top of the mineral soil

Percent of fine organic matter was calculated based on measurements from field surveys. The range of fine organic matter on top of the mineral soil is 20 percent to 97 percent; the average is 73 percent, the median is 77 percent, and the mode is 80 percent. According to the field data, 8 units out of the 101 units surveyed do not meet the desired condition of 50 percent or greater for fine organic matter on top of the mineral soil, those units are 002A, 002B, 036, 074, 224, 227A, 227B, and 576 (table 3-50). For the units that were not surveyed it is very probable that they do meet the desired condition because 92 percent of the units that were surveyed did meet the desired condition.

The above units are rated in fair condition except for unit 224 which is rated as poor condition because the percent of fine organic matter within the unit is below 30 percent. The unit is in poor condition because there was a lot of brush that counted as effective soil cover but the areas immediately adjacent were bare soil which does not constitute as fine organic matter in the analysis. Units 002A and 002B have 47 percent fine organic matter on top of the mineral soil which is just below the desired condition of 50 percent. The soil survey data indicates that the units have areas of bare soil which is reflected in the effective soil cover of 57 percent. Units 036, 074, 227A, 227B, and 576 all met effective soil cover but a combination of bare soil sample points and a significant portion of living vegetation sample points were adjacent to bare soil, which explains why the units do not meet the desired condition for fine organic matter on top of the mineral soil.

Measure 3: Percent detrimental compaction

The majority of the project area contains past land management activities. The locations of landings, skid trails, temporary roads and mining are still visible on the landscape. However, the extent of compaction is generally low throughout the project area. Detrimental compaction was observed in just 10 of the 101 units surveyed. For these 10 units, the extent of detrimental compaction ranged from 3 to 10 percent and the average was 5 percent.

Soil survey data indicates the primary reason why soils were not compacted was due to the high percent of rocks fragments found in the 4 to 8 inches depth (table 3-50). A secondary reason why observed detrimental compaction levels were zero to minimal was because past timber management activities that involved mechanical treatment within the same analysis area are estimated to have occurred over just 16 percent of the analysis area. The most impactful timber management activities such as clearcuts and commercial thinning that have the highest potential for compaction occurred in

1989 to 1992. The time when these activities occurred suggest that any compaction that occurred may have naturally recovered over time. Given the limited mechanical treatment within the analysis area, the time for which the landscape could naturally recover, and the degree and extent of rock fragments found at the 4 to 8 inch depth explains why soil compaction was zero to minimal in the proposed project units.

Table 3-50. Existing condition of soil indicators.

Unit Number	Percent Effective Soil Cover	Percent Surface Fine Organic Matter	Percent Compaction	Rock Refusal	Soil Map Unit	Erosion Hazard Rating
002A	57	47	0	Very low	286	Moderate
002B						
003A	93	83	0	Very low	286, 294	Moderate
003B						
003C						
015A	93	77	0	Low	266, 286	Moderate
015B						
019	97	87	0	High	286, 287	High
021A	Not surveyed	Not surveyed	Not surveyed	Not surveyed	102, 286, 287	Moderate
021B						
021C						
026	87	70	0	Low	208, 231	High
027A	97	63	0	Very high	151, 208, 243, 231, 287	High
027B						
027C						
027D						
027E						
027F						
027G						
029A	87	70	0	Low	135, 151, 208, 243	High
029B						
029C						
209B						
030A	93	70	0	Very high	135, 200, 208, 243	High
030B						
030C						
032	97	80	0	Very high	102 , 287	Moderate
035	97	93	0	Low	199, 200, 212	High

Table 3-50. Existing condition of soil indicators (continued).

Unit Number	Percent Effective Soil Cover	Percent Surface Fine Organic Matter	Percent Compaction	Rock Refusal	Soil Map Unit	Erosion Hazard Rating
036	80	40	0	Low	135, 199, 287	High
037A	90	80	0	Moderate	135, 199, 287	Moderate
037B						
037C						
037D						
044	93	90	0	Very low	128, 199, 200, 211	Moderate
045A	93	83	3	Low	127, 128, 199, 211, 212	High
045B						
045C						
046A	87	60	0	Low	128, 209, 211	High
046B						
046C						
047	Not surveyed	Not surveyed	Not surveyed	Not surveyed	128, 212	High
051	93	93	0		208	High
053A	93	80	0	Very high	135, 200, 209, 287	High
053B						
053C						
054	Not surveyed	Not surveyed	Not surveyed	Not surveyed	200, 287	High
074	80	47	3	Very low	179, 293	Moderate
14A	93	90	0	High	286	Moderate
14C						
14D						
14E						
14F						
14B	93	63	0	Very high	284, 286	Moderate
206	97	87	0	Low	293	Moderate
211	100	83	0	Moderate	286	Moderate
213A	90	80	3	Low	128, 199	Moderate

Table 3-50. Existing condition of soil indicators (continued).

Unit Number	Percent Effective Soil Cover	Percent Surface Fine Organic Matter	Percent Compaction	Rock Refusal	Soil Map Unit	Erosion Hazard Rating
213B						
214	83	77	0	Low	211	Moderate
221A	87	50	3	Low	128, 208, 231, 286, 287	Moderate
221B						
221C						
221D						
222A	90	80	0	High	128, 231, 243, 286	High
222B						
222C						
222D						
223A	97	80	0	Moderate	138, 266, 294	High
223B	Not surveyed	Not surveyed	Not surveyed	Not surveyed	138, 266	High
224	97	20	0	Very high	286	Moderate
225	93	93	0	Low	212	High
227A	73	47	0	Very high	132, 208, 286	High
227B						
228A	97	80	0	High	177, 179, 208	High
228B						
230	100	90	0	High	177, 179	Moderate
231	Not surveyed	Not surveyed	Not surveyed	Not surveyed	179	Moderate
232	90	70	0	High	177, 208	High
233	80	57	3	Very high	266	Moderate
234	90	73	0	Very high	211, 212	High
235A	97	97	0	Moderate	200, 208, 212	High
235B	80	67	10	Low	212	High
235C	83	50	3	Low	128, 211	Moderate
235D	83	73	0	Moderate	211, 212	High
235E						

Table 3-50. Existing condition of soil indicators (continued).

Unit Number	Percent Effective Soil Cover	Percent Surface Fine Organic Matter	Percent Compaction	Rock Refusal	Soil Map Unit	Erosion Hazard Rating
236	90	90	0	Moderate	208, 212	High
237	90	73	3	High	208	High
238	90	87	0	Moderate	212	High
240	Not surveyed	Not surveyed	Not surveyed	Not surveyed	208, 212	High
241	70	60	0	Low	200, 212	High
37A	80	67	0	Low	179	Moderate
541	97	83	0	Very high	208	High
542A	90	83	0	Low	293	Moderate
542B	Not surveyed	Not surveyed	Not surveyed	Not surveyed	208, 293	Moderate
542C	93	83	0	Low	140, 208, 293	Moderate
542D	90	77	0	Very high	140, 208, 243, 265	Moderate
542E	Not surveyed	Not surveyed	Not surveyed	Not surveyed	293, 294	Moderate
543	Not surveyed	Not surveyed	Not surveyed	Not surveyed	208, 293	Moderate
547	77	60	0	High	294	High
573	90	63	0	Moderate	179, 293	Moderate
575	83	70	0	Very high	138, 266	High
576	83	43	0	Very low	138, 266	High
577A	93	80	7	Low	138, 266, 294	High
577B						
577C						
900	83	67	0	Low	138, 294	High
901A	Not surveyed	Not surveyed	Not surveyed	Not surveyed	180, 293	Moderate
901AH	93	87	0	Very low	180, 293, 294	Moderate
901AT	93	90	0	High	180, 293	Moderate
901B	90	67	0	Low	138, 180, 231, 294	High
901GHWK	83	77	0	Low	294	High
902	80	57	0	Low	179, 286, 293	Moderate
904A	77	60	0	High	266, 286	Moderate

Table 3-50. Existing condition of soil indicators (continued).

Unit Number	Percent Effective Soil Cover	Percent Surface Fine Organic Matter	Percent Compaction	Rock Refusal	Soil Map Unit	Erosion Hazard Rating
904B	90	77	0	Very high	286	Moderate
904C						
906	97	80	0	Low	128, 211	High
908	87	73	7	Very low	127, 211, 212	Moderate

NOTE:
Shaded rows indicate that soil surveys were not completed on those units.

3.8.6 Environmental Effects

Measure 1: Percent effective soil cover

Alternative A—Direct and Indirect Effects

The No-action Alternative would allow effective soil cover to remain and develop at its current rate in the project area. All the units would still meet the effective soil cover standard. Unlike the action alternatives, the project area would not realize a reduction in the risk of future high intensity wildfire under the No-action Alternative. If a high intensity wildfire fire were to occur, the affected stand(s) would not meet the Forest Plan standards and guides for effective soil cover due to the combustion of the soil cover. The loss of soil cover would increase erosion and the formation of hydrophobic soil layers (soils resistant to water adsorption and infiltration) would further increase runoff and erosion in the short term.

Alternative B—Direct and Indirect Effects

Direct and indirect effects for this alternative include partial removal of effective soil cover. Ground disturbance associated with the proposed activities (mechanical thinning, radial thinning, Group Selection treatment, mastication, piling and burning of hand-cut trees, prescribed underburning treatments, and machine piling of hand-cut trees) of alternative B are expected to temporarily reduce effective soil cover from the existing condition. While it is difficult to predict precise treatment effects on forest floor materials, general trends are well established. The implementation of alternative B, including the design features described below and in chapter 2, all treated units are expected to meet the project standard for extent of effective soil cover (either 50 percent or 60 percent, depending upon the EHR for each unit).

The 2011 HFQLG Soil Monitoring Report presents the effects to soil parameters for over 100 units treated on the 3 National Forests that are implementing the HFQLG pilot project, including units on Plumas National Forest. Pre-treatment data collection started in 2001 and post-treatment data collection began in 2004. The total number of treatment units compiled up to 2011 are 73 thinning and 44 Group Selection treatment units. According to the report, thinning units average 90 percent effective soil cover pre-activity and 83 percent post-activity while Group Selection units average 83 percent pre-activity and 66 percent post-activity, suggesting that Group Selection units are more prone to losses of effective soil cover (USDA 2011a). All but one of the mechanical thinning units had at least 50 percent cover post-treatment but 9 of the 44 Group Selection units were found with less than 50 percent soil cover. However, of those 9 units, two units were also lacking cover pre-treatment, due to shallow rocky soils with sparse vegetative productivity and little duff. Another 6 of the 9 units were located on the same project and were noted as lacking cover due to extensive subsoiling activity to reduce compaction. It therefore appears that many of the Group Selection units with low post-treatment ground cover had legitimate reasons for that result and the loss of soil cover was not due to lack of operational controls.

The HFQLG Soil Monitoring Reports demonstrate that mechanical thinning treatments such as those proposed under alternative B are likely to cause reductions in the areal extent of effective soil cover, with losses averaging 7 percent for thinned units and Group Selection units being more prone to losses of soil cover. As described in the Existing Condition section, all proposed treatment units

that were surveyed met the project standards for effective soil cover. Mastication units are expected to see increases in effective soil cover due to the nature of the fuels treatment activity.

Based on the Erosion Hazard Ratings presented in the 1989 Plumas National Forest Soil Resource Inventory, table 3-50 lists the project standard for effective soil cover for all of the proposed treatment units. A 2008 letter from the three Supervisors of the HFQLG Forests describes management techniques to assure project compliance with soil standards (USDA 2008). These techniques include utilization of post-logging slash and designation of skid trails in Group Selection units. *Monitoring by district watershed staff would occur within random units to assure that adequate cover is retained, particularly in Group Selection units. District staff would visit units during and after mechanical treatments and make ocular estimates of effective soil cover retained. Where units are observed to be lacking effective cover, consultations would occur with the timber sale administrator or contract administrator to refine the operator's techniques (e.g., raising the brush rake or piling less material) to assure that adequate cover is retained. Control of operations is expected to result in sufficient soil cover.*

Pile burning and underburning could reduce effective soil cover. Pile burning would remove forest floor cover at a relatively small scale compared with the area affected by mechanical traffic. In the majority of the proposed underburning treatment units, treatments are expected to occur under prescribed conditions that would not result in complete combustion of the duff and litter layers. Instead it will burn in a mosaic pattern only consuming the fine organic matter where the fire went through. Pile burning and underburning of the proposed treatments would occur within 3 years as a follow-up treatment or as a standalone treatment. *Treatment units 002A and 002B would be monitored for effective soil cover post implementation.* These units have a low probability of not meeting the project standard for effective soil cover because the units are currently at 57 percent effective soil cover and post implementation they may not be at 50 percent or better. If the ground cover standard was not met in these two units, the impacts would be minimal and not significant because the underburning within the RHCA and SMZ buffers would have a mosaic pattern due to the varying moisture conditions.

BMP monitoring of the Upper Slate DFPZ project occurred in 2006 in underburn treatment units where the fuel moisture was too dry, resulting in moderate to high intensity fire. During these treatments some areas had little to no consumption of the duff and litter while other areas had complete consumption that result in exposed bare soil, causing rilling and erosion of the surface soils (USDA Forest Service 2006). However, these effects were not widespread and were not observed to cause significant soil erosion. BMP evaluations were performed in 12 prescribed fire units on the Upper Slate DFPZ project, with 2 units rating as deficient for BMP implementation. To prevent a high intensity fire in proposed treatment units of the Sugarloaf Hazardous Fuels Reduction Project, burning would occur during cool conditions to prevent loss of effective soil cover below standards and guides. The BMP effectiveness was rated as 92 percent for underburn units for 2011 (USDA 2011b).

A significant reduction in effective soil cover would increase the risk of surface soil erosion temporarily in affected areas. While the overall percentage of effective soil cover for a unit is a very good measure for analyzing soil productivity effects, actual soil erosion realized would be highly dependent upon the size and distribution of bare areas as well as site specific factors such as soil

erodibility and slope unit. The effect of short term reductions in soil cover for alternative B would generally be well distributed across thinning and Group Selection units. Concentrated removal of soil cover is most likely to occur in areas such as landings, skid roads, temporary roads, and equipment tracks. Soil erosion would be minimized by the installation of erosion control structures such as cross ditches and waterbars. The 2011 Best Management Practices Evaluation Program (BMPEP) Report found that the implementation and effectiveness of the BMPs for 2011 was at 100 percent and 97 percent, respectively.

Operations would result in mechanical traffic throughout a substantial percentage of the treatment unit area as material is either yarded to the landing or raked into a burn pile. Mechanical cutting and yarding of trees results in substantial breakage of tops and limbs that can be left on the ground to maintain soil cover. Raking of this material can leave a substantial amount of material on the ground if the operator keeps the rake at a proper elevation. Throughout much of the mechanically-treated area, traffic would mostly occur with low ground pressure equipment that typically make only one or two passes over a given section of ground, and would generally leave enough live grass and shrub components to retain effective soil cover. Multiple passes by rubber-tired equipment on skid trails would remove most of the live vegetation components of soil cover on those areas. However, those areas are relatively small compared with the rest of the treated stand and BMPs can effectively prevent substantial erosion of skid trails and landing soils, allowing them to eventually re-vegetate.

The implementation of the project would not cause any significant negative effects to soil productivity for plant growth and soil hydrologic function due to lack of soil cover because of the initial condition (pre-treatment/existing) containing a high percentage of effective soil cover in conjunction with design features, mitigations, and BMPs. An adequate level of well-distributed soil cover is expected in all treated units and signs of erosion would not be visible or would be very limited in degree and extent.

Alternative C—Direct and Indirect Effects

The major difference between alternative B and C is that under alternative C the Group Selection treatments are dropped and converted to mechanical thin, hand cut pile burn, underburn or no treatment. Table 3-51 displays the proposed Group Selection units in alternative B and the changes in prescription of those units across the rest of the alternatives.

Table 3-51. Group Selection units in alternative B and changes to prescription across the action alternatives.

Unit Number	Proposed Treatments		
	Alternative B	Alternative C	Alternative D
019	GS	Mechanical Thin	UB
027A	GS	HCPB	HCPB
027E	GS	NT	HCPB
035	GS	UB	UB
037A	GS	HCPB	HCPB
037B	GS	Mechanical Thin	Radial Thin
037D	GS	HCPB	NT
046A	GS	Mechanical Thin	Reserve
046B	GS	Mechanical Thin	Mechanical Thin/Reserve
542A	GS	Masticate	Masticate
547	GS	NT	NT
573	GS	Mechanical Thin	NT
906	GS	Mechanical Thin	Radial Thin
908	GS	Mechanical Thin	Radial Thin

NOTES:

GS = Group Selection
NT = No Treatment
UB = Underburn
HCPB = Hand cut pile and burn
HCGP = Hand cut grapple pile

The analysis done under alternative B for this measure also applies to alternative C. Alternative B overall has the greater potential to affect effective soil cover, but all of the proposed treatment units are expected to meet the project standard for effective soil cover. *Under alternative C, units 002A and 002B would not be monitored because the proposed prescription is converted to no treatment and under the existing condition these units meet the standard for effective soil cover.*

Alternative D—Direct and Indirect Effects

Direct and indirect effects on this alternative include partial removal of effective soil cover. Ground disturbance associated with the proposed activities (mechanical thinning, radial thinning, mastication, piling and burning of hand-cut trees, prescribed underburning treatments, and machine piling of hand-cut trees) of alternative D is expected to temporarily reduce effective soil cover from the existing condition.

The major differences between alternative B and D is that alternative D the Group Selection treatments are dropped and converted to mechanical thin, hand cut pile burn, machine piling of hand-cut trees, underburn or no treatment. Table 3-51 displays the proposed Group Selection units in alternative B and the changes in prescription of those units across the rest of the alternatives.

The analysis done under alternative B for this measure also applies to alternative D. Alternative B overall has the greater potential to effect effective soil cover because there are more treatment acres of mechanical thin, radial thin and Group Selections when compared to alternatives C and D. All

proposed treatment units are expected to meet the project standard for effective soil cover due to overall high percentage of effective soil cover, LOPs, BMPs, design features and mitigations. *Treatment units 002A and 002B will be monitored for effective soil cover post implementation as identified in the alternative B analysis.*

Measure 2: Fine organic matter on top of the mineral soil

Alternative A—Direct and Indirect Effects

Under the No-action Alternative, the existing condition for fine organic matter on top of the mineral soil would remain same or better for the year 2014. The units that were identified as not meeting the desired condition for fine organic matter under the existing condition are expected to be the same if not slightly better. The rate of fine organic matter accumulation is unknown therefore the timeframe for those units to meet the desired condition is also unknown.

If a high intensity wildfire occurred the fine organic matter would be burned (combusted) and alter decomposition rates and nutrient cycling processes that are essential for plant growth and soil organisms. When fine organic matter burns, essential nutrient loss can occur during a fire due to nutrient transfer to the atmosphere through volatilization and ash convection or due to surface runoff (erosion) of deposited nutrients in the surface ash layer (Neary et al. 2005; Rasison et al. 1984). Nutrients at a greater depth in the soil profile may be immediately lost following a fire due to leaching (Boernew 1982; Neary et al. 2005). Soil temperatures may be elevated for months or years depending on the degree of fine organic matter consumption (Neary et al. 2005). Such changes in the soil temperature regime would affect the rates of biological activity in the soil, resulting in altered nutrient cycling regimes (Neary et al. 2005). These effects could adversely affect long term soil productivity for plant growth.

