Fed. Defs.' Ex. A
Part 2 of 3

4.4.2. Birds

4.4.2.1. CALIFORNIA SPOTTED OWL

Affected Environment

The California Spotted Owl: A Technical Assessment of Its Current Status (Verner et al. 1992), referred to here as the Technical Report, provides the most comprehensive assessment of the status of the California spotted owl. Much of the information contained in this analysis is summarized from the Technical Report. In addition, much of the research on Northern spotted owls is relevant to discussions about California spotted owls, given the similarity in concerns and methods used to study these birds. Papers in *Demography of the Northern Spotted Owl* (Forsman et al. 1996) provide excellent overviews of studies on that subspecies and are frequently referenced herein below.

Species Background

Population Status and Trend

Range and Distribution. The range of the California spotted owl includes the southern Cascades south of the Pit River in Shasta County, the entire Sierra Nevada Province of California (and extending into Nevada), all mountainous regions of the Southern California Province, and the central Coast Ranges at least as far north as Monterey County (Grinnell and Miller 1944, Gould 1977, cited in Verner et al. 1992). Within this range, the owl occurs on 15 National Forests/Management Units administered by the Forest Service, four National Parks, several State Parks and Forests, private timberlands, and scattered Bureau of Land Management lands. The elevation of known nest sites ranges from about 1000 feet to 7700 feet, with about 86 percent occurring between 3000 and 7000 feet.

The California spotted owl population has two major geographic groups, one inhabiting the Sierra Nevada Province and the other in the Southern California Province, with Tehachapi Pass as the dividing line between the two. These regions are distinct geographically, and owl populations in the two provinces probably seldom exchange individuals. Connectivity may exist, however, through the Tehachapi Mountains and the Liebre/Sawmill area east of Interstate Highway 5.

The California spotted owl's range adjoins that of the northern spotted owl in Siskiyou, Shasta, and Modoc Counties as described in the 1990 U.S. Department of Interior's final ruling listing the northern spotted owl as threatened. The range of the northern spotted owl includes a small portion of both the Modoc and Lassen National Forests, generally north of the Pit River and west of Highway 139. Although most of the northern spotted owl's range is covered under the Northwest Forest Plan, this EIS covers a small portion of its range. The primary concern for northern spotted owls in this area is the condition of dispersal habitat and the possible effects of activities in the Modoc National Forest adjacent to areas covered by the Northwest Forest Plan. This EIS does not change any requirements for northern spotted owl consultation with the U.S. Fish and Wildlife Service in this area.

Population Size and Distribution. Information on the historic distribution, abundance, and habitat associations of California spotted owls in the Sierra Nevada is unavailable (Verner et al. 1992). Thus, it is not possible to determine how current population numbers and distribution may have changed relative to historic conditions. Based on records from the California Department of Fish and Game recorded through 1999, a total of 1,323 owl sites are known on FS lands within the project area, with another 129 owl sites reported on non-FS lands within the boundaries of the project area (Table 4.4.2.1a). The Lassen, Plumas, Tahoe, Eldorado, Stanislaus, Sierra, and Sequoia National Forests have major populations of spotted owls, with 99 percent of the total known owl sites on FS lands in the project area occurring within these forests. These seven National Forests include the vast majority of suitable habitat for spotted owls in the Sierra Nevada. Numbers of California spotted owls are low on the Modoc, Inyo, and Humboldt-Toiyabe National Forests, and in the Lake Tahoe Basin Management Unit, and reproduction is infrequent. Private land comprises a portion of the home ranges of some owl sites on FS lands, with more than 15 percent of the owl sites on FS lands having greater than 15 percent of their home range within privately owned lands. Four National Parks, scattered Bureau of Land Management lands, industrial timberlands, and private timberlands provide the remainder of the estimated suitable habitat and additional spotted owl pairs.

These numbers represent an incomplete count of the California spotted owl population in the Sierra Nevada since not all areas have been surveyed and survey results, particularly on industrial forest lands, have not always been reported to the Department of Fish and Game (Gould 1999, pers comm.). Forest Service biologists estimate an additional 160 to 218 sites (singles and pairs) on National Forest System lands based on unsurveyed suitable habitat. The number of nonterritorial adults in the population remains unknown.

Table 4.4.2.1a. Number of California spotted owl sites by status known on Forest Service lands and non-Forest Service lands, since 1987, within the boundaries of the National Forests in the project area reported in the California Department of Fish and Game database (Fall 1998).

	National Forest Lands			(Non-NF Lands)			
National Forest	**Pairs**	**Territorial Singles**	**Singles**	**Pairs**	**Territorial Singles**	**Singles**	**Total NF (NF+pvt)**
Eldorado	160	36	13	12	5	5	209 (231)
Inyo	1	1	1	0	0	0	3 (3)
Lassen	99	18	20	6	0	2	137 (145)
Modoc	1	0	0	0	0	0	1 (1)
Plumas	171	53	31	8	2	4	255 (269)
Sequoia	72	44	17	6	1	1	133 (141)
Sierra	141	31	45	9	3	3	217 (232)
Stanislaus	113	52	30	20	6	6	195 (227)
Tahoe	107	26	24	17	4	8	157 (186)
Lake Tahoe Basin	8	0	4	1	1	0	12 (13)
Humboldt-Toiyabe*	4	0	0	0	0	0	4 (4)
Total	**873**	**185**	**261**	**73**	**36**	**26**	**1323 (1452)**

**data supplied by forest in 1999*

California spotted owls are currently distributed relatively continuously and uniformly throughout their range in the Sierra Nevada (Verner et al. 1992, Noon and McKelvey 1996), although concern exists for fragmentation effects at finer scales due to habitat alteration (Gutiérrez and Harrison 1996). Estimates of mean crude density (that is, number of owls divided by the total acreage of the study area) reported in the Technical Report from four study areas in the Sierra Nevada ranged from 0.526 owls per square mile on the Sierra National Forest to 0.259 owls per square mile on the Eldorado National Forest (Verner et al. 1992:175). Subsequent research has demonstrated that estimates of mean crude density varied annually during 1990-1998, ranging between 0.313-0.530 owls per square mile on the Sierra National Forest and 0.415-0.615 in Sequoia National Park (Steger et al. 1998). Although California spotted owls appear to be distributed throughout their historic range in the Sierra

Nevada at the present time, eight geographic areas of concern were identified in the Technical Report as having the potential to contribute to future gaps in owl distribution within the Sierra Nevada (Verner et al. 1992). Concerns associated with each of these areas of concern are described in this assessment under the section on "Risk Factors."

Population Trends. Estimates of California spotted owl population trends are available from demographic studies conducted at four study areas across the range of the owl in the Sierra Nevada (Lassen NF, Eldorado NF, Sierra NF, Sequoia/Kings Canyon National Park). All four studies reported statistically significant declining trends over the duration of each study based on estimates of lambda (Table 4.4.2.1b.) (Blakesley and Noon 1999, Gutierrez et al. 1999, Steger et al. 1999). These estimates suggest rates of decline during the periods of study that range from 6 to 11 percent per year. Extrapolating the annual decline over each study period results in expected overall declines of 49 to 73 percent. The estimate of lambda from the Lassen NF is very close to the overall average (0.923). Using vital rates from the Lassen study (Blakesley and Noon 1999), the cohort replacement rate (R) is calculated to be 0.53, suggesting that the population is declining by nearly half each generation.

By comparison, 11 demographic studies of northern spotted owls exhibited an average annual decline of 8.3 percent (standard error of 1.3 percent) over the period 1985 through 1998. Using estimates of juvenile emigration to adjust the vital rates, an adjusted estimate of lambda suggests an overall rate of decline of 3.9 percent for the northern spotted owl during the study period (Franklin et al. 1999).

Table 4.4.2.1b. Estimates of the finite rate of annual population change (lambda) from four California spotted owl demographic studies conducted in the Sierra Nevada, 1986-1998. Overall change is computed by extrapolating lambda over the period of study.

