Chapter 3. Affected Environment

This chapter summarizes the physical, biological, social, and economic environments of the Diamond Project Area.

Each resource section in this chapter provides a summary of the project-specific reports, assessments, and input prepared by Forest Service specialists, which are incorporated by reference in this draft environmental impact statement (EIS). The reports or memoranda are part of the project record on file at the Mt. Hough Ranger District in Quincy, California. Copies on compact disc have been distributed with this EIS. Printed copies are available upon request by contacting Merri Carol Martens, Project Leader, at (530) 283-7689.

3.1 Forest Vegetation and Fire, Fuels, and Air Quality

Ecologically, the dynamics between vegetation and fire and fuels are inherently linked because vegetation type, structure, and development have a profound effect on fuels accumulations and fire behavior, and conversely, fuel accumulations and fire behavior have a profound effect on vegetation establishment, development, and structure. Consequently, forest vegetation and fire and fuels are examined with an integrated approach for the purposes of this analysis.

The forested landscape in the Diamond Project Area consists primarily of pine-dominated Sierra mixed conifer forests, true fir forests, and plantations established over the last 40 years in burned areas and clear-cut units. Forests in the Project Area range from 4,000 feet to 7,700 feet in elevation. These forests are within the transition zone—an ecological zone used to describe the transition between the wet productive westside forests of the Sierra Nevada and the relatively dry, less productive eastside forests of the Sierra Nevada. The Diamond Project Area lies on the eastern edge of the transition zone (HFQLG 1999), and consequently, forests in the Project Area tend to be drier and occur on less productive sites characterized by less developed soils. The Forest Survey Site Class (FSSC) in the Project Area ranges from 5 to 7 (based on an index where FSSC 7 represents the least productive site class) (USDA SCS 1988).

3.1.1 Forest Structure, Species Composition, and Fuels and Fire

As with many areas in the Sierra Nevada, the landscape in this Diamond Project Area and the HFQLG Pilot Project Area has been heavily influenced over the last 150 years by past management activities that include mining, grazing, 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 Diamond 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 North Fork of the Feather River, John Leiberg (1902) noted:

> It [yellow pine] has been more exhaustively logged than any other species in the type except the sugar pine, and the restocking has not kept pace with the cutting, (page 29) and
>
> White fir is increasing its ratio in the restockings, partly at the expense of the yellow pine, partly as an offset to a lessened percentage of sugar pine. On the Pacific side of the main range there is a steady increase of the species, both in reforestation on the logged areas and on the tracts denuded by fire. Its [white fir] increase throughout the region examined is due to exhaustive logging of yellow and sugar pine and sparing of white fir. (page 50)

Past harvest activities have resulted in the reduction of large dominant and codominant overstory trees and the retention of smaller diameter intermediate and suppressed trees, 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 (Skinner and Chang 1996) (see figure 4-2c in the "Forest Vegetation and Fire, Fuels, and Air Quality" section of chapter 4). Finally, severe drought in the late 1980s and early 1990s, combined with high stand densities, have resulted in extensive mortality (up to 80 percent in some areas) of white fir (Guarin and Taylor 2005; Ferrell 1996; Macomber and Woodcock 1994). The past management history of the Diamond Project Area has strongly influenced stand structure, species composition, fuels, and potential fire behavior at both stand and landscape levels. This structure has affected both upland and dry riparian forest areas, aspen stands, and areas where Baker cypress (*Cupressus bakeri*) occurs.

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 1994; Guarin and Taylor 2005; Macomber and Woodcock 1994). Extensive drought in the late 1980s and early 1990s, combined with high stand density, resulted in extensive mortality (up to 80 percent in some areas) of white fir (Guarin and Taylor 2005; Ferrell 1996; Macomber and Woodcock 1994). Despite many past salvage treatments to remove drought-related mortality, much of this material has fallen over in the last 17 years and become dead and down fuel with high fuel loadings. Within the Diamond Project Area, fuel loads in stands that have experienced deadfall of drought-related mortality range from 50–100+ tons per acre, with most of the fuel load found in material greater than 8 inches in diameter. 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 under drought conditions;
- conditions in which disease (including *annosum* root rot, which is already present in the Boulder Creek watershed) and insect infestations may grow beyond endemic levels;

- 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) (see figure 4-2 in the "Forest Vegetation and Fire, Fuels, and Air Quality" section of chapter 4); and

- high accumulations of ladder fuels and canopy fuels (Weatherspoon and Skinner 1996).

The combination of these factors leads to the continued accumulation of surface, ladder, and canopy fuels, and this accumulation increases the potential for stand-replacing high-severity fire events (Weatherspoon and Skinner 1996).

At the landscape level, past management activities have had a marked effect on forest structure and potential fire behavior. As a result of these past management activities, conditions across the Sierras 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 Diamond Project Area. This stand structure is 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 Diamond Project Area shows a relative overabundance of CWHR size class 4, indicating a departure from desired distributions of seral stages (see table 3-1). Taylor 2004 observes in his study of the Lake Tahoe Basin that "presettlement forests were more structurally diverse than contemporary forests" and consisted of larger trees at lower densities. 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. Because such stand structure has increased vulnerability to high-severity fires, a homogenous (same species or structure) occurrence of this seral stage across the landscape is unstable (McKelvey and Johnston 1992). 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.

Historically, the average number of years between fires in the mixed conifer forests adjacent to the Project Area has been reported as 8 to 14 years (the range is 1 to 46 years) in the Antelope Lake watershed (Moody and Stephens 2002). In higher elevation red and white fir-dominated forests (up to approximately 6,400 feet in elevation), the average number of years between fires has been reported as 33.8 years (the range is 18 to 54 years) (Beatty and Taylor 2001). Prior to fire exclusion and intensive timber harvest of the early to mid-20th century, the relative frequent occurrence of fires generally contributed to open stands dominated by large-diameter fire-resistant trees with relatively low surface fuel loads with interspersed areas of young seral stands (Weatherspoon 1996). Prior to fire suppression policy in 1902, John Leiberg (1902) described the surface fuels in similar unharvested forests on the Plumas National Forest types as follows:

> There is no humus; the forest floor is bare, or at the most is covered with a layer of pine needles rarely exceeding 2 inches in depth, most commonly an inch or less.

Table 3-1. Existing CWHR size class and density distribution in the Diamond Project Area.

CWHR Size Class	CWHR Tree Sizes (average)	CWHR Density Class	CWHR Canopy Cover (percent)	Diamond Project Area	
				Acres	Percent
1	<1 inches dbh		**Total**	**217**	**0.2**
2	1–6 inches dbh		**Total**	**2,118**	**2.1**
3	6–11 inches dbh	Dense	>60	127	0.1
		Moderate	40–59	1,630	1.6
		Poor	25–39	1,895	1.9
		Sparse	10–24	950	1.0
			Total	**4,602**	**4.6**
4	11–24 inches dbh	Dense	>60	2,891	2.9
		Moderate	40–59	42,785	43.2
		Poor	25–39	9,246	9.3
		Sparse	10–24	2,434	2.5
			Total	**57,356**	**57.9**
5	>24 inches dbh	Dense	>60	4,440	4.5
		Moderate	40–59	21,142	21.3
		Poor	25–39	4,274	4.3
		Sparse	10–24	435	0.4
			Total	**30,291**	**30.6**
			Nonforest Total	**4,519**	**4.6**
			Grand Total	**99,103**	**100.0**

Notes: < = less than.

> = greater than.

Given the spatial and temporal extent of past fires well documented in scientific literature (Taylor 2000; Moody and Stephens 2002; Skinner and Chang 1996), this type of surface fuel loading would have been much more common prior to fire exclusion than the ubiquitous high surface fuel loading found today. Overall, the historical vegetation structure, species composition, and surface fuels reflected, in part, past fire regimes as well as land management practices of both the Northern Maidu (Anderson 2005; Stewart 2003) and land uses of the thousands of settlers who moved to the Plumas County region after the gold rush (Young 2003).

The overall conditions in the Diamond Project Area are, in part, described by the Fire Regime Condition Class (see table 3-2). The conditions in the Diamond Project Area have led to high-severity fires, such as the Stream Fire in 2001 (USDA 2003; Raley 2001; Duncan, personal communication). The Stream Fire burned over 3,500 acres of pine-dominated mixed conifer forest immediately to the south and west of Antelope Lake. This high-severity fire resulted in the direct mortality of 75 percent of the live trees on 2,300 acres of the fire, including areas along fish-bearing streams and rivers (USDA 2003). Extensive recreational use in developed and dispersed recreational site poses a continued risk of human-caused ignitions throughout dry summer months. The ignition risk puts residential development (primarily summer homes) on private lands in the Diamond Project Area at risk of wildfires that may occur on adjacent public lands; likewise, public lands are at risk from fires ignited on these private lands. In addition, large undeveloped areas of the forested wildlife habitat in the Diamond Project Area are at continued risk of high-severity fire and drought-related mortality.

Table 3-2. Acreage and description of Fire Regime Condition Classes 1, 2, and 3.

Fire Regime Condition Class	Acres in the Diamond Project Area	Description
1	6,592	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	14,425	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	76,800	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.

Source: Hann and Strohm (2003).

Note: The differences in total acres compared to the actual Diamond Project Area are due to unclassified areas such as a lake, barren land, and rock.

3.1.2 Forest Health

Forest insects and disease currently occur in many stands in the Project 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), populations of insects and disease may grow beyond endemic levels associated with forest health.

Bark beetles are the primary insects of concern found in the Diamond Project Area and are associated with ponderosa and Jeffrey pines and true fir. Ponderosa and Jeffrey pines are also 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 trees within high-density stands. The *Ips* species breed in activity slash and may grow beyond endemic levels in areas where logging slash is not properly treated. 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 Diamond Project Area is *annosum* root disease, caused by the fungus, *Heterobasidion annosum* (Schmitt et al. 2000). *H. annosum* infects the butts and roots of its host trees and is a common and natural disease of North American forests (Adams 2004). *H. annosum* is known to occur throughout the forests of northern California and southern Oregon (Schmitt et al. 2000) and there are well-documented occurrences of *annosum* root disease in both pine and fir species on the Plumas National Forest and neighboring Lassen National Forest (Kliejunas 1989; Kliejunas 1993; Woodruff 2006).The occurrence of *annosum* has been confirmed in true fir and is suspected to occur in pine stands in the Diamond Project Area (Woodruff and Kliejunas 2005). There is the potential for new infection in any harvest area because spores can travel far

distances, up to 100 miles (Goheen and Otrosina 1998; Adams 2004), and viable spore deposition rates in the central Sierra Nevada mountains have been observed between May and October as ranging from 28 to 662 viable spores per square meter per hour (James and Cobb 1984).

While many 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. Other species within the Project Area that are susceptible to *annosum* root disease include Douglas-fir and incense-cedar (Adams 2004). 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 Diamond Project Area have a higher incidence of the disease than un-entered stands. This root disease weakens trees, leading to increased susceptibility to bark beetle attack and drought. 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.

3.1.3 Air Quality

The Diamond Project Area is located in Plumas County and a small portion of Lassen County, California. Nearby towns, communities, and highways are shown in table 3-3. The entire Project Area is contained in the Northern Sierra Air Quality Management District (NSAQMD) within the Mountain Counties Air Basin. The air quality attainment status for ozone, carbon monoxide, sulfur dioxide, and other compounds is listed in table 3-4 below. The attainment status was derived directly from the NSAQMD "Annual Air Monitoring Report" (2004).

Table 3-3. Towns, communities, National Parks, and highways within 20 miles of the Diamond Project boundary.

Town or Feature	Distance and Direction from Diamond Project Boundary
Susanville	7 miles north
Greenville	7 miles west
Taylorsville	9 miles southwest
Genesee Valley	2 miles south
Chester	10 miles northwest
Highway 89	7 miles west
Highway 395	2 miles east
Highway 36	5 miles northwest
Mt. Lassen National Park	>20 miles northwest

Table 3-4. Attainment designations for Plumas County.

Compound	National Attainment Status	State Attainment Status
Ozone (1 hour)	Attainment	Unclassified
Ozone (8 hour)	Attainment	Not applicable
Carbon monoxide	Attainment	Attainment
Nitrogen dioxide	Attainment	Attainment
Sulfur dioxide	Attainment	Attainment
PM_{10}	Unclassified	Nonattainment
$PM_{2.5}$	Unclassified	Nonattainment – only the Portola Valley is in nonattainment for the state $PM_{2.5}$ annual standard

Source: NSAQMD (2004).

Currently, Plumas County is in nonattainment status for particulate matter $(PM)_{10}$ (county wide) and $PM_{2.5}$ (Portola Valley only). The Project Area is 20 miles northwest of Portola Valley at its closest point. According to the NSAQMD 2004 report, the major contributors to both PM_{10} and $PM_{2.5}$ levels include forestry management burns, woodstoves, residential open burning, vehicle traffic, and windblown dust. These problems can be relieved or made worse by local meteorology, winds, and temperature inversions. In addition, large areas in and adjacent to local communities can be heavily impacted by smoke for extensive summer periods (several weeks) due to wildfire such as in the 3,500-acre Stream Fire, which occurred in the Diamond Project Area in 2001 (USDA 2003). The community of Quincy is subject to strong inversions and stagnant conditions in the wintertime. Those conditions, coupled with intensive residential wood burning, can result in very high episodic $PM_{2.5}$ levels (NSAQMD 2004). Levels of PM_{10} have been greatly decreased due to a reduction of non-EPA (Environmental Protection Agency) approved woodstoves in existing residences. The NSAQMD (2004) report noted four key points relating to current air quality within the NSAQMD:

1. The NSAQMD's state and federal nonattainment status for ozone is due to overwhelming air pollution transport from upwind urban areas, such as the Sacramento and Bay areas.

2. Improvements in air quality, with respect to ozone, will depend largely on the success of air quality programs in upwind areas.

3. Anticipated growth in local population will add to locally generated pollution levels. Therefore, local mitigations are needed to prevent further long-term air quality degradations. Otherwise, the local contribution may increase to the point where the transport excuse will become less viable, and more emphasis will then be placed on mandated local controls.

4. State and federal land managers anticipate a marked increase in prescribed burning within the next 5 years. This may have a tremendous impact on local PM_{10} and $PM_{2.5}$ levels, unless appropriate mitigations are employed.

Current sources of particulate matter from the Diamond Project Area include smoke from large wildfires, smoke from underburning and pile burning, emissions and dust from standard and off-highway vehicles, dust and emissions from harvest activities occurring on private lands, smoke from

campfires, emissions from boats at Antelope Lake, and wind-generated dust from exposed soil surfaces. The amount and duration of these emissions vary by season, with most emissions from wildfires, timber harvest, and recreational activities occurring between May and late August, and emissions from prescribed burning occurring from late September through mid-November.

3.2 Soils and Hydrology

3.2.1 Affected Environment: Soils

The Soils Analysis Area (see figure 3-1) consists of the Defensible Fuel Profile Zone (DFPZ) Fuel Treatment Units and Area Thinning Units described for the proposed action in chapter 2.

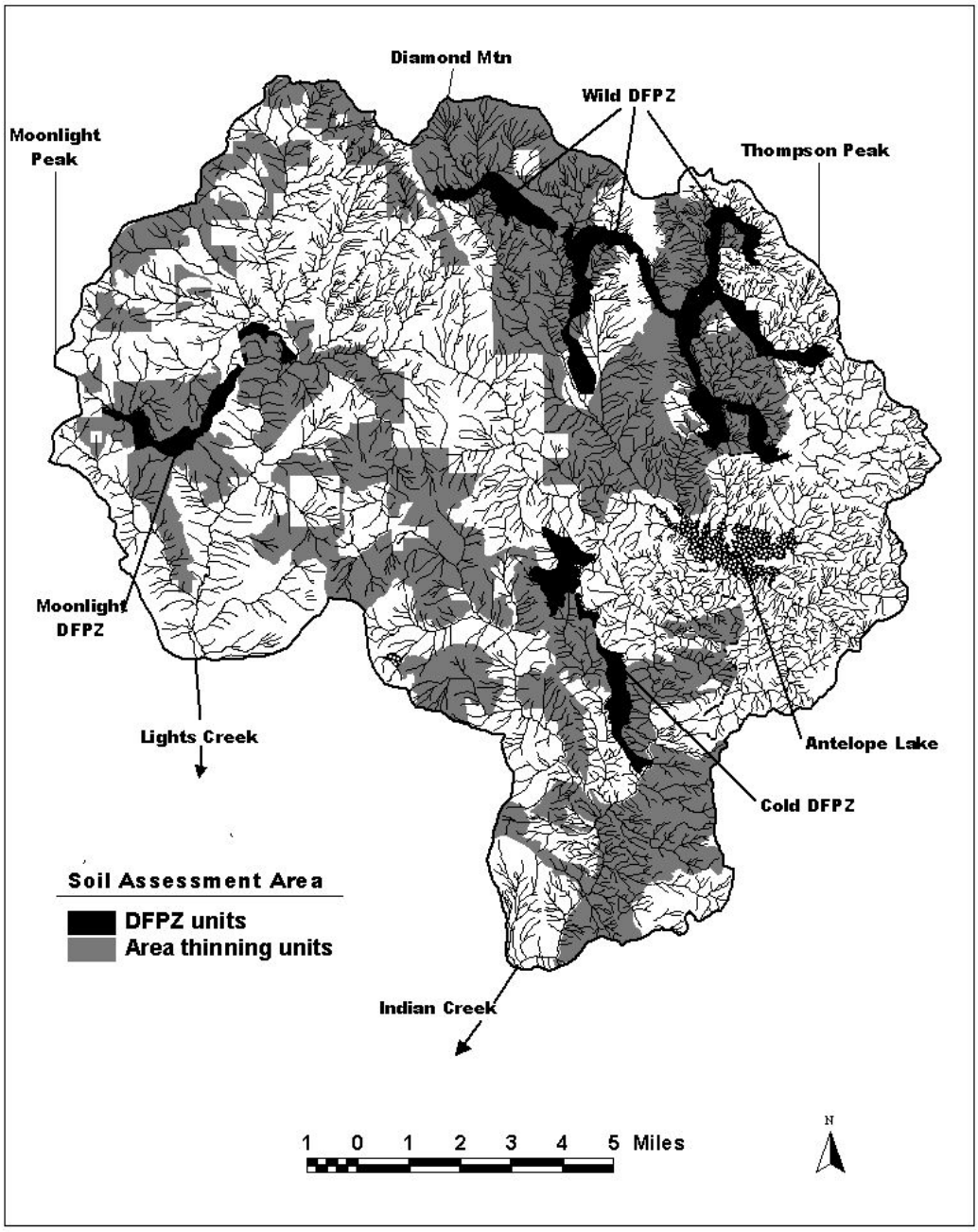

Figure 3-1. Soils Analysis Area.

3.2.1.1 Soil Condition

Forest productivity in the Soils Analysis Area ranges from low productivity to nonproductive sites (USDA Forest Service 1988a). Forest Survey Site Class (FSSC) is a measure of site productivity in cubic feet of wood per acre per year. FSSC 1 is the most productive, while FSSC 7 is the least. The DFPZs and Area Thinning Units are predominantly classified as FSSC 6, but there are substantial acres in FSSC 5 and 7 (see table 3-5). FSSC 7 lands are considered nonproductive and occur largely along ridgetops and steep rocky slopes in the DFPZs and Area Thinning Units. FSSC 5 and 6 lands are both interpreted as having low productivity (USDA Forest Service 1999). In DFPZs, FSSC 5 lands occur in the Cold and Wild Units. These are generally found on the west-facing slope above Middle Creek, east of Wildcat Ridge, and east of the Beaver Ponds. FSSC 5 and 6 soils occur throughout the Area Thinning Units. Ninety-five percent of the Area Thinning Units have some component of FSSC 6, and more than half of the Area Thinning Units contain some FSSC 5 lands.

The maximum Erosion Hazard Rating (EHR) ranges from moderate to very high in the Soils Analysis Area (see table 3-5). This rating predicts the potential for sheet, rill, and gully erosion under existing conditions if vegetation and litter are removed. Very high erosion ratings generally occur on the steep FSSC 7 lands. Most of the DFPZs and Area Thinning Units have high maximum EHRs.

Table 3-5. Forest Survey Site Class and maximum Erosion Hazard Rating for the Fuel Treatment Units and Area Thinning Units.

	Forest Survey Site Class[a] (acres)			Maximum Erosion Hazard Rating[b] (acres)		
Unit type	5	6	7	Moderate	High	Very High
Moonlight DFPZ	5	723	71	5	723	71
Cold DFPZ	260	756	157	260	762	151
Wild DFPZ	1,516	2,282	0	1,251	2,547	0
Area Thinning Units	8,616	27,613	3,738	5,815	31,084	3,068

Notes:

a. Forest Survey Site Class (FSSC) is an index of the productive potential of well-stocked stands. FSSC reflects the mean annual increment of a stand at the point of culmination, and is based on normal yield tables as follows: FSSC 5: 50–84 cubic feet per acre per year; FSSC 6: 20–49 cubic feet per acre per year; FSSC 7: less than 20 cubic feet per acre per year.

b. The maximum Erosion Hazard Rating (EHR) predicts the potential for sheet, rill, and gully erosion under existing conditions if vegetation and litter are removed.

Soils in the Project Area are largely derived from granitic parent material. There are also volcanic and metavolcanic rock types, found mostly in the northern and western portions of the Project Area. These include the Moonlight, Indicator Peak, and Cairn Butte areas, Diamond Mountain area, and portions of Wildcat Ridge. Volcanic rocks underlie the Moonlight DFPZ and western portions of the Wild DFPZ, while the Cold DFPZ has a combination of volcanic and granitic parent materials. The Area Thinning Units, which are dispersed throughout the Project Area, contain both volcanic and granitic substrates. Soils in the DFPZs and Area Thinning Units are predominantly well drained to somewhat excessively well drained. They have moderate infiltration rates when wet and moderate runoff potential.

3.2.1.2 Soil Standards and Guidelines

Forest Service Region 5 soil quality analysis standards (USDA Forest Service 1995) provide threshold values for soil properties and conditions to use as indicators of significant change in soil productivity, soil hydrologic function, and soil buffering capacity. Detrimental soil disturbance is the resulting condition when threshold values are exceeded. The components of soil productivity addressed by these standards are soil cover, soil porosity (as it relates to compaction), and organic matter.

The 1988 *Plumas National Forest Land and Resource Management Plan* (the "Forest Plan") provides standards and guidelines for protecting the soil resource. The Forest Plan provides specific guidelines for soil productivity measures, such as soil cover and compaction. All standards and guidelines are presented in the "Cumulative Watershed Effects and Soil Assessment Report" in the project record.

Table 3-6 summarizes the results of soil field assessments conducted during the summer of 2005. The data for individual units are shown in the "Cumulative Watershed Effects and Soil Assessment Report." Effective soil cover is necessary to prevent accelerated soil erosion. On average, soil cover ranges from 72 to 86 percent for the surveyed units. Forest Plan standards and guidelines for effective ground cover vary by the soil EHR. Effective ground cover should be maintained at 60 percent for soils having a high EHR, and 50 percent for soils having a moderate EHR. Four individual units in the Wild DFPZ do not currently meet these standards. Fuel Treatment Unit 1 was estimated as having 10 percent cover. This unit is a mule ear field with widely dispersed conifers. The mule ear does not provide much litter material to generate soil cover. Soil cover was estimated as 47 percent in Fuel Treatment Unit 21. This is an old clearcut which has not yet developed a continuous forest floor. Units 21 and 22 were assessed with 53 and 57 percent cover, respectively. Each of these units is south facing, near the eastern edge of the Project Area. South slopes are generally less productive than north slopes due to drier conditions and shallower soils. In addition, precipitation is lowest in the eastern part of the Project Area. Low soil cover likely resulted from very low productivity of these units, given the environmental conditions there.

Table 3-6. Soil productivity results from field surveys.

Unit Type	Average Percent Soil Cover	Average Percent Detrimental Compaction	Average Percent Skid Trails and Landings	Average Percent Cover of Fine Organic Matter	Average Number of Down Logs (per acre)
Moonlight DFPZ	84	12	19	73	23
Cold DFPZ	86	6	15	72	32
Wild DFPZ	72	12	19	61	24
Area Thinning Units	85	15	17	82	26

To limit the extent of compaction, the Forest Plan standards and guidelines indicate that no more than 15 percent of a stand should be dedicated to landings and permanent skid trails. Therefore, at least 85 percent of a stand should be in a noncompacted, productive state. The percent of each stand in a compacted state is shown above in table 3-6. The percent of each stand existing as a landing or skid trail is also shown above in table 3-6. In each case, the percent of landings and skid trails exceeds

the percent of detrimental compaction. This difference can most likely be accounted for by the recovery of skid trails and landings that were constructed in the more distant past. The average values for percent of detrimental compaction range from 6 to 15 percent for the surveyed Treatment Units. However, five units in Moonlight DFPZ, seven units in the Wild DFPZ, and five of the surveyed Area Thinning Units do not currently meet this standard. Four of these Moonlight DFPZ Units are plantations regenerated from clearcuts. One of the Wild DFPZ Units is unit 1, which was described above as the mule ear flat. It is unlikely that this unit is compacted from forestry activities, as no skid trails were recorded. Legacy grazing in this area may have influenced compaction, though it is also possible that the unit was incorrectly sampled. The remaining Wild DFPZ Units with excessive compaction have all received some previous harvest treatment. Skid trails were recorded in each of these units although, in some cases, the skid trails and landings occupied less than 15 percent of the unit. Three of the Area Thinning Units contain plantations regenerated from past clearcut harvests. Each sampled Area Thinning Unit with excessive compaction has been harvested in the past. The area of detrimentally compacted ground is primarily occupied by skid trails and landings.

The Forest Service Region 5 soil quality standards state that surface fine organic matter should be retained at 50 percent cover in all stands. Fine organic matter consists of plant litter, duff, and woody material less than 3 inches in diameter. Average cover of fine organic matter ranged from 61 to 82 percent in surveyed units (refer to table 3-6 above). However, two Moonlight DFPZ Units and four Wild DFPZ Units do not meet this standard. Fuel Treatment Unit 53 is a plantation that has not yet developed a continuous litter layer. Unit 42 is on a ridge top location with some areas of nonproductive soils. These conditions contribute to the low amount of fine organic matter in this stand. Unit 1 in the Wild DFPZ is the mule ear flat discussed above. Unit 3 is generally southwest facing, and units 6 and 21 are regenerated clearcuts. The aspect and past harvest history in these units have likely led to the lower levels of fine organic matter conditions, as discussed above for soil cover.