The benefits from the action alternatives associated with fuel treatments across National Forest System lands would not occur under alternative A. In the event of a future wildfire, soil fine organic matter would be reduced in larger quantities than expected with the proposed project.

Alternative B—Direct and Indirect Effects

Direct and indirect effects on this measure include the removal of soil fine organic matter, potential short-term reduction of soil nutrients, and loss of habitat for organisms inhabiting soil fine organic matter. To protect soil productivity for plant growth, surface fine organic matter should be maintained in the amounts sufficient to sustain soil microorganisms and provide for nutrient cycling.

Fine organic matter is plant litter, duff, and woody material less than 3 inches in diameter which are all components of effective soil cover. Like the analysis for effective soil cover above, a similar reduction of fine organic matter can be expected for the thinning units under this project. After the initial reduction in fine organic matter due to the primary treatment, fine organic matter would increase over the next 2 years due to needle cast and leaves falling from the trees that remain.

The Long Term Soil Productivity (LTSP) study is a national and international study initiated in 1989 comprised of 62 study sites, including sites in the Sierra Nevada (Powers et al. 2005). The goals of the study are to gain understanding of potential soil productivity and effects of land management activities across a variety of sites. The national ten year results indicate that bole only and whole tree

removals, similar to the thinning and Group Selection treatments proposed for this project, have had no detectable effects on soil nutrition or biomass productivity. Significant reductions in soil carbon and nutrient availability were observed only for the extreme case of whole tree removal plus complete removal of all surface fine organic matter on the forest floor. However, the data trend indicated no general decline in biomass productivity across any of the fine organic matter removal levels. Given the modest and short-term reductions of fine organic matter that are expected due to the proposed treatments, those reductions would not significantly change the soil production potential within the proposed units.

As indicated under the existing condition, 8 units do not meet the desired condition of 50 percent or greater for fine organic matter on top of the mineral soil, those units are 002A, 002B, 036, 074, 224, 227A, 227B, and 576 (table 3-49). Units 002A, 002B and 227B are proposed for underburn treatment which will further decrease the amount of fine organic matter short term but within a few years fine organic matter would recover to preexisting condition. Units 074, 224, 227A, and 576 are all plantations that are proposed for mastication treatment under alternative B. The plantations are engulfed in manzanita and small conifers when masticated will contribute to fine organic matter on top of the mineral soil, likely resulting in the units achieving the desired condition. Unit 036 is a hand-cut, pile, and burn unit that would have material less than 3 inches in diameter cut and left alone, increasing the extent of fine organic matter and likely achieving desired condition. Material greater than 3 inches in diameter will still be hand-cut, piled, and burned. There are 5 units that meet the desired condition pre-activity but have the potential not to meet the desired condition for fine organic matter on top of the mineral soil; those units are 046A, 046B, and 573 which are all Group Selection units while the other two units 902 and 904A are underburns. If the desired condition for fine organic matter is not achieved, it still would not significantly change the soil biomass productivity potential as indicated by the LTSP study. After the initial reduction in fine organic matter due to mechanical treatments, fine organic matter would increase over the years due to needle cast and leaves falling from coniferous and deciduous trees that remain. For the units that were not surveyed it is highly probable that they meet the desired condition post implementation because 91 percent or more of the units that were surveyed currently meet the desired condition.

Alternative C—Direct and Indirect Effects

The major differences between alternative B and C were discussed earlier and for more specifics refer to chapter 2. Of the 8 units that were identified as not meeting the desired condition for fine organic matter on top of the mineral soil under the existing condition, three units (002A, 002B, and 227B) would continue to be below the desired condition because they are no treatment units. The other 4 units (074, 227, 227A, 576) are mastication treatment units that would meet the desired condition after treatment due to the nature of the treatment. Unit 036 is a hand-cut, pile, and burn unit that would have material less than 3 inches in diameter cut and left alone, increasing the extent of fine organic matter and likely achieving desired condition. Material greater than 3 inches in diameter will still be hand-cut, piled, and burned.

There are 5 units that are at 50 percent organic matter and those units are 221A, 221B, 221C, 221D, and 235C. Units 211D and 235C are no treatment units therefore they shall remain at desired condition for fine organic matter on top of the mineral soil. Unit 221B and 221C are hand cut pile burn units, to ensure that the unit remains at desired condition material less than 3 inches in diameter will be cut and left. Material greater than 3 inches in diameter will still be hand cut piled and burned.

Unit 221A is a mastication unit and would continue to achieve the desired condition after implementation; in fact the percent of organic matter will increase.

All the proposed treatment units are expected to meet the desired condition of 50 percent coverage of fine organic matter on the soil surface except for the units mentioned above. Those units did not meet the desired condition pre-activity and will not post-activity because they are no treatment units. The units not meeting the desired condition would not significantly change the soil biomass productivity potential as indicated by the LTSP study. For the units that were not surveyed it is highly probable that they would meet the desired condition post implementation because 97 percent of the units that were surveyed are expected to meet the desired condition post implementation under alternative C. If any of the non-surveyed units do not meet the desired condition for soil organic matter on top of the mineral soil it will not significantly change the soil biomass productivity potential.

Alternative D—Direct and Indirect Effects

The major differences between alternative B and D were discussed earlier and for more specifics refer to chapter 2. As indicated under the existing condition, 8 units do not meet the desired condition of 50 percent or greater for fine organic matter on top of the mineral soil. Units 002A, 002B and 227B are proposed for underburn treatment which will further decrease the amount of fine organic matter short term but within a few years fine organic matter would recover to preexisting condition. Units 074 and 227A are plantations that are proposed for mastication. The plantations are engulfed in manzanita and small conifers when masticated will contribute to fine organic matter on top of the mineral soil, likely resulting in the units achieving the desired condition. Units 036, 224, and 576 would continue to be below the desired condition because they are no treatment units.

There are 5 units that are at 50 percent fine organic matter and those units are 221A, 221B, 221C, 221D, and 235C. The proposed treatments in this alternative are the same as in alternative C. The discussion of these 5 units in alternative C applies to this alternative.

All proposed treatment units are expected to meet the desired condition except for units 002A, 002B, and 227B as discussed earlier. The units not meeting the desired condition would not significantly change the soil biomass productivity potential as indicated by the LTSP study. For the units that were not surveyed it is highly probable that they would meet the desired condition post implementation because 97 percent of the units that were surveyed are expected to meet the desired condition post implementation under alternative D. If any of the non-surveyed units do not meet the desired condition for soil organic matter on top of the mineral soil it will not significantly change the soil biomass productivity potential.

Measure 3: Percent detrimental compaction

Alternative A—Direct and Indirect Effects

Within the project area, the existing extent of compaction is not of a size or pattern that would result in significant change in soil productivity potential or soil hydrologic function. During project surveys, signs of erosion or overland flow were absent or very limited in degree and extent. Under the No-action Alternative, no new soil compaction or displacement would occur. In areas where there had been compaction as a result of past land management activities, soil porosity may continue to slowly

recover to pre-disturbance levels. In the event of a future high intensity wildfire, severe soil heating may cause physical changes in soils, including a reduction in soil porosity (Clark 1994). However, this effect to soil productivity would be much less important than the increased risk of soil erosion due to soil cover losses from the severe wildfire.

Alternative B—Direct and Indirect Effects

Modest increases in soil compaction are expected in all mechanically treated areas such as mechanical thin, mastication, radial thin and Group Selection units while hand cut pile burn and underburn units are not expected to result in increases in soil compaction. Other areas with expected increases in soil compaction are existing and proposed skid trails, landings, and temporary roads.

The degree of soil compaction varies with soil texture, soil moisture content at the time the activity takes place, the weight or ground pressure of the equipment used, and whether woody material remains in place to cushion the weight of the equipment while the operation is occurring. Proposed treatment units are susceptible to compaction when the soil moisture content is near field capacity regardless of the type of soil texture. However, soils with high clay content are much more likely to be compacted if operated on by heavy timber equipment when the soils are wet (near field capacity) as opposed to sandy soils and/or soils with high rock content. Soil textures collected in the field generally indicate that the type of soils found are moderately high in silt content and moderate in clay. Higher rock content in soil decreases the potential for compaction. Soil textures presented in the Soil Resource Inventory for all of the map units within the project area describe the soil surface layer as either gravelly or very gravelly (table 3-49). Forty-two percent of the surveyed units exhibited high or very high rock refusal rates (table 3-50). To further reduce the risk of thinning treatments causing detrimental compaction, a Limited Operation Period (LOP) would be applied to the entire project. The LOP would allow ground-based harvest equipment to operate only when soils are considered dry. Soil in the first 8 inches below the ground surface is defined as “dry” when it is not sufficiently moist to allow a soil sample to be squeezed and hold its shape, or when the squeezed sample crumbles when the hand is tapped. Dryness would be determined by the sale administrator along with the recommendation of district watershed staff.

The 2011 HFQLG Soil Monitoring Report compiled pre- and post-soils data starting in 2001 for the pre-data and 2004 for the post-data. The total number of treatment units compiled up to 2011 is 73 thinning and 44 Group Selection treatment units. The HFQLG Soil Monitoring Reports determines compaction as ‘detrimental’ when more than 10 percent of the total porosity is lost (Young, Dillingham and Baldwin, 2010 HFQLG Soil Monitoring Report 2010). The HFQLG soil monitoring determined that compaction at the depth of 4 to 8 inches which is similar to how compaction was determined for the proposed units.

Soil porosity and compaction monitoring results reported in the 2007 HFQLG Soil Monitoring report stated that a review of monitoring data indicates that legacy compaction is commonplace (USDA 2008c). Most of the detrimental compaction observed post-project also existed pre-project (USDA 2011a). The 2011 report stated that the observed overall changes in detrimental compaction levels were small, averaging 1 percent difference from pre- to post-treatment across units. For the 124 sets of pre- and post-treatment data available, only 13 units were below the report’s analysis threshold for spatial extent of detrimental compaction (15 percent of the units area) in the pre-treatment condition then over that threshold in the post-treatment condition (USDA 2011a).

The 2011 report found that the level of compaction in Group Selections to be half of that in thinning units, which can be counter-intuitive because Group Selections remove more timber than thinning units. A partial explanation of the fore mentioned observation is that a greater portion of Group Selections (70 percent) were subsoiled versus thinning units (60 percent) because groups were expected to have greater impacts from harvest activities (USDA 2011a). Another explanation is that in thinning units heavy logging equipment are more confined to skid trails which experience more traffic when compared to Group Selections where traffic is not as confined due to the nature of the prescription/activity.

Subsoiling is one tool that the Forest Service uses to reduce/mitigate the impacts of detrimental compaction; however subsoiling would not be used in this project for various reasons. One of the reasons is because according to survey data the existing level of compaction is low. Another reason is the majority of the project units have relatively high fractions of gravel or rock in the 4–8 inch depth. The higher the rock fragment percentage the lower potential for compaction. The operation of heavy equipment over rock fragments at the aforementioned depth would not compact the soil at the specific space/site.

To prevent excessive overland flow and erosion, soil structure and macro-porosity in the top 8 inches of mineral soil for most of the stand area should be similar to the undisturbed, natural condition for the soil type and should provide sufficient infiltration and permeability for the given climate. Low levels of detrimental compaction found during field surveys indicate that this desired condition generally exists throughout the project area. Soil hydrologic function is not expected to be significantly impacted under alternative B. Visually, soil structure and macro-porosity in the top 8 inches of soil would predominately be unchanged from natural condition for the area of each treatment unit. Localized areas of overland flow and signs of erosion such as pedestals, rills, or gullies are not expected within treatment units. Exceptions could occur along skid trails and landings but erosion on these features would be controlled by implementation of Best Management Practices.

The ten year results of the Long Term Soil Productivity (LTSP) study looked at specifically two key components readily affected by management: soil porosity and soil fine organic matter. The LTSP study has 1-acre study plots with 3 levels of compaction (none, intermediate, and severe [similar to a landing]), in factorial combination with 3 levels of fine organic matter removal (bole only, whole tree, whole tree and all forest floor). All plots were clearcut and planted with native species. In addition, to investigate the role of understory vegetation in compaction recovery, vegetation was allowed to naturally return on half of each plot, and controlled on the other half by manual or chemical methods.

The results indicate that soil compaction effects on total biomass productivity (all vegetation within a site, not just tree growth) differs depending upon the soil particle size or soil texture, along with other factors such as initial bulk density, rock content, and climate. On soils characterized as sandy, compacted plots had greater biomass productivity than uncompacted plots; on soils characterized as loamy, compaction generally resulted in little change in biomass productivity; and on soils characterized as clayey, compaction resulted in up to a 50 percent reduction in biomass productivity at particular sites, primarily in areas with poor soil drainage or high water table (Powers et al. 2005).

It is important to note that LTSP compaction treatments were experimental; the maximum extent of plot area was compacted (90+ percent) and to greater severity than normally encountered during operational practices (a mechanical roller, typically used for compaction of highway subgrades, was used). Therefore, treatments represent a "worst case scenario" when compared with current operational practices, and resulting effects would presumably be much greater. Despite this, no significant effects of compaction on soil biomass productivity have been discovered at sites with sandy or loamy soils which are the majority of soil textures found throughout the proposed project. There are units that do contain soils with moderate clay content which have the potential for short term reduction in plant growth productivity but that is highly unlikely because of the high rock fragment content and the LOP to restrict operations when soils are wet.

Alternative C—Direct and Indirect Effects

Under alternative C there are 91 acres of HCGP, 111 acres of mastication, and 1086 acres of mechanical thin gained when compared to alternative B. Alternative C has no radial thin and Group Selection units. The numbers discussed here for the compaction measure and across alternatives are the maximum extent possible for mechanical treatment that accounts for the stream buffers that limit the operation of mechanical equipment. The numbers discussed and represented in table 3-52 do not include other exclusion areas where mechanical operation is not allowed.

The potential for compaction is higher under this alternative when compared to alternative B because of the net gain of 454 acres of mechanical treatment. The relatively high rock content found across the proposed units would help minimize the potential for compaction. The LOP on soils would only allow mechanical operation when soils are considered dry and would also help to minimize the potential for compaction. The analysis conducted for this measure under alternative B applies to this alternative. The implementation of this alternative would not have direct and/or indirect significant negative effects to compaction nor effect productivity for plant growth and soil hydrologic function.

Table 3-52. Maximum acres of mechanical treatment across alternatives.

Mechanical Treatments	Alternative B	Alternative C	Alternative D
	Acres		
HCGP	0	91	71
Masticate	223	334	278
Mechanical Thin	229	1,315	76
Radial Thin	763	0	859
GS	71	0	0
Total	**1,286**	**1,740**	**1,284**

Alternative D—Direct and Indirect Effects

Under alternative D there are 71 acres of HCGP, 55 acres of mastication, and 96 acres of radial thin gained when compared to alternative B. Alternative D has a net loss of 153 acres of mechanical thin when compared to alternative B. Alternative D has no Group Selection units. The total net loss of mechanical treatment for alternative D is 2 acres when compared to alternative B so the potential for occurrence of detrimental compaction is relatively the same just distributed differently spatially. The relatively high rock content found across the proposed units would help minimize the potential for

compaction. The LOP on soils would only allow mechanical operation when soils are considered dry and would also help to minimize the potential for compaction. The analysis conducted for this measure under alternative B applies to this alternative. The implementation of this alternative would not have direct and/or indirect significant negative effects to compaction nor effect productivity for plant growth and soil hydrologic function.

Measure 1, 2, and 3.

Alternative A—Cumulative Effects

No cumulative effects would occur under this alternative because nothing would be implemented on the ground that would affect any of the measures that influence plant growth productivity and soil hydrologic function.

Alternative B, C, and D—Cumulative Effects

The implementation of the non-action alternatives has important positive cumulative effects for long term soil productivity, which is the reduction of future wildfire risk or a modification of future wildfire behavior and intensity. A high intensity wildfire, occurring under conditions of high heat and low humidity, would result in nearly complete combustion of soil cover, and a significant increase in the risk of erosion of organic-rich surface soils. This risk of accelerated erosion represents a far greater risk to soil productivity and hydrologic function than the localized and relatively small soil quality impacts that would result from mechanical treatments proposed under the action alternatives. A high severity wildfire would burn much hotter than the prescribed burn treatments proposed for the alternatives and would consume more of the surface soil organic matter. The loss of organic matter on top of the mineral soil does not have a significant effect on biomass productivity as indicated by the LTSP study. The proposed treatments are designed to reduce the risk of wildfire and behavior of a wildfire by modifying the arrangement of fuels and by regenerating disease free and fire-resilient species. Based on the type of soils and the LOPs on both projects, increases in compaction would not have a significant effect on soils biomass productivity and hydrologic function. The implementation of any the non-action alternatives will not have a cumulative effects on soil productivity for plant growth and soil hydrologic function.

3.8.7 Comparison of Alternatives

Productivity for Plant Growth and Soil Hydrologic Function

Effective Soil Cover

Alternative B overall has the greatest potential to effect soil cover because there are more treatment acres of mechanical thin, radial thin and Group Selections than alternatives C and D. All proposed treatment units are expected to meet the project standard for effective soil cover due to overall high percentage of effective soil cover, LOPs, BMPs, design features and mitigations. Treatment units 002A and 002B will be monitored for effective soil cover post implementation under alternatives B and D. The implementation of any action alternative will not have any direct, indirect, or cumulative effects to soil productivity for plant growth and soil hydrologic function.

In Alternative B Group Selection units are to be randomly monitored for effective soil cover. District staff would visit units during and after mechanical treatments and make ocular estimates of

effective soil cover retained. Where units are observed to be lacking effective cover, consultations would occur with the timber sale administrator or contract administrator to refine the operator's techniques (e.g., raising the brush rake or piling less material) to assure that adequate cover is retained. Control of operations is expected to result in sufficient soil cover.

Fine Organic Matter

Unit 036 is a hand-cut, pile and burn unit across all action alternatives. Material less than 3 inches in diameter will be cut and left on the ground to increase fine organic matter to achieve the desired condition. Once the desired condition is achieved then the remaining material may be piled and burned. The design feature mentioned above will apply to units 221B and 221C under alternatives C and D, and unit 221B under alternative B.

Under alternatives C and D, three of the surveyed units would not meet the desired condition for fine organic matter. Units 002A, 002B, and 227B would not meet desired condition because they are no treatment units in alternative C while underburn alternatives B and D the treatments are underburn. If the desired condition cannot be achieved, it still will not significantly change the soil biomass productivity potential as indicated in the LTSP study. The implementation of any of the action alternatives will not have significant negative effects on soil productivity for plant growth and soil hydrologic function.