Study Area	Years	Lambda	95% C.I.	S.E.	Overall change*
Lassen NF	1990-1998	0.923	0.888-0.958	-	-51.4%
Eldorado NF	1986-1998	0.930	-	0.027	-61.1%
Sierra NF	1987-1998	0.898	-	-	-72.5%
Sequoia NP	1988-1998	0.940	-	-	-49.4%

There is reason to believe that the lambda estimates unadjusted for emigration may overstate the rate of decline in California spotted owls (Franklin et al. 1999). There is no evidence, substantiated or anecdotal, to suggest that actual spotted owl abundances declined by the amount indicated in the "Overall change" column in Table 4.4.2.1b. There are two study areas where the model-based estimates are complemented by census data, the Sierra NF and the Sequoia NF. Based on data in Steger et al. (1999) the number of nesting pairs counted on the Sierra NF study area decreased from 31 to 20 from 1990 to 1998, an annual rate of decline of 5.3 percent -less than half the model-based estimate. In contrast, the number of nesting pairs in the Sequoia NF study area increased from 22 pairs in 1990 to 24 pairs in 1998. The number of nesting pairs counted in both studies peaked at 34 in 1994, suggesting a period of population increase from 1990 to 1994, followed by decline. Only by calculating annual rates of decline in counts of nesting pairs over the shorter period, 1994 to 1998, can one obtain values that approach lambda estimates. Gutierrez et al. (2000) report that there were noticeably fewer territorial individuals encountered on the density area of their study in 1999 than during the previous seven years. They suggest that, although another year or two of study is required to confirm if this drop in territorial owls was due to mortality or detectability, the apparent decline in territorial holders increases concerns about the health of this population.

Whether lambda estimates obtained in the manner common to spotted owl research are inherently inaccurate (biased) is a much debated proposition. Raphael et al. (1996) discuss five potential sources of bias, both positive and negative: assumptions of the Lotka-Leslie model, duration of studies, senescence (older birds might have reduced reproductive potential), estimating reproductive rates, and emigration. Emigration is usually identified as the major factor biasing estimates. The mark-recapture models used to estimate vital rates cannot distinguish between owls that die and owls that permanently leave the area and survive elsewhere. This confusion can lead to overestimates of mortality. Recognizing this, researchers often calculate the emigration rates that would be necessary in a stable population to reproduce the estimated mortality rates (e.g., Burnham et al. 1996, Blakesley and Noon 1999). Even allowing for reasonable estimates of emigration, the demographic projections suggest declining populations.

In summary, the demographic studies strongly suggest population declines in California spotted owls. The declines are sufficiently severe to warrant concern, even in light of uncertainties in the magnitude of the declines.

Habitat Status and Trend

Habitat Preferences

Five vegetation types provide spotted owl habitat in the Sierra Nevada Province: foothill riparian/hardwood, ponderosa pine/hardwood, mixed-conifer forest, red fir forest, and the east side pine forest. The mixed-conifer forest type is the predominant type used by spotted owls in the Sierra Nevada: about 80 percent of known sites are found in mixed-conifer forest, 10 percent in red fir forest, 7 percent in ponderosa pine/hardwood forest, and the remaining 3 percent in foothill riparian/hardwood forest and eastside pine.

Six major studies (Verner et al. 1992, Chapter 5) described habitat relations of the owl in four general areas spanning the length of the Sierra Nevada. These studies examined spotted owl habitat use at three scales: landscape; home range scale; and nest, roost, or foraging stand. By comparing the amount of time owls spend in various habitat types to amount of habitat available, researchers determined that owls preferentially used areas with at least 70 percent canopy cover, used habitats with 40 to 69 percent canopy cover in proportion to its availability, and spent less time in areas with less than 40 percent canopy cover than might be expected.

Foraging. In studies referenced by the Technical Report, owls foraged most commonly in intermediate- to late-successional forests with greater than 40 percent canopy cover and a mixture of tree sizes, some larger than 24 inches in dbh. The owls consistently used stands with significantly greater canopy cover, total live tree basal area, basal area of hardwoods and conifers, snag basal area, and dead and downed wood, when compared with random locations within the forest. Studies on the Tahoe and Eldorado National Forests found that owls foraged in stands with large diameter trees (defined as trees greater than 24 inches in dbh in one study and trees 20 to 35 inches in dbh in the other) significantly more than expected based on availability. Owls foraged in stands in the 4G timber stratum significantly more than expected, based on the proportion of that stratum. Several studies have identified foliage height class diversity, or canopy layering, as a stand structural characteristic associated with preferred foraging sites for the northern spotted owl (North et al. 1999, Carey et al. 1992).

In general, stands suitable for owl foraging have (1) at least two canopy layers, (2) dominant and codominant trees in the canopy averaging at least eleven inches in dbh, (3) at least 40 percent canopy cover in overstory trees, (30 percent canopy cover in the red fir type), and higher than average numbers of snags and downed woody material. Although canopy covers down to 40 percent are suitable for foraging, they appear to be only marginally so. Radio-tracking data from the Sierra National Forest showed that owls tended to forage more in sites with greater than 50 percent canopy cover than predicted from their availability; stands with 40 to 50 percent canopy cover were used about in proportion to their availability (Verner pers. comm. 1999). Recent analysis by Hunsaker et al. (in press) found that productivity was positively correlated with the proportion of individual owl home ranges having greater than 50% canopy-cover and negatively correlated with the proportion having less than 50% canopy cover, based on aerial photo interpretation. From these correlations, the authors conclude that the threshold between canopy cover values that contribute to or detract from occurrence and productivity is a value near 50 percent. Table 4.4.2.1c summarizes the range of means for foraging stand attributes reported in the Technical Report.

Nesting and Roosting. In studies referenced by the Technical Report, spotted owls preferred stands with significantly greater canopy cover, total live tree basal area, basal area of hardwoods and conifers, and snag basal area for nesting and roosting. Owls used stands in the 4G and 4N timber strata for nesting significantly more than expected, based on the proportion of those strata. In general, 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 in 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. Table 4.4.2.1c summarizes the range of means for these attributes reported in the Technical Report.

Table 4.4.2.1c. Range of mean values of some attributes in suitable habitat for spotted owls in Sierra Nevada mixed-conifer forests (from Verner et al. 1992:96).

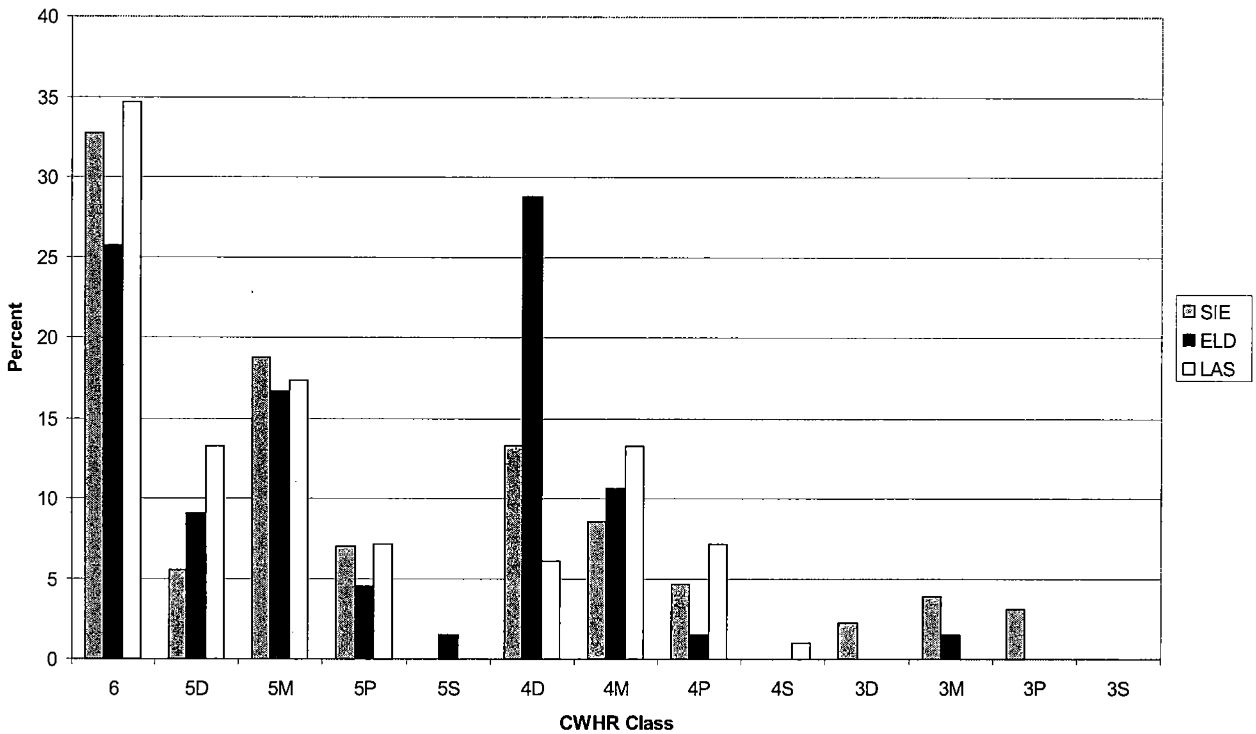
Attribute	Nesting and Roosting Stands	Foraging Stands
Percent canopy cover[1]	70-95	50-90
Total live tree basal area[2]	185-350	180-220
Total snag basal area[2]	30-55	15-30
Basal area of large snags[2,3]	20-30	7-17
Downed woody debris[4]	10-15	10-15

1 Mostly in canopy >30 feet high, including hardwoods.
2 Square feet per acre.
3 Dead trees > 15 inches d.b.h. and > 20 feet tall.
4 Tons per acre.