Large down woody material is addressed by the Forest Service Region 5 soil quality standards. At least five well-distributed logs per acre, representing the range of decomposition classes, should be present. The average number of large down logs per acre in the surveyed units is shown above in table 3-6. The average values range from 23 to 32 logs per acre, but four individual units do not meet the Region 5 standard. Two of these units are plantations regenerated from past clearcuts. During site preparation for planting, large logs may have piled and burned with harvest slash.

3.2.2 Affected Environment: Watershed

The Diamond Project is located on the Mt. Hough Ranger District of the Plumas National Forest. The area defined for the watershed assessment encompasses 48 subwatersheds, which are contained in five Hydrological Unit Code (HUC) 6 watersheds. The Lights Creek and Indian Creek systems drain the Soils Analysis Area (see figure 3-2). The divide between these two networks runs in a north-south direction, roughly between Red Rock, Lone Rock, Eisenheimer, and Kettle Rock peaks. Lights Creek drains lands to the west of this line, which comprises about 35 percent of the Soils Analysis Area and 17 subwatersheds. The remaining 65 percent of the Soils Analysis Area lies to the east of this divide and drains to Indian Creek. Both creeks flow south and Lights Creek joins Indian Creek in Indian Valley. From here, Indian Creek continues south and joins with Spanish Creek to form the East Branch North Fork Feather River. East Branch joins the North Fork Feather River, which flows westward to Lake Oroville.

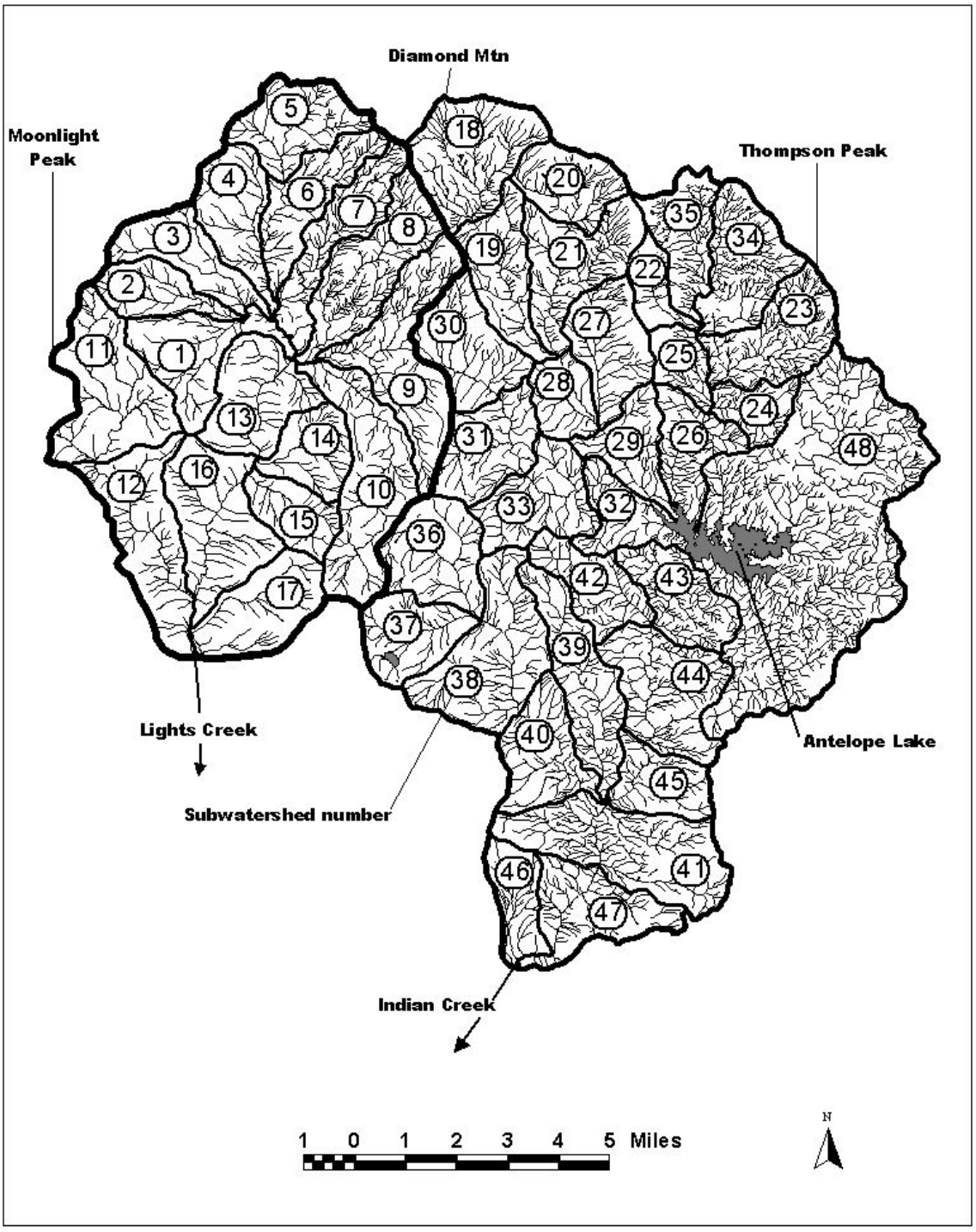

Figure 3-2. Watershed Analysis Area.

3.2.2.1 Beneficial Uses

Existing beneficial uses of surface waters in the Diamond Project Area are found in the Central Valley Region Water Quality Control Plan (California Regional Water Quality Control Board 2004). The Diamond Project Area drains to the North Fork Feather River, for which existing beneficial uses include municipal and domestic supply, hydropower generation, recreation, freshwater habitat, habitat suitable for fish reproduction and early development, and wildlife habitat.

3.2.2.2 Precipitation

The Diamond Project is situated at the eastern edge of the Sierra Nevada. Precipitation decreases toward the east, reflecting the range's strong rain shadow effect. Average annual precipitation varies from about 40 inches in the western portions of the Watershed Analysis Area and decreases eastward to about 24 inches near the Diamond Mountain ridgeline around Thompson Peak. Precipitation falls primarily as snow above 6,500 feet and as a combination of snow and rain below that elevation. Precipitation distribution is characteristic of the Mediterranean climate, with most precipitation occurring between October and May. Surface runoff depends on the snowmelt regime, which normally extends into late spring and early summer.

3.2.2.3 Forest Vegetation

Vegetation in the Watershed Analysis Area is primarily dominated by mixed conifer forest types and plantations established over the last 40 years in burned areas and clearcut units. This area contains dense ladder fuels and fuel loading from 50 to 100 tons per acre. High fuel loads occur in stands that experienced deadfall of mortality due to a region-wide drought in the late 1980s. High densities of small trees and high fuel loads contribute to high accumulations of ladder fuels and canopy fuels. These fuel conditions are conducive to crown fire initiation and propagation and increased potential for stand-replacing high-severity fire events. The conditions in Riparian Habitat Conservation Areas (RHCAs) are similar to those described above; this includes conifer encroachment within the RHCAs, which can lead to a decline in riparian species that cannot tolerate a shaded environment. The high density of small trees makes many RHCAs in the Diamond Project Area vulnerable to the effects of severe wildfire because drainages can rapidly funnel hot air upslope and contribute to fire spread. For example, several RHCAs in the Diamond Project Area were severely burned in the 2001 Stream Fire.

3.2.2.4 Stream Condition

There are over 1,200 miles of streams in the Watershed Analysis Area (see table 3-7). About 80 percent of the stream miles are ephemeral, 20 percent are intermittent, and 10 percent are perennial. Ephemeral and intermittent streams are seasonal—they run water during some portion of the year but are typically dry by late summer. Ephemeral streams flow in response to storm events and generally do not flow every year. Perennial streams typically flow year round. About 30 percent of all stream miles in the Watershed Analysis Area flow through the Lights Creek system, and the remaining 70 percent flow through the Indian Creek drainage. While the Indian Creek drainage system has a greater overall stream density, the Lights Creek drainage has a higher density of perennial streams. Information about stream miles in individual subwatersheds can be found in the "Cumulative Watershed Effects and Soil Assessment Report" in the project record.

Table 3-7. Miles of stream type and stream density in the Watershed Analysis Area.

Drainage System	Drainage Area (acres)	Miles of Stream by Type			Total Stream Miles	Stream Density[a] (miles per square mile)
		Ephemeral	Intermittent	Perennial		
Lights Creek	39,524	204	105	57	366	5.9
Indian Creek	72,694	675	157	78	910	8.0
Total	**112,218**	**879**	**262**	**135**	**1,276**	**7.3**

Note:

a. Stream density is determined as the miles of stream per square mile of drainage area. Drainage area is shown in acres to be consistent with other area representations in this document.

Stream condition inventories have been conducted on several perennial streams in the Watershed Analysis Area (see table 3-8) for HFQLG aquatic pre-monitoring. The fisheries crew conducted the inventories between 1995 and 2005. Response reaches have low-gradient (less than 3 percent slope) alluvial conditions. The morphology of response channels reflects depositional processes associated with flowing water. Transport reaches have higher gradient (3 to 12 percent slope) non-alluvial conditions. The morphology of transport channels is generally resilient to change. Both response and transport reaches have shown improvements in overall stream condition when compared to previous surveys. Moonlight Creek received an overall condition rating of good. Both the percentage of sediment in pool tails and the percentage of unstable banks were low and were also rated as good. Shade was also rated as good, with shade conditions of 96 percent. Hungry Creek was rated as good overall, with both shade and unstable banks rating as good. Sediment in pool tails, however, was more than 15 percent and rated as poor. Pierce Creek at Wheeler Sheep Camp and Boulder Creek at Hallett Meadow rated at moderate to poor. Sediment in pool tail fines was high in both reaches, which rated at very poor and poor, respectively. Historic grazing activity has occurred around both reaches and has contributed to bank instability.

Table 3-8. Summary of stream condition inventory data for the Diamond Project Area.

Stream	Reach Type	Year Surveyed	Overall Rating[a]	Previous Survey Years	Change Since Previous Surveys[b]
Moonlight	Response	2005	Good	1998 2000 2001	Improvement
Boulder: Hawlett Meadow	Response	2004	Moderate-poor	2001	Improvement
Antelope	Response	2005	Poor	2000	NA[c]
Little Antelope	Response	2005	Poor	2000 2003	Improvement
Pierce: Wheeler Sheep Camp	Response	2003	Poor	—	NA
Hungry	Transport	2001	Good	1995 1998	Improvement
Hungry: below Middle confluence	Transport	2004	Poor-moderate		NA

Notes:

a. The overall condition rating is given for the most recent survey data. Ratings are based on physical characteristics including bank full width:depth ratio, bank angle, shade, pool tail fines, particle count less that 2 millimeters, and unstable banks.

b. Improvement indicates that the overall rating improved (for example, from moderate to good) compared to previous surveys.

c. "NA" indicates that no previous rating was available for comparison.

All streams in the DFPZ Units were surveyed by the watershed crew in the summer of 2005. Riparian and channel data were collected on about 37 miles of streams. About 70 percent of the stream miles had stable banks. Bank instability was noticeable in about 22 percent of the miles, prevalent in 6 percent, and extensive in less than 1 percent. Eleven headcuts were identified, and all were in the Wild DFPZ Unit. These sites are in seven subwatersheds and are found primarily on ephemeral and intermittent tributaries to Boulder and Thompson Creeks (see figure 3-3). One headcut was located on an ephemeral tributary to Indian Creek, and one was on an intermittent tributary to Pierce Creek. The width and type of riparian vegetation adjacent to streams were recorded for each surveyed stream segment (see table 3-9). On 33 miles of stream, the width of the riparian vegetation was 20 feet or less—this accounts for roughly 90 percent of the surveyed miles. Many ephemeral streams do not support riparian vegetation, and many intermittent and some perennial streams have narrow riparian zones as well.

Table 3-9. Riparian vegetation characteristics along surveyed streams.

Riparian Width (in feet)	Miles of Streams by Riparian Vegetation Type							Total
	Alder	Aspen	Grasses, Forbs	Mixed Riparian	Sedge, Rush	Willow	Other	
0 to 20	3.4	1.0	8.4	8.4	6.3	1.6	4.2	33.2
21 to 50	0.3	0.1	0.0	1.7	0.2	0.7	0.0	2.9
51 to 75	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.2
75 to 100+	0.2	0.0	0.0	0.2	0.5	0.1	0.0	0.9

Large woody debris was rated as good or fair on 33 miles of stream (about 90 percent of surveyed miles). In addition, large woody debris was rated as good or fair on about 91 percent of perennial streams. The reaches rated as having poor large woody debris were located on tributaries to Indian, Boulder, and Thompson Creeks.

There are over 450 miles of existing roads in the Watershed Analysis Area. Although the road network is generally in good condition, a number of poorly located roads contribute to substantial resource damage. These roads generally run parallel to and extremely close to stream channels. Rainfall can run off of road surfaces, carrying sediment into the stream network and reducing water quality. Through a road assessment process, about 10 miles of road have been identified as contributing to egregious resource damage. The fisheries crew identified at least six locations where roads restrict fish passage (see figure 3-3). Culverts can prevent fish from accessing upstream habitat by creating depth, leap, and exhausted burst barriers.

More than 400 locations of Canada thistle (*Cirsium arvense*) were recorded in DFPZs and Area Thinning Units. Many of these are located in Riparian Habitat Conservation Areas (RHCAs). Canada thistle is a noxious invasive weed that can spread rapidly and potentially displace native plant species. The presence of Canada thistle is a high management concern due to its distribution and abundance in the Diamond Project Area. As a noxious weed, it poses a threat to biological plant diversity in RHCAs. Canada thistle was recorded in both the Lights Creek and Indian Creek drainage networks, although many more locations were found in the latter system. The affected creeks in the Indian Creek drainage include Indian, Pierce, Boulder, Thompson, Lone Rock, Cold, Middle, and Hungry and their tributaries. The affected creeks in the Lights Creek drainage include Moonlight, East Branch Lights, Lights, Fant, and Smith.

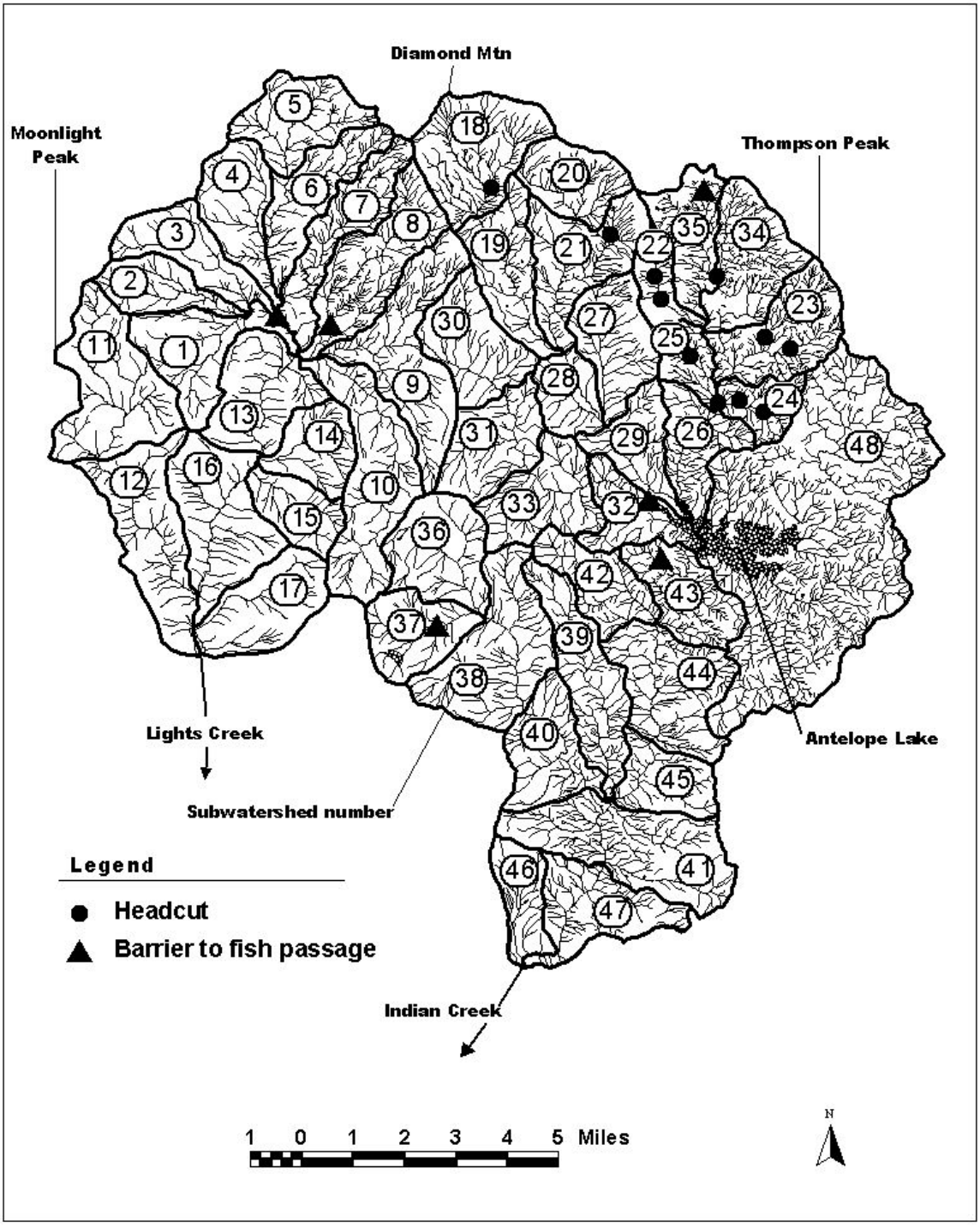

Figure 3-3. Headcuts and barriers to fish passage.

3.2.2.5 Watershed Sensitivity

Watershed sensitivity analyses for the Herger-Feinstein Quincy Library Group (HFQLG) Pilot Project watersheds were reported in the final EIS for the *HFQLG Forest Recovery Act* (USDA Forest Service 1999). The sensitivity ratings were based on the erosion potential, slope steepness, amount of alluvial channels, risk of rain-on-snow and/or thunderstorm events, and on revegetation potential. The HFQLG Pilot Project watersheds applicable to the Diamond Project received moderate sensitivity ratings. Based on these ratings, each subwatershed analyzed in this assessment was considered to have moderate sensitivity and was assigned a "Threshold of Concern" (TOC) value of 12 percent of the subwatershed area.

3.2.2.6 Watershed Condition

"Equivalent Roaded Acres" (ERA) is a conceptual unit of measure used to assess ground-disturbing activities. One acre of road surface equals one "Equivalent Roaded Acre" or ERA. Numeric coefficients are used to convert acres of timber harvest and other disturbance activities to ERAs. For example, 1 acre of underburning equals 0.05 ERA. In a given watershed, disturbances are often added together to determine a cumulative ERA for that watershed. This value is often expressed as a percentage of the TOC.

The TOC is an indicator used to assess the risk of cumulative watershed effects. The TOC is generally expressed as a percentage of watershed area. When the total ERA in a watershed exceeds the TOC, susceptibility for significant adverse cumulative effects are high. The cumulative ERA in a watershed is often expressed as a percent of the TOC. For example, in a 1,000-acre watershed where the TOC is 12 percent of the watershed area, 100 percent of the TOC represents a condition where the amount of disturbance is similar to 120 acres of road surface. The ERA model and cumulative effects methods are fully described in the "Soils and Hydrology" section of chapter 4 of this document and in the "Cumulative Watershed Effects and Soil Assessment Report" in the project record.

Existing ERA values for the subwatersheds in the Watershed Analysis Area currently range from 8 to 175 percent of the TOC (see table 3-10). The percent of TOC varies across subwatersheds due to the cumulative effects of past land management practices and natural disturbances such as wildfire. The transportation system typically accounts for about 1 to 2 percent of the area in a given subwatershed. Road density in the Watershed Analysis Area averages about 2.6 miles of road per square mile of land, but ranges from 0.8 mile to 4.1 miles in individual subwatersheds. Past harvest activities, whether public or private, have occurred in each subwatershed. Past wildfires generally contributed only very minor additions to the ERA within each subwatershed. However, the 2001 Stream Fire had large impacts on subwatersheds 32, 42, and 43—these three subwatersheds currently exceed the TOC as a result of the Stream Fire. Subwatershed 32 is the Lower Lone Rock drainage, 42 is the Cold Stream drainage, and subwatershed 43 is the Indian Creek drainage between Antelope Lake dam and Cold Stream. The Stream Fire burned with high intensity in these subwatersheds. Vegetative cover is returning in both uplands and riparian areas as these subwatersheds continue to recover. Past activities are further discussed in section 4.2 of chapter 4 and also appendix B.

Table 3-10. Subwatershed disturbance in Equivalent Roaded Acres.

Subwatershed			Current ERA Contribution by Activity (percent of threshold of concern)[a]				
Number	Name	Size (acres)	Roads	Public Harvest	Private Harvest	Wildland Fire	Total
1	Upper West Branch Lights	2,196	16	13	18	0	47
2	Mid West Branch Lights tributary	1,353	10	8	0	0	18
3	Lower West Branch Lights	1,766	10	23	8	0	40
4	Upper Lights tributary	1,897	13	21	38	0	73
5	Upper Lights – top	2,046	12	22	20	0	54
6	Upper Lights – Flemings	1,959	8	3	77	0	88
7	Bear Valley	2,057	13	3	82	0	98
8	Morton	2,739	11	1	28	0	41
9	Smith-Fant	3,312	11	10	21	0	43
10	East Branch Lights	3,476	17	67	0	0	83
11	Moonlight Valley	3,341	11	13	16	0	40
12	Moonlight	3,051	9	4	0	2	15
13	Middle Lights – Shake Cabin	2,343	11	4	0	0	15
14	China Gulch	1,446	9	2	0	0	11
15	Superior Ravine	1,281	7	1	0	0	8
16	Warren	3,027	7	4	3	0	15
17	Freds	2,235	8	6	2	0	15
18	Indian above Antelope – top	2,882	9	37	<1	0	46
19	Indian above Antelope –upper	2,014	9	38	1	0	48
20	Upper Pierce – top	1,615	9	41	<1	0	50
21	Pierce	2,508	17	42	0	0	58
22	Upper Boulder – west tributary	848	25	18	0	0	43
23	Thompson	2,372	7	34	0	0	41
24	Mid Boulder – east	969	8	42	0	0	50
25	Mid Boulder – west	894	17	25	0	0	42
26	Lower Boulder	1,663	7	24	0	8	39
27	Willow	2,018	13	5	0	0	18
28	Indian above Antelope – middle	1,149	17	25	17	0	58
29	Indian above Antelope – lower	1,469	12	39	0	15	66
30	Lone Rock Valley	2,188	12	0	27	0	40
31	Lone Rock – Lonesome	2,050	4	9	67	0	80
32	Lower Lone Rock	1,451	17	33	0	83	133
33	Lower Lone Rock Valley	2,150	6	30	7	0	43
34	Upper Boulder – east tributary	2,377	8	50	0	0	58
35	Boulder - top	1,699	17	25	0	0	42
36	Upper Hungry – Wilcox	2,285	10	25	2	0	38
37	Upper Hungry – Taylor	1,752	10	31	4	0	44
38	Mid Hungry	3,430	11	37	<1	0	48
39	Middle	2,512	9	20	0	0	29
40	Lower Hungry	2,025	9	10	8	0	27
41	Indian below Antelope – Babcock/Wheeler	3,827	7	14	0	0	21

Table 3-10. Subwatershed disturbance in Equivalent Roaded Acres (continued).

Subwatershed			Current ERA Contribution by Activity (percent of threshold of concern)[a]				
Number	Name	Size (in acres)	Roads	Public Harvest	Private Harvest	Wildland Fire	Total
42	Cold	1,638	8	33	0	92	133
43	Indian below Antelope – dam to Cold	1,890	17	58	0	100	175
44	Indian below Antelope – Cold to Babcock Crossing	2,845	11	47	0	0	58
45	Indian below Antelope – Babcock Crossing to Hungry	1,478	15	27	0	0	42
46	Indian below Antelope – Elephants	1,230	3	25	0	0	28
47	Indian below Antelope – Red Clover Ranch	2,246	6	21	0	0	27
48	Antelope Lake – east	13,220	10	52	0	6	72

Note:

a. ERA is shown as the percent of the TOC for each subwatershed. For example, a subwatershed that is above the TOC will have a total value greater than 100. Total ERA contributions less than 100 are below the TOC. As disturbance approaches and exceeds the TOC, the risk of detrimental watershed effects increases.

3.3 Wildlife – Aquatic and Terrestrial

3.3.1 Introduction

This section presents a summary of the biological assessment / biological evaluation (BA/BE) for the Diamond Project and includes complete discussions of possible effects of the proposed project and alternatives on federal Threatened and Endangered species, Proposed Candidate species, and Species of Concern; and Forest Service Sensitive species and Management Indicator Species (MIS). The BA/BE and MIS report (and appendices) are on file at the Mt. Hough Ranger District office and available upon request.

Threatened and Endangered Species. 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). Endangered species are in danger of extinction throughout all or a significant portion of their range (16 USC 1532).

Proposed and Candidate Species. A Proposed species is any species that is proposed in the *Federal Register* to be listed as a Threatened or Endangered species under the *Endangered Species Act* (50 Code of Federal Regulations [CFR] 402.03). A Candidate species is a candidate for listing as a Proposed species. The U.S. Fish and Wildlife Service recently changed its policy on Candidate species—the term "Candidate" now strictly refers to species for which the service has enough information on file to warrant or propose listing as Endangered or Threatened.

Federal Species of Concern. Formerly referred to as "Candidate Category 2" species for which listing is possibly appropriate but for which the U.S. Fish and Wildlife Service lacks sufficient information to support a listing proposal. These species are now referred to as "Species of Concern" and are only analyzed if they are also listed as Forest Service Sensitive species.