Percent Detrimental Compaction

Subsoiling is one tool that the Forest Service uses to reduce/mitigate the impacts of detrimental compaction; however subsoiling would not be used in this project to due to various reasons. One of the reasons is because according to survey data the existing level of compaction is low. Another reason is the majority of the project units have relatively high fractions of gravel or rock in the 4-8 inch depth. The higher the rock fragment percentage the lower potential for compaction. The operation of heavy equipment over rock fragments at the aforementioned depth would not compact the soil at the specific space/site. To further reduce the risk of thinning treatments causing detrimental compaction, a Limited Operation Period (LOP) would be applied to the entire project. The LOP would allow ground-based harvest equipment to operate only when soils are considered dry.

The ten year results of LTSP study indicates that sandy or loamy soils showed increases or little change in biomass productivity, respectively which are the majority of soil textures found throughout the proposed project. There are units that do contain soils with moderate clay content which have the potential for short term reduction in plant growth productivity but that is highly unlikely because of the high rock fragment content and the LOP. The 2011 HFQLG Soil Monitoring Report stated that the observed overall change in compaction levels was small, averaging 1 percent difference from pre- to post-treatment across units.

The potential for compaction is higher under alternative C then alternative B because of the net gain of 454 acres of mechanical treatment. The total net loss of mechanical treatment for alternative D is 2 acres when compared to alternative B and the potential for compaction is higher under alternative B. The implementation of any of the action alternatives would not have direct, indirect, and cumulative significant negative effects to compaction nor effect productivity for plant growth and soil hydrologic function.

3.8.8 Forest Plan Consistency

All three action alternatives would be in compliance with Forest Plan Standards and Guidelines and other regulations pertinent to the Soil Resource.

3.9 Botanical Resources and Noxious Weeds

3.9.1 Introduction

The following section describes the project effects to special botanical resources (especially rare plants) and noxious weeds, in terms of Significant Issues raised in Chapter 1. This section on botanical resources and noxious weeds summarizes the analysis of Threatened, Endangered, Proposed, and Sensitive (TEPS) plant species (the Biological Assessment/Evaluation), Plumas National Forest Special Interest plant list (Watch List species), special habitats, and other botanical resources (the Botany Report), and noxious weeds and other invasive non-native plant species (the Noxious Weed Risk Assessment). Threatened, Endangered, Proposed, Sensitive (TEPS), and Special Interest plant species are generally referred to as rare plants in this section. The complete botany input is available in the project planning files.

- *Biological Assessment/Evaluation*. A biological assessment/evaluation (BA/E) is prepared to determine if a project may affect any Forest Service Sensitive species or U.S. Fish and Wildlife Service (USFWS) Threatened, Endangered, or Proposed species. The purpose of the botany BA/E is to describe the effects of the proposed project on all Threatened, Endangered, Proposed, and Sensitive (TEPS) plant species of record for the project area.

- *Botany Report*. The Botany Report describes the effects of the proposed project on plant species of the Plumas National Forest Special Interest Plant list (Watch List), special habitats, and other botanical resources. The Botany Report includes notes about revegetation with native species.

- *Noxious Weed Risk Assessment*. The Noxious Weed Risk Assessment is prepared in order to evaluate the effect of the proposed project on California Department of Food and Agriculture (CDFA) listed noxious weeds and other invasive non-native plant species.

- *Botany Protection Plan*. This report summarizes mitigation measures and project design parameters designed to reduce or eliminate project impacts to botanical resources and noxious weeds.

Four Forest Service Sensitive plant species and four Plumas National Forest Special Interest plant species are found within the project area. One Sensitive fungus species is presumed present within the project area based on habitat modeling. Project effects to these nine species are generally minor, if any, due to project design features and the botany protection plan, and will thus be only briefly mentioned in this section. All nine species are discussed and analyzed in detail in the Biological Assessment/Evaluation and Botany Report.

Small occurrences of two noxious weed species of management concern are found within the project area. These species, and the general management of noxious weeds during project

implementation, are briefly discussed in this section. The risk of project activities spreading weeds into the project area is discussed along with a summary of standard weed control and prevention measures. A more detailed analysis is presented in the Noxious Weed Risk Assessment.

3.9.2 Analysis Framework: Statute, Regulatory Environment, Forest Plan and Other Direction

The Sugarloaf Hazardous Fuels Reduction Project is designed to fulfill the management direction specified in the 1988 Plumas National Forest Land and Resource Management Plan (PNF LRMP) (USDA 1988a), as amended by the Sierra Nevada Forest Plan Amendment (SNFPA) FSEIS and ROD (USDA 2004c, d).

Direction relevant to the alternatives as they affect rare plants

- Forest Service Manual and Handbooks (FSM/H 2670). Forest Service Sensitive species are plant species identified by the Regional Forester for which population viability is a concern. The Forest Service develops and implements management practices to ensure that Sensitive plant and animal species do not become threatened or endangered and ensure their continued viability on National Forests. It is Forest Service policy to analyze impacts to Sensitive species to ensure management activities do not create a significant trend toward federal listing or loss of viability. This assessment is documented in a Biological Evaluation (BE) and is summarized or referenced in this Chapter.

- Sierra Nevada Forest Plan Amendment (SNFPA), Plant Surveys (USDA Forest Service 2004, 2005). Conduct field surveys for Threatened, Endangered and Sensitive plant species early enough in the project planning process that the project can be designed to conserve or enhance Threatened, Endangered and Sensitive plants and their habitat. Conduct surveys according to procedures outlined in the Forest Service Handbook (FSH 2609.25.1.11). The standards and guidelines provide direction for conducting field surveys, minimizing or eliminating direct and indirect impacts from management activities and adherence to the Regional Native Plant Policy (USDA Forest Service 2004).

- Plumas National Forest Land and Resource Management Plan (LRMP) (USDA Forest Service 1988a). The LRMP provides management direction for all Plumas National Forest Sensitive plants; that direction is to “maintain viable populations of Sensitive plant species” (USDA 1988a, page 4-34). The LRMP also provides forest-wide standards and guidelines to:

  – Protect Sensitive and Special Interest plant species as needed to maintain viability,

  – Inventory and monitor Sensitive plant populations on an individual project basis, and

  – Develop species Management Guidelines to identify population goals and compatible management activities/prescriptions that will maintain viability.

- Plumas National Forest Interim Management Prescriptions for TEPS and Special Interest Plants (USDA 2007b). Management guidelines have been developed for each TEPS and Special Interest plant species on the Plumas National Forest. This represents Forest

Supervisor's direction to "ensure that these prescriptions are being applied appropriately to ensure compliance with our Land and Resource Management Plan."

Direction relevant to the alternatives as they affect noxious weeds

- Noxious Weed Assessment (FSM 2900). Evaluate the project effects on California Department of Food and Agriculture (CDFA) listed noxious weeds and other invasive non-native plant species. Assessment is in compliance with the Plumas National Forest Land and Resource Management Plan (USDA 1988a), the Sierra Nevada Forest Plan Amendment Final Environmental Impact Statement Record of Decision (USDA 2004c, d), and the direction in the Forest Service Manual section 2900, Invasive Species Management (USDA 2011c).

- Forest Service Manual. Overall objectives in FSM 2900 involve management of aquatic and terrestrial invasive species based on an integrated pest management approach, prioritizing (1) prevention and (2) early detection and rapid response actions as necessary, as well as (3) control and management and (4) restoration. The FSM includes a policy statement calling for a risk assessment for invasive species to be completed for any proposed action. Some FSM 2900 policy statements particularly relevant to project planning are as follows:

  - Determine the risk of introducing, establishing, or spreading invasive species associated with any proposed action, as an integral component of project planning and analysis, and where necessary provide for alternatives or mitigation measures to reduce or eliminate that risk prior to project approval.

  - Initiate, coordinate, and sustain actions to prevent, control, and eliminate priority infestations of invasive species in aquatic and terrestrial areas of the National Forest System using an integrated pest management approach.

  - Ensure that all Forest Service management activities are designed to minimize or eliminate the possibility of establishment or spread of invasive species on the National Forest System, or to adjacent areas.

  - Use contract and permit clauses to require that the activities of contractors and permittees are conducted to prevent and control the introduction, establishment, and spread of aquatic and terrestrial invasive species.

  - Make every effort to prevent the accidental spread of invasive species carried by contaminated vehicles, equipment, personnel, or materials.

  - Establish and implement standards and requirements for vehicle and equipment cleaning to prevent the accidental spread of aquatic and terrestrial invasive species on the National Forest System or to adjacent areas.

  - Make every effort to ensure that all materials used on the national Forest System are free of invasive species and/or noxious weeds (including free of reproductive/propagative material).

- Noxious Weed Management. The ROD for the SNFPA amends the management direction in the LRMP for the Plumas National Forest to address management of noxious weeds and invasive species (pages 30-31 of Appendix A of the ROD for SNFPA). The noxious weed management standards and guidelines state that a noxious weed risk assessment needs to be conducted to determine the risks for weed spread associated with different types of proposed management activities.

  The management goals and strategies for noxious weed management given in appendix A of the SNFPA ROD stress three priorities: (1) Prevent the introduction of new invaders, (2) Conduct early treatment of new infestations, and (3) Contain and control established infestations. Other SNFPA standard and guidelines that apply to this project for noxious weed management include:

  – **Assessment**. As part of project planning, conduct a noxious weed risk assessment to determine risks for weed spread associated with different types of proposed management activities.

  – **Prevention/Cleaning**. When recommended in project-level noxious weed risk assessments, consider requiring off-road equipment and vehicles used for project implementation to be weed free.

  – **Prevention and Control**. Minimize weed spread by incorporating weed prevention and control measures into ongoing management of maintenance activities that involve ground disturbance or the possibility of spreading weeds.

  – **Follow-up Inspections**. Conduct follow-up inspections of ground disturbing activities.

  – **Prevention/Revegetation**. Encourage use of certified weed free hay and straw.

3.9.3 Effects Analysis Methodology

Geographic and Temporal Bounds

The geographic area of analysis for rare plants, noxious weeds, and other botanical resources is restricted to the project area of the Sugarloaf Hazardous Fuels Reduction Project because no direct or indirect effects to rare plants from this project are expected outside of the project boundary. The distribution of each rare plant species extends beyond the project area, and the distribution of each species is different. Most extend beyond the boundaries of the Feather River Ranger District and some extend beyond the Plumas National Forest. These distinct distributions are taken into account in the analysis of impacts to each species. Specifically, a threshold of concern has not been reached for any of the taxa analyzed.

A 20 year time frame was selected for analysis. The western slope of the Sierra Nevada in the Plumas National Forest has a high rate of vegetation establishment and growth due to high annual precipitation and productive forest soils. According to the Sugarloaf Vegetation report this means that 20 years is the length of time in which vegetation can increase canopy closure, basal area, and tree density to a point where thinning would be needed again to maintain forest stand vigor, health, and

growth. As a result this is the time period in which the forest may return to a condition where treatments such as those planned for this project may need to be repeated to maintain Defensible Fuel Profile Zone (DFPZ) effectiveness.

Analysis Methodology

- All Threatened, Endangered, Proposed, and Sensitive plant species (TEPS), Special Interest plant species, and noxious weeds known or believed to have potential to occur in the analysis area were identified. This process made use of three major data sources: the USDA Forest Service Region 5 Sensitive Species List (USDA 2013), Plumas National Forest rare plant records and vegetation maps, and California Natural Diversity Database records (CNDDB 2012). In addition, for Threatened, Endangered, or Proposed plant species the U.S. Fish and Wildlife List for the land area of the Plumas National Forest (USDI 2013) was reviewed.

- The project area was surveyed for Threatened, Endangered, Proposed, and Sensitive plant species (TEPS), Special Interest plant species, and noxious weeds in 2010 and 2011 by USFS botanists. Botanical surveys focused on rare species with potential habitat. However, the surveys attempted to identify all plants encountered in the field (i.e. surveys were floristic in nature). Many species have specific habitat preferences (such as serpentine outcrops or wetlands), and botanists searched for these habitats as well as their constituent species. The project area has been adequately surveyed for TEPS plant species, Special Interest plant species, and noxious weeds.

- The Feather River Ranger District office maintains files of areas surveyed and plant species identified, plus detailed records of all TEPS, Special Interest, and noxious weed plant species found. Files are also stored in a Geographic Information System (GIS) format at the District office and in the nation-wide Forest Service Natural Resource Information System (NRIS). Location data in GIS for botanical resources were used to analyze proximity to treatment units and associated disturbances such as skid routes and landings. Potential benefits and detriments were determined from survey and GIS data and mitigations measures were subsequently developed.

3.9.4 Affected Environment

Threatened, Endangered, and Proposed plant species

No suitable habitat for Threatened, Endangered, or Proposed plant species is present in or near the project area. Thus, there was no need for formal or informal consultation with the USFWS.

Forest Service Sensitive plant and fungus species

Four Sensitive plant species are known from within the project area. One Sensitive fungus species is presumed to occur within the project area and is managed accordingly. These species are shown in table 3-53.

Table 3-53. Forest Service Sensitive plant and fungus species located within the project area.

Species	Common Name	USFS Status[1]	Global Rank[2]/ CA Rank[3]

Species	Common Name	USFS Status[1]	Global Rank[2]/ CA Rank[3]
Botrychium crenulatum	scalloped moonwort	Sensitive	G3 / 2.2
Cypripedium fasciculatum	clustered lady's-slipper	Sensitive	G4 / 4.2
Lewisia kelloggii ssp. *hutchisonii*	Kellogg's lewisia	Sensitive	G4 / 3.3
Peltigera gowardii	veined water lichen	Sensitive	G4 / not ranked
Phaeocollybia olivacea	olive phaeocollybia	Sensitive	G3 / not ranked

NOTES:

1. USDA Forest Service 2013.
2. Global Rank: G1- Critically Imperiled; G2- Imperiled, G3- Vulnerable, G4- Apparently secure, G5- Secure; T- Rank applies to a subspecies or variety (CNPS 2013, NatureServe 2012).
3. CA Rank = California Rare Plant Rank (CRPR) (CNPS 2013): formerly called CNPS List, 1B- Plants Rare, Threatened, or Endangered in California and Elsewhere, 2- Plants Rare, Threatened, or Endangered in California, But More Common Elsewhere, 3- Plants About Which We Need More Information, 4- Plants of Limited Distribution – A Watch List; formerly called CNPS Threat Rank, 0.1- Seriously threatened in California, 0.2- Fairly threatened in California, 0.3- Not very threatened in California.

Plumas National Forest Special Interest Plant Species

Three Special Interest plant species are known from within the project area. These species are shown in table 3-54.

Table 3-54. Plumas National Forest Special Interest plant species located within the project area.

Species	Common Name	PNF Special Interest category[1]	Global Rank[2] / CA Rank[3]
Clarkia mildrediae ssp. *lutescens*	golden-anthered clarkia	Category 1	G3T3 / 4.2
Lupinus dalesiae	Quincy lupine	Category 1[5]	G3 / 4.2
Sidalcea gigantea	giant checkerbloom	Category 1[4, 5]	G3 / 4.3
Viola tomentosa	wooly violet	Category 1	G3 / 4.2

NOTES:

1. USDA Forest Service 2007. Category 1- Survey and recommend conservation measures; Category 2- Report occurrences and recommend conservation measures.
2. Global Rank: G1- Critically Imperiled; G2- Imperiled, G3- Vulnerable, G4- Apparently secure, G5- Secure; T- Rank applies to a subspecies or variety, NR- Rank Not Yet Assessed (CNPS 2013, NatureServe 2012).
3. CA Rank = California Rare Plant Rank (CRPR) (CNPS 2013): formerly called CNPS List, 1B- Plants Rare, Threatened, or Endangered in California and Elsewhere, 2- Plants Rare, Threatened, or Endangered in California, But More Common Elsewhere, 3- Plants About Which We Need More Information, 4- Plants of Limited Distribution – A Watch List; formerly called CNPS Threat Rank, 0.1- Seriously threatened in California, 0.2- Fairly threatened in California, 0.3- Not very threatened in California; CBR- Considered But Rejected.
4. Hanson 2005. Dropped from the 2007 Plumas National Forest Special Interest list because the species was not yet described – it has been described since then (Clifton et al 2009).
5. Under review for addition to the Special Interest list.

Noxious weed species

Four noxious weed species were located within or adjacent to the project area. These species are shown in table 3-55. These species are discussed briefly below. There will be no further discussion of specific species of noxious weeds after this section.

Table 3-55. Noxious weed species located in or adjacent to the project area.

Species	Common Name	CDFA Category[1]	Project implications
Centaurea solstitialis	yellow star-thistle	C-rated	Along edge of thinning unit, Controlled Area to avoid
Cirsium arvense	Canada thistle	B-rated	In underburn unit and within RHCA[2] to avoid
Cirsium vulgare	bull thistle	C-rated	not managed
Hypericum perforatum	Klamathweed	C-rated	not managed

NOTES:

1. The California Department of Food and Agriculture's noxious weed list (CDFA 2010) divides noxious weeds into categories A, B, and C (CDFA 2012): A-listed weeds are those for which eradication or containment is required at the state or county level; B-listed weeds are those where eradication or containment is at the discretion of the County Agricultural Commissioner; and C-listed weeds require eradication or containment only when found in a nursery or at the discretion of the County Agricultural Commissioner.
2. Riparian Habitat Conservation Area, no ground-disturbing activities.

Three CDFA C-rated noxious weed species (CDFA 2010) were located within the project area. Bull thistle (Cirsium vulgare) and Klamathweed (Hypericum perforatum) have scattered occurrences within the project area. However, these two species are not managed on the Plumas National Forest due to their common occurrence and their generally successful control within the state. These two species are not mapped or tracked on the Forest and there will be no control measures for them.

A third CDFA C-rated weed, yellow star-thistle (Centaurea solstitialis), was located at one small site along the edge of a treatment area, and along the major public road through the area (LaPorte Road). Plants at the site were pulled several times in 2005 and 2006; no plants were found in 2011. However, the site will be excluded from project-related activities through the use of a Controlled Area.

The CDFA B-rated weed Canada thistle (Cirsium arvense) was located at one small site within a treatment unit only planned for underburning. This infestation has been hand-pulled once (2011) and the infested area will be avoided by project-related disturbances.

3.9.5 Environmental Consequences

Forest Service Sensitive plant species

Table 3-56 shows the acres of each Sensitive plant species that will be affected by project activities. The acreage of each species affected by project activities is very small to none. Also, negative effects from the implementation of either action alternative will be very small to none, and will be balanced by the potential positive effects to the condition of the species' habitat as a result of

Project implementation. See the Botany Biological Assessment/Evaluation for this Project for an in-depth analysis.

Table 3-56. Summary of acres of Sensitive plant and fungus species within the project area, within treatment units, and within Controlled Areas (CAs). Within botany CAs there would be no ground disturbance and no burn piles, but hand thinning may occur and underburns may pass into them.

Species	Acres in Project Area	Acres in Treatment Units	Acres in Groups	Acres in Controlled Areas (CAs)[1]	Acres Subject to Ground Disturbing Activities
Botrychium crenulatum	0.05	0.05	0	0.05	0
Cypripedium fasciculatum	0.39	0.39	0	0.39	0
Lewisia kelloggii ssp. *hutchisonii*	0.01	0.01	0	0.01	0
Peltigera hydrothyria	6.42	6.42	0	6.42	0
Phaeocollybia olivacea	5.34	5.34	0	5.34	0
Total acres	**12.21**	**12.21**	**0**	**12.21**	**0**

NOTE: Includes areas within RHCAs and in botany Controlled Areas, where no ground-disturbing activities will occur, but hand-thinning and underburns may occur.