Research on California spotted owls has continued on owl populations on the Lassen, Eldorado, and Sierra National Forests, and in Sequoia/Kings Canyon National Park, since publication of the Technical Report, resulting in an increased number of documented nest sites. Plot data centered on owl nests from these studies provides further information on vegetation characteristics around nest sites. Each of the plots was classified using the R5 FIA classification procedure as described in Appendix B. Standardized classification resulted in classification of the plots to CWHR class and measures of a consistent set of variables that are directly comparable to data analyzed using the same classification procedure from the FIA program. A total of 299 nest and main roost site plots were available for analysis. Seven nest plots from Giant Sequoia stands were excluded from the analysis because of the significant effects that individual large giant sequoia trees can have on plot summary statistics, rendering it inappropriate to compare them to plot data from other forest types.

Classification of the remaining 292 plots to CWHR class using the R5 FIA analysis procedure resulted in approximately 32% of the plots classified as structural class 6, 18% as structural class 5M, 14% as 4D, 11% as 4M, 9% as 5D, 7% as 5P, and 5% as 4P, with 2% or less of the remaining plots as each of the 5S, 4S, 3D, 3M, and 3P classes (Figure 4.4.2.1a). North et al. (2000) suggested that canopy cover, tree density, and foliage volume represent conditions found to be consistent across different forest types and therefore could indicate the basic nest-site conditions selected by owls. Owl nests were consistently located in sites with 75 percent canopy cover, 300 stems/ha, and 40,000 cubic meters/ha of foliage volume.

Figure 4.4.2.1a. Distribution of owl nest plots by CWHR class on the Sierra, Eldorado, and Lassen National Forests.



Nest Tree Characteristics. Spotted owls regularly use five nest types: (1) cavity nests placed in natural cavities resulting from decay; (2) broken-topped trees and snags; (3) platform nests placed on remnant platforms built by other species, or on debris accumulations; (4) dwarf mistletoe brooms; and (5) "undefined nest types" not fitting any of the previous descriptions. In the Sierra Nevada, 63 percent of nests were in live trees, and 37 percent were in snags (Verner et al. 1992:92).

Habitat Composition at Home Range and Landscape Scale. Single stand attributes preferred by spotted owls are relatively easy to measure and describe. Greater difficulty arises in describing habitat attributes at the landscape scale. The Technical Report examined habitat selection at the stand scale and reported on the habitat composition found within home ranges. It could not determine, however, whether the habitats used by owls were adequate to ensure their reproducing at a rate sufficient to maintain their population. This requires mapping of vegetation attributes important to the spotted owl across large areas and analyzing relations between vegetation and spotted owl productivity and survivorship. Such an effort is presently in progress for the demographic study areas in the Sierra and Lassen National Forests, using aerial photo interpretations of vegetation types from 1996 photos. At present, the Forest Service's vegetation inventory based on satellite imagery provides the only large-scale vegetation mapping of the remaining spotted owl demographic study areas in the Sierra Nevada where these types of analyses can be done. Considerable uncertainty remains as to whether this Forest Service vegetation inventory mapping can describe owl habitat with sufficient precision to provide a meaningful description of landscape vegetation characteristics important to the spotted owl.

Home Range Size. Estimates of California spotted owl home range size are extremely variable. All available data indicate that they are smallest in habitats at relatively low elevations that are dominated by hardwoods, intermediate in size in conifer forests in the central Sierra Nevada, and largest in the true fir forests in the northern Sierra Nevada (Verner et al. 1992). Based on an analysis of data from telemetry studies of California spotted owls, mean breeding season, pair home range sizes have been estimated (using 100 percent minimum convex polygon method): 9,000 acres on the Lassen National Forest, true fir type; 4,700 acres on the Tahoe and Eldorado National Forests, mixed conifer type; and 2,500 acres on the Sierra National Forest, mixed conifer type.

Using the FS vegetation inventory data, the Technical Report analyzed the sizes of stands containing nest trees and the cumulative sizes of each nest stand plus all adjoining stands that were in vegetation strata preferentially used by owls for nesting. The mean size of nest stands was about 100 acres; the mean size of the nest stand plus adjacent suitable stands was about 300 acres. In radio tracking studies, the area including half of the foraging locations of owls was found to vary from an average of 317 acres on the Sierra National Forest to an average of 788 acres on the Lassen National Forest (Verner et al. 1992:87). Bingham and Noon (1997) found the "overused" portion of a spotted owl's breeding home range (core area) to be 20 to 21 percent of the home range.

Habitat in Home Ranges. Spotted owls were found to more consistently select for habitat patches with high canopy cover than for large tree size-class (Verner et al. 1992:155). The average proportion of habitat with greater than 40 percent canopy cover within home ranges of spotted owls on the Sierra and Lassen National Forests was found to be 81 and 67 percent, respectively (Verner et al. 1992:153-155).

In its Science Review, the Forest Service Pacific Southwest Research Station (1998) reviewed an analysis by Bart (1995) examining the relation between the amount of an owl pair's home range that is suitable habitat and the productivity and survivorship of northern spotted owls. This analysis "...suggests that removing any suitable habitat within the vicinity of the nest tends to reduce the productivity and survivorship of the resident owls. ...It appears that the lambda statistic [essentially the annual balance between birth rate by age class on one hand, and mortality rate by age class on the other] is probably about 1.0 when suitable habitat covers

30 percent to 50 percent of the landscape." Reproduction would drop below replacement rate at some threshold percentage of suitable habitat between 30 and 50 percent in home ranges and in the larger landscape in general.

Recently completed analysis in the Sierra National Forest demographic study area concludes that canopy cover composition within owl home ranges is significantly correlated with owl occurrence and productivity (Hunsaker et al. in press). Owl home ranges were represented as concentric circles surrounding an owl activity center, equal to 50%, 70% and 90% MCP home-range estimates for owl sites. These analysis areas were analyzed in relation to five categories of canopy closure: 0-19%, 20-39%, 40-49%, 50-69% and 70-100%. Productivity was positively correlated with the proportion of the analysis area having greater than 50% canopy-cover and negatively correlated with the proportion having less than 50% canopy cover. The values ranged from 75% of the smallest analysis area (178 acres) with greater than 50% canopy cover to 60% of the largest analysis area (1,062 acres) having greater than 50% canopy cover.

Information on the desired configuration or patchiness of habitat within a spotted owl's home range is lacking for the California spotted owl. Demographic studies on the northern spotted owl in the Klamath Province have found that birds with access to larger blocks of suitable habitat had slightly lower mortality rates, but those with home ranges that were more patchy had slightly higher fecundity (number of young produced per breeding female). A landscape pattern with some fine-scale fragmentation of old forest (small patches of other habitats with convoluted edges) dispersed within and around a main patch of old forest appeared to provide the optimum balance in promoting both high fecundity and high survival (Franklin et al. 2000). A comparison of demographic data from spotted owls on the Sequoia/Kings Canyon National Parks with those on the Sierra National Forest finds that spotted owls on the National Forest average slightly higher fecundity but owls on the National Park had slightly higher annual survival. Although the differences are not significant statistically, the general results are consistent with those found in the Franklin et al. study, assuming that habitat on National Forest lands is patchier than that found on National Park lands (Verner, pers. comm. 1999).

The Science Report highlighted new information on the importance of large, old trees within spotted owl habitat, reporting that "Region 5 data on known ages and diameters of conifers at least 39 inches in dbh (but not owl nest trees) from the seven westside Sierra Nevada National Forests demonstrate that tree ages in different timber strata were 157 to 438 years old, with an average age of 258 years. "Most strata-level age estimates averaged between 250 and 300 years" (Verner and McKelvey 1994). "These findings suggest that the spotted owl requires large conifers 250 or more years old distributed at the landscape scale."