Forest Service Sensitive Species. Those species, generally federal Candidates for listing or Species of Concern, that have been 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.

Management Indicator Species (MIS) and Neotropical Migratory Birds. The MIS are used in project analysis because it is believed their population changes indicate whether management activities are having an effect on the viability and diversity of animal and plant communities. The proposed activities in the Diamond Project Area may affect the habitat for MIS and Neotropical migratory bird species. There are four MIS listed as Forest Service Sensitive species (peregrine falcon, California spotted owl, northern goshawk, American marten) and one MIS listed as Threatened (bald eagle). These species are addressed in the "Forest Service Sensitive Terrestrial Species" section (3.3.3.2 below) and the "Threatened and Endangered Wildlife Species" section (3.3.3.1 below).

3.3.2 Affected Environment: Aquatic Wildlife Species

The Watershed Analysis Area (as described in the "Soils and Hydrology" section in this chapter) and the Analysis Area for aquatic species are the same. The term "Watershed Analysis Area" is used

when referring to the analysis boundary for aquatic wildlife species. This is also the same analysis boundary for the cumulative watershed effects analysis (refer to the "Soils and Hydrology" sections in chapters 3 and 4) completed by the hydrologist on the Diamond Project Interdisciplinary Team (ID Team), who determines effects on beneficial uses such as fisheries.

The area defined for the Watershed Analysis Area encompasses 48 subwatersheds (refer to figure 3-2 in the "Soils and Hydrology" section of this chapter), which are contained in five Hydrological Unit Code (HUC) 6 watersheds. The Lights Creek and Indian Creek systems drain the Watershed Analysis Area. Both creeks flow south, with Lights Creek joining Indian Creek in Indian Valley. From here, Indian Creek continues south and joins with Spanish Creek to form the East Branch North Fork Feather River. The East Branch joins the North Fork Feather River, which flows westward to Lake Oroville. This boundary was selected for the direct, indirect, and cumulative effects analysis of aquatic species in the Diamond Project Area because any effects resulting from the Diamond Project would occur within these 48 subwatersheds.

Two topics (beneficial uses and stream conditions), as they relate to aquatic wildlife species, are discussed in detail in the "Soils and Hydrology" section in this chapter; however, a brief discussion on stream and watershed conditions is provided below.

3.3.2.1 Stream and Watershed Conditions

A detailed description of stream conditions, watershed sensitivity, and watershed conditions can be found the "Soils and Hydrology" section in this chapter. There are over 1,200 miles of streams in the Watershed Analysis Area (refer to table 3-7 in this chapter). About 80 percent of the stream miles are ephemeral, 20 percent are intermittent, and 10 percent are perennial. There are approximately 103 miles of perennial fish-bearing streams, 15 miles of suspected perennial fish-bearing streams, and 12 miles of intermittent fish-bearing streams in the Watershed Analysis Area. As shown earlier in figure 3-3, fish Management Indicator Species (rainbow trout, brook trout, brown trout, and largemouth bass) and Forest Service Sensitive species (hardhead minnow, mountain yellow-legged frog, and northwestern pond turtle) are found primarily in perennial streams and water bodies and some intermittent streams. These species are discussed below.

A fish passage inventory was completed by the fisheries crew in the summer of 2005, and there are 120 road crossings on perennial and intermittent fish-bearing streams. Many of these crossings either were on private land, or found on steep drainages with natural barriers for aquatic species' passage above and below, or contained low-quality habitat, or there was a bridge that is passable for all aquatic species. Culverts can prevent fish from accessing upstream habitat by creating depth, leap, and exhausted burst barriers. Some of the culverts were found to be passable for all life forms of aquatic species. Twenty-five culverts were physically surveyed. The fisheries crew identified at least six locations where roads restrict fish passage (refer to figure 3-3 in the "Soils and Hydrology" section in this chapter).

Table 3-8 in the chapter 3 "Soils and Hydrology" section summarizes the stream condition inventory data for the Diamond Project Area. All streams in the proposed Defensible Fuel Profile Zone (DFPZ) units were surveyed by the watershed crew in the summer of 2005. Riparian and

channel data were collected on about 37 miles of streams. The "Soils and Hydrology" section also discusses the stream surveys performed in the proposed DFPZ units.

The Watershed Analysis Area contains a high road density. The density of roads near streams and the stream crossing density are problems in the Watershed Analysis Area under the existing condition. Roads modify drainage networks and accelerate erosion processes, resulting in the alteration of physical processes in streams. These changes can be dramatic and long lasting and can degrade water quality and aquatic habitat (see the "Hydrology Report" in the project file).

3.3.2.2 Riparian Habitat

Riparian habitats support a greater diversity and abundance of wildlife than most other cover types. These areas function as habitat for vertebrate wildlife and provide corridors for wildlife movement and migration. They act as refuges during wildfires, and stream sides are often the first areas that wildlife will re-occupy after stand-replacing fire events. Dense and diverse riparian vegetation provides herptofauna (reptile and amphibian) habitat as described in the Diamond Project biological evaluation (Collins and Hopkins 2006). Riparian Habitat Conservation Areas (RHCA) contribute to large woody debris within and adjacent to the stream channel, providing stream habitat (pools and cover) for fish species and herptofauna, and estivation (summer dormancy) areas adjacent to the stream channel for amphibians. There are 130 miles of perennial and intermittent streams in the Watershed Analysis Area for aquatic species. The width and type of riparian vegetation adjacent to streams were recorded for each surveyed stream segment (refer to table 3-9 in the "Soils and Hydrology" section of this chapter). The width of riparian vegetation on 33 miles of stream was 20 feet or less. The exclusion of fire and vegetation treatments, which are used as management tools in the RHCAs, has caused conifers to encroach on riparian vegetation—conifers compete with riparian species that cannot tolerate a shaded environment. The density of small trees makes many of the RHCAs in the Diamond Project Area vulnerable to catastrophic wildfire. High-intensity wildfire completely killed all vegetation in the RHCAs in the areas of the fire identified as "high severity" conditions. Large woody debris was rated as good or fair on 33 miles of stream (about 90 percent of surveyed miles). The reaches rated as having poor large woody debris were located on tributaries to Indian, Boulder, and Thompson Creeks.

3.3.2.3 Federal Threatened and Endangered Aquatic Species

California Red-legged Frog. The California red-legged frog (*Rana aurora draytonii*) is the only federal Threatened aquatic species occurring on the Plumas National Forest. No federally Endangered species are present. A complete discussion of the status, distribution, and occurrence of the California red-legged frog can be found in the BA/BE (Collins and Hopkins 2006) in the Diamond Project file.

The historical range of this species was limited to the coastal ranges, central valley, and the western slopes of the Sierra Nevada in California (Jennings and Hayes 1994). The Diamond Project Area is outside the frog's historical range. The current range of the California red-legged frog extends into Butte and Plumas Counties (USFWS 2002), but there are no populations of this species in Plumas County (Forest Service [SNFPA] 2001). There are no historical voucher specimens of this frog from within the forest boundaries, based on a review of collections (Roberts, personal communication). There are no known sightings in the Diamond Project Wildlife Analysis Area.

Critical habitat had been designated for this species (*Federal Register*, March 13, 2001, vol. 66, no. 49, 14625-14674), although there was no critical habitat designated within the Plumas National Forest or the Diamond Project Watershed Analysis Area. The *Federal Register* released on November 3, 2005, proposes that the California red-legged frog be managed under the HFQLG Pilot Project as amended by the Sierra Nevada Forest Plan Amendment and administered by the Plumas National Forest.

There are no confirmed sightings of California red-legged frogs on the Mt. Hough Ranger District, but there are numerous observations of foothill yellow-legged frogs distributed across the Ranger District. The reproductive success of these populations is unknown; however, sightings have been noticeably concentrated along the lower portion of Indian Creek, downstream to the North Fork Feather River, and up Spanish Creek, which suggests localized breeding success.

In 2001, Garcia and Associates completed California red-legged frog surveys in suitable habitat in the Wild Project Area, and in 2005, Mathew and Associates completed California red-legged frog surveys in suitable habitat in the Diamond Project Area. Both consultants used "Field Surveys for California Red-legged Frog" (a guide issued by the U.S. Fish and Wildlife Service) as the guiding protocols for their surveys. No California red-legged frog (*Rana aurora* or *Rana draytonii*) individuals were found at the sites.

3.3.2.4 Forest Service Sensitive Aquatic Species

Table 3-11 displays the Sensitive aquatic species that potentially occur on the Plumas National Forest. The mountain yellow-legged frog is highlighted in this Diamond Project EIS due to the proposed use of herbicides and the proposed DFPZ and area thinning within the RHCAs occupied by the mountain yellow-legged frog.

Table 3-11. Forest Service Sensitive aquatic wildlife species that potentially occur on the Plumas National Forest.

Species	Category
Fish	
Hardhead minnow (*Mylopharodon conocephalus*)	Sensitive
Amphibians	
Foothill yellow-legged frog (*Rana boylii*)	Sensitive
Mountain yellow-legged frog (*Rana muscosa*)	Sensitive
Northern leopard frog (*Rana pipiens*)	Sensitive
Reptiles	
Northwestern pond turtle (*Clemmys marmorata marmorata*)	Sensitive

Mountain Yellow-legged Frog. Garcia and Associates completed amphibian surveys on 48 miles of streams in the Wild Project Area in 2001 with detections of eight mountain yellow-legged frog larvae, one subadult, and five adults within Boulder and Pierce Creeks. Matthew and Associates completed amphibian surveys on 50 miles of streams in the Diamond Project Area in 2005, with no detections of Threatened, Endangered, or Sensitive amphibians or herptofauna. Both consultants followed "A Standard Protocol for Surveying Aquatic Amphibians" (Fellers and Freel 1995). There have been numerous detections of mountain yellow-legged frogs in the Watershed Analysis Area—the primary drainages are Boulder Creek, Lone-Rock Creek, and Pierce Creek. One season of radio-telemetry was conducted in Lone-Rock Creek, with 20 frogs tracked from July through September of 2003.

Foothill Yellow-legged Frog and Western Pond Turtle. There was only one detection of each of these species in the Watershed Analysis Area. The potential effects on the viability of these species would be minimal, so an analysis is not presented in this EIS. A detailed analysis can be found in the BA/BE (Collins and Hopkins 2006) for the Diamond Project.

Northern Leopard Frog. The Project Area and the Watershed Analysis Area are outside the range of the northern leopard frog. There have been no detections of this species within the Project Area boundary.

Hardhead Minnow. The hardhead minnow is found in nine subwatersheds where herbicide application is not proposed. With implementation of the project design standards, Best Management Practices, and Standard Management Requirements, there would be a low potential for direct, indirect, and cumulative effects on the hardhead minnow. A detailed analysis can be found in the BA/BE (Collins and Hopkins 2006) for the Diamond Project.

3.3.2.5 Aquatic Management Indicator Species

Rainbow Trout. A complete discussion of the status, distribution, and occurrence of Management Indicator Species (MIS) can be found in the MIS Analysis for the Diamond Project (Rotta and Hopkins 2006) in the Diamond Project file.

As MIS, rainbow trout represent the habitat requirements of coldwater fish species. Three species of trout are present in the Watershed Analysis Area. Rainbow and brown trout are present in several creeks (see table 3-12), and brook trout are found in Antelope and Taylor Lakes and Hungry and Indian Creeks below these lakes. Largemouth bass represent the habitat requirements of warm-water species—this species is found only in Antelope Lake, which is within the Watershed Analysis Area. The NEPA process requires agencies to identify "the significant environmental issues deserving study and de-emphasizing insignificant issues, narrowing the scope of the environmental impact statement" (40 CFR 15001.1(d)). It has been determined that the Diamond Project would have minimal to no direct, indirect, or cumulative effects on the brook trout, brown trout, and largemouth bass. In addition, there would be no change in the Forestwide trend for MIS trout populations with implementing the Diamond Project. Rainbow trout are the only MIS aquatic species analyzed in this EIS. For additional information on the effects on other MIS aquatic species, refer to the Diamond Project MIS analysis report (Rotta and Hopkins 2006).

Table 3-12. Subwatersheds with Threatened, Endangered, and Sensitive aquatic wildlife species and miles of streams.

Sub-watershed Number	Subwatershed Name	Sub-watershed Acres	Miles of Fish-Bearing Streams	Miles of Suspected Fish-Bearing Streams	Miles of Nonfish-Bearing Streams	Miles of Intermittent Fish-Bearing Streams	Miles of Intermitted Suspected Fish-Bearing Streams	Miles of Intermittent Nonfish-Bearing Streams	Miles of Ephemeral Streams	Threatened, Endangered, and Sensitive Aquatic Species
1	Upper West Branch Lights	2,196.12	1.03	2.52	0.45	0.00	0.00	4.27	8.84	MYLF (2)
21	Pierce	2,507.70	3.05	0.00	0.00	1.34	0.00	1.80	28.04	MYLF (1)
22	Upper Boulder West Tributary	848.22	0.00	0.48	1.03	0.00	0.00	0.63	6.90	MYLF (7)
23	Thompson	2,372.25	0.69	1.29	0.19	0.00	0.00	6.65	32.25	MYLF (2)
24	Mid Boulder – East	968.9	0.10	0.80	0.14	0.00	0.00	0.93	13.64	MYLF (suspected)
25	Mid Boulder – West	894.17	1.06	0.00	0.00	0.00	0.00	1.80	10.16	MYLF susp.
26	Lower Boulder	1,662.72	2.99	0.00	0.00	0.00	0.00	0.00	1.92	MYLF (1)
27	Lower Lone Rock	1,451.18	3.72	0.00	0.00	2.61	0.00	1.89	10.09	MYLF (2)
28	Lower Lone Rock Valley	2,149.85	2.53	0.00	0.00	0.00	0.00	1.73	12.09	MYLF (1)
29	Upper Boulder East Tributary	2,377.39	0.17	0.39	0.00	0.00	0.00	7.66	31.39	MYLF (3)
30	Boulder – top	1,699.30	0.40	2.55	0.00	0.00	0.22	1.90	20.66	MYLF (15) NPT (1)
31	Middle	2,511.69	0.00	0.50	0.00	0.00	0.00	5.03	16.24	Hardhead Minnow
32	Lower Hungary (exceeds ERA)	2,024.86	3.72	0.00	0.00	0.00	0.00	1.89	12.7	Hardhead Minnow
33	Indian Below Antelope – Babcock/Wheeler	3,827.09	—	—	—	—	—	—	—	Hardhead Minnow
34	Cold	1,638.35	1.92	0.00	0.00	0.06	0.00	4.04	24.82	Hardhead Minnow
35	Indian below Antelope – Dam to Cold	1,889.69	0.40	2.55	0.00	1.90	0.00	0.22	20.67	Hardhead Minnow
36	Indian below Antelope – Cold to Babcock	2,844.61	1.33	0.00	0.00	2.34	0.00	4.37	10.19	Hardhead Minnow
37	Indian below Antelope – Babcock Crossing to Hungry	1,477.86	1.89	0.45	0.17	0.00	0.00	2.55	10.90	Hardhead Minnow
38	Indian below Antelope – Elephants	1,229.52	2.27	0.00	0.00	0.33	0.00	7.95	24.56	Hardhead Minnow
39	Indian below Antelope – Red Clover Ranch	2,246.44	2.01	0.76	1.61	0.00	0.00	3.79	22.08	Hardhead Minnow
40	Antelope Lake East	13,219.82	3.09	0.00	0.00	0.00	0.00	5.75	13.26	FYLF (1)/ Hardhead Minnow

Notes: MYLF = mountain yellow-legged frog.
NPT = northwestern pond turtle.
FYLF = foothill yellow-legged frog.

Table 3-12 lists the fish-bearing streams, approximate miles and/or acres of occupancy, the type of fishery, and the reaches where fish occupy streams with proposed vegetative or herbicide treatments. Trout in Taylor Lake and the creeks are currently only recruited with natural reproduction because the state no longer conducts much stocking in these waters. Antelope Lake is stocked regularly with trout of catchable and noncatchable sizes.

Rainbow Trout (*Onorhynchus mykiss*). The rainbow trout is a native Californian game species with no official status. It is the most widely distributed and abundant native salmonid in California. Suitable habitat for the rainbow trout includes perennial lakes, ponds, and steams with cool water temperatures (0–78°F), high oxygen concentrations (can survive oxygen concentrations as low as 1.5–2.0 milligrams per liter (mg/L), but normally, concentrations close to saturation are required for growth) and clean, well-oxygenated gravel substrate for breeding (Behnke 1992).

3.3.2.6 Fishery Surveys

The Department of Water Resources conducted standing stock surveys in five tributaries to Indian Creek in the Watershed Analysis Area; those tributaries are Hungry, Lights, Little Grizzly, Red Clover, and Ward Creeks. Table 3-13 provides the results of the surveys, and the narrative below presents the findings of the general condition of the fishery within these drainages. The following discussion presents the results of the Department of Water Resources' standing stock surveys; the discussion includes all fish species in these surveys.

Rainbow trout dominate the fishery in Lights Creek, which has been altered by mining activities. Many of the trees that provide shade, cover, and nutrients through leaf drop have been removed. The substrate has been reduced to predominantly bedrock and cobbles. Habitat that could support trout has been greatly reduced. The loss of habitat is reflected in low trout biomass. Lights Creek has fewer trout than the average for five tributaries to Indian Creek and lower average biomass (see table 3-13).

Indian Creek (within the Watershed Analysis Area) remains cold and slightly turbid due to the deep-water outlet flow from the dam. Brown trout and rainbow trout dominate the fishery. Many large trout (mostly rainbows, but some browns and brooks) and largemouth bass typically enter the creek from Antelope Reservoir when it spills in spring.

Rainbow trout dominate the fishery in Hungry Creek.

Table 3-13. Estimates of rainbow trout standing stock and biomass in five tributaries to Indian Creek.

Stream	Average Number of Trout	Average Biomass (gallons/square meter)
Hungry Creek	76	2.8
Lights Creek	59	1.4
Little Grizzly Creek	131	4.6
Red Clover Creek	49	4.6
Ward Creek	101	4.4
Average	**83**	**3.6**

3.3.3 Affected Environment: Terrestrial Wildlife Species

3.3.3.1 Threatened and Endangered Terrestrial Wildlife Species

Table 3-14 shows all federally listed Threatened and Endangered terrestrial wildlife species that potentially occur on the Plumas National Forest.

Table 3-14. Federally listed Threatened and Endangered terrestrial wildlife species that potentially occur on the Plumas National Forest.

Species	Category
Invertebrates	
Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*)	Threatened
Birds	
Bald eagle[a] (*Haliaeetus leucocephalus*)	Threatened

a. Plumas National Forest MIS.

Valley Elderberry Longhorn Beetle. The beetle inhabits elderberry shrubs in riparian, savannah, and moist valley oak woodland habitats below 2,500 feet (Barr 1991). There are no sightings of this species on the Plumas National Forest (Roberts, personal communication 2006). The Diamond Project Area and Wildlife Analysis Area are outside the elevational and geographical range of this species and its habitat; therefore, this species is not present in the Wildlife Analysis Area. Informal consultation with the U.S. Fish and Wildlife Service (USFWS) on the Herger-Feinstein Quincy Library Group (HFQLG) final EIS, the supporting BA/BE and its supplement, and the Record of Decision concluded that the actions implemented on a programmatic level would likely not adversely affect this species within its current range (USFWS 1999).

Bald Eagle. The bald eagle was listed by the USFWS as a federally Endangered species in 1973. A *Bald Eagle Recovery Plan* was released in 1986 for the recovery and maintenance of bald eagle populations in the seven-state Pacific recovery region. The *Recovery Plan* has been adopted by the Forest Service within the range of the bald eagle. In the years since it was listed, the bald eagle has clearly increased in number and expanded in range (USFWS 1995). On August 11, 1995, the USFWS issued a Final Rule to reclassify the bald eagle from Endangered to Threatened in all of the lower 48 states. In the Pacific recovery region, which includes all of the National Forests in the Sierra Nevada, reclassification goals as set forth in the Recovery Plan have been met (USFWS 1995). The bald eagle was proposed for de-listing by the USFWS on July 4, 1999 (*Federal Register* vol. 64. no. 128, 36454). In 2006, the USFWS re-opened the comment period for the proposal to de-list the bald eagle (*Federal Register* vol. 71, no. 32, pages 8265-8268).

Critical habitat is currently not mapped or proposed for the bald eagle in the Sierra Nevada (USFWS 1986; USFS PSW 2001). In California, the species is still listed as "State Endangered" by the California Department of Fish and Game. The bald eagle is also a Plumas National Forest Management Indicator Species.

Each bald eagle territory on the Plumas National Forest is monitored a minimum of three times during the nesting season. There are currently 23 bald eagle nesting territories on the Forest. In 2006, 16 bald eagle nesting territories are active. In three locations (Lake Davis, Antelope Lake, Little Grass

Valley Reservoir), one pair occupies two different territories. Thus, the resident population on the Forest is approximately 32 individual birds.

In California, bald eagles are not known to nest further than 2 miles from an open water body (Lehman 1979; USFWS 1986). The species prefers a relatively open canopy (Lehman et al. 1980) ranging between 20 and 60 percent canopy cover. In the Pacific Northwest, bald eagle nests are usually located in uneven-aged (multistoried) stands with large, old trees (Anthony et al. 1982). Trees selected for nesting are characteristically one of the largest in the stand or at least codominant with overstory (USFWS 1986). Nest tree characteristics in California have been defined by Lehman et al (1980) as having a mean diameter of 44 inches (ranging between 27 and 85 inches) and being in excess of 100 feet tall. Most of these trees exhibit flat tops—large branches in the upper half of the tree that form large, open "windows" between the branches. In rare cases, snags are used as nest trees, though their most important function seems to be used as perches (Lehman 1980).

Breeding bald eagles require relatively large bodies of water containing a large standing population of suitably sized fish (Buehler 2000). Antelope Lake is the only open water body in the Project Area that could potentially support a nesting pair of eagles. Bald eagles have nested at Antelope Lake since at least 1978 when the first nest tree was discovered. A second pair of eagles established a nesting territory in 1995, and since then, two pairs have become year-round residents at the lake. There are currently three nest sites around Antelope Lake, one of which (Antelope II) was abandoned in favor of the Antelope III nest tree (USFS PNF 2006). Bald eagles at Antelope Lake have had a high rate of reproductive success, producing 33 fledglings in the 27 years (1979 to 2005) that the lake has been monitored for nesting eagles.

A bald eagle management plan for the territories around Antelope Lake was developed and approved in 2001; this was in compliance with the 1999 amendment to the 1988 Forest Plan (the *Plumas National Forest Land and Resource Management Plan*) and direction outlined in the HFQLG final EIS (table 2.1, page 2-7). The bald eagle management plan established the Antelope Lake Bald Eagle Management Area, which specified management actions to address current and future bald eagle foraging, roosting, and nesting habitat needs. The Plan was revised in 2006 to incorporate new information that became available since the original plan was implemented. This new information consisted of changes in forested habitat as a result of the 2001 Stream Fire, changes in nest locations after this fire, and incorporation of the 2004 Sierra Nevada Forest Plan Amendment (SNFPA) to the 1988 Forest Plan, as amended by the HFQLG *Forest Recovery Act*.

3.3.3.2 Forest Service Sensitive Terrestrial Wildlife Species

Table 3-15 lists the sensitive wildlife species that potentially occur on the Plumas National Forest.

The "Diamond Fuel Treatment, Group Selection, and Area Thinning Project: Biological Assessment / Biological Evaluation Terrestrial and Aquatic Wildlife" (Collins and Hopkins 2006) provides a discussion of the affected environment for all sensitive wildlife species analyzed for the Diamond Project. The BA/BE is located in the Diamond Project Record, and the analysis of effects on the species identified in table 3-15 is incorporated by reference. The California spotted owl, northern goshawk, American marten, and Pacific fisher are highlighted in this Diamond Project EIS because of the potential direct, indirect, and cumulative impacts of the proposed action and alternatives on their habitat (see the effects analysis in chapter 4).

Table 3-15. Forest Service Sensitive terrestrial wildlife species that potentially occur on the Plumas National Forest.

Species	Category
Birds	
American peregrine falcon (*Falco peregrinus anatum*) [a, b]	Delisted Sensitive
Northern goshawk (*Accipiter gentilis*) [a]	Sensitive
California spotted owl (*Strix occidentalis occidentalis*) [a]	Sensitive
Great gray owl (*Strix nebulosa*)	Sensitive
Willow flycatcher (*Empidonax trailii brewsteri*)	Sensitive
Greater sandhill crane (*Grus canadensis tabida*)	Sensitive
Swainson's hawk (*Buteo swainsoni*)	Sensitive
Mammals	
Sierra Nevada red fox (*Vulpes vulpes necator*)	Sensitive
American marten (*Martes americana*) [a]	Sensitive
Pacific fisher (*Martes pennanti pacifica*) [c]	Sensitive
California wolverine (*Gulo gulo luteus*)	Sensitive
Pallid bat (*Antrozous pallidus*)	Sensitive
Townsend's big-eared bat (*Corynorhinus townsendii*)	Sensitive
Western red bat (*Lasiurus blossevillii*)	Sensitive

Notes:

a. Plumas National Forest MIS.

b. The American peregrine falcon was delisted from Threatened status by the USFWS; status to be monitored for 5 years.

c. The West Coast population of the Pacific fisher is designated as a Candidate species by the USFWS (*Federal Register*, April 8, 2004, vol. 69, no. 68), but listing under the *Endangered Species Act* is precluded by other higher priority listing actions.

California Spotted Owl

Management Status—The California spotted owl has been at the center of controversy for well over a decade, and the extent of that controversy is reflected in the number of management strategies developed to address both owl conservation and other resource management concerns, such as fuels management. One of the first formal strategies to use land allocations was the development of Spotted Owl Habitat Areas (SOHA), first defined in the early to mid-1980s within the Forest Service Pacific Southwest Region. This was followed by the California Spotted Owl (CASPO) Interim Guidelines (USFS PSW 1993), which amended Forest Land Management Plans in the Sierra Nevada bioregion. In 2001, Forest Plans were again amended by the Sierra Nevada Forest Plan Amendment (SNFPA) (USFS PSW 2001), followed by the 2004 supplemental SNFPA (USFS PSW 2004).