Plumas National Forest Special Interest plant species

Table 3-57 shows the acres of each Special Interest plant species that will be affected by project activities. Because the acreages affected by project activities are very small for these of Special Interest plant species, they will not be discussed further in this section. The slight amount of potential negative effect to some individual plants is balanced by the potential positive effects to the condition of the species' habitat as a result of Project implementation. See the Botany Report, Appendix A to the Biological Assessment/Evaluation for this Project, for an in-depth analysis.

Table 3-57. Summary of acres of Sensitive plant and fungus species within the project area, within treatment units, and within Controlled Areas (CAs). Within botany CAs there would be no ground disturbance and no burn piles, but hand thinning may occur and underburns may pass into them.

Species	Acres in Project Area	Acres in Treatment Units	Acres in Groups	Acres in Controlled Areas (CAs)[1]	Acres subject to ground disturbing activities
Clarkia mildrediae ssp. *lutescens*	0.14	0.14	0	0.14	0
Lupinus dalesiae	0.03	0.03	0	0.03	0
Sidalcea gigantea	0.20	0.20	0	0.20	0
Viola tomentosa	0.50	0.50	0	0.43	0.07
Total acres	0.87	0.87	0	0.80	0.07

NOTE: Includes areas within RHCAs and in botany Controlled Areas, where no ground-disturbing activities will occur, but hand-thinning and underburns may occur. Some of this acreage includes areas that are not within Controlled Areas, but in which the treatment would only be underburning.

Noxious weeds – Anticipated Weed Response Summary

With or without project implementation there is an overall low potential for weed spread, although somewhat higher with project implementation and the resulting ground-disturbing activities. However, project implementation with standard noxious weed control and prevention measures in place would result in a greatly reduced risk.

Measures incorporated into project design

Forest Service Sensitive and Plumas National Forest Special Interest plant species

Various measures, principally botany Controlled Areas (CAs), for the protection of Sensitive and Special Interest plant species have been incorporated into the design of the Sugarloaf project. These measures have reduced the potential impacts to Sensitive and Special Interest plant species to the low levels shown in table 3-56 and table 3-57 above.

Botany Controlled Areas (CAs) would be avoided by ground-disturbing project activities. In general, activities within these CAs would be restricted to hand thinning and underburning. No burn piles would be placed within these CAs. The intent of these CAs is to avoid direct damage to plants and the soil structure (habitat) where they grow from the large machinery that will be used to implement many of the project treatments and to avoid the damage to plants that can occur from the intense heat produced by the burning of burn piles. Controlled Areas would be marked with suitable flagging and red Controlled Area tags (“flagged and tagged”) prior to project layout and project implementation, and would be included on project layout and sale maps. In most cases, project activities to thin the forest in creation and management of DFPZs would improve habitat conditions for these rare plant species. These botany CAs comprise only minor portions of project planning units.

Noxious weed control and prevention measures

Botany Controlled Areas (CAs) would be established for the two noxious weed sites that are within Project treatment areas. These CAs would be marked with suitable flagging and red Controlled Area tags (“flagged and tagged”) prior to project layout and project implementation, and would be included on project layout and sale maps. Specific management for these CAs would be to keep all project activities out of them to prevent the spread of seed and other propagules to other areas.

It is standard practice on the Feather River Ranger District that the following general prevention measures are regularly implemented. Detailed noxious weed prevention measures are presented in the Biological Evaluation/Assessment Appendix B (Noxious Weed Risk Assessment) and Appendix C (Botany Protection Plan). Prevention measures are summarized here:

- Clean all ground disturbing equipment, such as masticators, harvesters, and other off-road equipment before entering National Forest System land,
- Use weed free fill and mulch, and
- Avoid staging equipment on or immediately adjacent to noxious weed sites.

3.9.6 Summary and Comparison of Alternatives

The Effects Determination discussed here is based on professional experience and judgment, existing information, including existing condition of the analysis area, and the potential impacts of the alternatives. An effects determination is also the culmination of potential direct, indirect, and cumulative effects. The formal process of making an effects determination only applies to Threatened, Endangered, Proposed, or Sensitive species.

Alternative A (no action)

– **Will not affect:** Peltigera hydrothyria and Phaeocollybia olivacea.

Reasons:

- No change to habitat in absence of the Project's forest thinning activities and reduction of wildfire susceptibility.

– **May impact individuals but not likely to cause a trend toward federal listing or loss of viability:** *Lewisia kelloggii* ssp. *hutchisonii*, and to a lesser extent *Botrychium crenulatum* and *Cypripedium fasciculatum*.

Reasons:

- Habitat becomes less suitable for these species without activities to thin the forest and limit forest encroachment on natural openings.

- Habitat remains prone to catastrophic wildfire.

3.9.6.1 Alternatives B, C and D (action alternatives):

– **Will not affect:** Peltigera hydrothyria.

Reasons:

- No project related activities will impact known occurrences of this rare species.

– **X May impact individuals but not likely to cause a trend toward federal listing or loss of viability:** *Botrychium crenulatum*, *Cypripedium fasciculatum*, *Lewisia kelloggii* ssp. *hutchisonii*, and *Phaeocollybia olivacea*.

Reasons:

- Adequate surveys have been performed in the Sugarloaf project area.

- A habitat model was used to predict suitable habitat for *Phaeocollybia olivacea*, and potential high quality habitat was included in the following mitigation measures.

- Mitigation measures have been incorporated into the project design to minimize or eliminate negative impacts to these species.

- These four species will be protected from all ground-disturbing project activities through the use of Controlled Areas or other exclusions; prescribed underburn may affect some individual plants.

3.9.7 Compliance with the Forest Plan and Other Direction

Sensitive and Special Interest plant and fungus species

Implementation of the Sugarloaf Hazardous Fuels Reduction Project will maintain or improve habitat for the Sensitive species *Lewisia kelloggii* ssp. *hutchisonii*, and to a lesser extent for *Botrychium crenulatum* and *Cypripedium fasciculatum*. Habitat will also be maintained or improved for the Special Interest species *Clarkia mildrediae* ssp. *lutescens*, *Lupinus dalesiae*, and *Viola tomentosa*. The trade-off between potential impacts to some individual plants, and improving and maintaining suitable habitat for them, is squarely in favor improving and maintaining suitable habitat. Negative effects are decreased through the use of Controlled Areas and project prescriptions; plants are likely to respond positively to project activities that thin the forest.

Noxious Weeds

A noxious weed risk assessment has been conducted as outlined in the amendments to the Plumas National Forest Land and Resource Management Plan. Noxious weed prevention measures are implemented as a standard practice on the Feather River Ranger District. Standard management requirements (SMRs) would be incorporated into project design and implementation.

3.10 Economic and Social Environment

3.10.1 Introduction

The social and economic environment of the Plumas National Forest is described in the 1988 Plumas National Forest Land and Resource Management Plan (the "Forest Plan"), which was amended by the 2004 Record of Decision for the Sierra Nevada Forest Plan Amendment (SNFPA) final supplemental EIS. This economic analysis is not designed to model all the economic factors used in an intensive and highly complex timber sale appraisal process. This economic analysis takes a less complex, but consistent and systematic approach to display the relative differences in financial efficiency (i.e., relevant revenues and costs) between the alternatives being proposed in the environmental analysis.

3.10.2 Analysis Framework: Statute, Regulatory Environment, Forest Plan and Other Direction

The management direction for Fire and Fuels Management of the 2004 Record of Decision for the Sierra Nevada Forest Plan Amendment (SNFPA) final supplemental EIS (pages 34 and 35) includes: (1) Considering cost-efficiency in designing treatments to maximize the number of acres that can be treated under a limited budget; and (2) Revenues from the sale of commercial forest products may be obtained from fuel treatments Where consistent with desired conditions, area

treatments are designed to be economically efficient and meet multiple objectives. The project is designed to maintain ecological integrity, community stability, and forest health

Effects Analysis Methodology

This economic analysis focuses on those revenues and treatment costs associated with implementing fuel reduction treatments in the Sugarloaf Project area. The purpose of this economic analysis is to present the potential revenues and costs associated with each of the alternatives for comparison purposes.

This analysis does not include monetary values assigned to resource outputs such as wildlife, watersheds, soils, recreation, visual quality, and Fisheries. It is intended only as a relative measure of differences between alternatives based on the direct costs and values used. Other values are discussed in the appropriate sections of this document.

Geographic and Temporal Bounds

The geographic boundary for the social and economic analysis for the Plumas National Forest encompasses Butte, Lassen, Plumas, Sierra, and Yuba counties. The Sugarloaf Project is part of the Plumas National Forest and this economic analysis will be based on the incremental effect of the Sugarloaf Project within the Plumas National Forest.

As stated above, this economic analysis will not revisit the information presented in the PNF Forest Plan, but will focus only on the time frame associated with implementing fuels reduction treatments for the Sugarloaf Project. The time frame for completing the timber harvest removal would take approximately 3 to 5 years.

Analysis Methodology

Timber harvest values used in this assessment were based on the California State Board of Equalization, Timber Harvest Values, beginning July 1, 2012 through December 31, 2012. Harvest costs and road improvement costs were developed from the latest timber sale appraisals values. Manual (hand cutting, hand piling, etc.), and prescribed fire (underburning, pile burning) treatments are based on the latest service contract prices, Knutson-Vandenberg (KV) and brush disposal (BD) sale area improvement plans.

3.10.3 Affected Environment

The Plumas National Forest (the Forest) contributes to the regional economy in two primary ways: (1) through the generation of income and employment opportunities for residents of the immediate area, and (2) through direct and indirect contributions to local county revenues. The Forest also contributes in secondary ways, such as through production of goods and services in local and regional markets. Although some economic effects are dispersed over a broad area, the most substantial impacts are felt locally in Butte, Plumas, Lassen, Sierra, and Yuba Counties. The percentage of Plumas National Forest land in local counties is shown in table 3-58.

Table 3-58. Percentage of Plumas National Forest system lands by county.[a]

County	County Acres	Beckwourth Ranger District (ac)	Feather River Ranger District (ac)	Mount Hough Ranger District (ac)	Total PNF[b] Land in County (ac)	PNF[b] Land within County (percent)
Butte	1,072,708	0	143,517	0	143,517	13.4
Lassen	3,022,136	39,686	0	1,635	41,320	1.4
Plumas	1,672,778	448,365	183,210	579,196	1,210,771	72.4
Sierra	615,514	14,794	33,522	0	48,316	7.8
Yuba	411,695	0	33,734	0	33,734	8.2
Totals	**6,794,830**	**502,844**	**393,984**	**580,831**	**1,477,659**	**21.7**

NOTES:

a. Based on Geographic Information System (GIS) data.

b. PNF = Plumas National Forest.

The two employment sectors most related to forest planning processes are the timber industry and tourism. Both, however, are very difficult to quantify in terms of total employment and their relative importance to local economies as state and federal employers generally do not break down employment data into these categories.

Forest contributions to local county revenues come from three sources: (1) Payment in Lieu of Taxes, (2) timber yield taxes, and (3) *Receipt Act* payments or payments from the *Secure Rural Schools and Community Self-Determination Act* of 2000. Of these, *Receipt Act* or *Secure Rural Schools and Community Self-Determination Act* payments are by far the most significant, in terms of total contributions to each county, and therefore are most likely to be affected by Forest land management decisions.

Payment in Lieu of Taxes

Payments in Lieu of Taxes are administered by the Bureau of Land Management and apply to many different types of federally-owned land, including National Forest System lands. Payments in Lieu of Taxes payments compensate counties for the loss of property tax revenues due to non-taxable federal land within the county. Payments are made annually and are based on local population, Federal acreage in the county, and other federal payments during the preceding fiscal year. The minimum payment is 75 cents per entitlement acre. The funds may be used by the county for any purpose. The Forest has no control over the disbursement of these funds, and the amount disbursed every year is unaffected by Forest land management decisions.

Timber Yield Taxes

The second source of revenues to local government is the timber yield tax, administered by the State Board of Equalization. This tax is not paid by the Forest. Instead, it is paid by private timber operators, based on the amount of timber harvested in a given year on both private and public lands. The tax is 2.9 percent of the value of the harvested timber. The taxes are collected by the State, and approximately 80 percent is returned to the counties in which the timber was harvested. Decisions about the amount of timber to be offered for sale each year on the Forest can affect the amount of revenues disbursed to the counties.

Receipt Act

Receipt Act payments are distributed pursuant to the *National Forest Management Act* (Public Law 94-588). Under this law, 25 percent of National Forest revenues are allocated to the State in which the Forest is situated. The amount returned is based on the National Forest acreage within each county. According to State law, *Receipt Act* funds must be divided evenly between public schools and public roads of the county or counties in which the National Forest is located, and may not be spent on anything else.

Receipt Act payments are based on 25 percent of the total revenues collected from timber, grazing, land use, recreation, power, minerals, and user fees. Within the eleven western states, however, payments are based on 50 percent of revenue from grazing. Historically, at least 90 percent of total revenues have come from timber sale receipts. As a result, the amount of money available for distribution each year fluctuates widely, depending on the amount of timber harvested on National Forests.

Secure Rural Schools and Community Self-Determination Act

Congress passed the *Secure Rural Schools and Community Self-Determination Act* in 2000, offering counties an alternative to the *Receipt Act*. Under the *Receipt Act*, a state's three highest payment amounts between 1986 to1999 are averaged to arrive at a "compensation allotment" or "full payment amount." A county may choose to continue to receive payments under the *Receipt Act* or to receive its share of the state's full payment amount under the *Secure Rural Schools and Community Self-Determination Act.* Full payment amounts for Butte, Lassen, Plumas, Sierra, and Yuba Counties for years 2001–2011 are shown in table 3-59.

Table 3-59. Secure Rural Schools and Community Self-Determination Act full payment amounts to counties for years 2001–2011.

Year	Butte	Lassen	Plumas	Sierra	Yuba	Totals
2001	$866,419	$3,751,241	$7,024,648	$1,788,350	$231,268	$13,661,926
2002	$873,350	$3,781,250	$7,080,847	$1,802,657	$233,118	$13,771,222
2003	$883,830	$3,826,626	$7,165,816	$1,824,289	$235,915	$13,936,476
2004	$895,320	$3,876,372	$7,258,972	$1,848,005	$238,982	$14,117,651
2005	$915,912	$3,965,528	$7,425,928	$1,890,509	$244,479	$14,442,356
2006	$925,071	$4,005,183	$7,500,187	$1,909,414	$246,924	$14,586,779
2007	$923,173	$3,996,963	$7,484,795	$1,905,495	$246,417	$14,556,843
2008	$832,565	$3,604,665	$6,750,168	$1,718,472	$222,231	$13,128,101
2009	$749,308	$3,244,198	$6,075,151	$1,546,625	$200,008	$11,815,290
2010	$675,302	$2,923,783	$5,475,136	$1,393,872	$180,254	$10,648,347
2011	$536,109	$2,321,134	$4,346,602	$1,106,567	$143,100	$8,453,512

Counties can receive variable, revenue-dependent payments under the Receipt Act or receive stable funding for local schools and roads under *Secure Rural Schools and Community Self-Determination Act*. The legislation promotes local involvement, decisions, and choice by creating well-balanced resource advisory committees that recommend forest projects to the Secretary of the USDA, or advise counties on county project proposals. Counties that elect to receive the full payment amount under *Secure Rural Schools and Community Self-Determination Act* and receive more than

$100,000 are required to allocate 15 to 20 percent of their funding to projects under Title II or Title III.

Like traditional 25 percent funds, Title I funds are expended for public school and roads. Title II funds are allocated for projects on federal lands or projects that benefit federal lands. Resource Advisory Committees are established to determine Title II fund distribution. Title III funds are allocated for county projects that include search and rescue, community service work camps, easement purchases, forest-related education opportunities, fire prevention and county planning, or cost-share for urban community forestry projects. Secure Rural Schools and Community Self-Determination Act Title I, II, and III funds for 2011 for the five counties containing Plumas National Forest System lands are shown in table 3-60.

Table 3-60. Secure Rural Schools and Community Self-Determination Act Title I, II, and III payment amounts to counties for year 2011.

County	Full Payment Amount	Title I Funds	Title II Funds	Title III Funds
Butte	$536,109	$428,887	$69,694	$37,528
Lassen	$2,321,134	$1,972,964	$185,691	$162,479
Plumas	$4,346,602	$3,694,612	$347,728	$304,262
Sierra	$1,106,567	$940,582	$127,255	$38,730
Yuba	$143,100	$121,635	$0	$21,465
Total	**$8,453,513**	**$7,158,680**	**$730,368**	**$564,464**

Authority for the Forest Service to make the payments under the *Secure Rural Schools and Community Self-Determination Act* (SRSCSD) expired at the end of fiscal year (FY) 2006. Public Law 110-28, the *Iraq Accountability Appropriations Act of 2007*, was signed into law on May 25, 2007 and extended provisions of the Act for one more year. The proposal to utilize land sales to partially fund Secure Rural School payments was not included in the President's FY 2009 Budget request to Congress.

On October 3, 2008, the *Secure Rural Schools and Community Self-Determination Act of 2000* was reauthorized as part of Public Law 110-343. The new *Secure Rural Schools Act* has some significant changes. To implement the new law, the Forest Service requested states and counties to elect either to receive a share of the 25 percent rolling average payment or to receive a share of the Secure Rural Schools State (formula) payment. A county electing to receive a share of the State payment that is greater than $100,000 annually was required to allocate 15 to 20 percent of its share for one or more of the following purposes: projects under Title II of the Act; projects under Title III; or return the funds to the Treasury of the United States. The Act terminated in September 30, 2011, and if funds not obligated by September 30, 2012 they must be transferred to the Treasury.

Congress is currently in the process of extending the county payments for another year. If the *Secure Rural Schools Act* is not renewed, payments to counties would revert to the old system in which counties receive 25 percent of timber revenues. The result could be reduced payments to counties.

3.10.4 Environmental Consequences

Relative to the local economy, there is a potential to harvest 4.6–5.8 million board feet (mmbf) of timber over several years as part of the Sugarloaf Project. Plumas County can expect to receive 25 percent of the revenues generated from this fuels reduction project through the *Receipt Act* or receive full payment from the *Secure Rural Schools and Community Self-Determination Act*. The Sugarloaf Project area is located within Plumas County. Employment opportunities would be created from the fuels reduction activities. Furthermore, indirect and induced economic employment and monies would be generated when income received by contractors and the timber industry is re-spent within the local economy.

Economic consequences are a measure of the overall value of the various alternative management scenarios considered in this analysis. The level and mix of goods and services available to the public varies by alternative, resulting in a range of impacts on the social and economic environment. The impacts discussed in this section includes estimated government expenditures and revenues, as well as monetary impacts on local communities.