Habitat Status

Trends. Assessing historic to current changes in the amount and quality of California spotted owl habitat in the Sierra Nevada is problematic due to uncertainty about historic conditions, uncertainty about what constitutes high quality owl habitat, and uncertainty regarding current vegetation conditions due to accuracy, resolution, and scale concerns related to current inventory maps. Due to uncertainty about the historic size, distribution, and habitat relationships of California spotted owl populations in the Sierra Nevada, it is not possible to determine if changes in the distribution and amount of habitat have resulted in changes in owl distribution and abundance. As summarized in the Technical Report, the current distribution and abundance of owls in the Sierra Nevada does not suggest that they have declined in their overall distribution in the Sierra Nevada or that they have markedly declined in abundance within any forest type (Verner et al. 1992). Uncertainty exists regarding the suitability of the more open, parklike forest structure that occurred over a larger proportion of the historic landscape for California spotted owls and it has been hypothesized that owls may be more abundant in certain areas of the Sierra Nevada at the present time compared to 100 years ago (Verner et al. 1992).

Assessing changes in habitat quality for California spotted owls is further complicated by the history of vegetation management strategies predominantly used in the Sierra Nevada. In the Pacific Northwest, clearcutting was the predominant timber harvest method used and forest vegetation is generally either owl habitat (i.e., uncut or mature second-growth stands) or not owl habitat (i.e., recent clearcuts or young second-growth stands). Thus, the differences between owl habitat and non-habitat are relatively more straightforward to discern. In contrast, historic timber harvest in the Sierra Nevada was predominantly individual tree selection or high-grading focused on the most desirable trees (mostly large diameter pines). This harvest system, coupled with aggressive fire suppression, resulted in a finer-scale gradient in forest conditions, and subsequently, habitat quality for California spotted owls varies over a continuous gradient of quality (Noon and McKelvey 1996). Thus, compared to the Pacific Northwest, it is more difficult to discern discrete boundaries between habitat and non-habitat.

Current Estimates. California spotted owl occurrence and productivity appears to be significantly correlated with canopy cover composition within owl home ranges. Using the findings reported in Hunsaker et al., the habitat status surrounding individual spotted owl activity center in the Sierra Nevada has been evaluated. The proportion of moderate and dense canopied stands occurring within individual spotted owl home range areas was estimated using Forest Vegetation Inventory data calculated within a circular analysis area surrounding each spotted owl activity center. The analysis area used was equal in size to the breeding season pair home range sizes calculated from various studies and reported above. Based on this analysis, approximately 50 percent of spotted owl home ranges have less than 60 percent of their home range in moderate and dense canopied habitat (approximated as CWHR classes 6, 5D, 5M, 4D, and 4M). Considering the findings reported in Hunsaker et al. (*in press*), habitat associated with these owl sites may be insufficient to support a self-sustaining population of owls. Fifty-eight percent of owl sites in the Central Sierra Nevada (represented as the Plumas, Tahoe, Eldorado, and Stanislaus national forests) have less than 60 percent of their home range in moderate and dense canopied forest, whereas 32 percent of owl sites in the southern Sierra Nevada (Sierra and Sequoia national forests) have less than 60 percent of their home range in moderate and dense canopied stands. This analysis assumes private lands do not contribute to the proportion of moderate and dense canopied habitat within home ranges, since the future status of that habitat remains uncertain.

At the stand scale, studies described in this assessment have documented that the majority of nest sites occur in CWHR classes 6, 5D, and 5M. Timber strata 4G (similar to CWHR classes 5D and 6) has been documented as being preferentially selected by owls for foraging. These vegetation classes have the highest probability of providing stand structures associated with preferred nesting, roosting and foraging.

Diet

Large differences in observed home range sizes of spotted owls may result from differences in diet. In addition, although not confirmed for California spotted owls, studies of many other owl species from around the world confirm that whether a given pair of owls attempts to nest in a given year, and whether nest attempts are successful, are directly related to prey availability (Verner et al. 1992:74). Understanding how prey availability differs as habitat structure changes is essential to understanding how to manage spotted owl populations by providing suitable habitat for their prey.

Spotted owls above the mid-elevation conifer forests of the Sierra Nevada (about 4,000 to 5,000 feet) prey mainly on flying squirrels. Owls in the mid- to lower elevations of the mixed-conifer zone and the upper part of the ponderosa pine zone prey heavily on both flying squirrels and woodrats. Owls in the Sierra Nevada foothill riparian/hardwoods consume primarily woodrats. The Technical Report concludes that it is important to manage habitat to maintain thriving populations of flying squirrels in Sierra Nevada conifer forests since over 75 percent of all California spotted owl sites occur in these habitats where flying squirrels are the primary prey species (Verner et al. 1992:69). Managing conifer forests in the Sierra Nevada for flying squirrels should emphasize retention of very large and old trees, large snags, and large downed logs, as well as site preparation techniques that minimize disturbance of the soil organic layer.

Breeding Chronology

The spotted owl breeding cycle extends from about mid-February to mid- to late September. Egg-laying through incubation, when the female spotted owl must remain at the nest, extends from early April through mid- to late May. Young owls typically fledge from the nest in mid- to late June. In the weeks after fledging, the young are very weak fliers and remain near the nest tree. Adults continue to bring food to the fledglings until mid- to late September. The sensitivity of the spotted owl to nest site disturbance is not well-known. Wasser et al. (1997) found measurements of physiological stress to be significantly higher in owls centered within versus beyond 0.25 miles from a major logging road, or recent timber harvest activity.

Not all pairs of California spotted owls nest every year. In fact, over the ten years of demographic studies in the Sierra Nevada, 1992 was the only year when nearly all study owls nested. It is not unusual for owls in an established activity center to skip several years between one nesting and the next. Sites may be vacant for several consecutive years when the population is in decline, but then be reoccupied to support breeding pairs during a population upswing.

Migration and Dispersal. Information on the dispersal abilities of spotted owls is scant. An understanding of juvenile owl dispersal is essential to understanding effects of increasing distance or spacing between adjacent pairs of spotted owls. Information on the northern spotted owl included in Chapter 4 of the Technical Report, indicates that two-thirds of the juveniles would be expected to disperse at least eight miles.

Unlike northern spotted owls, many California spotted owls migrate altitudinally, moving downslope for the winter. Spotted owls migrated a mean straight-line distance of twenty miles in the Eldorado National Forest and a mean of 12.3 miles in the Sierra National Forest (Verner, et al. 1992:64). Three studies tracked 32 California spotted owls to determine whether they migrated: 44 percent were altitudinal migrants. The reasons why only some individuals migrate are unclear. Altitudinal migration seems not to be related to habitat quality, at least in these studies. Migration may expose owls to greater risk of mortality. Human use and development in traditional wintering areas may also have adverse impacts on the quality of owl habitat.

Risk Factors

1. Habitat Abundance and Distribution.

Habitat Abundance. The current distribution and abundance of owls in the Sierra Nevada does not suggest that habitat has markedly declined in abundance within any forest type. However, if habitat abundance is evaluated based upon new information about the proportion of habitat with specific canopy cover values that contribute to or detract from occurrence and productivity, the current abundance and distribution of habitat appears to be of concern. Fifty percent of owl sites in the Sierra Nevada (58 percent in the central Sierra Nevada) have less than 60 percent of their home range in moderate and dense canopied forest, indicating potentially lower productivity for these sites.

The Technical Report cautioned against future management increasing the mean nearest-neighbor distances among spotted owl sites. The Report stated that subtle factors that uniformly decrease habitat quality or increase fragmentation would act to reduce population density and incrementally increase the uncertainties associated with successful dispersal and mate finding. If suitable habitat is allowed to decline and become fragmented, the uncertainty of successful dispersal will become progressively more relevant to the subspecies long term population dynamics and likelihood for persistence (Verner et al. 1992:184).

Geographic Areas of Concern. As summarized in the Technical Report, the current distribution of spotted owls in the Sierra Nevada is characterized by its continuity and relatively uniform density. The Technical Report, nonetheless, described five conditions which give rise to some concern for the integrity of the California spotted owl's range in the Sierra Nevada (1) bottlenecks in distribution of habitat or owl populations; (2) gaps in the known distribution of owls; (3) locally isolated populations; (4) highly fragmented habitat; and (5) areas of low crude density of spotted owls. Nine areas in the Sierra Nevada were identified in the Technical Report as areas where one or more of these conditions currently limit the owl population. These areas of concern were thought to indicate potential areas where future problems may be greatest if the owl's status in the Sierra Nevada were to deteriorate. They represent areas where management decisions may have a disproportionate potential to affect the California spotted owl population. Of particular concern are areas of checkerboard ownership and large inclusions of non-federal lands which occur on the Tahoe, Eldorado, and Stanislaus national forests. Habitat projections in areas of checkerboard ownership are highly uncertain and the existing condition is often highly fragmented. The risk and uncertainty associated with maintaining a well-distributed population is certainly higher within these areas of concern.