The U.S. Fish and Wildlife Service (USFWS) was petitioned in 2000 to consider listing the California spotted owl under the *Endangered Species Act*. The USFWS found that listing was not warranted at the time, in part based on a draft population "meta-analysis" (Franklin et al. 2004) that indicated the California spotted owl was not declining at a rate previously believed. In 2004, the USFWS was sued in Federal District Court and, as a result, began another review of the owl's status. On June 21, 2005, the USFWS issued a finding in the *Federal Register* (vol. 70, no. 118) that determined there was sufficient new information that might warrant protection for the California

spotted owl under the *Endangered Species Act*. The factors that warranted a new review include revisions to the 2001 SNFPA in the 2004 SNFPA, revisions to the California State Forest Practices Code, possible changes to the draft meta-analysis, impacts of recent fires and anticipated future fires, and the potential for further expansion of the barred owl (USFWS 2005). A decision on the status of the California spotted owl is due nine months from the date (June 21, 2005) the finding was published in the *Federal Register*.

Population and Demographics—The latest published information regarding the California spotted owl, in terms of population status, distribution, population and habitat trends, and species requirements can be found in the *Federal Register* (Volume 71, Number 100/May 24, 2006). Based on this updated information, a total of 1,865 spotted owl territories are known within the Sierra Nevada range, including 1,399 territories on the Lassen, Plumas, Tahoe, Eldorado, Stanislaus, Sierra, and Sequoia National Forests; 129 territories in National Parks; 14 territories on Bureau of Land Management lands in the Sierra Nevada; and an additional 314 owl sites reported on private lands.

Three demographic studies have been investigating the population trend of the California spotted owl at four study areas (the Lassen, Eldorado, and Sierra National Forests and Sequoia/Kings Canyon National Park) within the Sierra Nevada range (Blakesley et al. 2001; Seamans et al. 2001; Steger et al. 2000). These studies strongly suggest negative population trends in some parts of the owl's range in the Sierra Nevada (USFS PSW 2001). A 2001 meta-analysis indicates that the declines were not as sharp as originally predicted. Rather, populations were either stable or only slightly declining (Franklin et al. 2004). These population changes may be the result of shifts in prey abundance, changes in regional weather patterns, or broad-scale land management practices (Steger et al. 2000).

The most current and comprehensive summary of population trends for the California spotted owl is found in the 2006 draft meta-analysis (Blakesley et al. 2006). The intended purpose of this report is to provide population analysis results relevant to the U.S. Fish and Wildlife Service listing decision. The report analyzed demographic data from the same four study areas mentioned above and included five additional years of data (2001–2005). Strong evidence for the decreasing trends was not reported on any of the study areas. In general, lambda (λ), the finite rate of population change, where λ less than 1 indicates a declining population, was not different from that of a stationary population. The Lassen National Forest study area had the lowest estimate of λ with a 95 percent confidence interval that barely overlapped 1, suggesting that the owl population on the Lassen may have been declining. The population viability analysis completed for the study indicated two of the four study areas (Lassen and Sierra) are likely to experience population declines within 7 years and very unlikely to experience population increases under current population trends.

The 2006 draft meta-analysis concludes that the potential consequences of the Forest Service management plan to spotted owls are unknown because (1) the extent of vegetation manipulations is largely under the control of local managers and will likely vary across the Sierra Nevada; and (2) threshold levels of quality habitat necessary to maintain individual pairs of spotted owls on a site are largely unknown. The recommendations from the meta-analysis are to develop well-designed experimental studies coupled with the spotted owl demographic studies.

The comprehensive adaptive management strategy to investigate the effects of fuels treatments and group selection silviculture on California spotted owl viability is referred to as the Plumas-Lassen Administrative Study. The Administrative Study is being conducted as a collaborative effort by the

Forest Service Pacific Southwest Research Station (at Sierra Nevada Research Center); the Universities of California at Berkeley and Davis; and Point Reyes Bird Observatory to determine the long-term effects from forest management practices on spotted owl, song birds, and small mammals. The study will identify the response of these old-forest-dependent species to changes in vegetation composition, structure, and distribution over space and time. Currently, all of the California spotted owl data for the Administrative Study are being collected on the Plumas National Forest but not in the Diamond Project Area.

The Plumas-Lassen Administrative Study spotted owl module has been gathering owl presence/occupancy information within treatment units on the Plumas National Forest for the last three years. In 2004, the study located 50 sites (identified as territories by the Plumas-Lassen Administrative Study) occupied by California spotted owls. Of these 50 owl sites, 43 had pairs and 7 locations had single owls. In 2005, 103 California spotted owl sites were located. Of the 103 sites, 76 contained pairs, 17 contained unconfirmed pairs (one member of pair confirmed as territorial single, plus single detection of opposite sex bird), and 10 contained single owls. The spotted owl population on the Forest is currently (2005) estimated at 218 pairs, 49 unconfirmed pairs, and 29 single owls—this is based on occupancy rates from the Plumas-Lassen Administrative Study. This California spotted owl population is well above the estimated number of owl pairs projected by the 1988 *Plumas National Forest Land and Resource Management Plan* (the "Forest Plan") during the first and second decades (Forest Plan, chapter 4, page 4-14). The Forest actually exceeded these projected numbers in 1991. Based on the estimated number of pairs and singles from 1996 to 2005, the spotted owl population on the Forest appears to have an upward trend (PNF 2006).

Habitat Use and Management Direction—Habitat suitability standards for the California spotted owl have been described in a number of sources, including the CASPO Interim Guidelines (USFS PSW 1993), the 1999 HFQLG final EIS, the 2001 SNFPA final EIS, the 2004 SNFPA final supplemental EIS, and the 2004 SNFPA Record of Decision.

Stands suitable for nesting and roosting have (1) two or more canopy layers; (2) dominant and codominant trees in the canopy averaging at least 24 inches diameter at breast height (dbh); (3) at least 70 percent total canopy cover (including the hardwood component); (4) higher than average levels of very large old trees; and (5) higher than average levels of snags and downed woody material (USFWS 2005). The CWHR size classes 5M and 5D (M = moderate; D = dense) have the highest probability of providing stand structures associated with preferred nesting, roosting, and foraging. The threshold canopy cover value that contributes to or detracts from occurrence and productivity is a value near 50 percent (USFS PSW 2001; Hunsaker et al. 2002). For the Diamond Project, all of the CWHR 5M size classes are considered owl nesting habitat.

Suitable foraging habitat is found in the same forest types listed above for nesting habitat (CWHR classes 5D and 5M), as well as class 4D (trees 11 to 24 inches dbh with dense canopy (60 to 100 percent), and class 4M (trees 11 to 24 inches dbh and moderate canopy cover between 40 and 59 percent). The stands considered to be suitable for foraging have at least two canopy layers, dominant and codominant trees in the canopy averaging at least 11 inches dbh, at least 40 percent canopy closure, and higher than average levels of snags and downed woody material (15- to 30-square-foot basal area in snags, 10 to 15 tons per acre downed woody debris) (Verner et al. 1992). Although canopy cover down to 40 percent is suitable for foraging, it appears to be only marginally so (based on owl occurrence and productivity threshold at around 50 percent canopy cover [ibid.]). In

its most recent notice concerning the California spotted owl, the USFWS states that owl foraging habitat "is generally described as stands of trees 30 centimeters (12 inches) in diameter or greater, with canopy cover of 40 percent or greater" (USFWS 2005), with no other habitat parameters for foraging habitat described. Thus, there appears to be an element of uncertainty associated with what constitutes foraging habitat. For this Diamond Project analysis, all class 4M are considered owl foraging habitat. In the red fir type, stands with 30 percent or greater canopy cover should be considered suitable for foraging (USFS PSW 2001).

The Wildlife Analysis Area totals 159,102 acres, of which 130,653 are National Forest (Plumas and Lassen) lands. The Wildlife Analysis Area differs from the Diamond Project Area because it was based on the distribution of spotted owl Protected Activity Centers (PACs), Spotted Owl Habitat Areas (SOHAs), Home Range Core Areas (HRCAs), and territories and not confined to watersheds. Table 3-16 summarizes the potential acres of suitable spotted owl habitat on National Forest lands in the Wildlife Analysis Area. Suitable CWHR types (USFS PSW 2001) are Sierra mixed conifer, white fir, red fir, montane hardwood-conifer, montane hardwood, ponderosa pine, montane riparian, lodgepole pine, and eastside pine.

Table 3-16. Potential acres of suitable owl habitat in the Wildlife Analysis Area based on 130,653 National Forest acres.

CWHR Type	Habitat Type	Acres in Analysis Area
4M	Foraging	47,903
4D	Foraging	6,575
5M	Nesting	28,314
5D	Nesting	5,769
Total	**Suitable**	**88,561**

The SNFPA Record of Decision (USFS PSW 2004) management strategy and direction for the California spotted owl recognizes two land allocations with discretely mapped areas, the nest area, or PAC, and the HRCA. Land allocation direction for HRCAs on the Mt. Hough Ranger District include the 300-acre PAC, plus an additional 700 acres of the best habitat available within a 1.5-mile radius of the activity center for a total of 1,000 acres. The direction in the 2004 SNFPA Record of Decision allows for full implementation of HFQLG Pilot Project activities within HRCAs that are established in the HFQLG Pilot Project area until the conclusion of the HFQLG Act in 2009. When the Pilot Project concludes, management direction associated with the HRCA designations will apply to the Lassen National Forest. Therefore, this analysis assesses the impacts of the proposed action and alternatives on HRCAs and suitable spotted owl habitat.

Spotted owl surveys have occurred in the Wildlife Analysis Area and Project Area. In 2003, as part of the Plumas-Lassen Administrative Study, a large percentage of the Diamond Project Area was surveyed following the *Protocol for Surveying for Spotted Owls in Proposed Management Activity Areas and Habitat Conservation Areas* (USFS 1993). The entire Diamond Project Area was surveyed in 2005 following the protocols set forth in the Plumas-Lassen Administrative Study (Hanson et al. 2004). This effort is being repeated in 2006 to complete the two-year survey effort.

Protected Activity Centers and Home Range Core Areas—There are a total of 44 PACs and associated HRCAs in the Wildlife Analysis Area, including 9 SOHAs (see figure 3-4). PACs and HRCAs have been delineated for each of these 9 SOHAs and are included in the total 44 PACs and HRCAs in the Wildlife Analysis Area. Twenty-eight spotted owl PACs are located in the Project Area that could potentially incur direct habitat impacts on the associated HRCAs. The remaining 16 PACs and HRCAs within the larger Wildlife Analysis Area could be indirectly affected by the proposed action but not directly affected by habitat change as a result of project implementation. There is one known PAC that occurs on private land in the Wildlife Analysis Area, with the most recent detection being a single male in 1991. Forest Service land falling within a circular core area drawn 1.5 miles around this private land PAC is included in two adjacent PACs/HRCAs (PL005, PL041). No management activities would occur in PACs or SOHAs.

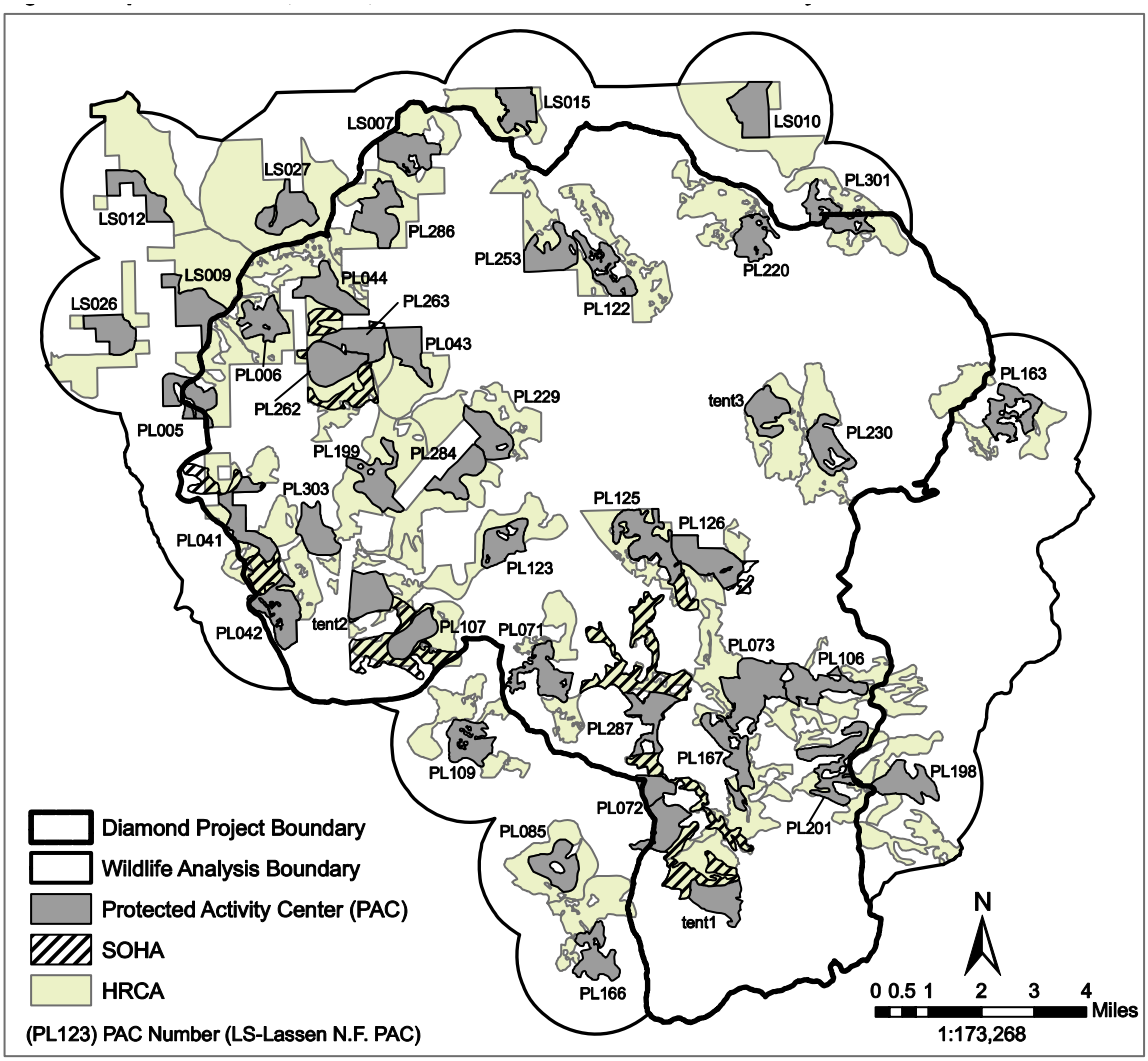

Figure 3-4. Spotted Owl PACs, SOHAs, and HRCAs in the Diamond Project Wildlife Analysis Area.

Area of Concern—The CASPO Technical Report (Verner et al. 1992) identified Areas of Concern (AOC) within the range and distribution of the California spotted owl. These AOCs are identified simply to indicate potential areas where future problems may limit owl populations and where future problems may be greatest if the owl's status were to deteriorate. The two AOCs identified in the CASPO Report are adjacent to the Plumas National Forest (page 46–49 of CASPO Report):

> **Area of Concern 1:** Located in Lassen County, within the Lassen National Forest and adjacent to the Plumas National Forest. The reason for the concern is that the habitat in this area is discontinuous, naturally fragmented, and poor in quality due to drier conditions and lava-based soils.
>
> **Area of Concern 2:** Located in Northern Plumas County, within the Lassen National Forest. The reason for the concern is a gap in known distribution, mainly on private lands, which extends east to west in a band almost fully across the width of the owl's range.

The AOC maps were extremely broad, and the method used to define those boundaries is unclear (Gould, CDFG, personal communication, 2006). The Diamond Project Area is located southeast of and outside of these AOCs. The larger Wildlife Analysis Area does include a small portion of AOC 1 and AOC 2, but these lie outside of all proposed activities and would not be directly affected by the Diamond Project.

Northern Goshawk. The latest published information regarding the goshawk, in terms of population status, distribution, population and habitat trends, and species requirements can be found in the SNFPA final EIS (chapter 3, part 4.4.2.2), and in part 3.2.2.4 of the 2004 SNFPA final supplemental EIS. A total of 588 northern goshawk breeding territories have been reported from Sierra Nevada National Forests. The Plumas National Forest supports approximately 144 goshawk territories—this is approximately 19 percent of the total number of breeding territories 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 1988 Forest Plan calls for a network of 60 nesting territories to provide for the viability of the goshawk. It is uncertain as to whether this figure is accurate. The Plumas National Forest has been developing territories (pre-SNFPA), and now there are 200-acre PACs (USFS PSW 2004a) for all newly discovered goshawk breeding sites. Therefore, it is believed that the current density of goshawk territories is contributing to goshawk viability within the Plumas National Forest.

The population trends of northern goshawks in the Sierra Nevada are unknown, although numbers are suspected to be declining due to habitat reductions and loss of territories to timber harvest (Bloom et al. 1986 in USFS PSW 2001). Based on numerous studies (Bloom et al. 1986; Reynolds et al. 1992; Kennedy 1997; Squires and Reynolds 1997; Smallwood 1998; DeStefano 1998—all citations are in USFS PSW 2001), 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. Annual monitoring of nest sites on the Mt. Hough Ranger District from 1998 to 2002 indicated that nesting activity occurred at approximately 36 percent of the monitored sites. Goshawk surveys were conducted in the Project Area in 2005 by contractors (MGW Biological and Klamath Wildlife Resources) who followed methodologies for broadcast acoustical surveys as described in the Forest Service Regions 5 Northern Goshawk Survey Protocols (USFS PSW 2000).

Approximately 2,289 stations were surveyed twice in 2005. Three new goshawk nesting sites were located, and corresponding 200-acre PACS for these territories were established (MGW Biological / Klamath Wildlife Resources 2005). Surveys will be repeated in 2006 to complete the two-year survey effort. A total of 13 goshawk PACs are present on National Forest lands within the Wildlife Analysis Area.

The northern goshawk requires mature conifers and deciduous forests with large trees, snags, and downed logs; dense canopy closure for nesting and forests with moderately open overstories; open understories interspersed with meadows, brush patches, or other natural or artificial openings; and riparian areas for foraging (USFS PSW 2001). Recent studies indicate that goshawks typically select canopy closures greater than 60 percent for nesting (Hall 1984; Richter and Callas 1996; Keane 1997). The following affected CWHR types provide high nesting habitat capability: Sierra mixed conifer, white fir, montane hardwood-conifer, lodgepole pine, montane riparian, ponderosa pine, and montane hardwood (CWHR size classes 5D, 5M, 4D, 4M). The following CWHR types are rated as providing moderate nesting habitat capability: aspen (4D, 4M, 5D, 5M), red fir (4D, 4M), and eastside pine (5D, 5M, 4D, 4M) (USFS PSW 2001).

There are approximately 88,571 acres of habitat in the Wildlife Analysis Area that provide high nesting habitat capability (CWHR size classes 5D, 5M, 4D, and 4M in Sierra mixed conifer, white fir, montane hardwood-conifer, montane riparian, ponderosa pine, lodgepole pine, and montane hardwood (see table 3-17).

Table 3-17. Acres of high and moderate capability goshawk nesting habitat in Wildlife Analysis Area.

CWHR Size Class	Nesting Habitat Capability	Acres[a] in the Wildlife Analysis Area
4M	High	47,291
4D	High	6,336
5M	High	28,309
5D	High	5,740
Subtotal	**High**	**87,676**
Eastside Pine 4M, 4D, 5M, 5D	Moderate	426
Red Fir 4M, 4D	Moderate	459
Subtotal	**Moderate**	**895**
Total	**All Nesting**	**88,571**

Note:

a. The acres are pre-treatment acres under the Diamond Project, and all are on National Forest land.

Mesocarnivores (Pacific Fisher and American Marten). The Plumas National Forest has mapped a forest carnivore network across the Forest that consists of scattered known marten sightings, large habitat management areas, and wide dispersal or connecting corridors. The SNFPA standards and guidelines for mesocarnivore habitat do not speak to carnivore networks, allowing each National Forest to decide on the management need for the network. The Plumas National Forest carnivore network is not incorporated into the Forest Plan as a land allocation with standards and

guidelines; rather, it is a plan to evaluate impacts of specific projects on habitat connectivity. The management intent of the network is to provide a continuously connected system of habitats focused on the needs of marten and fisher. This corridor is designed to provide a habitat connectivity corridor linking the Tahoe National Forest with the Lassen National Forest. However, there is concern for corridors between these reserves that allow immigration and emigration to maintain healthy populations. Approximately 27,311 acres (11.2 percent) of the forest carnivore network are within the Wildlife Analysis Area.

Approximately 50 percent of the Plumas National Forest has been systematically surveyed to protocol using track plates and camera stations (Plumas GIS database). To date, there have been no fisher, Sierra Nevada red fox, or California wolverine detections associated with these surveys. On the Plumas National Forest, all but about five sightings of marten occur within the Lakes Basin-Haskell Peak area or around Little Grass Valley Reservoir. All five sightings are unverified reports (verified report consists of photograph, tracks, hair sample, and sighting by a reputable biologist).

Portions of the Wildlife Analysis Area have been surveyed several times over the years for mesocarnivores, using both camera stations and track plates as detailed in USFS PSW (1995). This includes survey efforts by private contractors (North State Resources in 2000–2001), Forest Service crews in 2000, Ganda (contractor) in 2001, and Mathews and Associates (contractor) in 2001–2002. No mesocarnivores have been detected to date in the Wildlife Analysis Area using these methods. The most recent mesocarnivore survey completed in the Wildlife Analysis Area was in 2003 within Treatment Units 9 and 10 (then part of the Plumas-Lassen Administrative Study). Contractors Mathews and Associates surveyed, using baited photo stations, from January 15 to February 25, 2003. Forty-six camera stations were monitored for a total of 1,290 survey days—no target mesocarnivores were found.

Pacific Fisher—The USFWS completed an initial 90-day review of a petition submitted by 20 groups seeking to list the Pacific fisher as Endangered in Washington, Oregon, and California. After reviewing the best available scientific information, the USFWS found that substantial information indicated that listing the Pacific fisher as Endangered in its West Coast range may be warranted (USFWS news release July 10, 2003). After a 12-month status review, the West Coast population of the fisher was designated as a Candidate species by USFWS (*Federal Register* notice – April 8, 2004, vol. 69, no. 68), but listing under the *Endangered Species Act* is precluded by other higher-priority listing actions.

The current distribution of Pacific fisher in California suggests that the once continuous distribution is now apparently fragmented into two areas separated by a distance that greatly exceeds reported fisher dispersal ability. The methods used to detect fisher in numerous survey efforts have failed to detect this species in an area between Mount Shasta and Yosemite National Park (Zielinski et al. 1995). These authors strongly suggest that the absence of fisher detections within this large 240-mile area is because they do not occur in the areas surveyed. This gap in distribution may be effectively isolating the southern Sierra Nevada population from the rest of the fisher range in Northern California. Since 1990 there have generally been no detections or confirmed sightings of fisher within this 240-mile gap of the Sierra Nevada (note: gap equates to 240 miles as identified in the 2001 SNFPA and 260 miles in the April 8, 2004, *Federal Register*). The Diamond Project Area is located within this “gap.”

The reintroduction of fisher to the central and northern Sierra has been proposed and has strong support in the scientific and research community. The Forest Service Pacific Southwest Region supports reintroduction and will actively pursue partnerships in this effort as a feature of the SNFPA management strategy (USFS PSW 2004).

The 2004 SNFPA Record of Decision (USFS PSW 2004) identifies large trees, large snags, large down wood, and higher than average canopy closure as habitat attributes important to fisher. CWHR size classes 4M, 4D, 5M, 5D, and 6 are identified as being important to fisher. A vegetated understory and large woody debris appear important for their prey species. The fisher's preferred forest types include montane hardwood conifer, mixed conifer, montane riparian, ponderosa pine, lodgepole pine, eastside pine, and possibly red fir. The higher-elevation forests are less suitable for fishers because of deep snow packs (*Federal Register*, April 2004). Table 3-18 displays the acres of denning (CWHR size classes 4D and 5D) and foraging (CWHR size classes 4M and 5M) habitat present in the Wildlife Analysis Area.

Table 3-18. Suitable Pacific fisher habitat in the Wildlife Analysis Area.

Habitat Use	CWHR Type[a]	Analysis Area (acres)
Denning	4D, 5D	12,344
Foraging	4M, 5M	76,217
Total	—	**88,561**

Note:
a. Sierra mixed conifer, ponderosa pine, red fir, white fir, montane hardwood, montane hardwood-conifer, montane riparian, and eastside pine.

The physical structure of the forest and the prey associated with forest structures are thought to be the critical features that explain fisher habitat use. Powell (in *Federal Register* 2004) states that forest type is probably not as important to fishers as the vegetative and structural aspects, and fishers may select forests that have low and closed canopies. Numerous studies (as referenced in the 2004 SNFPA final supplemental EIS) indicate that canopy closure over 60 percent is important, and fisher preferentially select home ranges to include high proportions of dense forested habitat. The fisher's need for overhead cover was very well documented in the April 8, 2004, *Federal Register*. Fishers select stands with continuous canopy cover to provide security cover from predators. The dense canopy increases snow interception, lowers the energetic costs of traveling between foraging sites, and preferred prey species may be more abundant and vulnerable in areas of higher canopy closure (ibid.). A number of studies have shown that the fisher avoids areas with little forest cover or significant human disturbance and prefers large areas of contiguous interior forest (ibid.).

Habitat fragmentation has contributed to the decline of fisher populations because they have limited dispersal distances and are reluctant to cross open areas to re-colonize historical habitat (ibid.). There is no evidence that fishers are successfully dispersing outside known population areas in California and Oregon, which is possibly due to the extent of habitat fragmentation, developed or disturbed landscapes, and highways/interstate corridors (ibid.). Based on studies of home range sizes

referenced in the April 8, 2004, *Federal Register*, estimates of potentially suitable and contiguous habitat that must be present before an area can sustain a population of fishers range from 31,600 acres in California, 39,780 acres in the northeastern United States, and 64,000 acres in British Columbia (ibid.). These same studies also showed a positive association between fisher presence and forest stand area, detecting fishers more frequently in stands greater than 126 acres (ibid.).