Direct monetary impacts are discussed in terms of net cash value to the U.S. Treasury, including the costs associated with implementing the treatments and direct, indirect, and induced job opportunities. In general, the monetary value of proposed alternative depends on the amount and method of timber harvest and the acreage planned for fuels reduction treatments. Fuels reduction treatment costs that exceed harvest revenues would be financed through appropriated funds. Fuel reduction treatments would be implemented through service contracts.

This economic analysis for the Sugarloaf Project does not revisit the information presented in the 1988 PNF Forest Plan, as amended by the 2004 Record of Decision for the Sierra Nevada Forest Plan Amendment, but for comparison purposes, it focuses only on those revenues and treatment costs associated with each of the alternatives.

This economic analysis is focused on those revenues and treatment costs associated with implementing fuel reduction treatments within the Sugarloaf Project area.

Employment

Employment opportunities can have direct, indirect, or induced effects on the local economy. Direct effects are associated with the primary producer. For example, the manufacturing of lumber from the Sugarloaf Project has a direct effect on employment opportunities. Indirect effects account for employment in service industries that serve the lumber manufacturer. These industries may include logging, trucking, fuel supplies, etc. Induced effects are driven by wages. Wages paid to workers by the primary and service industries are circulated through the local economy for food, housing, transportation, and other living expenses. The sum of direct, indirect, and induced effects is the total economic impact in terms of jobs. This typically ranges from 10 to 15 jobs per mmbf harvested.

Revenue to the Government

Net revenue is the difference between the revenues generated by an alternative and the costs required to implement the alternative. In this analysis, revenues come from harvest of timber, and when appropriate, chips or fuelwood.

Payments to Counties

Local counties receiving payment through the *Receipt Act* rather than the *Secure Rural Schools and Community Self-Determination Act* would share part of the revenues generated from the timber harvest. Actual payment amount depends on estimated stumpage value and the price bid by the purchaser awarded the timber sale contract.

Treatment Costs

Treatment or management costs include those costs associated with timber harvesting, biomass removal, road improvements, fuels treatments, and mitigation measures requirements, as well as costs of resource enhancement measures not associated with the sale of timber. Costs vary widely depending on the amount of mechanical, manual, or thermal treatments prescribed; the board feet of sawlogs or tons of biomass removed per acre; and the accessibility of the treatment units.

Non-Priced Costs and Benefits

It should be noted that all costs and values are not represented in the economic analysis. Calculations do not include costs and values for those items that cannot be estimated in dollar terms. The economic analysis does not take into account non-priced benefits such as improved long-term wildlife habitat, improved watershed conditions, and reduced fire hazard. Examples of costs not estimated in dollar terms are the reduction in scenic value in the early years of fuels treatments, air pollution due to wildfire, or reestablishing a forest following a stand-replacing wildfire.

For a detailed discussion of these non-priced benefits and costs, refer to the appropriate resource section in this document. These non-priced benefits and costs will be considered along with the net economic value of each action alternative in order to make a judgment as to which treatment option offers the best overall mix of costs and benefits to society.

Alternative A – Direct and Indirect Effects

This alternative would not improve forest health, reduce critical fuel loadings or harvest any timber. No funds would be generated for the Treasury or returned to local counties. No additional employment opportunities or wages paid to the primary and service industries employees would be circulated through the local economy.

Under the No-action Alternative, fuel reduction activities would not take place. In addition, dense standing trees and high fuel loading in the Sugarloaf Project area would continue to pose a high fire hazard to the surrounding areas. If the No-action Alternative were implemented, additional money would be needed to remove hazard trees that pose a safety concern for Sugarloaf, conduct any fuel reduction treatment, as well as possible elevated fire suppression costs should a wildfire occur in the Sugarloaf Project vicinity.

Alternative A – Cumulative Effects

The No-action Alternative would have a negative cumulative impact on local industries dependent on Forest Service contract work or a steady supply of timber, as well as counties that use the timber yield taxes to fund county programs. These local industries would lack opportunities or business that would be provided from fuels reduction, site preparation or timber harvest activities

associated with the Sugarloaf Project. The local economy also would not benefit from associated employment, such as in food, lodging, and transportation businesses.

Throughout northern California, cumulative years of reduced timber harvesting activities (including those on federal lands) have resulted in the loss of infrastructure (i.e., local mill closures) to complete such activities. During the period from 1990 to 2010, there has been 74 sawmill and 11 miscellaneous mill closures (table 3-61) (Ehinger 2010). In addition, of the existing 40 biomass power plants, 23 are currently operational (Mayhead and Tittmann 2012). Loss of this infrastructure could significantly reduce or eliminate future economic and environmental opportunities generated by the removal of forest products from national forest lands. Fuel reduction activities in the creation and maintenance of DFPZs would not occur thereby further negating opportunities for long-term employment and rural community stability.

A loss of forest products infrastructure could eventually lead to a decline of other local small businesses such as auto and truck repair shops, gas stations, grocery stores, hardware stores, clothing stores, restaurants and so forth. As families leave the area to find employment elsewhere, then other infrastructures such as libraries, schools, and doctors or medical clinics would also see a decline or a collapse of services.

Table 3-61. Mill closures by type and year.

Mill Type	1990-1994	1995-1999	2000-2004	2005-2010	Totals
Sawmills	40	11	15	8	74
Plywood	0	1	0	0	1
Veneer	1	2	1	0	4
Pulp	2	0	1	0	3
Board	0	0	3	0	3
Totals	**43**	**14**	**20**	**8**	**85**

The economic resiliency of Plumas County is low. The major employment industries include manufacturing lumber, the logging operators, transportation, the Forest Service and the county are all inter-connected and represent nearly 40 percent of employment. If manufacturing of lumber is diminished or stopped, then all of these industries would be affected by the lack of production by the mill. There is not another industry which can carry the community through economic lows.

The Plumas National Forest is unique in that the infrastructure is still in place; however these industries in the county are experiencing numerous years of negative growth and are faced with lay-offs, mill closures, and operators liquidating equipment. The loss of this industry will have a negative effect on managing NFS lands in a cost effective manner. The continuation of current conditions under alternative A would preclude and/or notably limit opportunities for long-term employment and rural community stability.

Alternatives B, C, and D – Direct and Indirect Effects

Table 3-62 summarizes the economic impacts of alternatives in terms of employee jobs and employee related income on the local economy by alternatives.

Table 3-62. Comparison of employment and income by alternative.

Revenue/Cost/ Employment	Alternative A	Alternative B	Alternative C	Alternative D
Direct jobs	0	71	85	64
Indirect jobs	0	81	101	83
Total direct and indirect jobs	0	152	186	147
Total employee related income	**0**	**$6,529,009**	**$7,978,070**	**$6,322,505**

Fuel reduction, thinning, and Group Selection treatments for alternative B, would directly generate 71 full-time employment opportunities, compared to 85 for alternative C or 74 for alternative D. All action alternatives would create additional employment opportunities in service industries (such as logging supply companies, trucking companies, and fuel suppliers) that serve the timber industry. There would also be an induced effect driven by wages. Wages paid to workers by the primary and service industries would be circulated through the local economy for food, housing, transportation, and other living expenses.

The sum of direct, indirect and induced effects is the total economic impact in terms of jobs. In addition to the direct employment that would result from the timber harvest and fuel reduction treatments in the action alternatives, there would be some additional benefits to the local economy as wages earned by those employees are spent on living expenses. Alternative B would generate an estimated 152 direct, indirect, and induced jobs, compared to 186 jobs by alternative C, or 147 jobs by alternative D.

Although this economic analysis indicates overall project costs would exceed revenue generated under all action alternatives, ranging from an estimated -$1,668,386 to -$2,871,078, this is primarily due to the limitations of the methodology to quantify ecological benefits such as localized improved water quality, less intensive fire behavior, healthy forests, functioning habitats, reducing risk to people and property from wildfire (see chapter 3: “Fire and Fuels”) and contributing to local economic stability, in terms of realized revenue.

The comparison of employment (direct and indirect jobs) and employee related income summarized above is based on historical relationships between employment and harvest in California during the 1980's. Each million board feet harvested is assumed to support 6.5 year-around jobs (1 in logging, 4 in sawmill, and 1.5 in US Forest Service employment). In regional economic models of employment for California and the Pacific Northwest, an estimate of one indirect or induced job for every direct timber job is added. Indirect jobs are associated with employment created by the local purchasers of sawmill materials, local expenditures by workers, and the demand for local government employees. Each million board feet harvested is assumed to support a total of 13 jobs that are timber related. The restoration and fuel work would provide additional direct and indirect employment. There are approximately 1.4 indirect jobs for every full time field job. All jobs are equivalent to year-around employment.

Net harvest cost-benefit projections for sawlog thinning and biomass under alternatives B and C indicate deficit of -$211,236 and -$468,879 respectively. This assumes a worst case scenario and does not evaluate the optional provision under the alternative C.

Alternative D does not include below cost mechanical treatment areas, areas requiring skyline logging systems (generally higher operational unit costs) or biomass removal allowing for a positive cost benefit of $277,643 (table 3-63). Implementation of beneficial watershed road improvements, road decommissioning and fuel reduction treatments such as mastication, grapple piling, and hand cutting would cost $1,457,150 under alternative B, $2,402,200 under alternative C, and $2,259,350 under alternative D.

Table 3-63. Comparison of economic revenues and costs by alternative.

Revenue/Cost/ Employment	Alternative A	Alternative B	Alternative C	Alternative D
Sawlog Harvest Volume (MMBF)*	0	5.8	5.3	4.6
Sawlog and biomass harvest revenues	0	$963,799 (biomass optional)	$672,061 (biomass removal required)	$585,515 (no biomass)
Harvest costs	0	$1,175,035	$1,140,939	$307,872
Net harvest cost and revenues	0	-$211,236	-$468,879	$277,643
Non-harvest costs (fuels and watershed health)	0	$1,457,150	$2,402,200	$2,259,350
Total project value	0	-$1,668,386	-$2,871,078	-$1,981,707

NOTE: MMBF = million board feet.

Alternative B, C, and D – Cumulative Effects

The cumulative effects of the action alternatives (B, C, and D) would include increased overall economic activity in the project area. Though it is not a requirement, it is assumed in this analysis that most products from the Sugarloaf project will be processed locally due to high hauling costs of products and equipment. Likewise, it is also assumed most employment will be derived from Butte, Lassen, Plumas, Sierra and Yuba counties. The Sugarloaf timber sale revenues and service contract employment would complement all other projects across the forest.

Cumulative effects would also include the economic benefits of reducing potential of uncontrollable wildfire through thinning treatments. Although it is difficult to predict exact costs of future wildfires, not knowing future fire weather conditions, fire start locations, and so forth, the investment of doing fuels activities has been shown to be positive in time with the onset of future wildfire. Mason et al. (2006) estimate approximately 70 percent positive benefit to cost ratio for fuels reduction activities.

Irreversible, Irretrievable Effects

There are no irreversible or irretrievable effects on the economic environment.

3.10.5 Summary and Comparison of Alternatives

Under alternative A, economically, there would be no jobs, direct or indirect, created and there would be no employee-related income generated by the use of this alternative. There would be no income created by sawlog volume. Alternative A would not meet the purpose and need for this project.

Alternative B would provide timber products that contribute to the economic stability of rural communities by thinning and harvesting up to 5.8 million board feet of sawlogs. Alternative B provides the least full-time employment opportunities of the action alternatives and contributes to community stability by creating 152 direct and indirect jobs, generating $6.5 million of employee related income. Alternative B would meet the purpose and need to cost effectively implement the fuel reduction treatments.

Alternative C would to community stability. Alternative C would generate approximately 5.3 million board feet of sawlogs, 186 direct and indirect jobs, and $8.0 million in employee related income.

Alternative D would contribute also to community stability, but not as much as alternative B or C. Alternative D would generate approximately 4.6 million board feet of sawlogs, 147 direct and indirect jobs, and $6.3 million in employee related income.

3.10.6 Compliance with the Forest Plan and Other Direction

All alternatives would meet the intent of the *National Forest Management Act of 1976* where: “The harvesting system to be used is not selected primarily because it will give the greatest dollar return or the greatest unit output of timber (16 U.S.C. 1604 (g)(3)(E)).”

Alternative B would best meet the intent of providing an adequate timber supply (5.8 million board feet of sawlogs) by establishing Defensible Fuel Profile Zones and Group Selections contributing to the economic stability and employment of rural communities, designed to comply with the standards and guidelines as outlined in *Herger-Feinstein Quincy Library Group Forest Recovery Act* (HFQLG Act).

Alternative C is designed to meet the Region 5 guidance for the Noncommercial Funding Alternative addressed in a Memorandum and Order dated November 4, 2009. Alternative C includes area fuels treatment (no Group Selections) predicted to moderately meet the intent of providing an adequate timber supply (5.3 million board feet of sawlogs).

Alternative D is designed to meet the 2004 SNFPA in compliance with the standards and guidelines. Alternative D includes variable and area fuels treatments (no Group Selections) predicted to moderately meet the intent of providing an adequate timber supply (4.6 million board feet of sawlogs) to generate net harvest revenue.

3.11 Heritage Resources

3.11.1 Introduction

The Feather River Ranger District, Plumas National Forest, is responsible for the stewardship of cultural resources, which include a wide-variety of archaeological sites, buildings, structures, objects, and cultural landscapes. The District also manages natural resources which are critical to the continuation of the lifeways of indigenous peoples (these natural resources are referred to as traditional cultural properties). Preserving for future generations the important cultural, educational and scientific values of these nonrenewable resources is a Federal Agency priority. The Proposed Action and alternatives were designed to ensure compliance with federal historic preservation laws, and management strategies developed to balance resource protection, cultural values and recreation opportunities.

This need was made more explicit when the National Historic Preservation Act (NHPA) was amended in 1980, and Section 110 was added to expand and underscore federal agency responsibility for identifying and protecting historic properties and avoiding unnecessary damage to them. Once damaged or destroyed, historic properties cannot be repaired or replaced.

3.11.2 Analysis Framework: Statute, Regulatory Environment, Forest Plan and Other Direction

Direction relevant and specific to the alternatives as they affect cultural resources includes:

***National Historic Preservation Act* (NHPA).** The Forest Service is directed to identify, evaluate, treat, protect, and manage historic properties by several laws. In 1966, Congress declared it to be our National policy that the federal government "administer federally owned, administered, or controlled prehistoric and historic resources in a spirit of stewardship for the inspiration and benefit of present and future generations" (*National Historic Preservation Act* [NHPA] (16 USC 470-1(3)).

- The NHPA of 1966 performs three actions: 1). It extends the policy in the Historic Sites Act of 1935 (49 Stat. 666; 16 U.S.C. 461-467) to include resources that are of State and local significance; 2). It expands the NRHP, and; 3). It establishes the Advisory Council on Historic Preservation (ACHP) and State Historic Preservation Officers.

- NHPA Section 106 directs all federal agencies to take into account effects of their undertakings (actions, financial support, and authorizations) on properties included in or eligible for the National Register. The ACHP regulations (36 CFR 800) implement NHPA Section 106. NHPA Section 110 sets inventory, nomination, protection, and preservation responsibilities for federally-owned historic properties.

- Executive Order 11593: Protection and Enhancement of the Cultural Environment, issued May 13, 1971, directs federal agencies to inventory cultural resources under their jurisdiction, to nominate to the NRHP all federally owned properties that meet the criteria, to use due caution until the inventory and nomination processes are completed, and to assure that federal plans and programs contribute to preservation and enhancement of non-federally owned properties.

- Region 5 Section 106 Compliance Programmatic agreement (36 CFR 800.14(b)) provide procedures for complying with 36 CFR 800. In California the Forest Service has developed a Programmatic Agreement between the California State Historic Preservation Office and the Advisory Council on Historic Preservation that developed standard resource protection measures for projects on National Forest System lands (USDA 2013).

- The National Environmental Policy Act (NEPA) requires the Federal Government to preserve important historic and cultural aspects of our national heritage. To accomplish this, federal agencies utilize the above mentioned Section 106 process associated with the National Historic Preservation Act (NHPA).

As set forth in the Region 5 Section 106 Compliance Programmatic Agreement, (USDA 2001a), archaeological sites that have been evaluated against and found to be significant under the National Register of Historic Places Criteria or sites that have not yet had their significance determined, will be protected from project activities and potential damage that could be inflicted by the implementation of the project. Within the Sugarloaf project boundaries, no archaeological sites have been evaluated against the National Register criteria, thus all eighty-seven sites are considered potentially eligible. They will all be protected until such time as an eligibility determination can be made.

During the implementation of this project, cultural resources will be protected from ground disturbing activities using the *standard resource protection measures* set forward in the Region 5 Section 106 Compliance Programmatic Agreement, (USDA 2001a). Activities that could potentially cause ground disturbance for this project include mechanical thinning, piling, and burning, mastication, underburning and the creation of Group Selection units. All eighty-seven sites within the area of potential effect will be afforded protection using the following *standard resource protection measures* set forward in the Region 5 Section 106 Compliance Programmatic Agreement, (USDA 2001a):

- Flag and avoid archaeological sites

- A map showing the location of all sites in the project area will be provided to the Forest Service project manager

- Sites will be monitored during and after the project to ensure that archaeological sites are not impacted by project activity

- If additional archaeological sites are identified during project activities, all work shall stop in that area until the District Archaeologist can assess the situation

- Historic sites within burn units will have fire lines placed around them as to keep them from being burnt over.

Activities that do not cause ground disturbance will be allowed to occur on archaeological sites using an exemption provided in the Region 5 Section 106 Compliance Programmatic Agreement, (USDA 2001a). The only proposed activities that meet this exemption are under-burning and hand thinning.

Archaeological sites being hand treated will have the following restrictions placed on the project activities:

- All cut material must be carried off site
- All piles created during hand treatment must be piled out of the site boundaries
- No tracked equipment will be allowed within site boundaries.

3.11.3 Effects Analysis Methodology

The current project area has been surveyed for archaeological sites on thirty-five occasions the first occurring in 1974 and the last in 2011 (Forest Service archaeology files, Feather River Ranger Station). The combined coverage of these surveys covers all treatment areas and areas of potential ground disturbing effects (such as landings, water holes and logging systems) within the project area. There are eighty-seven archaeological sites within the project boundaries. Cultural resource effects are defined as:

- Direct Effect is or could be caused by proposed hazardous fuels reduction and vegetative treatments or the consequences of such action, including physical damage resulting from tree felling and use of heavy equipment (crushing and/or displacement) and prescribed burning (scorching and cracking caused by excessive heat)
- Indirect Effect to sensitive archaeological resources could occur, particularly where artifacts lie in proximity to proposed treatment areas
- Cumulative Effects to archaeological resources occur when long term Direct and Indirect effects linked to the proposed action and alternatives occur.

Effects for cultural resources were split between ground disturbing activities and non-ground disturbing activities. Ground disturbing activities include: (1) mechanical piling and burning, (2) mastication; and (3) creation of Group Selection units. The direct and indirect effects of using equipment for these actions are that cultural resources can be damage if equipment is used within the boundaries of these sites. The burning of piles can also damage cultural resources if the piles are created and burned on sites (Solomon 2000 and 2002). These direct and indirect effects can and will be mitigated by the standard resource protection measures (USDA 2001a). Therefore the mitigation measures ensure that there will be no direct or indirect effects to cultural resources.