2. Habitat Quality.

Much of the current concern regarding California spotted owl population trends is focused on the effects of vegetation management on the distribution and abundance of important habitat elements. Forest ecologists estimate that old forest conditions have declined from 50 to 90 percent compared to the range of historical conditions. Analyses conducted at both the plot and landscape scales have documented large reductions in late-seral/old-growth forests throughout the Sierra Nevada and reductions in the numbers and distribution of large trees as a result of selective harvesting of large pines, and increases in the numbers of smaller diameter trees, forest understory density, and surface fuels as a result of fire suppression (Laudenslayer 1990, McKelvey and Johnston 1992, Franklin and Fites-Kaufmann 1996, Beardsley et al. 1999, Bouldin 1999). These trends indicate that there has been a reduction in the amount and distribution of mature and older forests, and specific habitat elements such as large trees, snags, and downed logs, used for nesting and foraging by California spotted owls.

The Technical Report discusses five major factors of concern for California spotted owl habitat that have resulted from historical timber harvest strategies: (1) decline in the abundance of very large, old trees, (2) decline in snag density; (3) decline in large-diameter logs; (4) disturbance or removal of duff and topsoil layers; and (5) change in the composition of tree species. Of these concerns, significant changes in diameter distributions of trees in the Sierra Nevada and rapid reductions in the distribution and abundance of large, old, and decadent trees posed the greatest threat to the California spotted owl (Verner et al. 1992). This factor relates to two other factors--the decline in snag density and loss of large-diameter logs. The diameter of nest trees selected by owls in the Sierra Nevada is significantly greater than the average diameters of conifers in the Sierra Nevada. Large trees suitable for owl nesting contribute to the overall quality of owl habitat. Large trees become future large snags and large downed logs, the latter providing important habitat attributes for some prey species. The length of time required to recover old trees and increase their density over the landscape raises the level of concern associated with their decline.

Research by North et al. (2000), suggests that California spotted owl reproduction is influenced by both regional weather conditions and nest-site canopy structure, which protects fledglings from detrimental weather. Forest management practices which do no provide for retaining groups of large, old, high crown-volume trees may be reducing the number of potential owl nesting sites within the forest. Research on the northern spotted owl (North et al. 1999) found snag volume, foliage volume, and canopy layering to be stand attributes significantly associated with owl foraging intensity. Vegetation treatments, such as timber harvest and fuels reduction, that alter these habitat attributes may influence habitat quality for the California spotted owl.

3. Climate

Weather conditions, especially late winter and early spring storms, may have been important in the observed downward population trends. Research by Franklin et al. (2000) and North et al. (2000) indicate the importance of annual weather events in determining nesting success and survival. Temporal variation in reproductive output appears to be greatly influenced by annual variation in weather, primarily severe storms during the incubation and nestling periods, although it appears that higher quality habitat, at multiple spatial scales, can function to moderate weather effects on owls (Franklin et al. 2000, North et al. 2000). In demographic studies in the Sierra Nevada, failure of nesting owls has repeatedly been noted following cold, wet storms in the spring months (Verner, pers. comm. 1999). Reproductive rates of owls studied in the Klamath province were found to be negatively affected by increased winter precipitation and positively affected by increased precipitation during the early spring. Survival declined as climatic conditions progressed from an optimal warm, dry spring to a cold, wet spring (Franklin et al. 2000). Franklin et al's results indicated, however, that high habitat quality increased survival of territory occupants above individuals in poorer habitats. If the frequency of El Nino events increases with global warming, habitat conditions at nest-sites could be increasingly important for sustaining spotted owl reproduction (North et al. 2000). Annual variation in prey availability, which may be partially linked to weather, and other factors may also be important.

4. Wildfire

The ingrowth of shade-tolerant tree species and the excessive buildup of surface fuels are conditions that have resulted from past forest management and fire suppression, and which increase the risk of high-severity fire--an infrequent and small-scale event before 1850. The Science Report cited studies indicating that the number of multilayered stands with a large proportion of younger trees, and the amount of small downed material has likely increased since 1850. A change in fire severity has resulted, increasing the risk that wildfires will destroy owl habitat. The Science Review noted that twentieth century fire records from the Sierra Nevada show that fire risk is inversely related to elevation (McKelvey and Busse 1996). At the landscape or watershed scale, fire-severity patterns correspond to logging history, stand fuel treatments, topography, and forest type (Weatherspoon and Skinner 1995). These findings indicate that risks and hazards for owl habitat changes with elevation, topography, and forest condition. Such findings are important considerations in designing or implementing long-term management plans for the spotted owl.

Approximately 39 percent of the known owl sites on national forest lands occur in areas of high fire hazard risk (Table 4.4.2.1d). These high fire hazard risk sites include 38 percent of the known national forest pairs, 44 percent of the territorial singles, and 36 percent of the single birds. The known number of California spotted owl sites burned in recent wildfires is low. From 1993 through 1998, only 15 California spotted owl protected activity centers (PACs) or spotted owl habitat areas (SOHAs) burned in wildfires. (Three of the 15 are known to remain occupied.). This represents an annual rate of loss of about 0.2 percent of the PACs and SOHAs on national forests in the Sierra Nevada over a 6-year period. Only limited inferences may be drawn from this short period.

Table 4.4.2.1d. Distribution of known California spotted owl sites by reproductive status and fire hazard risk rating.

	Fire Hazard Risk Rating (Hazard Class)			
Reproductive Status	**Low (3& 4)**	**Moderate (5 & 6)**	**High (7-9)**	Total
Pairs	137	409	333	879
Territorial Singles	40	107	115	262
Singles	38	84	74	196
Total	**215**	**600**	**522**	**1337**

5. Breeding Site Disturbance

Management as well as recreational activities has the potential to disrupt spotted owl nesting efforts and reproductive success. In recent years this risk has been diminished by applying protections to known nest stands and limiting disruptive activities during the spotted owl breeding season within a distance of known nest sites. Habitat disturbance surrounding the nest site has been diminished through designation and protection of 300 acre PACs.

Conservation Measures

Conservation measures for the California spotted owl must provide the environmental conditions needed to establish a high likelihood of maintaining populations of the California spotted owl, well-distributed across the National Forests within the Sierra Nevada planning area. A primary concern for California spotted owls is the effects of vegetation management on the distribution, abundance, and quality of habitat (Verner et al. 1992, Gutierrez and Harrison 1996, Noon and McKelvey 1996). Conservation measures must consider habitat distribution, abundance, and quality at the landscape, home range, and stand-level scales.

At the landscape scale the issue is to provide for sufficient amounts and distribution of high quality habitat to facilitate natal and breeding dispersal among territories and to maintain California spotted owls well-distributed throughout their historic range in the Sierra Nevada. For this purpose, protecting occupied, as well as suitable but unoccupied habitat, over the long- term is important at this scale. A species with obligate dispersal and experiencing habitat limitation would be expected to show a pattern of less than full occupancy of habitat due to the uncertainty of the search process and the survival costs associated with searching for low-density habitat (Noon, pers comm. 2000). Conservation efforts should therefore consider not only occupied habitat, but also suitable unoccupied habitats, in developing conservation strategies for species for which dispersal may function as a primary limiting factor (Lande 1987, 1988).

At the spatial scale of the individual home range, the issue is to manage for high quality territories that provide sufficient amounts and distribution of nesting and foraging habitat to provide for adequate survival and reproduction rates needed to contribute to stable or increasing populations. At finer scales, conservation measures must also address the amounts and distribution of important habitat elements. Specifically, canopy cover and layering, and large trees and their derivatives, large snags and logs, are important habitat elements that influence the distribution, abundance, and availability of California spotted owl prey species. Individual large trees, and often snags, are used as nesting trees by California spotted owls. Spotted owl foraging success is likely to be improved in stands with high tree height diversity, providing perches at varying levels in the canopy.