American Marten—In the Sierra Nevada, marten are most often found above 7,200 feet, but the species' core elevation range is from 5,500 to 10,000 feet (USFS PSW 2001).

There are over 40 records of marten observations/detections on the Plumas National Forest dating back to 1975. Only one record, a sighting in 1980 at Taylor Lake, is within the Wildlife Analysis Area. Extensive surveys using both soot-covered track plates and baited photo stations have been conducted since the mid-1990s across the majority of the Mt. Hough Ranger District landscape; no marten have been found (documented survey results are on file). Marten have not been detected during the surveys conducted within and adjacent to the Diamond Project Area and Wildlife Analysis Area over the last eight years; therefore, it is suspected that marten are likely not present in the Wildlife Analysis Area.

Martens prefer coniferous forest habitat with large-diameter trees and snags, large down logs, moderate-to-high canopy closure, and interspersion of riparian areas and meadows (ibid.). Martens generally avoid habitats that lack overhead cover; rather, they select stands with 40 percent canopy closure for both resting and foraging and usually avoid stands with less than 30 percent canopy closure (ibid.). Foraging areas are generally in close proximity to both dense riparian corridors (used as travel ways) and forest meadow edges and include an interspersion of small (less than 1 acre) openings with good ground cover used for foraging (USFS PSW 2001).

Important forest types include mature mesic (moderately moist) forests of red fir, Sierra mixed conifer-fir, lodgepole pine, and eastside pine (USFS PSW 2001). The CWHR size classes 4M, 4D, 5M, 5D, and 6 are identified as moderately to highly important for the marten (ibid.). The red fir zone forms the core of marten occurrence in the Sierra Nevada (ibid.). Table 3-19 displays the acres of denning (4D, 5D) and foraging (4M, 5M) habitat present in the Wildlife Analysis Area.

Table 3-19. Suitable marten habitat available in the Wildlife Analysis Area.

Habitat Use	CWHR Type[a]	Analysis Area (acres)
Denning	4D, 5D,	12,023
Foraging	4M, 5M	72,477
Total		**84,500**

3.3.3.3 Project-level Management Indicator Species

All federally listed Threatened, Endangered, and Sensitive (TES) species are discussed in the Diamond Project BA/BE. All of the Plumas National Forest non-TES Management Indicator Species (MIS) listed in table 3-20 below were used for project-level analysis for the Diamond Project (see

MIS report in project record titled "Diamond Project: Affected Environment and Environmental Consequences – Management Indicator Species). These species are either present and/or have habitat that would be affected (directly or indirectly) by the project. The mule deer is highlighted in this EIS because of the potential effects of the proposed action and alternatives on their habitat (early seral/shrub and oaks). The effects on Canada goose, golden eagle, prairie falcon, trout, and largemouth bass are found in the MIS report in the project record.

Table 3-20. Plumas National Forest Management Indicator Species that are not federally listed Threatened, Endangered, or Sensitive species.

Species	Status[a]	Habitat Indicator
Mule deer	Harvest (category 3)[a]	Early seral, shrub
Canada goose	Harvest (category 3)	Wetlands
Golden eagle	Maintenance (category 3)	Open forest
Prairie falcon	Maintenance (category 3)	Early seral/cliff
Trout group	Harvest (category 3)	Coldwater aquatic
Largemouth bass	Harvest (category 2)	Warm water / lake aquatic

Note:

a. Category 1: MIS habitat not within or adjacent to project area and would not be affected.
Category 2: MIS habitat within or adjacent to project area, but would not be affected.
Category 3: MIS whose habitat would be affected by the project. (Source: Draft – MIS Analysis and Documentation in Project Level NEPA, R5 Environmental Coordination, May 23, 2006.)

The project-level MIS selection and project-level effects analysis for the Diamond Project are based on the one-page Forest Service Pacific Southwest Region (Region 5) "Clarification Regarding MIS Analysis and Documentation in Project level NEPA" dated October 29, 2004.

Mule Deer. The Diamond Project Area falls within an area that provides winter and summer range for the Sloat Deer Herd, as well as summer range for a portion of the Doyle Deer Herd. Both deer herds are managed under the guidance of deer herd management plans developed cooperatively between the California Department of Fish and Game and major land management agencies, including the Forest Service. These management plans provide deer population and habitat goals, as well as identify possible limiting factors to population growth. The management plans contain action plans for all cooperating agencies to follow to achieve management goals. The Wildlife Analysis Area also falls within a small portion of the Tehama Deer Herd summer range (see table 3-21). No Diamond Project activities would occur within the range of the Tehama Deer Herd; thus, the herd is not discussed further.

Table 3-21. Deer range within the Wildlife Analysis Area by deer herd.

	Doyle Deer Herd		Sloat Deer Herd		Tehama Deer Herd		
Range	Acres	Percent of Herd Range	Acres	Percent of Herd Range	Acres	Percent of Herd Range	Total
Summer	89,911[a]	18	49,611	16	14,587	1	154,109
Winter	0	0	4,016	4	0	0	4,016
Total	**89,911**	**18**	**53,627**	**20**	**14,587**	**1**	**158,125**

Note:

a. Antelope Lake has been removed from all acre figures.

The Forest Plan (USFS PNF 1988), as amended, provides as an objective a deer population goal of approximately 24,000 deer across the Forest. Deer numbers are known to be down in all Sierra Nevada Deer Herds (CDFG 1999).

California is divided into 11 Deer Assessment Units (DAUs) for purposes of analysis. The Diamond Project is located in one DAU: the Northeast Sierra Zone, which was designated DAU 3 (CDFG 1998) but is now identified as DAU 10 (CDFG 2003). Inexplicably, the California Department of Fish and Game changed the DAU reference numbers between 1998 and 2003. The boundaries and the deer hunting zones in DAU 10 did not change. DAU 10 has been identified by the California Department of Fish and Game as one of two top-priority DAUs to attempt to reverse the decline in deer populations through habitat-based efforts (CDFG 1998). Opportunities to improve summer range identified in the statewide DAU assessment plan for DAU 10 include thinning and burning, reducing livestock use in aspen and riparian areas, and encouraging aspen regeneration.

The 1984 Sloat Deer Herd Plan called for a desired population goal of 5,500 animals at a buck:doe ratio of 20–25:100, and a spring fawn:doe ratio of 45:100. The current population estimate for the deer hunting zone occupied by the Sloat Deer Herd is approximately 2,490 deer, with a buck:doe ratio of 18:100 (CDFG 2003). Based on observations and hunter kill, the population is well below the desired number, but it is suspected to be stable (Lidberg, CDFG, personal communication, 2006). It is suspected that the limiting factor for the Sloat Deer Herd is a lack of suitable forage (ibid.).

The Sloat Deer Herd is primarily comprised of Columbian black-tailed deer (*Odocoileus hemionus columbianus*), although there is some intermingling and hybridization with Rocky Mountain mule deer (*O.h. hemionus*), the dominant subspecies from the neighboring Doyle Deer Herd to the east. The Diamond Project is located within the X6A deer hunting zone, which allowed a total of 325 deer tags in 2003, increased to 390 tags in 2004, and 380 tags in 2005. The portion of the Wildlife Analysis Area below the dam at Antelope Lake east of Indian Creek, is within deer hunting zone X6B, which allowed 375 deer tags in 2004 and increased to 425 tags in 2005. The increase in the deer tag quota is somewhat reflective of a slight increase in deer numbers (Lidberg, CDFG, personal communication, 2006).

The Doyle Deer Herd is primarily comprised of Rocky Mountain mule deer (*Odocoileus hemionus hemionus*), although there is some intermingling and hybridization with Columbian black-tailed deer (*O.h. columbianus*) from the neighboring Sloat Deer Herd to the west. The 1982 Doyle Deer Herd Plan called for a desired population level of 14,000 animals at a buck:doe ratio of 25:100, and a spring fawn:doe ratio of 45:100. Habitat goals on summer range are designed to support an average deer density of 17 deer per square mile. Based on 2002 data supplied by the California Department of Fish and Game, the total population for the Doyle Deer Herd was 1,825, with a buck:doe ratio of 20:100, and a fawn:doe ratio of 38:100 (Lidberg, CDFG, personal communication, 2002). This is a population density of approximately 2 deer per square mile. The current 2003 estimate for the deer hunting zone occupied by the Doyle Deer Herd (X6b) was approximately 1,420 deer, with a buck:doe ratio of 34:100 (CDFG 2003). The current population is somewhere between 2002 and 2003 population numbers. Fall composition counts conducted by helicopter on winter range in 2005 revealed a buck:doe ratio of 8:100 and a fawn:doe ratio of 59:100, both of which

would indicate spring numbers well below objectives (Lidberg, CDFG, personal communication, 2006).

There are approximately 154,100 acres of summer range and 4,000 acres of winter range in the Wildlife Analysis Area; all winter range is designated for the Sloat Deer Herd (refer to table 3-21 above). Only a small portion of this winter range, located in Genesee Valley, has been designated as critical winter range (areas used by the majority of the deer on winter range due to exposure and availability of forage during very wet/snowy winters or winter storm events).

Statewide, it is thought that declines in deer populations are due to low fawn survival (CDFG 1999), but causal relationships have not been determined. Numerous factors have contributed to herd declines; those include conversions of brush fields to conifer plantations, lack of prescribed fire, high stand densities, increased road densities, competition and displacement by livestock, predation, urban sprawl, and loss of productive riparian systems (ibid.). California had large increases in mountain lion populations in the 1980s and 1990s. Pressure on the deer populations as a result of mountain lion predation may act to suppress deer numbers (SNFPA 2001). Fluctuations in wildlife populations are natural and occur as a result of hard winters, droughts, floods, loss of habitat, and disease. The current population trends for mule deer are considered "variable" (refer to section 3.2.3 in the 2004 SNFPA final supplemental EIS).

The "open-road density per square mile" is an index used to predict at what level upland habitat would be effective in providing potential ungulate use of that habitat, referred to as a "habitat effectiveness index" (Thomas 1979). Higher road densities infer increased use by human users, which can result in changes in behavior and habitat use patterns by ungulate species (Lyon 1979; Thomas 1979; Wisdom 1996). The higher the open-road density per square mile, the less the potential for the surrounding habitat to be fully used (Lyon 1983). The Western Association of Fish and Wildlife Agencies Mule Deer Working Group identified removing the negative effects of roads by reseeding and limiting access as a means of improving habitat for mule deer in forests (WAFWA 2002). Both Deer Herd Management Plans (Sloat Deer Herd Plan and Doyle Deer Herd) call for reducing road access in order to increase the value of habitats to deer by reducing disturbance and, also, to reduce illegal kill.

The open-road density for the Diamond Project is based on the approximate 100,000-acre Project Area. The open-road density in the Diamond Project Area is approximately 3 miles per square mile, for a habitat effectiveness rating of 80 (or the effectiveness of deer habitat in obtaining optimum use of the maximum area is reduced about 20 percent by the presence of roads that are open to vehicular traffic) (refer to table 3 in the Diamond Project MIS Report).

For 22 consecutive years, the Diamond Mountain Limited Vehicle Access program has been implemented to administratively close roads within a designated area to any motorized vehicles during the rifle deer season. This program is within the Wildlife Analysis Area. The closure was originally set up to respond to complaints about the volume of vehicles in the area during the deer-hunting season. The objective of removing vehicular traffic during the deer season is to curb excessive disturbance to deer and to improve the hunting experience for hunters. Partners in this successful effort include the Plumas County Fish and Game Commission, the California Department of Fish and Game, and the Plumas National Forest. Guidance for this program is found in the 1988 *Plumas National Forest Land and Resource Management Plan* (the "Forest Plan"), pages 4-287

and 4-292. Contracts issued to implement the Diamond Project would consider the need to reduce/remove traffic from this area for a two and a half week period in October.

Disturbances within Sierra mixed conifer usually result in a diverse, fire-adapted shrub component consisting of species that deer prefer as browse. The preferred browse in the Project Area includes snowbrush ceanothus (*Ceanothus velutinous*), whitethorn ceanothus (*C. cordulatus*), deerbrush (*C. integerrimus*), bittercherry (*Prunus emarginata*), and greenleaf manzanita (*Arctostaphylos patula*), while winter forage is provided by wedgeleaf ceanothus (*C. cuneatus*) and silktassel (*Garrya fremontii*). Within transition ponderosa pine and eastside pine, bitterbrush (*Purschia tridentata*) associated with Idaho fescue (*Festuca idahoensis*) can dominate the understory. Brush fields that develop on summer range following disturbances (such as wildfire, logging, and broadcast burning) have been found to be very important fawning areas, as well as providing highly nutritious forage, especially the first 10–12 years following the disturbance.

Within Plumas County, deer respond to manipulated habitats that set back the successional pattern of vegetation in a predictable manner. For the first 10 years within a disturbed area, there are local increases in deer use and numbers, regardless if the disturbance was created by logging or fire. Deer respond to the vegetative response of the disturbance, manifested by an increase in succulent shrub and forb growth. As habitat matures, and brush gets high and thick, fawning use starts to decline after about 15–25 years. Deer use can continue at lesser numbers than what was realized in the first 10 years, especially if natural openings and forested stands allow for movement. Planting the shrub areas with conifers accelerates the decline in deer use; thinning and release of conifers can result in a flush of new vegetative growth for deer browse up to the time that the conifers start shading out this growth. Somewhere between 25 and 50 years, the conifers within plantations or cut-over areas dominate the site, and browse is less available, but hiding and thermal cover is provided.

Shrub species may dominate and persist for up to 50 years or longer before conifer growth significantly reduces shrub growth through shading. This shrub stage has two characteristic successional sequences:

1. On poor, typically shallow soils, often overlaying bedrock, the shrubs tend to predominate to form a climax community.

2. On deeper forest soils, this shrub community represents secondary succession following disturbance. The shrub species may exclude conifers for many years. However, these same species may facilitate the germination of shade-tolerant conifer species by providing a protective cover, moderating microclimate, and improving soil conditions. If no conifer seed source exists, such as within the interior of a stand-replacing fire, the shrub community can occupy the site for several decades beyond normal successional timeframes. In mature timber stands, shrub species mature and die due to insufficient light and are only present as a sparse understory. The shrub component provides important habitat, including winter range, for deer, as well as early seral habitat for shrub nesting species, such as green-tailed towhees, fox sparrows, and mountain quail.

Within the eastside/transition areas, wildfire can burn at intensities that will result in loss of the bitterbrush component for several decades. On the other hand, prescribed burning in bitterbrush-dominated understories in the spring when soil moisture is present, has resulted in successful

regeneration of bitterbrush through sprouting on the Plumas National Forest (Rotta, USFS, personal communication, 2006) including the area within the Wildlife Analysis Area (Carpenter 2003).

Based on the California Wildlife Habitat Relationship (CWHR), the Wildlife Analysis Area (within the Plumas National Forest) supports 10,187 acres of grass/forb, shrub, and early successional habitat (refer to appendix 1 of the MIS Report). The majority of this habitat is due to numerous natural openings, even-aged timber harvest, and wildfire. The majority of the predominantly shrub stands in CWHR size classes 1 and 2 are the result of the 2001 Stream Fire. This wildfire area is providing excellent forage that should continue for the next 8–10 years. Early successional habitat is important to a number of wildlife associates, including ground-nesting birds, small mammals, several species of reptiles, and bats.

Forage for deer is defined as all CWHR vegetation types identified above as grass/forb, shrub, and early successional habitat, as well as all CWHR vegetation types with less than 40 percent canopy cover (sparse and poor). These more open stands support some element of understory vegetation in varying degrees of species composition and availability that probably are used by deer for forage more so than for cover. Cover is supplied by CWHR types with canopy cover greater than 40 percent (moderate and dense). Based on acres displayed in appendix 1 of the MIS Report (excluding water, rock, riparian), the National Forest acres within the Analysis Area support approximately 37,678 acres of forage and 90,413 acres of cover for a forage:cover ratio of approximately 30:70.

3.3.4 Affected Environmental: Neotropical Migratory Birds

Neotropical migratory birds are defined as species whose breeding area includes the North American temperate zones and, in many cases, those birds that migrate south of the continental United States during nonbreeding seasons (Hunter et al. 1993). The Breeding Bird Survey (BBS) coordinated by the USFWS indicates that certain populations of Neotropical migratory bird species in California have been declining over the past 26 years (1996 data). Although there appear to be multiple causes for declines, the primary causes seem to be habitat fragmentation and decreases in habitat quantity and quality brought on by changes in land use (Sherry and Holmes 1993; Terborgh 1992).

Saab and Dudley (1997) found that Neotropical migrant species with decreasing population trends tend to be those that nest in shrub layers, and species with increasing population trends tend to nest in tree canopies. The 1996 EIS for *Managing California Spotted Owl Habitat in the Sierra Nevada National Forests of California: An Ecosystem Approach* has a summary table of Sierran Neotropical migratory bird species with measurable population declines based on Breeding Bird Surveys conducted in coordination with the U.S. Fish and Wildlife Service. The table indicates that 32 species showing population declines have some habitat association with grassland/shrubland/open forest and/or riparian habitat.

The Forest Services Pacific Southwest (Region 5) *Land Bird Monitoring Implementation Plan* (USFS 1996) identified certain migratory birds as having a high priority for monitoring and mitigation efforts. The SNFPA EIS classified terrestrial birds as having high, moderate, and low vulnerability (high-vulnerability species are at greatest risk to loss of viability within the Sierra Nevada bioregion (SNFPA final supplemental EIS, appendix R). The SNFPA final supplemental EIS

(chapter 3, page 173) identified 40 land bird species (not all are Neotropical migrants) that are of particular concern and are a high priority for monitoring efforts in the Sierra Nevada bioregion.

The Diamond Project Neotropical Migrant Bird Report provides a list of selected bird species that occur in the Wildlife Analysis Area. The species have been grouped according to habitat type. Some species fall into more than one group. The assumption is that if the effects on several species within one group were analyzed, the effects on all species that belong to that group would be similar.

Executive Order 13186 was issued in 2001 to outline responsibilities of federal agencies to protect migratory birds under the *Migratory Bird Treaty Act* (66 *Federal Register* 3853-3856). The order directs federal agencies to work with the USFWS to promote conservation of migratory bird populations. The Forest Service and the USFWS entered into an interim memorandum of understanding (MOU) to strengthen migratory bird conservation. This interim MOU expired on January 15, 2003, yet the conservation measures contained in the MOU are still applicable for use in environmental planning (SNFPA final supplemental EIS, 2004, chapter 3, page 172). 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.

3.3.5 Snags/Logs

Snags, particularly large ones (greater than 24 inches dbh), are an important wildlife habitat component of forested stands. They provide habitat for primary cavity nesters (such as woodpeckers) and secondary cavity nesters (such as flying squirrels and some Neotropical migratory birds), including the western bluebird, violet-green swallow, Vaux's swift, and American kestrel. Snags are also the main source of large downed woody debris. Past management practices (such as logging, firewood cutting, road construction, and other activities) have probably led to a decline in the number of large-diameter snags in the Project Area, with a detrimental effect on associated wildlife species. By contrast, it is likely that small-diameter snags have increased somewhat due to the creation of densely stocked stands and resulting mortality, with a subsequent benefit to wildlife that use small-diameter snags.

Table 2 in the 1988 Forest Plan (as amended by the 2004 SNFPA final supplemental EIS Record of Decision) provides direction for snag densities. The proposed action for the Diamond Project (described in "Chapter 2: Alternatives") provides guidance for snag retention levels.

The CWHR suitability ratings for selected woodpeckers are provided in the Supplemental Wildlife Report, located in the project record, for selected conifer types that would increase and/or decrease under any of the action alternatives. The habitat description and projected changes in habitat suitability that could result from implementation of any of the action alternatives are provided in the chapter 4 wildlife section (4.3).

Based on the potential changes to CWHR suitability ratings that could result from the action alternatives, it appears that large tree, open-canopy habitat (Sierra mixed conifer [SMC5P] and white fir [WFR5S] and WFR5P) provides optimum habitat suitability for more species of woodpecker, and also has the highest combined suitability index for all woodpeckers, followed by the large tree,

moderate canopy cover (SMC5M and WFR5M). High habitat suitability is provided by some CWHR types in the Wildlife Analysis Area for all woodpeckers, except for the downy and black-backed woodpecker (both of which have been found in the Wildlife Analysis Area).

3.4 Economics

The Plumas National 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 Plumas National 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. Table 3-22 shows the percentage of Plumas National Forest land in local counties.

Table 3-22. Percentage of Plumas National Forest lands by county (based on GIS data).

County	County Acres	Beckwourth Ranger District (acres)	Feather River Ranger District (acres)	Mount Hough Ranger District (acres)	Total Plumas National Forest Lands in Each County (acres)	Plumas National Forest Lands within Each 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**

The two employment sectors most related to forest planning processes are the timber industry and tourism. They are very difficult to quantify, in terms of both total employment and their relative importance to local economies, because 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) Payments 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, the *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 are therefore most likely to be affected by forest land management decisions.

3.4.1 Payments in Lieu of Taxes

The Bureau of Land Management administers the Payments in Lieu of Taxes, which apply to many different types of federally owned land, including National Forest System lands. Payments in Lieu of Taxes compensate counties for the loss of property tax revenues due to nontaxable federal land in 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 county may use these funds 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.

3.4.2 Timber Yield Taxes

The second source of revenues to local government is the timber yield tax, which is administered by the State Board of Equalization. The forest does not pay this tax; 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 from which the timber was harvested. The amount of revenues disbursed to the counties can be affected by decisions about the amount of timber to be offered for sale each year on the forest.

3.4.3 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 11 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.

3.4.4 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 *Self-Determination Act,* a state's three highest payment amounts between 1986 and 1999 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*. National Forests and other federal agencies that contribute to the 25 percent fund would have to generate approximately $56.4 million in total revenues in order to offset the $14 million that the counties receive under the *Secure Rural Schools and Community Self-Determination Act*.

Counties can receive variable revenue-dependent payments under the *Receipt Act* or receive stable funding for local schools and roads under the *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 Agriculture or advise counties on proposals for county projects. The counties that elect to receive the full payment amount under the *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 (see table 3-23). Like traditional 25 percent funds, Title I funds are expended for public schools 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. The *Secure Rural Schools and Community Self-Determination Act* full payment amounts (fiscal year 2005) for the five counties containing Plumas National Forest lands are shown in table 3-23.

Table 3-23. *Secure Rural Schools and Community Self-Determination Act* full payment amounts to counties for fiscal year 2005.

County	Full Payment Amount	Title I Funds	Title I Percent of Full Payment	Title II Funds	Title II Percent of Full Payment	Title III Funds	Title III Percent of Full Payment
Butte	$895,320	$716,256	80%	$0	0%	$179,064	20%
Lassen	$3,876,372	$3,294,916	85%	$581,456	15%	$0	0%
Plumas	$7,258,972	$6,170,126	85%	$816,634	11%	$272,211	4%
Sierra	$1,848,005	$1,570,804	85%	$92,400	5%	$184,801	10%
Yuba	$238,982	$191,186	80%	$0	0%	$47,796	20%
Total	**$14,117,651**	**$11,943,288**	**—**	**$1,490,490**	**—**	**$683,872**	**—**

Relative to the local economy, there is a potential to harvest 4–7 million board feet of timber over several years as part of the Diamond Project. Plumas and Butte Counties can expect to receive 25 percent of the revenues generated from this timber sale through the *Receipt Act* or receive full payment from the *Secure Rural Schools and Community Self-Determination Act*. Approximately 82 percent of the Diamond Project area is located in Yuba County, and the remaining 18 percent is in Butte County. Employment opportunities would be created from proposed thinning and biomass removal, fuels reduction, site preparation, and planting 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.

3.5 Botanical Resources and Noxious Weeds

The "Diamond Vegetation Management Project: Biological Evaluation of Potential Effects to Threatened, Endangered, and Sensitive Plant Species" (Coppoletta 2006) is located in the project record and incorporated by reference.

3.5.1 General Existing Environment

Botanical Resources Analysis Area Definition. The Botany Analysis Area encompasses approximately 127,000 acres and consists of all proposed Treatment Units, access roads to the Treatment Units, and the area within 1 mile of Treatment Unit boundaries (see figure 3-5). This area was chosen in order to capture all rare plants and noxious weed species that occur (a) within the proposed Treatment Units or (b) have suitable habitat within the Diamond Project Area, as well as a "source" (potential for seed dispersal) population located within close proximity to the proposed treatment activities. Those species present in the Botany Analysis Area were considered to have the highest potential to be impacted or influenced by the proposed project activities. Conversely, rare species outside the Botany Analysis Area were not considered to have a high likelihood of being impacted by project activities either directly, indirectly, or cumulatively.

Species to be Analyzed. Field surveys for rare plants and noxious weed species were conducted on approximately 57,300 acres within the Diamond Project Area between 2000 and 2005 (Dillingham 2006; Taylor 2000; Buck and Clifton 2001; Garcia and Associates 2001; Lubin and Gross 2002; Buck 2005; Dittes and Guardino 2005; Vollmar Consulting 2005; and Wildwood Consulting 2005). For those areas outside of the surveyed area, but within the Botany Analysis Area, species occurrence information was compiled using the California Natural Diversity Database (2003) and rare plant and noxious weed records from the Plumas and Lassen National Forests.

Table 3-24 lists all Federally Threatened, Endangered, and Candidate plant species, Region 5 Forest Sensitive species, and Management Indicator Species (MIS) known to occur or with the potential to occur on the Plumas National Forest. The rare species analyzed in detail in this document (that is, those species that occur in the Botany Analysis Area) are also indicated in table 3-24 below.