Non-ground disturbing activities include hand thinning, piling, and underburning. Hand thinning and piling can affect cultural resources if the piles are placed within a site. Pile burning has been shown to damage archaeological sites (Solomon 2000 and 2002) and underburning can destroy combustible artifacts and features on sites (see following paragraph). All sites with combustibles within burn units will have fire lines placed around them so they are not burnt over. Sites without combustible material will be allowed to have the underburn traverse the site as long as the fire remains at low intensity.

The effect analysis follows the assumption that reductions in fuel loads have a positive effect for archaeological resources through a reduced risk of high intensity wildfire. Wildfire causes adverse impacts to archaeological resources through reduced vegetation and loose burned soils that can lead to erosion problems. Archaeological features made from combustible materials can burn, while features made from material such as rock, can crack and even explode due to the extreme heat that wildfires are capable of producing. Artifacts at sites can also be affected by fire, obsidian artifacts can lose hydration rings and can even melt, bone and wood artifacts can burn glass and ceramic artifacts can explode or melt. Metal artifacts can melt or fall apart. Low intensity and controlled burning on archaeological sites that do not contain combustible features or artifacts has been found to benefit and not adversely impact these resources (Solomon 2000 and 2002).

Geographic and Temporal Bounds

The project boundary was used as the baseline boundary to analyze the effect of the project to cultural resources. This project boundary was used due to the fact that it encompassed areas of potential effect, the location of historic properties within this boundary were used to consider direct, indirect and cumulative effects. The area of potential effect also includes the roads used by logging trucks and other mechanized equipment and the landings in which the equipment and logs will be staged. The timeframe for the analysis of both direct and indirect effects is the duration of the project activities, estimated between 5 to 7 years.

Analysis Methodology

The data sources for identifying the cultural resources in the project area were the thirty-five archaeological surveys that have been conducted in the project area. The entire project area was surveyed, using pedestrian transects that were spaced between 20 and 80 meters apart to inventory the project area. Log landing locations where also included in these surveys.

Several types of data were compiled to provide the basis for understanding the nature and extent of cultural resources within the Project Area, and the potential effects of proposed hazardous fuels reduction and vegetative forest health treatments on these resources:

- Archival and literature sources have been reviewed. Data from Forest Service cultural resource records, maps and geographic information system (GIS) layers were compiled to provide a prehistoric and historic overview of the geographic region, identify major historical themes and events, and provide information on previous archaeological inventories, known site locations, and the likelihood of unidentified resources within the project area.

- The entire project area, including areas proposed for treatment under the action alternatives and areas that had not been previously surveyed were inventoried for this project. Data collection was focused on physical location of archaeological resources. The project area was surveyed on thirty-five occasions, beginning in 1974, with the most recent survey occurring in 2011. The combined coverage of these surveys covers all treatment areas and areas of potential ground disturbing effects (such as landings, water holes and logging systems) within the Project Area.

- The archaeological surveys located eighty-seven sites, although not all of these sites are located in or near proposed treatment areas. Seventy-eight of the sites are historic, six are

prehistoric and three are multi-component sites (multi-component sites contain both historic and prehistoric artifacts and or features). All cultural resources identified within the Area of Potential Effects are considered archaeological properties, as defined by the National Historic Preservation Act (NHPA; 36 CFR 60), for purposes of this undertaking, unless they have already been determined not eligible in consultation with the State Historic Preservation Office or through other agreed upon procedures (36 CFR 60.4; 36 CFR 800). Sites that have not been evaluated for National Register eligibility shall be considered potentially eligible, and would therefore be protected until such time as an eligibility determination is made.

3.11.4 Affected Environment

Eighty-seven archaeological sites have been recorded within the project boundary, however many of these sites fall within the larger project boundary and are not in treatment areas. Seventy-eight of the sites are historic, six are prehistoric (Native American sites) and three are multi-component sites (multi-component sites contain both historic and prehistoric artifacts and or features).

These archaeological sites represent past use of the project area that spans as far back as 6000 BC (Kowta 1988). The project area is the ethnographic territory of the Northwest or Konkow Maidu (Dixon 1905 and Riddell 1978). Much of the evidence of this group has been destroyed by the destructive intrusion of Euroamerican gold miners. The intrusion of Euroamerican gold miners had extreme impacts on both the Native Americans as well as the landscape. Native American sites became hard to find in the archaeological record after 1850 due to changes in the material culture after the influx of Euro Americans into the project area (for more information see Moore 2002). Only a few prehistoric bedrock milling features and artifacts remain within the project area due to the destruction of the mining activity. Native populations were decimated by disease, genocide, and catastrophic environmental change. The native population was believed to be around 8000 prior to this intrusion (1846); populations had fallen to an estimated 900 by 1925 (Kroeber 1925). For more information on the Maidu culture see Roland Dixon 1905 ethnography and the more recent work of Francis Riddell in 1979. For more information on the archaeology of Native American sites in this area please refer to Kowta's 1988 report on the archaeology of Butte and Plumas Counties.

Euro-American emigrants entered and occupied the project area starting around 1850. Early use of the area was focused on gold mining. Evidence of the magnitude of European settlement can be seen in the numerous mining features (e.g. ditches, reservoirs, hydraulic pits, etc.) that cover the landscape of the Sugarloaf Project area. Mining activities in the area first focused on pan, rocker, and sluice boxing of the natural waterways. By 1853, miners had moved away from these waterways and were beginning to mine the dry banks of these channels. Small scale digging of adits (drift, tunnels, and shafts) into gravel banks was in use by 1854, as well as hydraulic mining techniques. A rush for water claims set in as water became an essential aspect of mining for both washing dirt and in numerous hydraulic operations (Baker and Shoup 1985). This rush for water resulted in the creation of a number of major ditch and flume systems in the area (Baker and Shoup 1985).

The settlement and industry of the Gold Rush, along with the impact of logging and ranching brought further irreversible changes. Additional evidence of the magnitude of European settlement can be seen from early photographs of historic town sites in and surrounding the project area provide a glimpse of landscapes almost barren of trees. These trees were cut down in order to build houses,

businesses, and other buildings, for heating these numerous buildings, and for shoring of mine shafts, and the building of flumes.

Many lumber mills were built in the project area during the 1850's (Thompson and West 1879; Garvis 2004). By the 1890's the denuding of the timbered land on the East Coast brought lumber companies west. These companies bought millions of acres in timbered lands. The archaeological sites and features associated with lumbering include logging camps, lumber mills, and artifacts.

Mines and Towns within the Project Area

LaPorte—Miners first discovered gold in Rabbit Creek in 1850, soon after the camp of Rabbit Creek was established. The camp held many houses and businesses and soon opened a post office under the name of Rabbit Town. Two years later the town's name changed to LaPorte and by 1857 the town of LaPorte housed over fifty businesses. By the turn of the century, most businesses had either consolidated, closed, or relocated out of the town of LaPorte. For more information on the history of the town of LaPorte see either Erwin Gudde's "California Gold Camps" (1975) or Jann Garvis's "Roar of the Monitors" (2004).

Secret Diggings—Large scale hydraulic mining at Secret Diggings began in the 1850s. Here a small town arose to hold many houses, a slaughter house, two saw mills, a billiard saloon, a store, a school, and a cemetery. The Illinois ditch transported water into the mining site by 1854 and by 1958 a 2000-foot flume was constructed to carry additional water in. For more information on Secret Diggings see either Erwin Gudde's "California Gold Camps" (1975) or Jann Garvis's "Roar of the Monitors" (2004).

American House—American House was established as an inn located on the Marysville-LaPorte Road. Extensive placer mining occurred in the direct vicinity of the inn and many ditches and flumes were constructed to move water into and around the area. For more information on American House see Erwin Gudde's "California Gold Camps" (1975). For more information on the history of the area refer to Fariss and Smith's 1882 History of Plumas, Lassen, and Sierra Counties.

3.11.5 Environmental Consequences

The following provides a description of potential effects of alternatives A, B, C, and D on cultural resources, as well as proposed mitigations measures, where needed. This discussion will take into account all direct, indirect and cumulative impacts to cultural resources.

Cultural Resources

Alternative A – Direct, Indirect and Cumulative Effects

This alternative will not change the existing conditions as they occur today. There would be no direct or indirect impacts to cultural resources under this alternative. This is due to the fact that that there would be no ground disturbing activities taking place. The cumulative effect of this alternative would be one of a slightly increased risk of a wildfire due to fuel build up in the project area. Wildfires can have multiple effects to cultural resources. They can lead to erosion problems due to reduced vegetation and loose burned soils. Cultural features made from combustible materials can

burn, while features made from material such as rock, can crack and even explode due to the extreme heat that wildfires are capable of producing. Artifacts at sites can also be affected by fire, obsidian artifacts can lose hydration rings and can even melt, bone and wood artifacts can burn, and glass and ceramic artifacts can melt or even explode (table 3-64). Some metal artifacts can melt or fall apart (Solomon 2000 and 2002). While there are no direct or indirect impacts of this alternative, the cumulative impact of a slightly increased risk if wildfire can be seen as a negative impact to cultural resources.

Table 3-64. Treatment areas with known cultural resources within or near them.

Treatment Area Number	Number of Archaeological Sites within or near the treatment area	Treatment Area Number	Number of Archaeological Sites within or near the treatment area	Treatment Area Number	Number of Archaeological Sites within or near the treatment area
2A	0	30A	3	213B	0
2B	0	30B	2	214	2
3A	8	30C	0	221A	3
3B	1	32	1	221B	1
3C	5	35	3	221C	2
14A	0	36	1	221D	1
14B	6	37A	1	222A	4
14C	0	37B	1	222B	1
14D	2	37C	1	222C	3
14E	0	37D	0	222D	1
14F	0	44	2	223A	2
15A	1	45A	3	223B	1
15B	0	45B	0	224	4
19	2	45C	4	225	0
21A	6	46A	2	227A	1
21B	3	46B	2	227B	0
21C	4	46C	1	228A	0
26	0	47	2	228B	1
27A	1	51	0	230	0
27B	0	53A	0	231	0
27C	0	53B	0	232	1
27D	2	53C	0	233	1
27E	0	54	0	234	0
27F	0	74	2	235A	1
27G	0	206	2	235B	0
29A	1	209B	1	235C	1
29B	0	211	11	235D	0
29C	1	213A	3	235E	0
236	0	904B	0		
237	1	904C	0		
238	0	906	2		
240	1	908	1		
241	0				

Table 3-64. Treatment areas with known cultural resources within or near them (continued).

Treatment Area Number	Number of Archaeological Sites within or near the treatment area	Treatment Area Number	Number of Archaeological Sites within or near the treatment area	Treatment Area Number	Number of Archaeological Sites within or near the treatment area
541	1				
542A	1				
542B	5				
542C	3				
542D	3				
542E	0				
543	0				
547	3				
573	1				
575	2				
576	2				
577A	2				
577B	1				
577C	3				
900	2				
901A	2				
901AH	1				
901AT	1				
901B	3				
901GHWK	3				
901B	3				
902	3				
904A	0				

Alternatives B, C, and D Direct, Indirect and Cumulative

Alternative B has three prescriptions for the project area; these prescriptions include mechanical thinning, Group Selections, and mastication. These three are being analyzed together since the risk of using ground based equipment is the same to the cultural properties within this project. The direct and indirect effects of using equipment for timber harvest and mastication is that the cultural resources can be damaged if equipment is used within the boundaries of archaeological sites.

There are a variety of risks associated with the hand cutting of trees, shrubs, pile burning and underburning. The burning of piles can also damage cultural resources if the piles are created and burned on sites. Underburing can do the same amount of damage as a wildfire if allowed to be more than a low intensity burn (Solomon 2000 and 2002). These direct and indirect effects can be mitigated by using the standard resource protection measures set forth in the Region 5 Section 106 Compliance Programmatic agreement (USDA 2001a). If these mitigation measures are followed there would be no direct or indirect effects to cultural resources.

The cumulative effect of alternative B would be a slightly reduced risk of wildfire damage to sites as fuel loading would be reduced under this alternative (Fuels and Fire). Current fuel loads are high and present a threat of high intensity wildfire burning through archaeological sites and causing irreversible damage. Compared to the current fuel levels this alternative would be considered an immediate and foreseeable positive effect since it is decreasing the fuel loads as well as the chances of high intensity wildfires (Fuels and Fire).

The three prescriptions in alternative C would have similar direct, indirect and cumulative effects as alternative B, with the exception that alternative C would reduce the risk of wildfire hazards to the highest degree (of the four alternatives), as the alternative includes a higher degree of fuel load removal (Fuels and Fire).

The three prescriptions in alternative D would have similar direct, indirect and cumulative effects as alternative B, with the exception that alternative D would reduce the risk of wildfire hazards the least of the three alternatives (excluding the no action alternative), as it removes fuel loads to a lesser degree due (Fuels and Fire).

3.11.6 Summary and Comparison of Alternatives

There are no significant effects to cultural resources from project activities within any of the alternatives. There would be no effect to cultural resources if alternative A is chosen since there would be no action taken and no ground disturbing activities. Alternative A would have a slightly negative cumulative effect due to a slight increase in the probability of a wildfire occurring within the project area. The probability of a wildfire burning within the current fuel loads is high (Fuels and Fire) and presents a threat of wildfire burning through archaeological sites and causing irreversible damage. Compared to the current fuel levels, this alternative would towards the protection of archaeological sites. Under alternatives B, C, and D there is the potential for a greater risk of direct and indirect effects, due to the possibility that cultural resources could potentially be damaged by project activities. These alternatives include use of ground based equipment that can cause inadvertent direct and indirect effects if equipment is used within the boundaries of archaeological sites; however, this probability of damage will be eliminated by the use of standard resource protection measures (USDA 2001). The cumulative effects under alternatives B, C, and D, are slightly reduced likely-hood of the cultural resources being irreversibly damaged by the effect of wildfire.

3.11.7 Compliance with the Forest Plan and Other Direction

The above analysis methodology complies with the Forest Plan and all Statute, Regulatory Environment laws and regulations. Under these alternatives, cultural resources would be protected from all project activities using the standard resource protection measures set forward in the Region 5 Section 106 Compliance Programmatic Agreement, (USDA 2001). All 87 of the archaeological sites within the project are considered potentially eligible to the National Register of Historic Places and therefore will be protected until such time as an eligibility determination can be made. All of the sites will be afforded protection using the above stated standard resource measures (Analysis Framework: Statute, Regulatory Environment, Forest Plan and Other Direction).

3.12 Air Quality

3.12.1 Introduction

Prescribed fire is one of the primary activities proposed for the Sugarloaf Project that would have a direct impact on air quality. Prescribed burning would be conducted to reduce surface fuel loading and small diameter tree densities over time as trees die and fall to decrease hazardous fuels. Prescribe fire is also an integral tool for reintroducing fire into a fire adapted ecosystem to maintain a healthy forest. Prescribed burning would be conducted during fall, spring, or winter, the most favorable times in terms of smoke dispersion and environmental conditions for prescribed burning. A secondary source of impacts on air quality would be from dust and internal combustion engine emissions during project activities. Criteria pollutants put off by these activities could have impacts to public health and visibility.

3.12.2 Analysis Regulatory Framework: Statute, Regulation, Forest Plan, and Other Direction

Air quality is managed through a complex series of federal, state, and local laws and regulations. The U.S. Environmental Protection Agency (EPA) has the primary federal role of ensuring compliance with the requirements of the *Clean Air Act*. The EPA issues national air quality regulations, approves and oversees State Implementation Plans, and conducts major enforcement actions. State and local Air Pollution Control Districts and Air Quality Management Districts (AQMDs) have the primary responsibility of carrying out the development and execution of State Implementation Plans, which provide for the attainment and maintenance of air quality standards.

The original *Air Quality Act* was passed in 1963. This act was followed by the *Clean Air Act* and its amendments of 1970, 1977, and 1990. The *Clean Air Act* is the primary legal instrument for air resource management. It requires the EPA to identify pollutants that have adverse effects on public health and welfare and to establish air quality standards for each pollutant. The EPA has issued National Ambient Air Quality Standards (NAAQS) for sulfur dioxide, carbon monoxide, ozone, nitrogen dioxide, lead, and particulate matter (PM) [of 2.5 microns ($PM_{2.5)}$ in diameter or smaller]. If the National Ambient Air Quality Standards are violated in an area for over a period of three years that area may be designated in “nonattainment” for acceptable levels of that pollutant, and the state must develop a plan for bringing that area back into “attainment.” Title 17 of the California Air Pollution Control Laws sets similar standard for these pollutants. States may impose stricter standards, but never less stringent than National standards.

A conformity determination is needed for areas in nonattainment for criteria pollutants. However the conformity rule published by the EPA on April 5, 2010 included a Presumption of Conformity for prescribed fires conducted in compliance with a state Smoke Management Program (SMP) (pg. 17,264, EPA 2010). The purpose of a SMP is to:

1. Mitigate nuisance smoke and public safety hazards,
2. Prevent NAAQS violation,
3. Protect public health,

4. Address visibility impacts in Class 1 airsheds and

5. Establish procedures and requirements for minimizing emissions.

California has an EPA approved SMP therefore there is no conformity analysis required for the Sugarloaf Project.

The 1977 *Clean Air Act* amendments set up a process to designate Class I and Class II areas for Air quality management. Class I areas receive the highest levels of protection under the Prevention of Significant Deterioration program, which regulates air quality through application of criteria for specific pollutants and use of the Best Available Control Methods.

On the Plumas National Forest, the 1988 Plumas National Forest Land and Resource Management Plan, the 2004 Sierra Nevada Forest Plan Amendment (SNFPA final supplemental EIS), and the 1999 HFQLG Act final EIS provide direction for coordination and cooperation with local Air Quality management Districts.

The following operating procedures are from the HFQLG Act final EIS (1999) and the SNFPA final EIS (2004):

1. Mitigate dust from project activities by including standard dust abatement requirements in sale and project contracts.

2. Conduct prescribed burns when favorable smoke dispersal is forecasted, especially near sensitive Class I areas.

3. Use appropriate smoke modeling software to predict smoke dispersion.

4. Minimize smoke emissions by following Best Available Control Methods.

5. Avoid burning on high visitor use days and notify the public before burning.

6. Consider alternative to burning.

7. Incorporate burn plan data into appropriate modeling software.

8. Comply with Title 17 of the 2004 California Air Pollution Control Laws and interim air quality policy and local smoke management programs.

9. Follow the Memorandum of Understanding on prescribed burning with the California Air Resources Board and the USDA Forest Service, Pacific Southwest Region.

3.12.3 Affected Environment

The Sugarloaf Project is located in Plumas County, California on the Southern border of the Feather River Ranger District of the Plumas National Forest. Plumas County is within the Mountain Counties Air Basin, so air quality is regulated by the Northern Sierra AQMD.

Climatic conditions in the project area are governed by a combination of large- and small- scale factors. Among the large-scale factors are the latitude, prevailing hemispheric wind patterns, and extensive mountain barriers to the east. Large-scale airflow is generally westerly throughout much of the year.