Environmental Consequences

This analysis considers six primary features of the alternatives which would influence identified risk factors and environmental outcomes for the California spotted owl: (1) Distribution of owl sites among various land allocations, (2) provisions for protection of known or potential nest stands, (3) provisions for habitat abundance at the landscape and home ranges, (4) levels and types of forest management activity, (5) standards and guidelines addressing important elements of habitat quality, and (6) levels of natural disturbance.

1. Distribution of owl sites among land allocations.

A. Proportion of owl sites occurring in land allocations where vegetation treatments are limited.

Each alternative includes one or more large land allocations where vegetation treatments would be limited (in other words, no vegetation treatments could be conducted or treatments would be limited to prescribed burning or light thinning). These allocations include: wilderness areas, old forest emphasis areas, biodiversity reserves, and large unroaded areas. Where California spotted owl activity centers occur within one of these allocations, vegetation treatments are less likely to degrade habitat suitability within and surrounding a given home range area. Opportunities for maintaining and improving old forest habitat conditions for spotted owls are increased. Providing for a portion of the owl population that will be minimally affected by habitat alteration increases confidence for at least two reasons. First, the response of California spotted owls to vegetation treatments remains largely unstudied (Verner et al. 1992). In particular, uncertainty remains regarding how each of the different vegetation management treatments (e.g., mechanical thinning, prescribed fire, CASPO harvest, etc.) affects the distribution, abundance, and availability of prey to California spotted owls. Secondly, trends for increasing amounts of habitat for the northern spotted owl did not show a threshold value above which little or no increase in productivity or survival occurred. This suggests that removing any suitable habitat (50 percent canopy cover or higher) within the vicinity of the nest tends to reduce the productivity and survivorship of owls (Bart 1995). This also suggests that it should not be assumed that habitat in all home ranges can be reduced to a threshold level without adverse effects on the population. The need to maintain and provide for higher than threshold amounts of habitat within some portion of the spotted owl home ranges is apparent in the Sierra Nevada where data indicates that approximately half of the owl home ranges have less than desired amounts of habitat to begin with.

Table 4.4.2.1e displays the percentage of California spotted owl sites (activity centers) that occur in allocations where limited vegetation treatments are allowed under each alternative. In Alternatives 2, 3 5, and 8 more than half the known spotted owl sites occur in these allocations; slightly less than half do in Alternatives 6 and Modified Alternative 8. In Alternatives 1, 4 and 7, less than 5 percent of owl sites occur outside of allocations where vegetation management would be limited to light thinning.

Table 4.4.2.1e. Percentage of California spotted owl activity centers in land allocations where limited vegetation treatments are allowed.

	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7	Alt 8	Mod 8
Percentage of spotted owl sites	4	86	54	4	67	46	4	58	49

B. Effects specific to implementation of the Herger-Feinstein Quincy Library Group Project

Risk and uncertainty associated with implementing vegetation treatments is reduced by including a substantial proportion of the owl population within an old forest allocation where limited treatments would occur. Implementation of Alternative 2 of the HFQLG Project would include a smaller proportion of owl sites in allocations where vegetation treatments are limited. On the Lassen, Plumas and a portion of the Tahoe national forests, treatments would not occur within Rank 4 and 5 Late Successional Old Growth polygons mapped by the Sierra Nevada Ecosystem Project. These polygons are smaller areas of high quality old forest, distributed within larger old forest emphasis areas. As such, they are unlikely to incorporate all habitat used by a number of spotted owl sites, and do not provide the same "buffer" for risk and uncertainty to the owl population as is provided by the larger old forest emphasis areas under Framework alternatives 2, 3, 5, 6, 8, and modified 8,. In the absence of a strategy which provides for a portion of the owl population to be minimally affected by habitat alteration, the effects of implementating the HFQLG Forest Recovery Act is more uncertain.

2. Provisions for protection of known or potential nest stands.

A. Survey Requirements

Survey efforts to inventory California spotted owls throughout the Sierra Nevada are incomplete to date and some unknown number of breeding territories have not been documented. An additional 160-220 territories are estimated on FS lands based on unsurveyed suitable habitat. The likelihood of locating (and subsequently protecting) these additional owl territories is lowest under Alternative 1 since surveys are not required. Under Alternative 1 the number of known owl territories would increase slowly over time as new locations were opportunistically discovered. All action alternatives establish standards requiring owl surveys to protocol for all activities that occur in suitable nesting habitat. The proportion of owl breeding territories and nest stands known and potentially protected would be higher under these alternatives.

B. Proportion of California Spotted Owl Breeding Territories Protected

All alternatives maintain the existing 1050 PACs established through the 1993 Interim Guidelines for the California Spotted Owl and establish PACs for the approximately 260 spotted owl sites within SOHAs. Unlike alternative 1, all of the action alternatives provide protection for owl sites discovered subsequent to 1992. Alternative 1 maintains the existing number and distribution of PACs (those established in 1993 under the Interim Guidelines), but does not require the creation of additional PACs for newly discovered owl sites. Under this alternative, a biological evaluation would evaluate whether a PAC should be created or a new PAC substituted for an existing PAC, but the absence of criteria for making this determination results in uncertainty about the outcome. Given declining population trends, there is greater risk associated with limiting protection to only a subset of known spotted owl nest sites. The potential for increasing nearest neighbor distances between owl sites is greater under Alternative 1, increasing uncertainties associated with effective dispersal and mate-finding. An additional concern is that the existing number of PACs will decline over time as nest stands are lost to wildfire.

The action alternatives all require the establishment of PACs for newly discovered owl sites (including those discovered between 1992 and present). These alternatives would protect known spotted owl nest sites, and allow the creation of additional PACS, offsetting the potential loss of PACS to wildfire.

All action alternatives maintain PACs in the network unless they are rendered unsuitable by wildfire and protocol surveys indicate that they are no longer occupied. This is important given the high temporal variability of California spotted owl reproductive rates. Owl populations may go through periodic declines followed by major breeding pulses. The loss of available nest sites that become unoccupied during periods of decline may preclude population expansion following breeding pulses. This, in turn, may result in declining populations with lower likelihood of persistence over time. The Sierra Sequoia/Kings Canyon study area documented one instance where an owl site remained unoccupied for eleven consecutive breeding seasons prior to becoming reoccupied (Verner, pers. comm., 1999).

C. Size and Configuration of Protected Activity Centers.

The size of PACs and delineation of habitat within PACs is the same across all Alternatives. PACs are 300 acres in size and should consist of the best available habitat, including known and suspected nest stands, in as compact a unit as possible.

A PAC size of 300 acres is based on two criteria provided in the CASPO report that determined that: 1) nest stands plus adjoining suitable nest, and 2) activity centers that encompassed 50% of radio-telemetry locations from owls on the Sierra National Forest, were both approximately 300 acres (Verner et al. 1992:87). Activity centers are areas within which owls find suitable nesting sites and several suitable roost sites, and in which they do a substantial amount of foraging. Uncertainty exists regarding the general adequacy of 300 acre PACs to represent owl activity centers given variation in habitat conditions across the range of the owl in the Sierra Nevada. Radio-telemetry studies conducted on the Lassen National Forest indicated that areas including 50% of foraging location averaged 788 acres (Verner et al. 1992). Subsequent analysis by Bingham and Noon (1997) indicated that core use areas averaged 2,300 acres within individual California spotted owl home ranges on the Lassen National Forest. The degree to which 300 acre PACs will be adequate to maintain owl territories will depend on the distribution and abundance of suitable habitat surrounding PACs. PACs alone are not an adequate conservation strategy for maintaining a viable population of owls. They are important because they do provide protection to nest sites. However, the distribution and abundance of owl habitat around PACs and across the landscape are critical considerations that will determine the ultimate adequacy of a PAC-based conservation strategy for maintaining owl viability in the Sierra Nevada.

Modified alternative 8 does the best job of addressing this issue by applying additional habitat protection measures within a larger home range core area surrounding the PAC within the General Forest allocation (Hunsaker et al., in press). In this alternative, habitat alteration in the general forest is limited within a larger area that is expected to represent the overused portion of the spotted owl's home range (ranging in size from 2,400 acres in the northernmost portion of the Lassen National Forest, to 600 acres in the southern Sierra Nevada). Alternative 2 largely addresses the issue through incorporation of the vast majority of owl sites in biodiversity reserves.