Two Federally Threatened plant species that have potential to occur on the Plumas National Forest are *Orcuttia tenuis* (slender Orcutt grass) and *Senecio layneae* (Layne's butterweed) (USFWS 2006). *Orcuttia tenuis* is limited to relatively deep vernal pools or vernal pool type habitat with clay soil. *Senecio layneae* grows in open rocky areas on serpentine-derived soils that are 650–3,300 feet in elevation. Another species that is listed as potentially occurring on the Plumas National Forest is *Ivesia webberi* (Webber's ivesia), which is considered to be a Candidate species by the U.S. Fish and Wildlife Service. *Ivesia webberi* is found in open areas of sandy volcanic ash to gravelly soils in sagebrush and eastside pine. Based on soil and geology maps and field surveys, no suitable habitat for these species occurs in the Botany Analysis Area; therefore, no Threatened, Endangered, or Candidate species are considered likely to occur in the Botany Analysis Area.

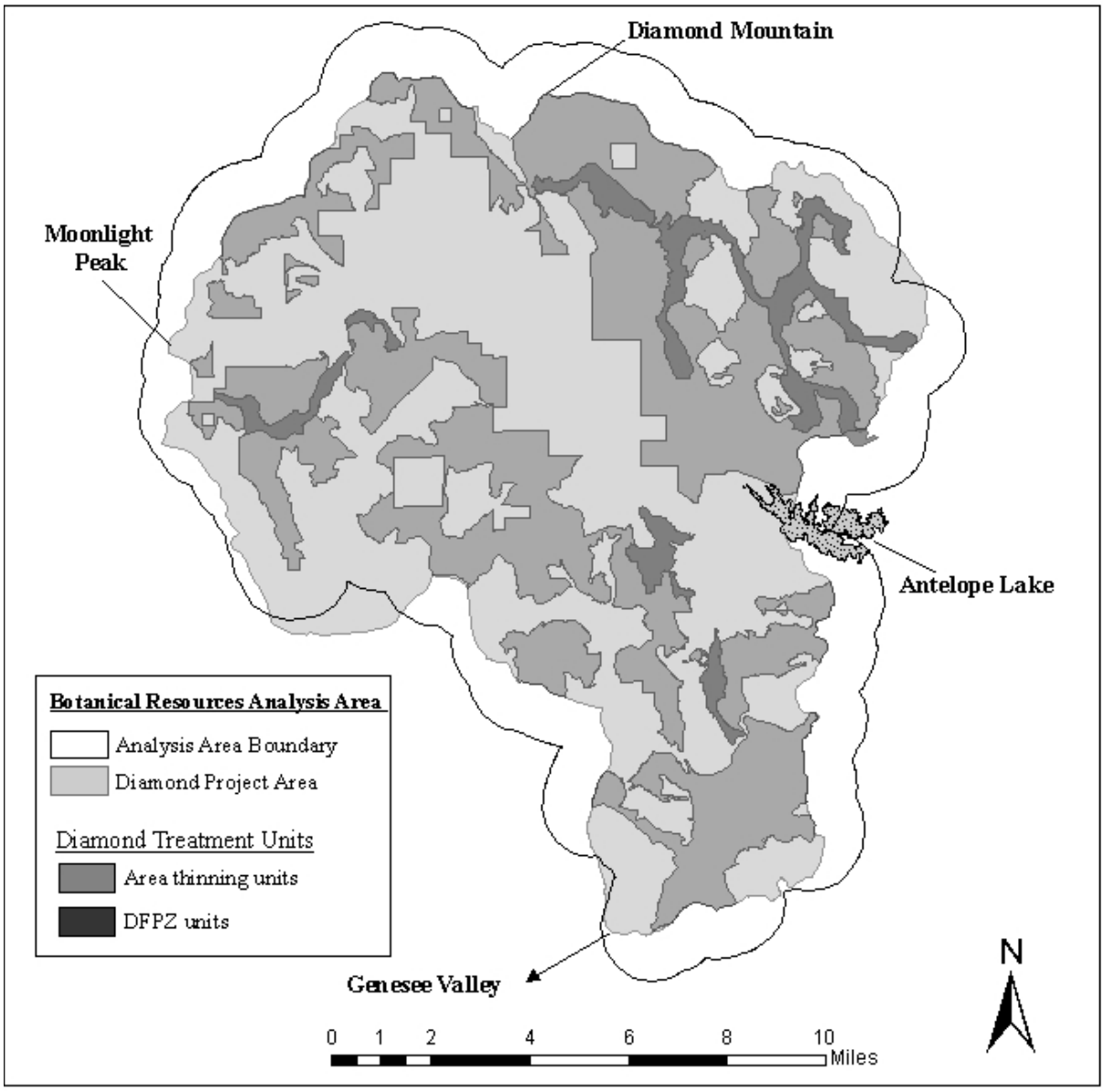

Figure 3-5. Botany Analysis Area—the geographic area used to analyze the effects of the proposed project on botanical resources.

Table 3-24. Plumas National Forest Threatened, Candidate, Sensitive, and Management Indicator (MIS) plant species.

Species	Common Name	Listing Status	Known within the Treatment Units	Known within the Analysis Area
Allium jepsonii	Jepson's onion	Sensitive		
Arabis constancei	Constance's rock cress	Sensitive, MIS		
Astragalus lemmonii [a]	Lemmon's milkvetch	Sensitive		
Astragalus lentiformis	lens-pod milk-vetch	Sensitive		
Astragalus pulsiferae var. *coronensis* [a]	Modoc Pateau milkvetch	Sensitive		
Astragalus pulsiferae var. *pulsiferae*	Pulsifer's milk-vetch	Sensitive	X	X
Astragalus pulsiferae var. *suksdorfii* [b]	Suksdorf's milk-vetch			
Astragalus webberi	Webber's milk-vetch	Sensitive		
Balsamorhiza macrolepis var. *macrolepis* [a]	big-scale basamroot	Sensitive		
Botrychium ascendens	upswept moonwort	Sensitive		
Botrychium crenulatum	scalloped moonwort	Sensitive		
Botrychium lineare [b]	moonwort			
Botrychium lunaria [a]	common moonwort	Sensitive		
Botrychium manganese [a]	Mingan moonwort	Sensitive		
Botrychium montanum	western goblin	Sensitive		
Botrychium pinnatum [a]	northern moonwort	Sensitive		
Bruchia bolanderi	Bolander's bruchia	Sensitive		
Buxbaumia viridis [a]	green bug-on-a-stick	Sensitive		
Calycadenia oppositifolia	Butte County calycadenia	Sensitive		
Calystegia atriplicifolia ssp. *buttensis*	Butte County morning-glory	Sensitive		
Clarkia biloba ssp. *brandegeae*	Brandegee's clarkia	Sensitive		
Clarkia gracilis ssp. *albicaulis*	white-stemmed clarkia	Sensitive		
Clarkia mildrediae ssp. *mildrediae* [a]	Mildred's clarkia	Sensitive		
Clarkia mosquinii	Mosquin's clarkia	Sensitive		
Clarkia stellata [b]	starry clarkia		X	X
Cypripedium fasciculatum	clustered lady's-slipper	Sensitive		
Cypripedium montanum	mountain lady's-slipper	Sensitive		
Dendrocollybia racemosa [a]	branched collybia (fungi)	Sensitive		
Eleocharis torticulmis [a]	California twisted spikerush	Sensitive		
Erigonum umbellatum var. *ahartii* [a]	Ahart's sulphur flower	Sensitive		
Fissidens aphelotaxifolius [a]	brook pocket-moss	Sensitive		
Fissidens pauperculus [a]	minute pocket moss	Sensitive		
Fritillaria eastwoodiae	Butte County fritillary	Sensitive, MIS		
Helodium bandowii [a]	Blandow's bog-moss	Sensitive		
Hydrothyria venosa	veined water lichen	Sensitive		
Ivesia aperta var. *aperta*	Sierra Valley ivesia	Sensitive		

Table 3-24. Plumas National Forest Threatened, Candidate, Sensitive, and Management Indicator (MIS) plant species (continued).

Species	Common Name	Listing Status	Known within the Treatment Units	Known within the Analysis Area
Ivesia sericolueca	Plumas ivesia	Sensitive		
Ivesia webberi	Webber's ivesia	Federal Candidate, Sensitive		
Lewisia cantelovii	Cantelow's lewisia	Sensitive, MIS		
Lewisia kelloggii ssp. *Kelloggii* [a]	Kellogg's lewisia	Sensitive		
Lewisia kelloggii ssp. *hutchisonii* [a]	Hutchison's lewisia	Sensitive		
Lomatium roseanum [a]	adobe parsley	Sensitive	X	X
Lupinus dalesiae	Quincy lupine	Sensitive, MIS		
Meesia longiseta [a]	long-stalked hump-moss	Sensitive		
Meesia triquetra	three-ranked hump-moss	Sensitive		
Meesia uliginosa	broad-nerved hump-moss	Sensitive		
Miellichhoferia elongate [a]	elongate copper-moss	Sensitive		
Monardella follettii	Follett's monardella	Sensitive		
Monardella stebbinsii	Stebbin's monardella	Sensitive, MIS		
Orcuttia tenuis	slender Orcutt grass	Federally Threatened		
Oreostemma elatum	Plumas alpine-aster	Sensitive		
Packera eurycephalus var. *lewisrosei*	cut-leaved ragwort	Sensitive		
Penstemon personatus	closed-throated beardtongue	Sensitive		
Penstemon sudans [a]	Susanville beardtongue	Sensitive	X	X
Phaecollybia olivacea [a]	fungi	Sensitive		
Pyrrocoma lucida	sticky pyrrocoma	Sensitive		
Rupertia hallii [b]	Hall's rupertia			
Scheuchzeria palustris var. *Americana* [b]	American scheuchzeria			
Sedum albomarginatum	Feather River stonecrop	Sensitive, MIS		
Senecio layneae	Layne's butterweed	Federally Threatened		
Silene invisa	cryptic catchfly	MIS		
Silene occidentalis ssp. *longistipitata* [b]	western campion			
Vaccinium coccinium	Siskiyou Mountains huckleberry	MIS		

Sources: Hanson 2006, Dillingham 2006; Taylor 2000; Buck and Clifton 2001; Garcia and Associates 2001; Lubin and Gross 2002; Buck 2005; Dittes and Guardino 2005; Vollmar Consulting 2005; Wildwood Consulting 2005; CNDDB 2006.

Notes:

a. Species recommended for addition to the Region 5 Sensitive Species List in 2006.

b. Species recommended for removal from the Region 5 Sensitive Species List in 2006.

3.5.1.1 Sensitive Species That Occur in the Botany Analysis Area

The following summarizes the rare plant species that are known to occur in the Botany Analysis Area. For each species, information is provided on the abundance, distribution (both on a global and local scale), and habitat specificity. Figure 3-6 displays the number of occurrences that have the potential to be affected by the proposed project activities; the total number of occurrences outside of the Botany Analysis Area, but within the Plumas National Forest; and the total number of occurrences known in California. It is important to note that many of these species, such as *Astragalus pulsiferae* var. *pulsiferae*, *Lomatium roseanum*, and *Penstemon sudans*, occur in limited numbers outside of California.

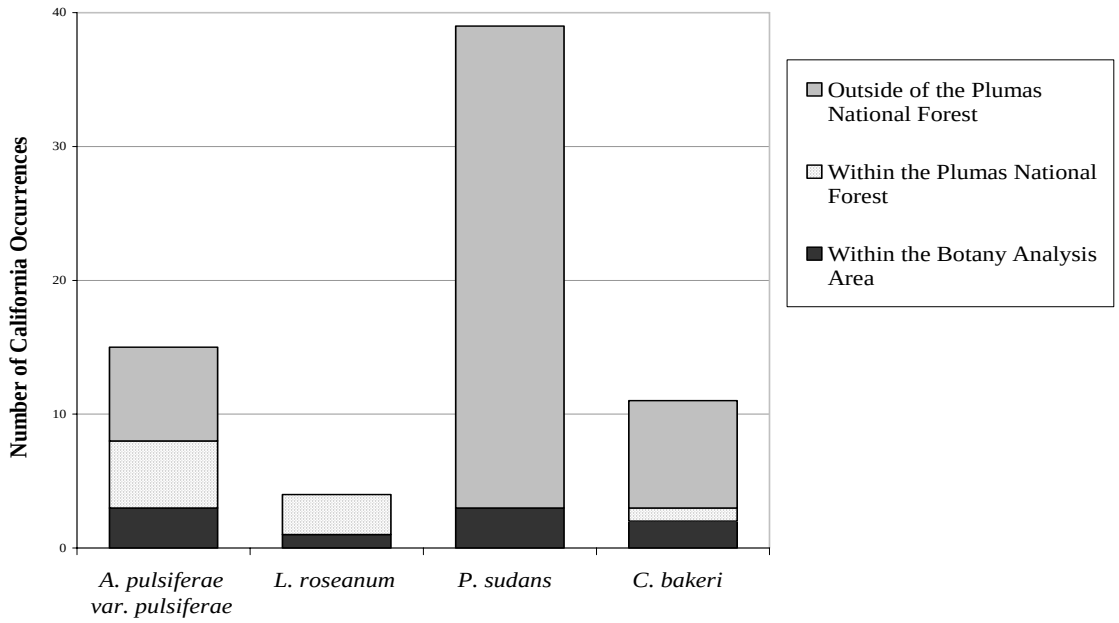

Figure 3-6. Number of rare plant occurrences with potential to be affected by the proposed project activities compared to the total number of occurrences known in California.

***Astragalus pulsiferae* var. *pulsiferae* (Pulsifer's milk-vetch).** Pulsifer's milk-vetch is known to occur in Lassen, Modoc, Plumas, and Sierra Counties in California, as well as in two counties in the state of Nevada. This species is presently known from a total of 15 occurrences, 5 of which are located on the Plumas National Forest (CNDDB 2003).

Pulsifer's milk-vetch typically occupies steep, sandy, or gravelly slopes in Great Basin scrub, pinyon, and juniper woodlands and lower montane coniferous forests between 4,200 and 6,000 feet in elevation. It is considered to be an "unusual edaphic" species, which means that it is often more influenced by soil conditions than by light regimes (USDA Forest Service 2003). In many cases, the substrate where this species occurs inhibits the growth of other species, resulting in a lower accumulation of biomass. Although this species recruits after disturbance, it is unknown to what extent these activities cause local extinction and seed burial.

Three occurrences of Pulsifer's milk-vetch have been documented in the Botany Analysis Area. All of these occurrences occur within Area Thinning Unit 111, where they occupy relatively steep (40 to 50 percent) sandy slopes (Buck 2005). The occurrences range in size from 1 to 100 plants and occupy an area that varies from a few square feet to 2,000 square feet.

***Clarkia stellata* (starry clarkia).** Starry clarkia is presently known from the southern Cascades and northern Sierra Nevada of California. Since its placement on the Forest Service Region 5 Sensitive Plant List in 1998, hundreds of starry clarkia occurrences have been documented on the Lassen, Plumas, and Tahoe National Forests. The overall trend for this plant is considered to be increasing. The species appears to withstand human disturbances, such as forest thinning activities and road maintenance, if plants are not impacted until after seed set. Activities that create or maintain forest canopy gaps may enhance starry clarkia habitat. This species is not considered to be rare by the California Native Plant Society (CNPS 2006) and was recommended for removal in 2006 from the Region 5 Sensitive Species list due to its extensive abundance and frequency of occurrences in disturbed habitats.

Starry clarkia is considered widespread in the Botany Analysis Area. It was documented during the 2005 field surveys, but due to its abundance, occurrences were not quantified (Dittes and Guardino 2005; Buck 2005).

***Cupressus bakeri* (Baker cypress).** Baker cypress is a Plumas Special Interest species, which means that it is on the Plumas National Forest watch list. This species is also listed as a plant of limited distribution by the California Native Plant Society (CNPS 2006). There are two occurrences of Baker cypress documented in the Botany Analysis Area—these occurrences represent a significant range limit for the species that is unique based on its high elevation, cool montane climate, and distance inland from the coast. One of the two occurrences covers a total of 159 acres and is located in Area Thinning Unit 115. The second occurrence is comprised of one individual Baker cypress tree that was discovered during field surveys in Area Thinning Unit 111 in an open, relatively disturbed site where no vegetation or fuel activities are proposed.

In May of 1989, the Forest Service designated a portion of the larger Diamond Baker cypress occurrence as the Mud Lake Research Natural Area (MLRNA). Approximately 141 acres of the Baker cypress are located in the MLRNA, and 18 acres of Baker cypress are outside the MLRNA. The primary management objective for the establishment of the MLRNA was to protect, enhance, and maintain the long-term viability of Baker cypress (Keeler-Wolf 1985; USDA Forest Service 1988). The "Mud Lake Research Natural Area Management Plan" (USDA Forest Service 2006), located in the project file, describes the policy and long-term management objectives for the MLRNA.

Baker cypress has been identified as a highly fire-dependent species (Keeler-Wolf 1985). Natural regeneration of Baker cypress requires sufficient conditions for establishment; these conditions include exposed mineral soil and adequate sunlight to the ground (Keeler-Wolf 1985) and fire to open the cones (Vogl et al. 1977). In some cases, detached cones have been observed to open and shed seed as they dry; however, these seeds rarely result in cypress establishment in the absence of fire (Vogl et al. 1977). The only evidence of cypress regeneration in the MLRNA is in the form of seedlings or saplings in sites that were previously logged. In contrast, surveys of undisturbed areas with exposed mineral soil and healthy, mature, Baker cypress trees, have documented no seedlings or saplings.

The fire suppression policy over the last century and the subsequent increase in the number of years between fires have also impacted stands of Baker cypress by creating dense thickets of shade-tolerant conifers, which have resulted in high levels of cypress mortality (Wagener and Quick 1963; Keeler-Wolf 1985). Large areas in the Mud Lake Unit may have been covered at one time by either near-equal mixtures of Baker cypress and white fir or dense stands of young pole-size cypress (Keeler-Wolf 1985). Today, many Baker cypress individuals in this stand are largely dead or over-topped by white fir (Keeler-Wolf 1985; J. Belsher-Howe, Forest Service, personal communication, November 2005). Many Baker cypress individuals have been lost in the past 20 years (G. Rotta, Forest Service, personal communication, September 2005).

Current fuel conditions within the Baker cypress stands in the Mud Lake Unit preclude the safe reintroduction of fire to this site without a pre-treatment of fuels. Extensive drought in the late 1980s and early 1990s, combined with high stand densities, 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 17 years and contributed to high levels of dead and down fuels. Current fuel loads within the Mud Lake Baker cypress stand are estimated to be as high as 80 to 100 tons per acre (P. Duncan and J. Moghaddas, Forest Service, personal communication, September 2005).

***Lomatium roseanum* (adobe parsley).** Adobe parsley is known from four occurrences in California, all of which occur on the Plumas National Forest. It is also known from nine occurrences in Washoe County, Nevada, and historically from Malheur County, Oregon. This species was recently added to the Region 5 Sensitive Plant List and is presently being evaluated by the California Native Plant Society as an addition to their rare plant list.

Adobe parsley occurs in pockets of clay on open rocky ridges and slopes and open gravelly volcanic scabland. On the Plumas National Forest, this species has been found in dry habitats with little to no canopy cover. The elevational range for this species is between 5,880 and 7,280 feet.

This species was documented at one site in the Botany Analysis Area. This occurrence occupies approximately 0.4 acre and is located on a dry, windswept ridge that contains approximately 50 percent bare rock and gravel (Janeway 1998). At the time it was surveyed, grazing and off-highway vehicles were listed as potential threats (Janeway 1998).

***Penstemon sudans* (Susanville penstemon).** Susanville penstemon is known from 38 occurrences, most of which occur on land managed by the Bureau of Land Management in the vicinity of Susanville, California (CNDDB 2003). Four occurrences are known from the Plumas National Forest. The number of plants at known occurrences varies from fewer than 50 to more than 1,000. Although often abundant where it occurs, Susanville penstemon is restricted to a relatively small area in Lassen and Plumas Counties, California, and adjacent Nevada.

This species is found in pinyon and juniper woodlands and openings in yellow pine and mixed conifer forests, usually on rocky volcanic soils. Apparently, suitable habitat is widespread in northeastern California, and the factors restricting the range of Susanville penstemon are unknown. Threats to this species include noxious weed spread, grazing, road construction, and logging.

Three occurrences are known to occur in the Botany Analysis Area. These occurrences occupy approximately 4.5 acres in Area Thinning Unit 131 and 0.8 acre approximately 0.12 mile outside of Area Thinning Unit 102. The occurrences are found in Great Basin scrub communities consisting of very low plant cover (Vollmar 2005).

3.5.2 Noxious Weeds

Six invasive plant species of high management concern have been documented in the Botany Analysis Area (see table 3-25). These weed species, which are known from 502 locations, occupy a total area of approximately 193 acres. Of these known occurrences, 26 locations (comprising about 65 acres) occur on lands not administered by the Plumas National Forest (that is, private land or on the Lassen National Forest). The weed sites in the Botany Analysis Area range in size from 4 square feet to over 10 acres, with the majority of infestations (over 75 percent) occupying an area less than 0.25 acre. Information describing the distribution of individual species is included in table 3-25. Also included in the table is the rating from the California Department of Food and Agriculture's noxious weed list (CDFA 2006), which divides noxious weeds into three categories: A, B, and C. The A-listed weeds are those for which eradication or containment is required at the state or county level. Eradication or containment of B-listed weeds 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.

Table 3-25. Noxious weed species in the Botany Analysis Area.

Species	CDFA Rating	Number of Locations in the Botany Analysis Area	Total Acres in the Botany Analysis Area	Total Acres in the Proposed Treatment Units
Centaurea maculosa (spotted knapweed)	A	7	0.01	0.01
Cirsium arvense (Canada thistle)	B	502	193.2	125.37
Centaurea solstitialis (yellow starthistle)	C	2	0.02	0.01
Cytisus scoparius (Scotch broom)	C	5	1.8	1.00
Salsola tragus (Russian thistle)	C	2	0.07	0.07
Taeniatherum caput-medusae (medusahead)	C	2	0.01	0.01

Source: California Department of Food and Agriculture's (CDFA) noxious weed list (2006).

Two additional noxious weed species, *Cirsium vulgare* (bull thistle) and *Hypericum perforatum* (Klamathweed), are also known to occur at scattered locations in the Botany Analysis Area. At present, neither the Forest Service nor Plumas County actively treats occurrences of bull thistle or Klammathweed. Biological control agents (*Chrysolina quadrigemina* and *C. hyperici*, leaf-feeding flea beetles, and *Agrilus hyperici* a root-boring beetle) largely control Klamathweed. These biological control agents have reduced infestations by 97 to 99 percent since 1940 (CDFA 2004). Klamathweed is found along many Forest Service roads on the Plumas National Forest. Populations rarely form dense stands or invade the adjacent forest.

The large number of occurrences, as well as the high level of disturbance associated with the proposed project activities, increase the potential for introduction and spread of these invasive plant species. The need to control and eradicate invasive species in the Diamond Project Area arises from

the threat that noxious weed species pose to biological diversity. Invasive species have been shown to displace native plant species, alter nutrient and fire cycles, decrease the availability of forage for wildlife, and degrade soil structure (Bossard, Randall, and Hoshovsky 2000).

It is Forest Service policy to develop, practice, and encourage Integrated Pest Management (IPM) tactics and strategies in vegetation management programs (FSM 3403, WO Amendment 3400-90-1). IPM is a widely recognized multidisciplinary approach to tackling the problem of invasive species. Current IPM efforts to manage noxious weed species on the Plumas National Forest are primarily focused on methods such as prevention, mechanical (hand pulling), biological, and cultural (flaming and prescribed fire) treatments. Each method has its strength, and when used in succession, can substantially increase the effectiveness of a program. While not always necessary, the option of using herbicides in noxious weed control is considered an integral part of the IPM process.

3.5.2.1 Species That Occur in the Botany Analysis Area

The following summarizes the noxious weed species that are known to occur in the Botany Analysis Area and have been identified as priority for control.

***Centaurea maculosa* (spotted knapweed).** Spotted knapweed is a highly aggressive weed species that is adept at using available moisture and nutrients, allowing it to quickly colonize both disturbed and undisturbed habitats. Spotted knapweed is able to spread through seed dispersal as well as vegetatively from lateral roots. There are currently several control methods available for this species; these include mechanical, biological, and chemical methods, which have shown variable levels of effectiveness (Mauer, Russo, and Evans 1987).

Seven locations of spotted knapweed have been documented in the Botany Analysis Area. These locations are all small, ranging from 4 square feet to just over 300 square feet. The number of plants at each of these sites ranges from a few individuals to approximately 50 plants (Belsher-Howe, Forest Service, personal observation, 2005). All seven of these locations have been treated (by hand pulling and/or digging) annually since the time of their discovery.

***Centaurea solstitialis* (yellow starthistle).** Yellow starthistle is considered a high priority for control and eradication in Plumas County, as well as on the Plumas National Forest (Karl Bishop, Plumas-Sierra Counties Agricultural Commissioner, personal communication). This species reproduces exclusively from seed, with most long-distance dispersal (greater than 16 feet) attributed to wildlife or human-related factors. The control or eradication of this species requires elimination of seed production as well as depletion of the soil seedbank (seeds residing in the soil that have not germinated). This species is actively treated on the Plumas National Forest where control methods have ranged from hand pulling to limited herbicide control.

Yellow starthistle is common in Indian Valley, which is less than 10 miles to the southwest of the Diamond Project Area. However, within the Botany Analysis Area, only two locations of yellow starthistle have been documented, one of which is located on private land. The Plumas National Forest occurrence is concentrated in an old landing and scattered along Forest Service Road 29N46. This site has been treated by hand pulling since its discovery in 2004.

***Cirsium arvense* (Canada thistle).** Due to its distribution and abundance in the Diamond Project Area, Canada thistle has been identified as a high management concern. This perennial thistle spreads rapidly by producing long horizontal underground roots that give rise to aerial shoots (Bossard, Randall, and Hoshovsky 2000). Canada thistle has an extensive root system, and the species has been shown to produce over 66 feet of new roots over a two-year period, some of which have been shown to grow 15–20 feet deep. This species is considered particularly difficult to eradicate. Several insect species have been identified as possible biocontrol agents, but none of them have been shown to be effective controls (Bayer 2000; Nuzzo 1997; Tu et al. 2001). Mechanical methods, such as hand pulling or mowing, are generally not recommended because they may exacerbate the problem by spreading root fragments to new locations (Bossard, Randall, and Hoshovsky 2000). The most effective method is herbicide control, which is oftentimes used in conjunction with revegetation activities (Bossard, Randall, and Hoshovsky 2000).