Small-scale or local factors include drainages as well as vegetation cover (Schroder and Buck, 1970). During the summer, winds over the proposed project area are typically southwest from the Sacramento River Delta. Temperature inversions are rare. When they do occur, they are usually in the early morning, breaking up by mid-morning. Local up-canyon, up valley winds are prevalent during the remaining months with occasional northerly and easterly winds. These surface air flow patterns account for pollution transport between the Sacramento valley and Sierra foothills and mountains.

The communities of LaPorte and American House are within the project boundary. Little Grass Valley Recreation Area is approximately 1 mile north of the project area and is a high-use recreation area in both summer and winter months. Other communities near the project area are: Strawberry Valley, 4 miles southwest and Quincy, approximately 16 miles northeast.

Smoke sensitive areas include, but are not limited to schools and hospitals; the closest area is in the community of Quincy. The nearest air quality monitoring stations are in the communities of Quincy, approximately 16 miles northeast, and Portola, approximately 40 miles east. Air quality is considered good throughout most of the year in the project area. Currently air quality designations for Plumas County are in unclassified/attainment for $PM_{2.5}$ and ozone at both state and federal levels.

See table 3-65 and table 3-66 for baseline data for $PM_{2.5}$ and ozone pollutants in Mountain Counties. All baseline data was derived from California Resources Board website. The national and state averages may differ due to different samplers, and slightly different methods used to calculate. Exceedance of the national and state standards does not necessarily constitute a violation of the standards (CARB 2010).

Table 3-65. PM2.5 Annual Averages for Mountain Counties Air Basin

	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000	1999	Average
National	10.4	15.2	13	10.9	10.6	11.7	13.3	9.9	15.6	9	11.1	11.9
State	13.8	*	14.2	8.6	10.6	11.7	8.6	9.9	8.1	9	11.1	10.6

NOTE: * insufficient data to calculate value.

Table 3-66. Ozone maximum 8-hour average** for Mountain Counties Air Basin

	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000	1999	Average
National[1]	0.096	0.118	0.106	0.115	0.120	0.124	0.122	0.137	0.109	0.113	0.118	0.116
State[2]	0.096	0.118	0.107	0.116	0.120	0.124	0.123	0.138	0.109	0.114	0.119	0.117

NOTES:

1. All concentrations expressed in parts per million (ppm).
2. The maximum 8-hour average is the highest 8-hour average ozone concentration in the year, not an overall yearly average. A maximum average greater than or equal to 0.075 ppm or 0.070 ppm is indicative of the severity of the ozone problem in the area and is not necessarily related to a violation of the standard (CARB 2010).

Visibility concerns include the communities of LaPorte and the American House. The communities of LaPorte and American House are within the project area. Visibility in both communities is considered good.

3.12.4 Methodology of Effects Analysis

3.12.4.1 Geographic extent of area analyzed, and Timeframe for analysis

The analysis area for direct and indirect effects for air quality is the area potentially affected by smoke emissions, fugitive dust, and emissions from proposed treatments. This includes the project area and Northern Sierra AQMD. See Figure 3-10and Figure 3-11 for geographic extent of Northern Sierra AQMD.

Data Sources

Baseline data on criteria pollutants and air quality for Plumas County was obtained from the California Environmental Protection Agency Air Resources Board website (EPA) and California Air Resources Board website. These websites are updated yearly with air quality information.

The predicted emissions from wildfire, prescribed fire and harvest activities in the proposed project area have been estimated using emission factors from Environmental Protection Agency (EPA) Document 42. Estimated consumed fuel loading, volume of timber removed, estimated miles of road construction, reconstruction and acres treated will be calculated using the emission factors from EPA Document 42 to estimate criteria pollutants.

Basis for Analysis Methods

Common stand exam data was input into the Forest Vegetation Simulator (FVS) program to estimate harvestable timber volumes. Fofem 5.0 (Reinhardt 2005) was used to estimate consumed fuel load in tons per acre for California white fir vegetation type. Consumed fuel loading was estimated for wildfire, prescribed understory burning and pile burning.

The annual arithmetic averages for national and state ambient air quality standards for PM2.5 are 15.0 ug/m^3 and 12.0 ug/m^3 respectively. The 8 hour averages for national and state standards for ozone are 0.075 ppm and 0.070 ppm (CARB 2010). State standards are allowed to be more restrictive than national standards, but never less restrictive.

The air quality analysis for activities associated with each alternative includes identification of adjacent and downwind air basins of concern (nonattainment areas), comparison of the amount of $PM_{2.5}$ and ozone precursors Nitrogen Oxides (NOx) and Volatile Organic Compounds (VOCs) to be produced by fuels treatment and other project activities within the project boundary, and a discussion of the consequences of wildfire produced emissions compared to prescriptive fire, the less emissions produced the better.

Assumptions specific to resource analysis

A primary assumption is that predicted emissions will be generated by wildfire, prescribed fire and harvest activities in the proposed project area. All activities could occur over the life span of the environmental document, approximately 10 years depending on forest funding. Prescribe fire would

be implemented in the spring, fall and winter months because these are the best times of year for smoke dispersion and environmental conditions for burning. Each year the burning would take place over a period of months, with treated areas spread throughout the project area.

Figure 3-10. California air basins and counties.

Figure 3-11. California air quality districts and counties.

The following are the assumptions used for determining emissions from timber operations and prescribed burns:

1. The emission factors used to determine effects from the project were taken from EPA Document 42 (EPA 1995) for prescribed burning, and from the *National Environmental Policy Act Air Quality Desk Reference Guide* (CH@M Hill 1995; table 3.3.2-1 for timber harvest operations).
2. All harvest thinning equipment will be diesel powered, and thinning treatments will occur over a three-year period (typical length of a timber contract).
3. Harvest operations include harvesting, processing, skidding, loading, hauling, and road construction and closure (including road obliteration for watershed restoration).
4. Tractor ground logging systems will be whole tree yarded and de-limb at landing.
5. Slash piles are constructed free of dirt, with 90 percent consumption.
6. Estimated daily burning would be approximately 100 acres. Burning would not be continuous but separated by wet weather patterns and seasons.
7. Predicted weather forecasts are accurate.

3.12.5 Measurement Indicators for Resource Analysis

The air quality analysis for the Sugarloaf Project uses one indicator for air quality: criteria pollutant totals required for compliance with federal, state and local laws and regulations. Criteria pollutants used for this analysis are $PM_{2.5}$ and ozone precursors, Nitrogen Oxides (NOX) and Volatile Organic Compounds (VOC). $PM_{2.5}$ has been shown to impact visibility as well as incur health threats to humans.

Criteria pollutants in total tons produced will be evaluated for wildfire, prescribed burning (pile and understory burning) and for timber operation to compare the different alternatives analyzed.

3.12.6 Environmental Consequences

Alternative A (No Action)

Direct and Indirect Effects. Under this alternative, no increase in ozone precursors or $PM_{2.5}$ emission levels would be produced from prescribed burning or harvest operations. Alternative A would not result in a reduction of surface fuels, so the potential for substantial degradation of air quality from future wildfire would not be reduced. Air quality can be severely impacted by particulate matter and other pollutants during large wildfire events. Impacts from the 2007 Moonlight fire on the Plumas National Forest, for example affected air quality over 100 miles away.

An example of the indirect effect of a wildfire was experienced during the 2008 Canyon Complex. The Complex started on June 20, 2008 on the Plumas National Forest, the fires burned

through August, 2008. The diurnal wind flow caused smoke to be transported toward Quincy, California in the daytime and down canyon towards Oroville, California at night. During this time period according to the air quality index Plumas County experienced, 5 days in the unhealthy and 1 day in the unhealthy for sensitive groups categories, for $PM_{2.5}$ pollutants. Butte County reported 2 days in the unhealthy and 2 days in the unhealthy for sensitive groups categories for $PM_{2.5}$ pollutants. Given the topography and diurnal wind pattern in the project area similar effects could occur if a large fire started in the Sugarloaf Project area.

The No-action Alternative would not provide any opportunities for reducing existing forest fuels and the hazard they pose in wildland fires. During the flaming phase of a catastrophic wildfire, air quality degradation can exceed federal and state standards hundreds of miles downwind. The predicted $PM_{2.5}$ from a 6,614 acre (approximate project acreage) wildfire is 2,978 tons. Predicted ozone precursors, VOCs and NOx from a 6,614 acre wildfire are 1,797 tons and 634 tons respectively.

Cumulative Effects. Under alternative A, the project area would be subjected to long-term deposition of surface fuels. Forest fuels would continue to increase with biomass production and would out-produce the decomposition rates in this climate.

The long-term chronic effects of wildfires could be unregulated higher $PM_{2.5}$ and ozone emissions that can affect the public welfare and health of asthmatics and others with sensitive respiratory systems.

Sources found to contribute ozone and $PM_{2.5}$ emissions to Mountain Counties Valley air basins include: fuel combustion, industrial processes, on road motor vehicles, other mobile sources, and natural sources, which include wildfires and miscellaneous processes, including but not limited to fugitive dust and managed fires, (retrieved from http//:www.arb.ca.gov, March, 2011).

3.12.6.1 Alternative B (Proposed Action)

Direct and Indirect Effects. See table 3-67 and table 3-68 for the volume of predicted pollutants produced from alternative B.

The annual predicted criteria pollutant totals for timber operations (emissions from trucks and other equipment) and prescribed fire would vary according to the acres of mechanical treatment performed each day and amount of acres approved by AQMD for burning.

Table 3-67. Harvest emissions for alternative B.

Criteria Pollutant	Alternative B
$PM_{2.5}$	2.26 tons
NOx	34.46 tons
VOC	2.26 tons

Table 3-68. Total prescribed burning emissions for all action alternatives.

	Criteria Pollutant	Understory Burning	Pile Burning	Total
		(tons)		
Alternative B	$PM_{2.5}$	864	85	949
	NOx	185	43	228
	VOC	524	38	562
Alternative C	$PM_{2.5}$	856	236	1,092
	NOx	183	119	302
	VOC	519	106	625
Alternative D (Proposed Action)	$PM_{2.5}$	871	250	1,121
	NOx	186	126	312
	VOC	528	112	640

In the event of a wildfire, the stands in the Sugarloaf Project area that are treated would have less material to burn producing less particulate matter emissions than untreated areas.

The method of prescribed burning to accomplish fuel load reduction is understory and pile burning (piles created by machine and by hand). Hand piling will be used in sensitive plant habitat, along cut banks, or other steep pitches where mechanical equipment is not capable of maneuvering. Pile burning would be used to reduce both natural and activity-generated fuels. The objective of pile burning would be to reduce fuel loading while protecting the residual over story trees from damage caused by heat and flames or damage from equipment. Piled material is allowed to cure, and a portion of the pile is covered with a water proof barrier, so that piles can be ignited with lower fuel moistures, which ensures complete and efficient consumption.

The release of particulate matter into the air during prescribed burning can have adverse effects on visibility and public health. As described above, the volume of particulate matter is related to which burning method is used and the extent of the burning, typically the Feather River Districts burn no more than 100 acres per day of either piles or understory burning (table 3-69).

Table 3-69. Predicted daily emissions for prescribed burning.

Criteria Pollutant	Understory Burning (100 acres)	Pile Burning (100 acres)
	(tons)	
$PM_{2.5}$	37.38	18.67
NOx	5.78	9.38
VOC	16.39	8.40

Particulate concentration in the Mountain Counties air basins (table 3-70) are influenced by climatic conditions and other emission-generating activities carried out in the air basin. Particulate concentrations are regulated through compliance with the California Air Resources Board (CARB) and local AQMDs.

Table 3-70. Total emissions for alternative B.

Criteria Pollutant	Total (tons)
Total $PM_{2.5}$	951.26
Total NOx	262.46
Total VOC	563.98

By following the required burn plan and the AQMD requirements for burning it is unlikely that emissions caused by the project would exceed California Air Quality Standards. The Forest is required to notify the AQMD prior to ignition of a prescribed fire; the AQMD in turn gives the Forest approval (or may not approve) to burn a certain amount of acres each day. Notifications of prescribed burning would be made through the North East Air Alliance (NEAA) to share burn information; such as type of burning, acreage, and predicted smoke path. This helps coordinate prescribed burning for multiple land management agencies, private landowners and air quality management districts. The goal of the agencies working together is less smoke impact to the public. Under favorable smoke-dispersal conditions, the smoke from prescribed burns would likely effect visibility and air quality during ignition and for approximately one to three days following ignition.

Another impact of the action alternative would be the emissions and dust caused by project activities. Fugitive dust caused by the use of unpaved roads can produce $PM_{2.5}$ in quantities great enough to impair the visual quality of the air. These affects are localized and can be mitigated by effective dust abatement methods.

Cumulative Effects to all Action Alternatives. The $PM_{2.5}$ and ozone emissions from alternative B or alternative B Modified would contribute to criteria pollutant loading locally and regionally. Local effects include cumulative emissions from prescribed burning resulting from past practices, natural surface fuel buildup, and activities on federal, state, and private lands near the Sugarloaf Project area. By following an approved smoke management plan the $PM_{2.5}$ and ozone atmospheric concentrations are not expected to exceed national or state standards; however, emissions could exceed CARB standards if (1) weather conditions predicted by CARB meteorologists do not prevail, or (2) emissions do not disperse as predicted, and/or (3) emissions from other Air Quality Management District’s adversely impact air quality in local districts. Forest Service and CARB smoke-dispersal forecasting would be used as part of the burn plan to mitigate effects within the regulatory framework.

Alternative C (Non-commercial funding)

Direct and Indirect Effects. See table 3-71 for predicted pollutants produced from the mechanical treatment and harvest of alternative C. There is less particulate matter generated from alternative C because of the absence of Group Selections. The annual predicted criteria pollutant totals for timber operations (emissions from trucks and other equipment) and prescribe fire would vary according to the acres of treatment performed each year.

Table 3-71. Emissions from mechanical treatments in alternative C.

Criteria Pollutant	Total (tons)
$PM_{2.5}$	1.74
NOx	26.49
VOC	1.53

Prescribe burn emissions generated in Plumas County (Mountain Counties air basin) can be found in Table 3-72.

Table 3-72. Total prescribed burning emissions from alternative C.

Alternative C (Non-commercial funding)	Criteria Pollutant	Understory Burning	Pile Burning	Total
		(tons)		
Mountain Counties	$PM_{2.5}$	856	236	1,092
	NOx	183	119	302
	VOC	519	106	625

There are slight variations in treatment acreages between the B alternatives and alternative C because the primary fuels treatment replaces the Group Selection and there is approximately 50 to 100 acres more of hand cut grapple pile and burn treatment in alternative C.

In the event of a wildfire, the stands in the Sugarloaf Project area that are treated would have less material to burn producing less particulate matter emissions than untreated areas.

Depending on market demand biomass may be transported from the area in the form of chips; total biomass removed is estimated at 13,926 bone dry tons or 6.6 tons per acre. Total predicted $PM_{2.5}$ emissions removed from the project area are 99.4 tons. If fuel loading does not meet the desired condition after the biomass removal then an understory burn is prescribed, this is predicted to produce fewer emissions because of the lighter fuel load.

The method of prescribed burning to accomplish fuel load reduction in alternative C is pile burning (piles created by machine and by hand). Hand piling will only be used along cut banks or other steep pitches where mechanical equipment is not capable of maneuvering. Pile burning would be used to reduce both natural and activity-generated fuels. The objective of pile burning would be to reduce fuel loading while protecting the residual over story trees from damage caused by heat and flames or damage from equipment. Pile burning will produce more particulate matter per acre than understory burning because the standing biomass will be cut and piled producing higher fuel loads.

However, piled material is allowed to cure and covered with barrier so that piles can be ignited with lower fuel moistures, which ensures complete and efficient consumption.

The release of particulate matter into the air during prescribed burning can have adverse effects on visibility and public health. As described above, the volume of particulate matter is related to which burning method is used and the extent of the burning. Particulate concentration in the Mountain Counties air basin (see table 3-73) is influenced by climatic conditions and other emission-generating activities carried out in the air basin. Particulate concentrations are regulated through compliance with the California Air Resources Board (CARB) and local Air Quality Management Districts.

By following the required burn plan and the AQMDs requirements for burning it is unlikely that emissions caused by the project would exceed California Air Quality Standards. The Forest is required to notify the AQMD prior to ignition of a prescribed fire; the AQMD in turn gives the Forest approval (or may not approve) to burn a certain amount of acres each day. The goal of the agencies working together is less smoke impact to the public. Under favorable smoke-dispersal conditions, the smoke from prescribed burns would likely affect visibility and air quality during ignition and for approximately one to three days following ignition.

Another impact of the action alternative would be the emissions and dust caused by project activities. Fugitive dust caused by the use of unpaved roads can produce $PM_{2.5}$ in quantities great enough to impair the visual quality of the air. These effects are localized and can be mitigated by effective dust abatement methods.

Table 3-73. Total emissions for alternative C.

Alternative C (Non-commercial funding)	Total Emissions (tons)
Total $PM_{2.5}$	1093.74
Total NOx	328.49
Total VOC	626.53

Alternative D

Direct and Indirect Effects. See table 3-74 for predicted pollutants produced from the mechanical treatment and harvest of alternative D. The annual predicted criteria pollutant totals for timber operations (emissions from trucks and other equipment) and prescribe fire would vary according to the acres of treatment performed each year.

Table 3-74. Emissions from mechanical treatments in alternative D.

Criteria Pollutant	Total (tons)
$PM_{2.5}$	1.24
NOx	18.84
VOC	1.10

Prescribe burn emissions generated in Plumas County (Mountain Counties air basin) can be found in table 3-75.

Table 3-75. Total prescribed burning emissions from alternative D.

Alternative C (Non-commercial funding)	Criteria Pollutant	Understory Burning	Pile Burning	Total
		(tons)		
Mountain Counties	$PM_{2.5}$	871	250	1,121
	NOx	186	126	312
	VOC	528	112	640

In the event of a wildfire, the stands in the Sugarloaf Project area that are treated would have less material to burn producing less particulate matter emissions than untreated areas.

Depending on market demand biomass may be transported from the area in the form of chips; total biomass removed is estimated at 13,926 bone dry tons or 6.6 tons per acre. Total predicted $PM_{2.5}$ emissions removed from the project area are 99.4 tons. If fuel loading does not meet the desired condition after the biomass removal then an understory burn is prescribed, this is predicted to produce fewer emissions because of the lighter fuel load.

The method of prescribed burning to accomplish fuel load reduction in alternative D is pile burning (piles created by machine and by hand). Hand piling will only be used along cut banks or other steep pitches where mechanical equipment is not capable of maneuvering. Pile burning would be used to reduce both natural and activity-generated fuels. The objective of pile burning would be to reduce fuel loading while protecting the residual over story trees from damage caused by heat and flames or damage from equipment. Pile burning will produce more particulate matter per acre than understory burning because the standing biomass will be cut and piled producing higher fuel loads. However, piled material is allowed to cure and covered with barrier so that piles can be ignited with lower fuel moistures, which ensures complete and efficient consumption.