D. Management within Protected Activity Centers.

All Alternatives limit activities within PACs to those designed to improve the suitability or integrity of the PAC. Fuels treatment and vegetation management that can occur within PACs differ between Alternatives. There are two main issues concerning vegetation treatments in PACs. One regards the uncertainty that exists related to the trade-off between treating PACs, with the goal of reducing their susceptibility to stand replacing fires, versus the potential negative effects of treatments on California spotted owl occupancy and habitat quality. It seems reasonable to hypothesize, given historic fire patterns in the Sierra Nevada, that light underburns similar to those likely to have occurred prior to the late 1800s, would not typically result in territory abandonment. However, no studies have been conducted that address the effects of fuels treatments on California spotted owl occupancy, survival, and reproduction in PACs. The second issue regards uncertainty about how different treatments or combinations of treatments affect fire risk and severity within PACs or in areas surrounding PACs. This uncertainty stems from differences in the ability of mechanical thinning and/or prescribed fire to reduce surface fuel loads and subsequent risk of stand-replacing wildfire (Weatherspoon et al. 1992, Van Wagtendonk 1996). Thus, given both types of uncertainty it is difficult to evaluate the consequences of the different proposed treatments in the Alternatives.

Given this scientific uncertainty, all alternatives entail degrees of risk associated with the management of PACs. Alternatives that provide the opportunity to address this uncertainty through the use of formal adaptive management projects to better understand the effects of treating PACs have the potential to advance our scientific knowledge and improve our ability to manage California spotted owl habitat. Uncoordinated efforts to conduct treatments within PACs outside of a formal adaptive management framework would provide only limited opportunity to measure management effects at best and would result in a squandered opportunity to address an important area of scientific uncertainty. Additionally, the rates at which treatments would occur also need to be factored into the assessment. Treating a high proportion of territories without knowledge of how treatments will affect habitat quality nor how they will affect short and long-term fire risk, and without a formal monitoring strategy, entails high risk and uncertainty. Alternatives 2, 4, 5, 6, 7 and 8 require formal adaptive management approaches to assess the effects of treatments on PACs.

Alternative 2 permits no habitat altering activities within PACs unless associated with a formal research project. Only light underburning and hand clearing are permitted in Alternative 5 and Modified Alternative 8, unless associated with a formal research project to assess effects. Thus, these alternatives provide the strongest direction to establish an adaptive management strategy for addressing uncertainty. Alternative 8 permits light underburning and mechanical treatment of trees $\leq$12" dbh, with a BE required to justify management activity within a PAC. Alternatives 1, 3, 4, 6, and 7 permit sufficient fuels treatment in up to 30% of the PAC to meet fuels objectives while attempting to minimize reductions in habitat suitability. Alternatives 1 and 3 do not require establishment of an adaptive management strategy. A greater number of PACs could be expected to be affected annually under Alternatives 1 and 3 relative to the other alternatives. Alternatives 4, 6, 7, 8 and Modified 8 allow treatment in no more than 10% of PACs per decade per National Forest; if Forests plan treatments affecting a greater proportion of PACs, they must occur as part of a formal research study designed to monitor treatment effects. Given the lack of scientific knowledge about treatment effects, it is not possible to evaluate outcomes unless a formal adaptive management strategy is implemented.

Since the primary intent of treatments within PACs is to reduce the risk of loss to high-severity fire, this risk should be weighed against the uncertainty of such treatments. The risk of losing PACs to high-severity fire is uncertain, and likely varied considerably among PACS. The annual rates of loss are about 0.2 percent of the PACs/SOHAs on national forests in the Sierra Nevada over the past 6-years. While the observed rate seems low, six years is a very short period from which to draw inferences.

E. Effects specific to forests implementing the Herger-Feinstein Quincy Library Group Project

Alternative 2 of the HFQLG project would continue to manage existing spotted owl PACs. Lacking requirements to survey for owls or to establish PACs for newly discovered owl sites, however, implementation of HFQLG raises the concern that not all owl sites would receive PAC protection on the Lassen, Plumas, and Tahoe National Forests, as vegetation treatments are implemented over the next 5 years. Over the 5-year timeframe of this project, there would be greater potential for increasing nearest neighbor distances between owl sites on these forests, increasing uncertainties associated with effective dispersal and mate-finding.

3. Provisions for habitat abundance at the landscape and home range scales.

A. Modeled Changes in Habitat Abundance.

Modeled projections of the change in vegetation classes over time can provide a coarse mechanism for evaluating changes to the overall amount of spotted owl habitat under each alternative. Habitat projections in this assessment are limited to projected changes in the total abundance of California spotted owl habitat under the different alternatives across individual national forests or other large areas within the overall range of the owl in the planning area. It is not appropriate to use vegetation projections generated in this assessment at small scales, such as individual home ranges.

Trends are projected for larger landscapes where statistical sampling properties of the basic information layers improve the accuracy of the comparisons. While vegetation estimates are reported for large areas, these estimates are based are stand-level plots. These plots are congruent with how owls might perceive their environment. Thus, a reported increase in average tree diameter or canopy closure can be correctly interpreted to mean that more stands across the reporting unit will have larger trees and higher canopy closure in the future than today. Furthermore, it is expected that California spotted owls will perceive these differences. This does not suggest, however, that every stand everywhere will exhibit meaningful increases, or even that the average tree diameter or canopy closure in every home range will be higher. The end result is individual variations from the central tendency; some smaller areas are expected to be below average and some above. The concern is that some of these below (or above) average areas may be concentrated or connected in various parts of the landscape, leading to a more patchy distribution of habitat than apparent in the aggregate measures. Indeed, the effect of wildfire or spatially concentrated fuel treatments may create this result. This potential is discussed in following sections.

Approximately 84% of 292 California spotted owl nest vegetation plots were classified as CWHR classes 6, 5D, 5M, 4D, and 4M (see Affected Environment). These CWHR types are also rated as providing high and moderate suitability foraging habitat for owls based on the expert opinion habitat relationship models contained in the CWHR database. Thus, available evidence indicates that these CWHR classes provide high and moderate suitability nesting and foraging habitat for California spotted owls. The regionwide overall trends in total projected amounts of nesting and foraging habitat (CWHR classes 4M, 4D, 5M, 5D, 6) suggest slightly increasing trends over the next 50 years across all alternatives (Figure 4.4.2.1b). However, greater changes in the relative differences within each of the five individual CWHR strata are projected to occur over the next 50 years (Table 4.4.2.1f, Figures 4.4.2.1c to 4.4.2.1g). In general, classes 4M and 4D are transitioning into classes 5M and 5D through growth. As a consequence of the general increasing projected trends in CWHR strata 5D, 5M, and 6, the overall habitat suitability for California spotted owls in the Sierra Nevada based on the existing CWHR habitat suitability models exhibit increasing trends across all alternatives (Table 4.4.2.1g, Figure 4.4.2.1h). All of the above projected trends are similar across Alternatives, although the magnitude of the differences among Alternatives is difficult to interpret with confidence due to uncertainty associated with the vegetation information and the assumptions that underpin the modeling process. Greater differences among Alternatives are observed over longer time periods. However, confidence in these longer-term future projections is further lowered due to additional uncertainty regarding future conditions.

Figure 4.4.2.1b. Region-wide projected acres of pooled CWHR classes 4M, 4D, 5M, 5D and 6.

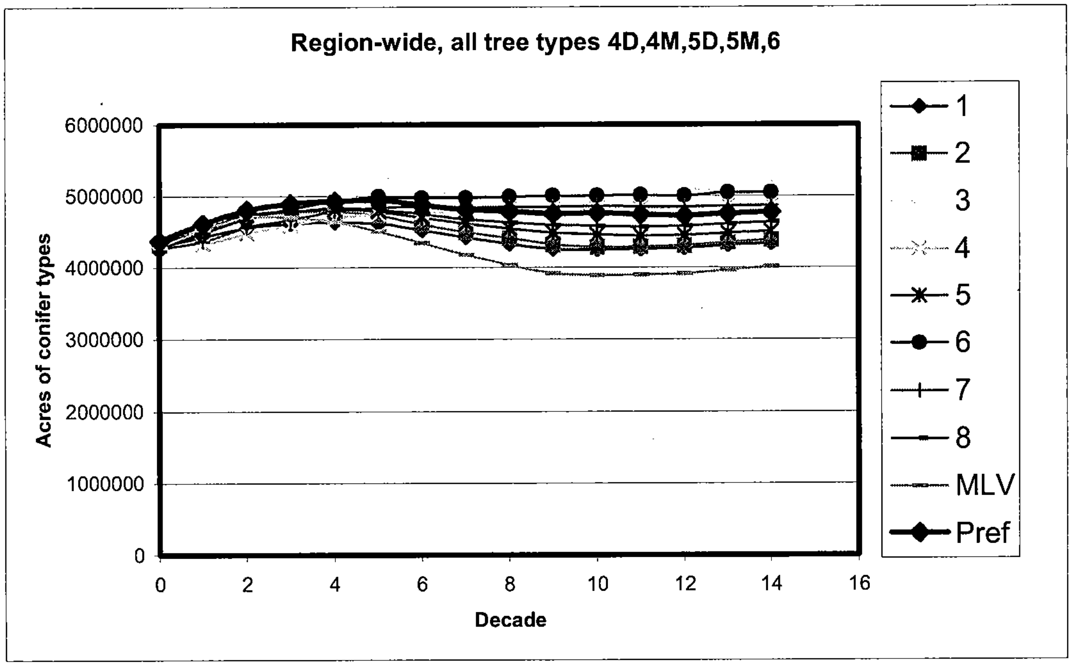


Figure 4.4.2.1c Region-wide projected change in CWHR class 5D.