Canada thistle was documented at over 500 locations, covering approximately 190 acres (refer to table 3-25 above) in the Botany Analysis Area. At present, none of these locations are actively treated. Surveys conducted in other portions of the Plumas National Forest for projects of comparable size and scope have not documented similar levels of Canada thistle infestations (Belsher-Howe 2005, 2004).

***Cytisus scoparius* (Scotch broom).** Scotch broom is an invasive shrub that currently occupies more than 700,000 acres in the central to northwest coastal regions and Sierra Nevada foothill regions of California (Bossard 2000). In disturbed areas, this species has been shown to form dense thickets that decrease native plant diversity and have the potential to modify fire frequency and intensity.

This species spreads by producing large quantities of seed—one medium-sized plant can produce over 12,000 seeds (Bossard 2000). Scotch broom is also capable of stump sprouting after cutting, freezing, or fire. Scotch broom has been documented at five locations in the Botany Analysis Area. Four of these have been treated annually since their discovery using a combination of hand pulling and manual removal with a weed wrench. Pulling plants with a weed wrench has proven effective for small infestations because it removes the entire mature shrub and eliminates resprouting. After three years of treatment, three of the Scotch broom infestations decreased by 95 percent while another site decreased to zero individuals.

***Salsola tragus* (Russian thistle).** Russian thistle is a bushy summer annual that reproduces by seeds, which are dispersed over long distances as the mature plants break off at ground level and are scattered by the wind as tumbleweeds (Whitson et al. 2002). In Plumas County, this species is considered fairly frequent along roadsides, old fields, and waste places (Clifton 2005). Plumas County does not actively manage this species at this time (K. Bishop, Plumas County Agriculture Commissioner, personal communication).

The two locations of Russian thistle documented in the Botany Analysis Area were discovered during 2005 field surveys. The two locations were estimated to contain approximately 635 plants and to occupy 0.07 acre. To date, mechanical, biological, and chemical methods of control have shown variable levels of effectiveness for control of Russian thistle (CDFA 2004).

***Taeniatherum caput-medusae* (medusahead).** Over the past 10 years, managers of public lands in the western United States have witnessed an explosive spread of this invasive species (Bisson

1999). This species spreads primarily by seeds that are dispersed by wind and water, although it can be dispersed to more distant sites by grazing animals, machinery, vehicles, and clothing (Bossard, Randall, and Hoshovsky 2000). Medusahead is able to grow in a wide range of climatic conditions and has been documented in plant communities up to 7,000 feet in elevation. Within the Botany Analysis Area, medusahead has been documented at two small locations occupying approximately 0.10 acre.

Traditional methods of control (such as mowing and hand pulling) are not considered practical for medusahead. A relatively recent and innovative approach to wildland weed control is flaming—a heat treatment method that uses a propane torch to kill individuals but not ignite them. This method is currently being tested on a number of medusahead sites in the Plumas National Forest and, if shown to be successful, may be used as a potential method of control for the two sites in the Diamond Project Area.

3.6 Transportation System

Two major arterial routes access the Diamond Project Area: the Antelope Lake Road (Plumas County Road 111) on the east side and the Lights Creek Road (Plumas County Road 213). The Diamond Project Area is considered to have a fully developed arterial and collector road system.

There are a total of approximately 368.6 miles of existing classified roads in the Project Area; this total consists of

- 56.1 miles of Level 1 roads assigned to intermittent service;
- 177.5 miles of Level 2 roads assigned where management direction requires the road to be open for limited passage of traffic;
- 116.2 miles of Level 3 roads where management direction requires the road to be open and maintained for safe travel by a prudent driver in a passenger car; and
- 18.8 miles of Level 5 roads where management direction requires the road to provide a high degree of user comfort and convenience at moderate travel speeds.

In addition to the existing classified roads, there are numerous unclassified roads, abandoned roads, and skid trails in the Project Area.

3.7 Heritage Resources

3.7.1 History of the Project Area

The following is a broad historical overview of the human or cultural mechanisms that have influenced the Diamond Project Area. Ecosystem models based solely on biological and physical elements often disregard the complex interaction between humans and their environment. More than any other phenomenon, cultural landscapes provide a unique opportunity to interpret the history of the effects humans have had on the environment. Together, natural and cultural influences have shaped the overall character of the project vicinity.

3.7.1.1 Prehistory Period

Archaeological studies on the Mt. Hough Ranger District have primarily been limited to cultural resource inventories for proposed Forest Service activities. Because intensive archaeological research in the Diamond Project Area sufficient to define prehistoric complexes and establish a reliable cultural chronology is not available, cultural assessments and interpretations for the Project Area rely upon extrapolations from several studies that were completed for lands adjacent to the Project Area.

Archeological investigations at Plumas National Forest have revealed Native American occupation spanning at least 8,000 years. Cultural resources include flaked-stone artifact scatters, which reflect resource procurement activities and seasonal campsites, and habitation sites with cultural deposits and, in some instances, housepits. Flaked-stone artifact scatters documented in the Project Area consist of flaked-stone tools, debris, and occasionally groundstone artifacts that most likely resulted from one or more occupational episodes. Obsidian sources north and east of the Project Area account for the majority of the lithic material used in flaked-stone tool manufacturing, although locally available chert and igneous rock sources were also used. The distribution of Native American archeological sites in the Project Area appears to have been influenced by the occurrence of perennial or reliable intermittent water sources, with most sites found in close proximity to these features.

Only a few projectile points have been identified within Plumas County that date to the *Paleo-Indian period* between 9000–6000 B.C. (Nilsson et al. 1996:8). Later assemblages are summarized under two comprehensive archaeological periods, the *Archaic Period* and *Emergent Period*. These two periods date between 6000 B.C.–A.D. 500 and A.D. 500–Historic Contact, respectively. The Archaic is also generally divided into Lower (6000–3000 B.C.), Middle (3000–1000 B.C.), and Upper (1000 B.C.–A.D. 500).

Prehistoric material culture in the northern Sierra region of California has been further categorized according to local chronologies that define technological, economic, social, and ideological elements. This northern Sierra region includes the drainages of the upper Feather, Yuba, Bear, and American Rivers and Lake Tahoe. The Martis-Kings Beach chronological sequence was first developed by Heizer and Elsasser (1953) after an extensive survey of the Sierran area around Lake Tahoe. The sequence was revised later by Elsasser (1960), Elston (1971), Elston et al. (1977), Humpreys (1969), Ritter (1970), and Elsasser and Gortner 1991.

The Tahoe Reach chronological sequence by Elston et al. (1977) has been adopted and used by the majority of archaeologists working in the northcentral Sierran mountains and foothills, though

questions have been raised about its validity (see, for example, Jackson et al. 1994:I.B.10). Some of these issues were examined recently by Basgall (2003). A second chronological scheme (Mesilla-Bidwell-Sweetwater-Oroville-Historic) was developed for the west slope of the Sierran foothills, summarized by Ritter (1970) based on work at Lake Oroville, and later by Kowta (1988) based on his work at Lake Almanor. Prehistoric influences from both the high Sierra and Great Basin to the east (Martis Complex) and from the Sacramento Valley to the west have been recognized within this western foothill sequence. Recently, for example, as a result of shoreline surveys at Lake Almanor, Compas (2003) identified Martis, Mesilla, Sweetwater, and Kings Beach assemblages, among others.

Although assemblages earlier than the Martis Complex (Spooner and Tahoe Reach phases) have been tentatively identified as part of the Tahoe Reach sequence (Elston et al. 1977), the Martis Complex is the earliest well-documented phase. The sequence attempted to show continuity in cultural development, using projectile point typologies, from the Martis and Kings Beach complexes through ethnographic times. Using this argument, the Kings Beach is taken to represent the Washoe, with ancestral Washoe represented by the Martis Complex (Elston et al. 1977; Kowta 1984). This assessment, however, is not universal (Moratto 1984:303). Elston and others also suggest that prehistoric occupation of the Sierras may have occurred as a result of the movement westward of peoples from the Great Basin. Kowta (1988) suggested Penutian-speaking peoples from the east displaced indigenous Sierran Hokan speakers about A.D. 1000.

The seven phases of the Tahoe Reach sequence (Elston et al. 1977:171), which span most of the Holocene, are summarized in table 3-26. The Martis and Kings Beach complexes account for five of the seven phases; these two complexes are detailed below.

Table 3-26. Cultural phases of the Tahoe Reach chronology.

Age	Phase	Characteristics	Climate
A.D. 1200—Historic Contact	Washo-Late Kings Beach	Desert Side-notched and Cottonwood Series points, chert cores, utilized flakes, and other small chert tools.	Neoglacial; wet and cool but with little summer precipitation
A.D. 1200—500	Early Kings Beach	Eastgate and Rose Spring series points, chert cores, utilized flakes, and other small chert tools.	Nonglacial; dry, trees growing in former bogs; Tahoe may often not overflow
A.D. 500—500 B.C.	Late Martis	Corner-notched and eared points of the Martis and Elko series. Large side-notched points? Large basalt bifaces and other basalt tools.	Neoglacial; wet but not necessarily cooler, increased summer precipitation
500 B.C—1500 B.C.	Middle Martis	Steamboat points, other types in Elko-Martis series. Large basalt bifaces and other basalt tools.	Possible warm, dry interval centered on 1500 B.C.
1500—2000 B.C.	Early Martis	Contracting stem points of the Elko-Martis series. Large basalt bifaces and other tools. Light-colored basalt artifacts.	Beginning of Meditherimal; Neoglacial, wet but not necessarily cooler, increased summer precipitation; Tahoe begins to overflow
2000—5000 B.C.	Spooner	Point in the Pinto and Humboldt series, light-colored basalt artifacts.	Altithermal; generally hot and dry; Tahoe does not overflow for long periods of time
6000 B.C.	Tahoe Reach	Parman points.	Anathermal; warming trend, climate similar to later Neoglacial intervals

Martis Complex (2000 B.C. – A.D. 500). This well-documented complex has been identified from the Lake Tahoe area, extending northward into Plumas and Lassen Counties, as well as southward into Alpine County (Elsasser 1960). Radiocarbon dates and obsidian hydration measurements indicate the complex was present from 2000 B.C. to A.D. 500 (Elsasser and Gortner 1991:361). Excavation of Martis Complex sites included the Chilcoot Rockshelter in Plumas County (CA-PLU-44) (Payen and Boyolan 1961). Characteristics of the Martis Complex include an emphasis on hunting and seed collecting. Projectile points were large, heavy, and roughly flaked; they also varied in form (although they resemble Great Basin forms, including the Elko series). An abundance of distinctive tool forms included finger-held drills or punches, large biface blades and cores, spokeshave-notched tools with a concave edge, and basalt pressure-retouched flake "scrapers." For the manufacture of flaked tools, there was an apparent preference for using local basalt other than chert or obsidian. The milling equipment used to process seeds was predominantly grinding slabs and handstones.

There is a firmly dated association with unique "Central Sierra Abstract Style" or Style 7 rock art sites within the Middle Archaic Period, between 2000–500 B.C., which is equated with the Martis Complex (Elsasser and Gortner 1991:361; Foster et al. 2002). Payen (1966) initially defined the distinctive Style 7 or "High Sierra Abstract-Representation" petroglyphs. The panels, which contain a greater variety of design elements and are very complex, appear on bedrock surfaces in the higher elevations of the northern Sierra. Common design elements include wavy lines of varying complexity, tracks, concentric circles, simple circles elaborated by line elements, and anthromorphic-zoomorphic images.

Style 7 petroglyph sites are distributed within the drainages of the Feather, American, Bear, Truckee, and Yuba Rivers and occur within the counties of Nevada, Placer, Plumas, and Sierra. The sites range in elevation from 1,408–2,329 meters (4,620–7,640 feet) above sea level, usually on glaciated bedrock of various rock types, but in various natural settings along canyons, streams, and domes. At present, there is an ongoing inventory of Style 7 sites being conducted by the California Department of Forestry and Fire Protection (Foster 1999). Recordation will ensure their protection during future logging operations in the region.

Kings Beach Complex (A.D. 1200 – A.D. 500). In contrast to the earlier Martis Complex, a fishing and gathering economy characterizes the succeeding Kings Beach Complex. Tools included the bow and arrow, as evidenced by the small, light projectile points. These smaller points resemble Desert Side-notched, Cottonwood, and Rosegate forms. Flaked tools were mainly manufactured from obsidian and chert instead of basalt. This may reflect a change in preference and/or availability of these raw material types, suggesting an increase in trade. The milling equipment used during this period was predominantly bedrock mortars, with pestles made from cobbles. This shift in milling technology may reflect a growing reliance on acorns as a dietary staple.

The Kings Beach Complex was initially dated to no earlier than 1,000 years ago, which left a gap between the end of this period and the beginning of the Martis Complex (Heizer and Elsasser 1953). There is no gap in the revised sequence developed by Elston et al. (1977:16, 171), who described a transitional phase between these two periods.

Recent data recovery excavations at a prehistoric archaeological site (CA-PLU-1485) located in the northern Sierra Valley, Plumas County, indicate that the site was apparently well known and

occupied throughout the earlier Middle Archaic period (Waechter 2005). The site contains more than 50 rock-lined cooking basins, as well as a house floor and deep midden, and is located near two popular basalt quarries (Siegfried Canyon Ridge and Gold Lake). Radiocarbon dates from the cooking basins range from approximately A.D. 1000–1500. Ethnographic data suggests the rock-lined features were used to process camas roots (*Camassia quamash*), which appears to have intensified during the Medieval Climatic Anomaly (also known as the Medieval Warm Period) (approximately A.D. 900–750). The site is immediately south of the southern edge of Plumas National Forest.

3.7.1.2 Ethnographic Period

The Diamond Project Area is in the ethnographic territory of the Maidu, also known as the Mountain or Northeastern Maidu (Dixon 1905:123-125; Kroeber 1925:391-392; Riddell 1978:370-371). The Maidu are a linguistic subfamily of the Maiduan family, Penutian stock (Shipley 1978:83). There are two other languages in the Maiduan family, Konkow (Concow, Northwestern Maidu) and Nisenan (Southern Maidu). Maidu dialects were probably spoken in four major areas, known as American Valley, Indian Valley, Big Meadows, and Susanville.

Maidu territory included the drainages of the Feather and Susan Rivers, in the high mountain meadows of the Sierra Nevada generally 1,219 meters (4,000 feet) above sea level or higher. This homeland was bounded by Lassen Peak to the north, the Sierra Buttes to the south, present-day Quincy on the west, and extending into the Great Basin to the east between Honey and Eagle Lakes. By the time of contact, however, the Maidu had withdrawn from the Honey Lake area, which was taken over by neighboring Paiute. Neighboring groups included the Konkow on the lower reaches of the Feather River to the west, Yana to the northwest, Atsugewi and Achumawi to the north, Nisenan to the southwest, with Northern Paiute and Washoe to the east.

The most important mountain valleys inhabited by the Maidu included American, Big Meadows (now under Lake Almanor), Butt, Genesee, Indian, Mountain Meadows, and Red Clover (Riddell 1978:370-372). One or more permanent villages were established in these valleys, winter weather permitting. Occupation was restricted to seasonal use in other valleys, including Sierra and Mohawk. The nearest recorded Maidu villages to the Project Area would have been *Tse'lim-nah* and *Yow'-koo*, located in the North Arm of Indian Valley.

Political organization of the Maidu was limited to a settlement pattern of village communities (Kroeber 1925:397-398; Riddell 1978:373). A central village housed a circular, semi-subterranean ceremonial assembly structure and the home of the community spokesman. A community was composed of 3 to 5 villages, and the villages were apparently self-sufficient. Kroeber (1925:397) estimated village size as less than 200. Houses were either semi-subterranean or conical bark structures. Because of water discharge during the spring and summer snowmelt, villages were situated on the edges rather than the center of the valleys. Each village community owned and defended their common hunting and fishing grounds near these mountain valley settlements. Some fishing holes and deer fences were owned by individual families and inherited by male descendants.

The fundamental economy of the Maidu was one of subsistence hunting, fishing, and collecting plant foods in an area where abundant natural resources varied seasonally (Riddell 1978:373-374). Acorns were a dietary staple, and were collected from oak groves at lower elevations. Oak varieties in

the area included the black oak (*Quercus kelloggii*), canyon or golden oak (*Q. chrysolepis*), and interior live oak (*Q. wislizenii*). The Maidu gathered nuts from the sugar pine and yellow pine and ate them raw or cooked into a soup or patties. In the northeastern part of their territory near Susanville, nuts from the huckleberry oak (*Q. vaccinifolia*) and bush chinquapin (*Chrysolepis sempervirens*) were also collected. Other vegetal resources included hazelnuts, buckeye nuts, wild nutmeg, grass seeds, berries, and underground roots and bulbs. Roots included camas, Indian root, cattail root, and tule root. Camas roots were harvested early in the summer and roasted in rock-lined cooking basins (Waechter 2005). Salmon, eel, birds, waterfowl, grasshoppers and other insects, as well as large and small mammals, were also consumed. Large animals included deer, elk, and grizzly bears.

A wide variety of tools, implements, and enclosures were employed by the Maidu to gather and collect food resources. These included the bow and arrow, traps, nets, slings, snares, clubs, and blinds for hunting land mammals and birds; salmon gigs, traps, and nets for fish. During communal drives, deer were driven over cliffs or shot by concealed hunters. Woven tools, including seed beaters, burden baskets, and carrying nets, as well as sharpened digging sticks, were used to collect plant resources. Snowshoes were used for winter travel, and dugout canoes or log rafts for navigating or crossing the mountain waterways (Riddell 1978:373-379).

The Maidu processed food resources with a variety of tools, including portable stone mortars, bedrock mortars and pestles, anvils, woven strainers and winnowers, leaching baskets and bowls, storage baskets, woven parching trays, wooden mortars, and knives. Baskets were either coiled or twined. They also traded between neighboring Konkow for various resources and implements, and with the Achumawi for beads, obsidian, money beads, and green pigment dye.

Log drums, rattles, flutes and whistles accompanied Maidu ceremonial dances. Mortuary practices among the Maidu included extended burials, generally facing east, that were accompanied by grave offerings (Riddell 1978:381-384).

Prior to the discovery of gold in 1848, at Sutter’s Mill near Coloma on the American River, Maidu lifeways were little affected by exploration into mainly Konkow territory by Spanish explorers and American trappers. With the tens of thousands of gold seekers came the mass introduction and concentration of diseases, and a great epidemic that swept the Sacramento Valley in 1833 also decimated the Konkow Maidu. Even the remote, traditional lands of the Maidu were overrun in the early 1850s with explorers and miners. The results were devastating and included the loss of land and territory, including traditional hunting and gathering locales, violence, malnutrition, and starvation. The Maidu then worked for miners for very low wages. By 1910, estimates indicate the Maidu population had been reduced to only 200 individuals from perhaps 2,500 prior to contact (Kroeber 1925; Riddell 1978:385-386).

Today, approximately 2,500 Maiduan people live on seven rancherias (Auburn, Berry Creek, Chico, Enterprise, Greenville, Mooretown, and Susanville) and the Round Valley Reservation, located in Plumas and Butte Counties (Alliance of California Tribes 2005). The Konkow Maidu were forcibly marched to the Round Valley Reservation in 1863, with few provisions or water over a long, hot dry trail. The Greenville Rancheria was originally called the Indian Mission, which was allotted several parcels of land. The Rancheria was restored to federal recognition in 1983, and three or four of the original land allotments were also restored to its members. Nearly 200 members are serviced today by this federally recognized group in Greenville, Plumas County.

3.7.1.3 Historic Period

The majority of the current Project Area is within Plumas County, with minor acreage to the north extending into Lassen County. When Plumas County was formed in 1854 from portions of Butte County and named for the river that flows through it, the Spanish name for the river, "Plumas," was employed. Around this time, "El Rio de las Plumas" was also anglicized and became known as the Feather River. Some territory was transferred from Plumas to Lassen County in 1864. Quincy was later named the county seat (Plumas 2005).

The National Forest System was established in March 1905 by President Theodore Roosevelt (Plumas National Forest 2005). At that time, as the importance of minerals to the regional economy decreased and the value of timber and agriculture increased, President Roosevelt recognized the value of the area's forests as national resources. The boundaries of the extensive terrain within this forest roughly include the branches of the Feather River. Lassen National Forest borders Plumas National Forest to the north, with Tahoe National Forest on the south. Today, Plumas National Forest is best described as a multiple-use area. The lands provide recreational opportunities, wildlife habitat, and sustainable timber supplies (Plumas National Forest 2005).

The following history of Plumas County and the Project Area is divided into three major themes: gold and copper mining, ranching and farming, and timber industry. Reference is made to a few of the previously recorded archaeological sites pertaining to the history within the Diamond Project Area. Today, the county remains rural in character, with a population density of eight people per square mile, only one incorporated city in the entire county (Portola), and only two stoplights (in Quincy) The county boasts 1,000 miles of rivers and streams, more than 100 lakes, and over a million acres of national forest (Plumas National Forest 2005).

Gold and Copper Mining. The history of Plumas County is firmly entwined with the Gold Rush and the elusive search for "Gold Lake" by Thomas Stoddard and other miners. In the fall of 1849, Stoddard and his partner discovered a lake with large gold nuggets somewhere in the vicinity of Sierra Valley and Downieville. After losing his way and reaching the gold camps in the Downieville-Nevada City region, Stoddard's tale encouraged thousands of miners to search for the lake in the mountains that would become Plumas and Sierra Counties (Young 2003:20-24).

Although "Gold Lake" was never relocated, its quest started the Plumas County gold rush of 1850. Numerous rich placer diggings were discovered at Nelson Creek, Hopkins Creek, and Butte Bar, among others, as well as five mining bars on the East Branch of the North Fork of the Feather River. These included French Bar, Indian Bar, Junction Bar, Rich Bar, and Smith Bar. Rich Bar, for example, became a famous placer mining camp, and by 1852, boasted a population of 2,500 and the prominent Empire Hotel (Young 2003:25-30). James Beckwourth's discovery in 1850 of the lowest pass (Beckwourth Pass) across the Sierra Nevada permitted a steady flow of immigrants and miners who came searching for gold. The trail over the pass left present-day Reno across the pass to the American Valley (near Quincy), onward to the Sacramento Valley.

Placer mining and prospecting in the 1850s and 1860s included the current Project Area within the Lights Creek drainage system. Although not very rich, claims were filed for gold and silver, as well as copper. A number of placer ditches were mined in the Project Area, including China Gulch,

Fant Ditch (see site record FS 05115200177) and Ruffa Ditch (see site record FS 05115200344/CA-PLU-2107-H) and the slopes of Moonlight Valley (Foote 1991:15).

In the 1860s, quartz mining was introduced to the region. In the Greenville area to the west of the current Diamond Project Area, for example, 15 mines and a total of 314 stamps to crush gold-bearing quartz were operating between 1860 and 1880 (Young 2003:35). With the advent of hydraulic mining in the early 1870s, gravels were worked on the Feather River near Seneca to the west of the current Project Area (Foote 1991:13). A few years later, these destructive mining practices were outlawed.

There was a brief "copper boom" in 1862–1863 in Plumas and other counties in California. At nearby Genesee, the first important discovery was made at the Cosmopolitan (now Reward) Mine in what was later known as the Plumas Copper Belt. James Ford may have discovered the rich copper deposits along Lights Creek, within the current Project Area, as early as 1865 (Foote 1991:12). This early boom ended by 1868 when easily available, high-grade copper was mined out.

James Ford was also responsible for the construction of a wagon road between Susanville and Taylorsville, which was financed by both Lassen and Plumas Counties in the 1860s. The route, still in use today, traverses Diamond Mountain and runs along Lights Creek through the North Arm of Indian Valley (Torrey 1945:28). It was the main route to Indian Valley from the north until at least 1908 (Aubrey 1908:178-179). To travel westward, people and goods traversed from Indian Valley to Greenville via Wolf Creek to the Feather and Sacramento Rivers.

A second "copper boom" occurred between 1915 and 1930. Three major mines opened and operated in Plumas County, near the northern and southern ends of the 18-mile-long Plumas Copper Belt (Foote 1991:13-14; Smith 1970:56). The Engels and Superior Mines, on Lights Creek north of the North Arm of Indian Valley, were at the north end of the Copper Belt; Walker Mine was at the southern end, south of Genesee Valley. Of these three major operations, the Engels and Superior Mines are within the current Project Area.

Henry A. Engels and his family arrived in the area in 1880 and, shortly thereafter, established copper claims in China Gulch and Superior Ridge. After 20 years of prospecting, the Engels Copper Mining Company was founded in 1901 in order to gain the capital needed to develop mining on a large scale. Although other mining corporations were founded about this time between Lights Creek and Moonlight Valley, only the Engels Mine successfully developed into a major concern, with access to large quantities of high-grade copper (Foote 1991:15-16; Smith 1970:63; Young 2003:43-45).

By 1911, the Engels Copper Mining Company built a smelter in China Gulch. Shortly thereafter, however, the Forest Service prohibited its operation (MacBoyle 1918:57; Foote 1991:16). Next, a flotation mill, used to concentrate the ore, was constructed at Upper Camp after the price of copper increased in 1914. Upper Camp was located at the headwaters of China Gulch. The mill operated for five years, during which time sacks of the concentrated ore were loaded onto a 7,000-foot aerial tramway that descended to Indian Valley. A second tramway, about 2 miles long, transported crushed ore from a crusher on the level 6 adit to an ore bin at the Superior Mill, which operated from 1917 to 1930. The mill was located immediately south of the junction of the Superior Ravine with Lights Creek.

The ore was hauled or trucked from the Superior Mill and Indian Valley to Keddie (8 miles northeast of Quincy) and then shipped via the Western Pacific Railroad to Garfield, Utah, for smelting. The Western Pacific had become the nation's sixth transcontinental railroad in 1903. With the Western Pacific, the Engels Copper Mining Company also invested in the construction of a broad gauge short line, used to haul freight and passengers. Completed in 1917, the Indian Valley Railroad ran daily from Lower Camp to a junction at Paxton with the Western Pacific (Young 2003:44, 72-75).