The release of particulate matter into the air during prescribed burning can have adverse effects on visibility and public health. As described above, the volume of particulate matter is related to which burning method is used and the extent of the burning. Particulate concentration in the Mountain Counties air basin (see table 3-76) is influenced by climatic conditions and other emission-generating activities carried out in the air basin. Particulate concentrations are regulated through compliance with the California Air Resources Board (CARB) and local Air Quality Management Districts.

By following the required burn plan and the AQMDs requirements for burning it is unlikely that emissions caused by the project would exceed California Air Quality Standards. The Forest is required to notify the AQMD prior to ignition of a prescribed fire; the AQMD in turn gives the Forest approval (or may not approve) to burn a certain amount of acres each day. The goal of the agencies working together is less smoke impact to the public. Under favorable smoke-dispersal conditions, the smoke from prescribed burns would likely affect visibility and air quality during ignition and for approximately one to three days following ignition.

Another impact of the action alternative would be the emissions and dust caused by project activities. Fugitive dust caused by the use of unpaved roads can produce $PM_{2.5}$ in quantities great enough to impair the visual quality of the air. These effects are localized and can be mitigated by effective dust abatement methods.

Table 3-76. Total emissions for alternative D.

Alternative D	Total (tons)
Total $PM_{2.5}$	1,122.24
Total NOx	330.84
Total VOC	641.1

3.12.7 Summary of Effects across all Alternatives

Alternative A is predicted to create the most criteria pollutants in the event of a wildfire. Large wildfires burning in similar vegetation types on the Plumas National Forest have lasted for weeks creating smoke impacts to multiple air districts. Alternative B predicts the least emission because there is more mechanical thinning reducing the amount of material to be burned. The direct and indirect effects of alternatives B, C, and D, are similar because air quality regulations limit the amount prescribed burning allowed in the air district at one time. Any action alternative selected for implementation would be subject to an approved smoke management plan by Northern Sierra AQMD prior to any prescribed burning. Timber harvest contracts are subject to provisions and clauses that require dust abatement plans and equipment is subject to state and federal emission regulations (table 3-77).

Table 3-77. Predicted emissions of wildfire compared to action alternatives.

Criteria Pollutants	Wildfire (6,614 acres*)	Alternative B	Alternative C (Non- Commercial)	Alternative D (Proposed Action)
	(tons)			
Total $PM_{2.5}$	2,979	951.26	1,093.74	1,122.24
Total NOx	634	262.46	328.49	330.84
Total VOC	1,797	563.98	626.53	641.1

NOTE: *Acres treated in the Sugarloaf Project boundary are approximately 6,614 acres; this table compares predicted emissions of a wildfire the size of the areas treated.

3.12.8 Forest Plan Consistency

Indicators linked to Issues

Alternative A is not consistent with the HFQLG Act final EIS (1999) and the Plumas land management plan direction to reduce surface fuel load and decrease canopy cover density to reduce the threat of high intensity wildfires. Large wildfires increase criteria pollutants for short durations and can create visibility and health concerns to the public.

Alternatives B and C are consistent with both the HFQLG Act final EIS (1999) and the Plumas land management plan direction of reducing the risk of high intensity wildfire. Alternative D is

consistent with the 2004 Sierra Forest Framework ROD. Both alternative B and C follow the operating procedures in the Plumas land management plan and the HFQLG Act. In the development of treatments, alternatives to burning were considered depending on vegetation, degree of slope and resources of concern.

Other treatment considered to understory and pile burning during the environmental process are mastication, biomass removal, lop and scattering and no treatment. Alternatives were considered if they met the desired condition set by the 1999 HFQLG final EIS ROD as amended by the 2004 SNFPA final supplemental EIS ROD. Mastication was prescribed when slopes were less than 35 percent and impacts by mechanical equipment were deemed acceptable. Biomass removal fluctuates as an option depending on market value of chips, mileage to the closest facility accepting chips, and cost of removal of material (skyline versus tractor). Lop and scattering of material was considered when increases to surface fuel loading did not exceed the desired condition of surface fuel loading of ≤5 tons per acre of dead and down material less than 3 inches in diameter.

3.13 Short-term Uses and Long-term Productivity

NEPA requires consideration of "the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity" (40 CFR 1502.16). As declared by the Congress, this includes using all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans (NEPA Section 101).

Although the action alternatives are designed to modify forest structure and tree species composition using mechanical thinning, mastication, hand thinning, and prescribed burning, these land management techniques provide for retention of large trees and species diversity in sufficient amounts to meet desired stocking levels and maintain appropriate forest cover, as specified by NFMA. The combined removal of biomass using harvest methods and consumption using prescribed burning would enhance long-term productivity in terms of forest health, by promoting tree vigor and forest resilience to disturbances such as fire, drought, and insect and disease occurrences, off-setting short-term reductions.

Action alternatives, primarily through the removal of vegetation and treatment of fire and fuels, would directly impact terrestrial habitat for Region 5 Forest Service sensitive wildlife species. Potential short-term effects of entry, use, and alteration of suitable wildlife habitat to achieve project objectives is disclosed in chapter 3 of this FEIS. Treatments would enhance long-term productivity in terms of forest health to increase both the quality and quantity of existing and potential suitable habitat for wildlife species.

Short-term reductions to fine organic matter, soil permeability, large woody debris, and channel shading are expected as a result of the proposed activities. Long-term productivity would far exceed these short-term impacts through promoting forest resilience to disturbances such as catastrophic wildfire capable of much greater impacts to the previously mentioned soil and hydrology resources.

In the short-term individual rare plants may be indirectly impacted from the proposed activities; however over the long-term, these treatments are expected to increase both the quality and quantity of existing and potential habitat for these species.

Over the short-term, the proposed treatments would create disturbed conditions that favor noxious weed establishment and spread. Implementation of the standard management requirements (DEIS; Appendix A) and the weed treatment measures proposed under action alternatives B, C and D would greatly reduce the risk of noxious weed spread and establishment over the long-term.

The Sugarloaf Project may affect mining operations in the area in the short-term due to access issues, increased heavy equipment traffic and/or smoke production. No long-term effects to productivity are expected.

3.14 Unavoidable Adverse Effects

Action alternatives would implement prescribed burning treatments which would create smoke. Smoke may affect air quality while prescribed fire activities occur; however, prescribed fire activities would be accomplished with an approved smoke management plan to minimize effects to air quality and public health.

Some unavoidable adverse effects may result, including immediate changes in habitat conditions and disturbance/harassment of individual wildlife species, including direct mortality, during project activities. There are no known threatened or endangered wildlife species, therefore no adverse effects are expected. It is assumed in this analysis that all action alternatives would be implemented as proposed, in compliance with all rules and regulations governing land management activities, including the use of Limited Operating Periods. Direct disturbance, including mortality to Forest Service classified Sensitive species addressed in this document, would be highly unlikely due to results of survey efforts for selected species, incorporation of Limited Operating Periods, where appropriate, and implementation of Forest Plan standards and guidelines.

Direct effects on wildlife species could occur as a result of tree removal, mastication, and prescribed burning. These activities have the potential to kill young of the year birds in the nest that cannot fly and species confined to den sites, such as gray squirrels. Increased road use resulting from of project implementation could result in increased road kills of various animals. It is recognized that the proposed project, when implemented during the breeding season (April-September) could directly impact nesting birds. This would affect individual birds. Conservation measures for landbirds, such as snag/down woody retention, use of LOPs for TES species, avoidance of riparian vegetation, retention of trees greater than thirty inches diameter, which are incorporated into project design, as well as large tracts of forested land not treated with proposed management actions, would alleviate the overall effect on Neotropical migratory bird populations within the analysis area. The Forest Service and the U.S. Fish and Wildlife Service entered into a memorandum of understanding (MOU) in 2008 to strengthen migratory bird conservation. The MOU recognized that direct and indirect actions taken by the Forest Service in the execution of duties and activities, as authorized by Congress, may result in the take of migratory birds, and that short-term negative impacts are balanced by long-term benefits.

The extent of detrimental soil compaction would increase due to mechanical harvest operations. Implementation of standard management requirements would help reduce the amount of detrimental compaction. Treatment activities may lead to increased surface runoff and sedimentation. Implementation of best management practices and standard management requirements would help reduce the amount of detrimental compaction.

There are no foreseeable unavoidable adverse impacts to mining under any of the alternatives for the Sugarloaf Project.

There are no unavoidable Adverse Effects for Heritage Resources, as all known sites would be avoided during operations.

3.15 Irreversible and Irretrievable Commitments of Resources

Irreversible commitments of resources are those that cannot be regained, such as the extinction of a species or the removal of mined ore. Irretrievable commitments are those that are lost for a period of time such as the temporary loss of timber productivity in forested areas that are kept clear for use as a power line rights-of-way or road

Action alternatives would implement mechanical thinning, mastication, hand thinning, and prescribed burning treatments which would (1) remove and/or kill trees, (2) reduce surface fuels and snags and (3) include the removal of forest vegetation for the construction of landings and temporary roads – these effects would be irretrievable commitments of a resource in terms of lost timber productivity and structural attributes. However, these treatments would maintain stocking and appropriate forest cover per NFMA, and tree regeneration, snag and surface fuel recruitment, and rehabilitation of landings and temporary roads would occur over time.

Surface organic matter would be reduced by prescribed fire and underburning, which is an irretrievable effect. Soil porosity would be reduced, also an irretrievable effect, resulting in detrimental compaction. Detrimental compaction is described in the “Hydrology and Soils” section of this chapter under the “Affected Environment—Soils” heading.

Surface fuels, including coarse woody debris, may be removed directly by prescribed underburning and pile burning, an irretrievable effect. Coarse woody debris would be recruited over time via recruitment from existing snags and future tree mortality.

Snags, particularly “soft” or rotten snags, may be removed due to underburning; snags that pose a hazard to firefighters may be felled prior to conducting underburning or pile burning, an irretrievable effect. Snags would be recruited over time from future tree mortality.

Adverse impacts to rare plants will be minimized under all action alternatives through implementation of the design criteria described in FEIS; Appendix A-6.

If allowed to spread, noxious weed species can have significant adverse impacts to native plants, wildlife species, soil structure, nutrient and fire cycles, and the recreational or aesthetic value of native habitats. The weed control measures proposed under the action alternatives would minimize the likelihood of adverse impacts.

There are no irreversible or irretrievable commitments of mineral resources expected under any of the alternatives for the Sugarloaf Project.

There are no irreversible and irretrievable commitments of Resources for Heritage Resources.

3.16 Legal and Regulatory Compliance

NEPA at 40 CFR 1502.25(a) directs "to the fullest extent possible, agencies shall prepare draft environmental impact statements concurrently with and integrated with …other environmental review laws and executive orders." The proposed action and alternatives must comply with following:

3.16.1 Principle Environmental Laws

The following laws contain requirements for protection of the environment that apply to the proposed action and alternatives:

Endangered Species Act

Section 7(a)(2) of the *Endangered Species Act* requires that Federal agencies consult with the United States Fish and Wildlife Service and National Marine Fisheries Service, as appropriate, to ensure that their actions do not jeopardize the continued existence of species listed as threatened or endangered under ESA, or destroy or adversely modify their critical habitat.

A biological assessment was prepared for Federally Proposed, Threatened or Endangered wildlife and botany species and their critical habitat. Implementation of the project would have no effect on valley elderberry longhorn beetle and California red-legged frog. No Federally Proposed, Threatened or Endangered wildlife or botany species were located within the Sugarloaf Project area during past or current surveys.

Clean Water Act

The Forest Service is complying with the provisions of the *Clean Water Act* as it pertains to the Sugarloaf Project. Section 208 of the *Clean Water Act* requires States to prepare nonpoint source pollution plans that are to be certified by the State and approved by the United States Environmental Protection Agency (EPA). In response to this law, and in coordination with the State of California Water Quality Resources Control Board and EPA, the Forest Service, Region 5, began developing best management practices (BMPs) in 1975 for water quality management planning on National Forest System lands in California. This process identified the need to develop a BMP for addressing the cumulative off-site watershed effects of forest management activities on the beneficial use of water.

The Sugarloaf Project meets this through the incorporation of project design features (FEIS, chapter 2), Scientific Analysis Team (SAT) Guidelines for riparian habitat conservation areas (RHCAs) (USDA 2004b, page 67; USDA 1999a, Appendix L, pages APP L 9-APP L 12; Appendix A of this DEIS), soil standards and guidelines (PNF LRMP, pages 4-43 – 4-45); and best management practices, standard management requirements, and monitoring listed in Appendix A of the DEIS.

Clean Air Act

The Forest Service is complying with provisions of the *Clean Air Act* as it pertains to the Sugarloaf Project. All burning implemented under the Sugarloaf Project would be completed under approved burn and smoke management plans. Burning permits would be acquired from the Northern Sierra Air Quality Management District. The Air Quality Management District would determine days when burning is allowed. The California Air Resources Board provides daily information on burning conditions. Burning would be implemented in a way to minimize particulate emissions.

National Historic Preservation Act of 1966 as Amended

The Forest Service is complying with the provisions of the *National Historic Preservations Act of 1966* as amended as it pertains to the Sugarloaf Project. Section 106 of the *National Historic Preservation Act* requires Federal agencies to take into account the effects of their undertakings on historic properties and afford the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity to comment on such undertakings. The Advisory Council on Historic Preservation has defined a Federal undertaking in 36 CFR 800.16(y) as a project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a Federal agency, including those carried out by or on behalf of a Federal agency; those carried out with Federal financial assistance; those requiring a Federal permit, license or approval; and those subject to State or local regulation administered pursuant to a delegation or approval by a Federal agency.

Coastal Zone Management Act

There are no coastal management zones within the Sugarloaf Project area or on the Plumas National Forest. The *Coastal Zone Management Act* does not apply to the Sugarloaf Project.

National Forest Management Act

The Forest Service is in compliance with the *National Forest Management Act* as it pertains to the Sugarloaf Project. Projects occurring on National Forest System lands must meet minimum specific management requirements under 16 U.S.C. 1604 (g)(3). The Sugarloaf Project meets all applicable guidelines for land management plans according to 16 U.S.C. 1604 (g)(3).

3.16.2 Executive Orders

The following executive orders provide direction to federal agencies that apply to the proposed action and alternatives:

Indian Sacred Sites, Executive Order 13007 of May 24, 1996

Section 1. *Accommodation of Sacred Sites*. (a) In managing Federal lands, each executive branch agency with statutory or administrative responsibility for the management of Federal lands shall, to the extent practicable, permitted by law, and not clearly inconsistent with essential agency functions, (1) accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners and (2) avoid adversely affecting the physical integrity of such sacred sites. Where appropriate, agencies shall maintain the confidentiality of sacred sites.

Invasive Species, Executive Order 13112 of February 3, 1999

This document provides an analysis of the effects of the proposed project on noxious weed introduction and spread. The standard management requirements and proposed weed treatment measures were developed to prevent the introduction of invasive species, control the spread of existing infestations, and minimize adverse impacts to National Forest System lands.

Recreational Fisheries, Executive Order 12962 of June 6, 1995

The effects to fish habitat from the project are expected to be so small that direct effects on fish productivity and the quality of the recreational fishing would be negligible.

Migratory Birds, Executive Order 13186 of January 10, 2001

The environmental analyses of deferral actions are to evaluate the effects of actions and agency plans on migratory birds, with emphasis on species of concern. There is no interagency determination to be made for migratory birds with Federally-listed species. Proposed activities and alternatives are not expected to affect migratory birds.

Floodplain Management, Executive Order 11988 of May 24, 1977

These executive orders provide for protection and management of floodplains and wetlands. Compliance with these orders will be assured by incorporating the project riparian management objectives; adhering to the Scientific Analysis Team guidelines, as set forth in the HFQLG FEIS and Record of Decision; and implementing best management practices, standard management requirements, and project design criteria.

Protection of Wetlands, Executive Order 11990 of May 24, 1977

These executive orders provide for protection and management of floodplains and wetlands. Compliance with these orders will be assured by incorporating the project riparian management objectives; adhering to the SAT guidelines, as set forth in the HFQLG FEIS and ROD; and implementation BMPs, standard management requirements, and project design criteria.

Environmental Justice, Executive Order 12898 of February 11, 1994

Although low-income and minority populations live in the vicinity, activities proposed for the Sugarloaf Project would not discriminate against these groups. Based on the composition of the affected communities and cultural and economic factors, proposed activities would have no disproportionately adverse effects to human health and safety or environmental effects to minorities, low income, or any other segments of the population. Scoping was conducted to elicit comments on

the proposed action from all potentially interested and affected individuals and groups without regard to income or minority status.

Use of Off-Road Vehicles, Executive Order 11644, February 8, 1972

The Sugarloaf Project is in compliance with the Plumas National Forest Public Motorized Travel Management Final Environmental Impact Statement (FEIS) (August 2010) and Record of Decision (ROD) (September 2010).

3.16.3 Special Area Designations

The selected alternative will need to comply with laws, regulations and policies that pertain to the following special areas:

Research Natural Areas

There are no Research Natural Areas within the Sugarloaf Project area.

Valley Creek Special Interest Area

Management treatments are designed to be consistent with standards and guidelines in the Plumas NF LRMP linked to SIAs per the Lost Creek Management Area (Area 13, p. 4-189) and the Minimum Management Prescription (Rx-7, p. 4-86) as specified: (a) protection of the area's unique botanical and scenic values; (b) maintenance of existing physical characteristics through low intensity management; (c) management of vegetation only to perpetuate the old-growth characteristics; and (d) where compatible, encouragement of public use and/or use of other resources. The Forest Supervisor retains the authority to oversee preparation and implementation of an SIA's management direction, whereas the District Ranger is expected to implement all management direction for the area (FSM 2372.04).

Inventoried Roadless Areas

There is no PNF LRMP Semi-Primitive land allocation or designated Inventoried Roadless Areas (IRAs) within the Sugarloaf Project area. Therefore there would be no impacts to the Semi-Primitive or IRA features within the Sugarloaf Project area.

Wilderness Areas

There are no Wilderness Areas within the Sugarloaf Project area. Therefore there would be no impacts to wilderness features.

Wild and Scenic, and Recreation Rivers

There are no treatments proposed within the Wild and Scenic designations. Therefore there would be no impacts to these features.

Municipal Watersheds (FSM 2540)

There are no municipal watersheds within the Sugarloaf Project area. Therefore there would be no impacts to beneficial uses associated with water quality or quantity.

The Grass Flat Reservoir lies within the cumulative watershed analysis area for hydrology. There are no adverse effects expected due to the incorporation of project design features (FEIS, chapter 2), Scientific Analysis Team (SAT) Guidelines for riparian habitat conservation areas (RHCAs) (USDA 2004b, page 67; USDA 1999a, Appendix L, pages APP L 9-APP L 12; Appendix A of this FEIS), soil standards and guidelines (PNF LRMP, pages 4-43 – 4-45); and best management practices, standard management requirements, and monitoring listed in Appendix A-6 of the FEIS. Refer to the Hydrology and Soils Environmental Consequences section of this chapter for a discussion of environmental consequences.