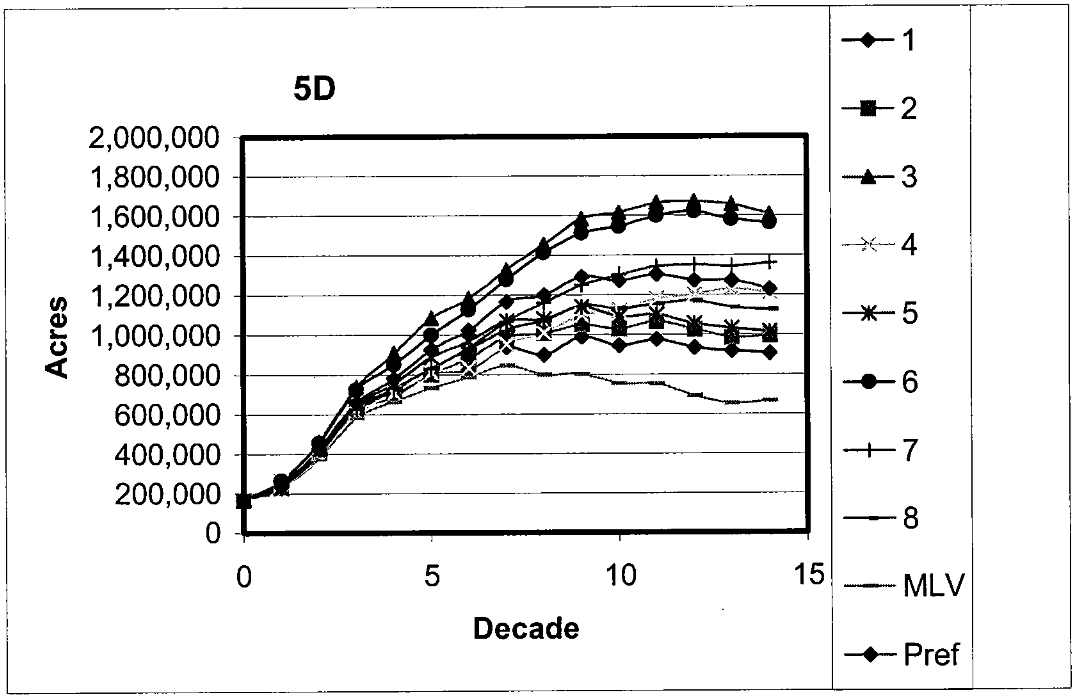


Figure 4.4.2.1d. Region-wide projected change in CWHR class 5M.

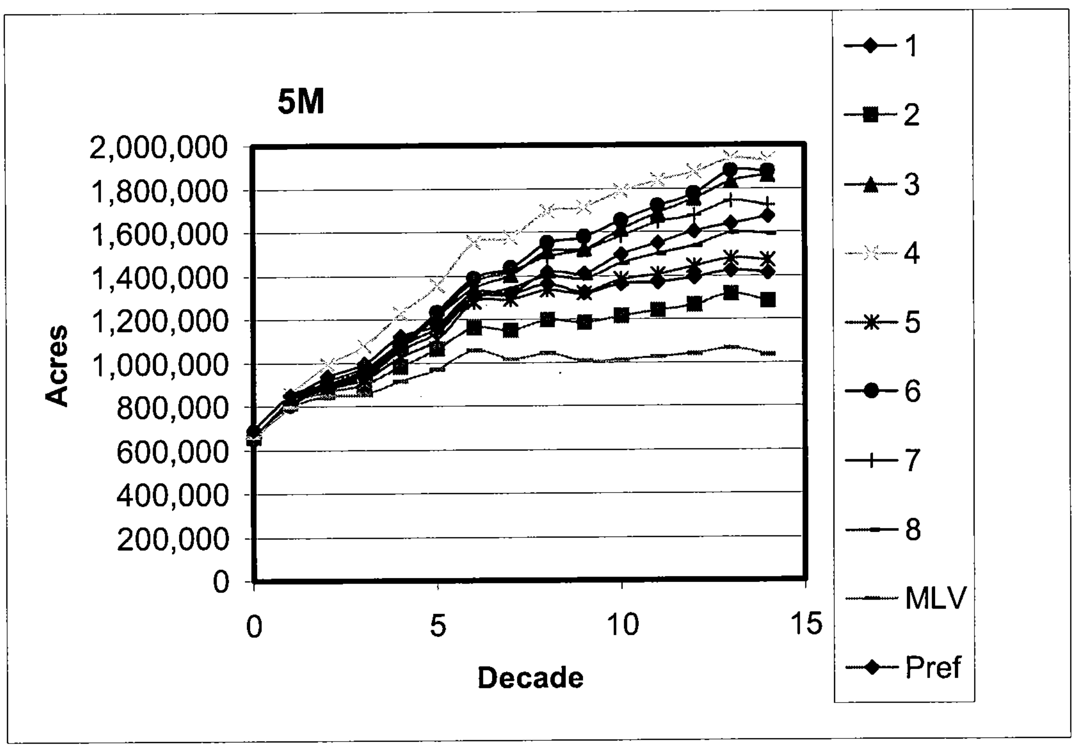


Figure 4.4.2.1e. Region-wide projected change in CWHR class 4D.

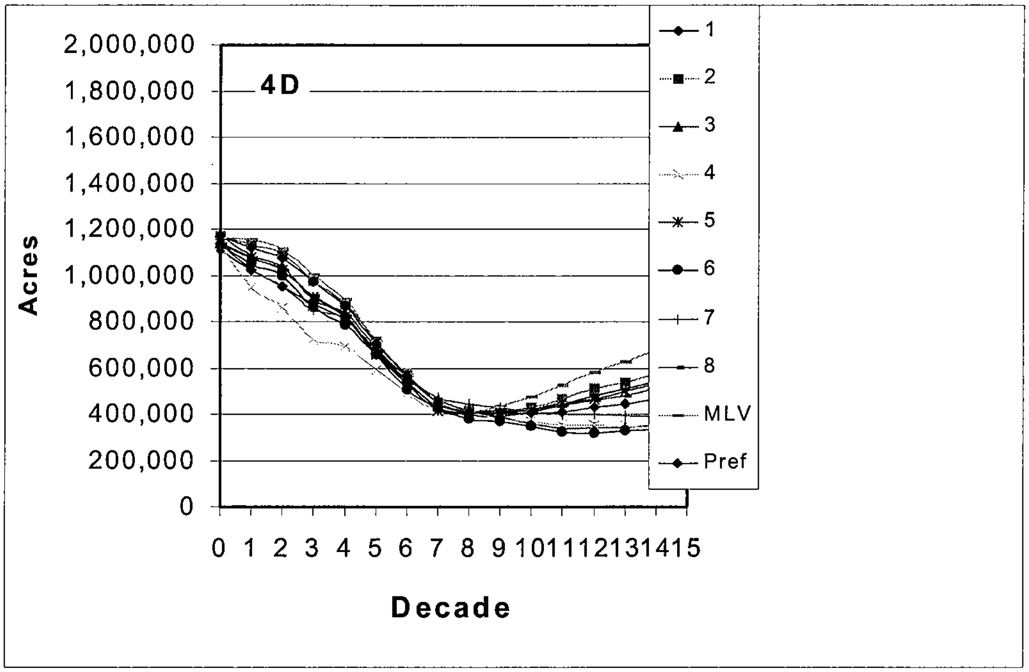


Figure 4.4.2.1f. Region-wide projected change in CWHR class 4M.