By 1923, a 2.5-mile, mostly underground, electric railroad was used to haul the ore from the level 10 adit to the Superior Mill. The level 10 adit was extensive, with a 8.5- × 8-foot portal that was 2 feet higher than the ore bin at the mill. A 12-inch diameter redwood flume was completed in 1922, connecting the water ditch in the level 10 adit, which drained the higher levels of the mine to the processing plant at Superior.

The townsite of "Engelmine" was gridded and graded in 1918 near Lower Camp on Lights Creek north of the Superior Mill, between the junctures of Lights Creek with China Gulch and Superior Ravine. The planned townsite included a dining hall, recreation hall, hospital, school, post office, store/hotel, large dormitories, and family housing. When the level 10 adit was completed in 1923, housing at the Upper Camp was moved down to the Engelmine townsite, the level 6 aerial tram was closed, and Upper Camp abandoned (Foote 1991:17-18). Additional dormitories and family housing were constructed at the townsite near Lower Camp a year later. Utilities included sewer, power, and water. Two additional portions of the town, "Hollywood" and "Tijuana," were located north of the townsite. At its peak during the 1920s, the population of the townsite was approximately 1,200.

Copper production emerged as Plumas County's economic giant in the 1920s and 1930s, although gold mining also continued into the 19th century on a smaller scale in various areas. The Engels Mine on Lights Creek was the largest copper mine in the state of California and yielded some 117 million pounds of copper over its lifetime. At least $25 million in copper was produced at that mine in northern Indian Valley and some $23 million at the Walker Mine 15 miles to the south (Young 2003:43-45).

Although it also produced some gold and silver, the Engels Copper Mining Company closed in 1930 when the price of copper was too low to maintain a profit. In 1936, it merged with the California Copper Corporation to form the California-Engels Mining Company. People continued to live at the Engel Mine townsite, and operations continued on the Indian Valley Railroad until 1940. At the end of this period, all the equipment and metal was sold, the railroad right-of-way abandoned, and the town dismantled. A new paved road was built on the railroad right-of-way, and includes part of Highway 89 and Plumas County Road 213. Houses were moved to Greenville, Quincy, Portola, Taylorsville, and other nearby towns. The last cabin was removed in the 1960s (Foote 1991:18).

During the 1850s to 1900, particularly during the 1880s, Chinese miners comprised a significant portion of the population in Plumas County. Typically, they worked abandoned placer gold diggings. China Gulch, the location of the Upper Camp operated by the Engels Mine, may be named for a placer stream that had been worked by Chinese miners (Young 2003:43). Evidence of Chinese culture has been identified within the current Project Area at the Engel Mine townsite. Commercial, cultural, and social centers, known as Chinatowns, were established in a number of towns, including Greenville and Taylorsville to the west of the current Project Area. The largest Chinese community in the county was located at Silver Creek (Young 2003:46-51).

Placer miners continued to work the gold diggings in Lights Creek, particularly during the 1930s depression. There was also a short-lived dredging operation established in 1940 near the confluence of the East and West Branches of the creek. Although gold was found, the operation was not economical and had to be abandoned. There are still active placer mining claims on Lights Creek, but companies like the California-Engels Mining Company await an increase in the price of copper before beginning to mine the remaining disseminated, though extensive, deposits (Foote 1991:18).

Ranching and Farming. The growth of ranching and farming in the region was a direct effect of the Gold Rush and the demands for food and transport (mules and horses). Ranching in the fertile valleys of Plumas County has roots as early as 1850 when miners were renting grasslands for their mules. Adjacent to the current Project Area, hay and oats were grown in Indian Valley. The first gristmill in Indian Valley was constructed in 1856, with 8,000 tons of hay cut in 1876. The valley was also famous for its horses and the quality and quantity of its butter. By 1880, the valley had a large population approaching 2,000 individuals. Ranching in the area grew to include raising beef and dairy cattle, sheep, and hogs; farmers grew hay, oats, barley, potatoes, vegetables, and fruit orchards. The Taylorsville Creamery sold butter, cheese, and milk. A store and stage stop was established around 1880 in the Genesee Valley at the southern terminus of the current Project Area (Young 2003:52-55).

During this period, particularly in the eastern portion of Plumas County, flocks of sheep and their Basque sheepherders became a routine, seasonal presence (Young 2003:58). The Basques were originally from the Pyrenees mountains in Spain and France. They immigrated to the United States, initially, as part of the European influx during the Gold Rush. Particularly after completion of the transcontinental railroad in 1869, Basques started to arrive in the sheep country of the western states (Zubiri 1998). There was also a large influx of Basque sheepherders between 1900 to 1930 in concert with a high demand for lamb and wool.

Basque tenders and herders dominated the western sheep industry, a position they maintained from the 1890s to the 1970s. Tenders, who lived in summer “sheep camps,” brought food and supplies up to the sheepherders who stayed at the higher elevations grazing the sheep during the summer months. Basque sheep camps typically included hand-built traditional outdoor ovens for baking bread. Today, these structures are rare in California (Tahoe National Forest 2005).

The Basques were well known in the greater Sierra Nevada region, including the Project Area, for their unique tree carvings, referred to as “arborglyphs” or “dendroglyphs.” Carvings were typically made on aspen trees and included names, dates, images, and inscriptions in different languages (Basque, Spanish, or French; rarely English). The images frequently had sexual themes, and sometimes included drawings of animals or zoomorphs. Since all the herders were young men, the glyphs reflect the absence of women and indicated a desire for female companionship (Nevada Historical Society 2005). As one consequence, the carvings have been viewed as curiosities and little more than pornography (Crawford 2005:26).

With the growth of Basque studies in this country (for example, the Center for Basque Studies at the University of Nevada Reno, http://basque.unr.edu) and scholarship by Basque-Americans, translations and new interpretations of the carvings have become available. In addition to names and dates, carvings include the name of the carver’s birthplace, patriotic statements about France and Spain, evidence of ethnic rivalries and conflicts between the herders from the Basque provinces of France or Spain, support for an independent Basque homeland, and support for Basque guerillas (ETA

or Euskdita Askatasuna) fighting in Spain, as well as the loneliness and everyday life in the mountains (Mallea-Olaetxe 1992). The isolation is reflected in thousands of textual messages longing for women and also numerous portrayals of nude women in erotic poses. The drawings of animals included sheep, deer, antelope, and cougars, among others.

In addition to depicting the culture of the Basque sheepherders, recent research by an archaeologist with the Tahoe National Forest demonstrates that the dendroglyphs also preserve a general idea of land capacity and use (Crawford 2005). The carvings preserve the seasonal rounds of specific historic bands of sheep and the length of time sheep foraged in a given area.

Timber. The initial growth of the timber industry in the region is another result of the Gold Rush and the mining industry. The first sawmill in Plumas County was erected circa 1850 at Rich Bar on the Middle Fork of the Feather River. Other mills were erected in 1852 at Rich Bar on the East Branch of the North Fork of the Feather River. By 1855, there was a mill in Indian Valley, which was powered by diverting the water from Indian Creek. Initially hauled by oxen, mules, or horses to the mills, much of the wood was used to shore up the expanding mine tunnels and then as supports for hydraulic mining (Young 2003:79-80).

Timber was also used to build flumes or skid roads to transport the lumber down from the mountains and the mills. As early as 1856, timber was floated from the western areas of the county all the way to Sacramento to meet the housing needs for the burgeoning population in the valley. Economical V-shaped logging flumes were introduced to the county in 1870. Some of the flumes, owned by large lumber companies, such as the Sierra Flume and Lumber Company and the Red River Lumber Company based in Big Meadows, reached lengths of nearly 50 miles (Young 2003:81-83).

The growth of the Western Pacific Railroad, beginning in 1903 and completed in 1909, gave an economic boost to Plumas County's timber industry. As many as nine standard- or narrow-gauge rail lines were built and snaked from the sawmills into the forests. By 1912, motorized trucks were being used to haul logs and had nearly supplanted the shortlines by the end of World War II. The industry was revolutionized again by the introduction of caterpillar trucks in the 1920s. About this same time, chainsaws replaced the hand axes and two-man saws (Young 2003:88-93).

In July 1968, the first skyline timber sale from the Plumas National Forest occurred 17 miles southeast of Greenville. The sale included 17.3 million board feet. The freshly cut logs were transported via overhead cable to a landing site for transport by trucks to a mill. In 1971, Plumas National Forest chose Lights Creek Canyon as the location for the nation's first helicopter timber sale. The use of helicopters to harvest the timber helped preserve the habitat and prevent erosion on the steep slopes. Helicopters were used at Happy Valley and Baloney over the next 15 years where economically feasible. Today, with changing environmental policies and a changing economy, only two sawmills remain in operation in Plumas County, and timber production is at an all-time low. Over half a century of unregulated logging, followed by three-quarters of a century of intensely regulated logging, have left visible marks in the timber areas (Young 2003:94-96).

3.8 Recreation and Mining

3.8.1 Recreation

The 1988 *Plumas National Forest Land and Resource Management Plan* (the "Forest Plan") classifies recreational opportunities for the Forest under the Recreation Opportunity Spectrum (ROS). Recreation opportunities in the Diamond Project Area include "Semi-Primitive Non-Motorized" and "Roaded Natural" ROS classes, with the majority of the Project Area falling under the "Roaded Modified" ROS class. (USFS PNF, 1988; 4-83, 4-88, 4-106) The existing condition of the landscape in the Diamond Project Area is described in the "Forest Vegetation and Fire, Fuels, and Air Quality" section of this chapter (section 3.1). Past management activities are common where recreation occurs, but a naturally appearing landscape still dominates the Project Area.

3.8.1.1 Developed Recreation

Developed recreation activities are very popular at Antelope Recreation Area—opportunities include camping, picnicking, boating, swimming, fishing, driving for pleasure and bike riding. The Diamond Project Area overlaps with two campgrounds at Antelope Lake (Lone Rock and Boulder Creek Campgrounds*)*, a picnic area, an interpretive amphitheatre, an information center, and a general store. There were approximately 20,000 visitor days at Lone Rock and Boulder Creek Campgrounds in 2005 (P. Dyer, Northwest Park Management Year End Use Summary, 2005). Campgrounds are, on average, 75 percent full and have a capacity of approximately 1,000 persons (156 campsites). The developed campgrounds and general store are under a special use permit with a campground concessionaire, Northwest Park Management, and are open from mid-May to early October.

3.8.1.2 Dispersed Recreation

Dispersed recreation activities within the Diamond Project boundary include camping, hiking, swimming, boating, fishing, horseback riding, mountain biking, off-highway vehicle (OHV) riding, snowmobiling, hunting, rock hounding, driving for pleasure, Christmas tree cutting, and firewood cutting. Dispersed camping is very common along Indian Creek, and Taylor Lake is popular for day-use activities such as fishing.

There are approximately 17 miles of multiple-use trails in the Project Area that were once used by hikers, equestrians, mountain bikers, and dirt bikers until they became impassable from down snags and trees. These trails include Antelope to Taylor Trail (10 miles), Cold Stream Trail (2–3 miles), and Middle Creek Trail (5 miles). Hikers are still able to recreate on these trails.

Traveling on back roads and trails on an OHV has been a part of forest recreation for many years. OHV use is permitted on existing forest roads in the Project Area. In addition, there are approximately 70-100 miles of nonsystem OHV routes that users can access. The Plumas National Forest has been receiving state funds since 1989 to operate and maintain the OHV program on the forest. In 2004, OHV use was estimated at 35,000 visitor days per year on the roads and trails of the Plumas National Forest, and it is estimated that the Diamond Project Area has approximately 2,000 visitor days per year by OHV users.

The Forest Service is currently undergoing an OHV route designation process. By 2008, the Plumas National Forest will establish a designated OHV route system based on existing nonsystem and system trails on the Forest. It is likely that a number of nonsystem routes in the Diamond Project Area will be decommissioned or closed through this process.

There are three areas in the Project Area where motorized vehicles are restricted or prohibited. The Diamond Mountain Limited Vehicular Access Area administratively closes roads within this designated area to any motorized vehicles during the zone X-6A rifle deer season. Vehicles are limited to existing roads year round in the Thompson Peak Roadless Area and the Antelope Recreation Area (USFS, PNF 1988; 4-88, 4-286 & 287).

Woodcutting for personal and commercial use is permitted throughout the Project Area. It is estimated that approximately 3 percent of the Mt. Hough Ranger District's fuel wood permit sales and approximately 5 percent of the Christmas tree sales are within the Diamond Project boundary.

There are three special uses that occur in the Project Area; these include power lines, recreation events, and a campground concession operation. These uses require annual maintenance for access, fire protection, and hazard tree removal.

3.8.2 Mining

The Diamond Project Area has experienced extensive copper and gold mining over the last century, and some gold mining continues today. Historic mining created deep vertical mine shafts that still dot many locations in the Project Area. Terrain, ground cover, and a lack of surrounding structures make many of these mine shafts difficult to see, and because the open shafts are not readily visible, they pose a direct hazard to forest visitors. There are 11 known abandoned mines in the Diamond Project Area; two of these mines may be closed in the reasonably foreseeable future.

There are approximately 224 active mining claims in the Project Area: 75 are placer claims and 149 are lode claims (BLM LR 2000, 2005). The Mt. Hough Ranger District currently administers six active plans of operation and eight notices of intent for active mining claims in the Project Area. Suction dredging operations are very common in the Project Area—Indian Creek and Lights Creek, in particular, experience a lot of mining activity involving suction dredging.

3.9 Scenic Resources

3.9.1 Existing Landscape

The landscape in the Diamond Project Area ranges from the flat areas near North Arm and Genesee Valley, to moderately and extremely steep slopes. The forests are primarily pine-dominated mixed conifer and red fir forest types. Red and white fir-dominated forests exist at higher elevations. Past activities (such as mining, grazing, and timber harvesting, fire exclusion, and high-severity wildfires) have heavily influenced the existing landscape character of the Project Area. Past timber harvest activities have created many areas where dense even-aged stands of trees dominate the landscape.

Scenic resources include views of naturally appearing landscapes such as landforms, vegetation, rock formations, and water features. Scenic resources in the Diamond Project Area are important to forest visitors who may enjoy views from places like Antelope Lake Recreation Area. Viewpoint opportunities are also important along forests roads and trails such as the Taylorsville-Antelope Road (National Forest System Road 43). Scenic attractiveness is common in many locations in the Project Area and is used as a measure of the scenic importance of the landscape.

3.9.2 Visual Quality Objectives

The Visual Quality Objectives (VQOs) contained in the 1988 *Plumas National Forest Land and Resource Management Plan* (the "Forest Plan") are used to identify and classify scenic resources in the Diamond Project Area.

The VQOs were mapped as part of the forest planning process using Agriculture Handbook 462 – Visual Management System, volume 2, chapter 1 (USDA 1974). The VQOs describe different degrees of acceptable alteration of the natural and characteristic landscape. The objectives are considered the measurable standards for the management of the "seen" aspects of the land. The following VQO definitions apply to the landscape in the Project Area:

- **Retention**—activities are not to be evident to the casual forest visitor.
- **Partial Retention**—activities may be evident but must remain subordinate to the characteristic landscape.
- **Modification**—activities may dominate the characteristic landscape but must, at the same time, use naturally established form, line, color, and texture. Activities should appear as a natural occurrence when viewed in the Foreground or Middleground.
- **Maximum Modification**—activities may dominate the characteristic landscape but should appear as a natural occurrence when viewed as background.

The majority of the Project Area has a VQO of "Modification" to "Maximum Modification." There are three areas in the Project Area where VQOs are classified as "Retention" and "Partial Retention." Scenic attractiveness is common to each of the following areas:

- **Antelope Lake Recreation Area**—This is a high-use recreation area with a VQO of "Retention." Management direction is to provide visual resources with a naturally appearing landscape where management and other activities are generally not evident to the casual forest visitor (USFS 1988, page 4-95).

- **Taylorsville-Antelope Road**—This road parallels Indian Creek and is classified as a VQO of "Partial Retention." Management direction is to provide a naturally appearing landscape where management activities remain visually subordinate (USFS 1988, page 4-287).

- **Thompson Peak Roadless Area**—This area should maintain high visual quality objectives and meet a VQO of "Retention" but provide adequate treatment of damage from catastrophic events (USFS 1988, page 4-89).

3.9.3 Existing Scenic Integrity

Overall, the scenic integrity in the Diamond Project Area meets the VQOs for Maximum Modification, Modification, Retention, and Partial Retention. The exception is the Antelope Lake Recreation Area where the 2001 Stream Fire severely burned 3,502 acres. The charred landscape is still visible from developed campgrounds and roads near the lake.

3.9.4 Desired Landscape Character

The desired landscape character for the Diamond Project is a generally continuous forest cover through uneven-aged stands that achieve desired VQOs (USFS 1988, pages 4-95 and 4-105).

3.10 Range Resources

Livestock grazing has occurred on the Plumas National Forest since the mid-1800s, even prior to the establishment of the Forest. The Diamond Project Area overlaps with eight grazing allotments (see figure 3-7). Six of the eight allotments are active cattle allotments, and the remaining two are vacant sheep allotments. The use of allotments is authorized under a grazing permit from the Forest Service, and a permittee may graze livestock only in authorized areas. Foraging areas for livestock are within the allotment boundary, and most foraging areas in the Diamond Project Area are considered transitory range areas. These transitory grazing areas typically exist in forest openings, near roads, and along creeks. A grazing permit may also authorize use of range improvements in an allotment that could include use of fences, gates, cattle guards, and spring developments. Range improvements in the Diamond Project Area are identified in maps contained in the project record.

The following are the active allotments in the Diamond Project Area:

- **Antelope Allotment**—Approximately 65 percent of the 24,872 acres of this allotment are in the Diamond Project Area; 207 cow/calf pairs are permitted from to June 14 to August 31.
- **Antelope Lake Allotment**—Approximately 30 percent of the 5,043 acres of this allotment are in the Diamond Project Area; 150 cow/calf pairs are permitted from June 14 to August 31.
- **Clarks Creek Allotment**—Approximately 5 percent of the 16,635 acres of this allotment fall within the Diamond Project Area; 163 cow/calf pairs are permitted from June 1 to September 4.
- **Lone Rock Allotment**—The Lone Rock allotment is 25,025 acres. One hundred percent of this allotment is in the Diamond Project Area; 34 cow/calf pairs on and 51 cow/calf pairs off are permitted from June 1 to September 15.
- **Jenkins Allotment**—Approximately 10 percent of the 27,366 acres of this allotment are in the Diamond Project Area; 600 cow/calf pairs are authorized from August 1 to September 1.
- **Lights Creek Allotment**—Approximately 55 percent of the 29,721 acres of this allotment are in the Diamond Project Area; 24 cow/calf pairs are permitted on and 16 permitted off from June 1 to September 1.

The vacant allotments in the Diamond Project Area include the following:

- **Taylor Lake Allotment**—Approximately 45 percent of the 26,718 acres of this allotment are in the Diamond Project Area. This allotment is currently vacant, but the past authorization allowed 75 sheep from June 1 to September 1.
- **Hungry Creek Allotment**—100 percent of the 17,774 acres of this allotment lie within the Diamond Project Area. The allotment is currently vacant, but under past authorizations, 75 sheep were permitted from June 1 to September 1.

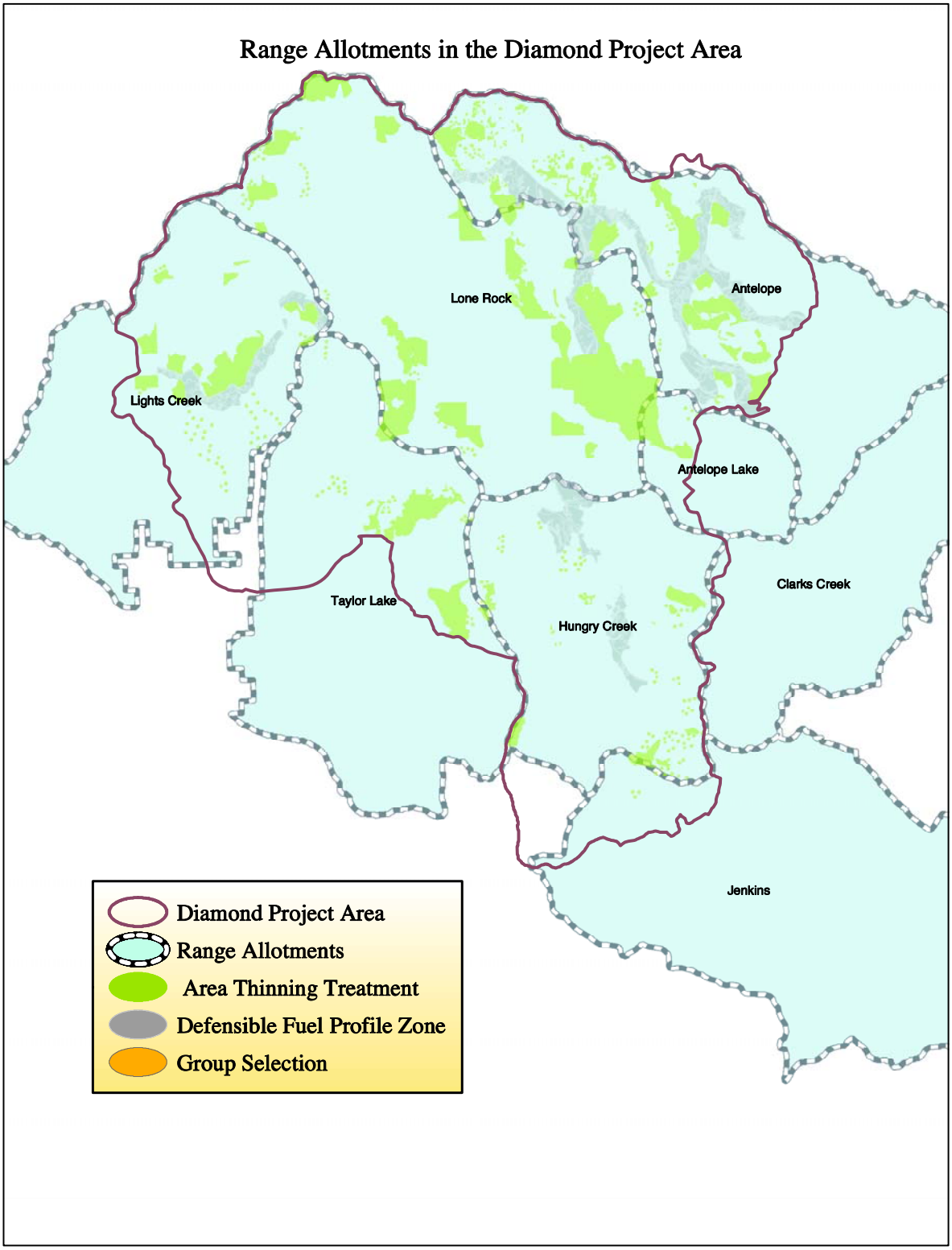

Figure 3-7. Range allotments in the Diamond Project Area.

The 1988 *Plumas National Forest Land and Resource Management Plan* (the "Forest Plan") contains the general direction and forestwide standards and guidelines for range management. The following is the general direction outlined in the Forest Plan for range management (USDA 1988b, pages 4-35 and 4-36):

- maintain or increase grazing and range productivity on a sustained yield basis as demand and economy warrant;
- implement a system to protect riparian areas; and
- suspend use on vacant allotments valued for other uses and use transitory range.

A forestwide "Range NEPA Strategy and Implementation Plan" was signed by the Forest Supervisor on December 16, 2005. The intent of this plan is to document the analyses performed (in accordance with the *National Environmental Policy Act* [NEPA]) on all 65 allotments on the Plumas National Forest, which include the eight allotments described above that occur within the Diamond Project boundary.

3.10.1 Annual Operating Instructions (AOI)

The Plumas National Forest has developed annual operating instructions (AOI) for each allotment in the Diamond Project Area. The management direction for AOIs comes from the *Herger-Feinstein Quincy Library Group Forest Recovery Act* (HFQLG Act) and its final EIS and the 2004 Record of Decision on the Sierra Nevada Forest Plan Amendment final supplemental EIS. In 2005, all allotments in the Diamond Project Area were consistent with the guidelines identified in the AOIs. The standards and guidelines for range management are listed in tables 3-27 and 3-28.

Table 3-27. The 2005 AOI use standards for range allotments on the Plumas National Forest.

Stubble Height (continuous grazing)	Shrub Use	Bank Alteration
6 inch – early seral	Less than 20%	Less than 20%
4 inch – late seral	Less than 20%	Less than 20%

Source: 2004 Record of Decision on the Sierra Nevada Forest Plan Amendment final supplemental EIS.

Table 3-28. Scientific Analysis Team guidelines for range allotments.

Grazing Management Reference	Establish Vegetation Reference Areas
GM-1 Promptly adjust grazing to eliminate adverse effects on riparian resources	Follow Forest Plan standards and guidelines as amended; there should be no change to current grazing practices.
GM-1 DFPZ Prescribed Burn	Case-by-case basis. If DFPZ prescribed burn is severe, rest a season or two; if normal prescribed burn, then defer grazing until after seed set or limit to 35 percent use preferred species until after seed set.
GM-2 Facilities	Build new facilities outside Riparian Habitat Conservation Areas.

Sources: HFQLG Act final EIS; Scientific Analysis Team, Grazing Management (Appendix L, GM-1 and GM-2).

3.10.2 Key Areas

The AOI for each allotment requires identification of Key Areas. A sign is posted in the allotment grazing area to identify it as a Key Area, which will generally be located in a riparian area, and will typically be in a meadow with a creek running through it. The Key Area is the prime place to monitor but may not be the only area monitored. If more than one area in a grazing area is monitored, livestock need to be moved to the next grazing area based upon the first area monitored in order to reach standard.

The location of the Key Area is flexible and may change depending upon the effectiveness of improvement maintenance and/or use patterns by livestock. Year-end use checks are done at Key Areas between August 1 and October 31, depending on when livestock leave the forest allotment and when the forage growing season ends. A monitoring form is included as part of the AOI for each allotment. Key Area locations for each allotment and monitoring results are maintained within the permit files on the Beckwourth Ranger District.