California Spotted Owl

California Spotted Owl (*Strix occidentalis occidentalis*)

Management Status

Heritage Status Rank: G3, T3, S3

Federal: Forest Service Sensitive

State: Species of Special Concern

General Distribution

The spotted owl (*Strix occidentalis*) occurs as a resident breeder in western North America from British Columbia south through Washington, Oregon, California, Utah, Colorado, Arizona, New Mexico, and southwest Texas to central Mexico (König and others 1999). The California spotted owl (*S. o. occidentalis*) occurs on the western side of the Sierra Nevada (and very locally on the eastern slope) from the vicinity of Burney, Shasta County south through the southern Cascade Range and Sierra Nevada to Kern County; in the southern part of the Coast Ranges from Monterey County to Santa Barbara County; and in the Transverse and Peninsular Ranges of southern California south to Baja California (Gutiérrez and others 1995, Verner and others 1992).

Distribution in the Planning Area

California spotted owls occur predominately on National Forest System lands in all the major mountain ranges on the four southern California national forests (although some ranges support very few pairs) (Beck and Gould 1992). They are found at elevations from below 1,000 feet (305 meters) along the Monterey coast to approximately 8,500 feet (2,590 meters) in the San Bernardino Mountains (Stephenson 1991). This is a territorial species with large acreage requirements; spotted owls in southern California are clustered in disjunct mountain and foothill areas where suitable habitat exists. Large areas of unsuitable habitat surround these clusters (Stephenson and Calcarone 1999).

Systematics

Xántus de Vesey first described the spotted owl in 1860 from a specimen at Fort Tejon, California (American Ornithologists' Union 1957). There are currently three recognized subspecies of spotted owl: the California spotted owl occurs in the Sierra Nevada, central Coast Ranges, and mountains of southern

California and Baja California; the northern spotted owl, *S. o. caurina*, occurs from southern British Columbia to northern California; and the Mexican spotted owl, *S. o. lucida*, occurs in the mountains and canyons of the southwestern United States south to central Mexico (American Ornithologists' Union 1957, Clements 2000).

The spotted owl is known to hybridize with the barred owl (*Strix varia*) (Hamer and others 1994), and at least one hybrid has paired with a barred owl. One California spotted owl hybrid in the Sierra Nevada has been identified. The extent of hybridization is unknown, but is presumed to be low (Gutiérrez and others 1995).

Natural History

Habitat Requirements

The spotted owl is a forest dwelling owl that is found throughout most forests and deep canyons of the western United States (Gutierrez and others 1995). In southern California, California spotted owls occur within four general but distinct forest types: riparian/hardwood forest, live oak/bigcone Douglas-fir forest, mixed conifer forest, and redwood/California laurel forest (Verner and others 1992). With the exception of redwood forest, which is limited in distribution to the Los Padres National Forest, these forest types generally occur on all four southern California national forests (USDA Forest Service 1994).

The California spotted owl is strongly associated with forests that have a complex multi-layered structure, large-diameter trees, and high canopy closure (Bias and Gutiérrez 1992, Gutiérrez and others 1995). Nest stands often have a well-developed hardwood understory (e.g., canyon live oak [*Quercus chrysolepsis*]) and a conifer overstory. However, some high-elevation territories (above 6,500 feet [1981 meters]) consist primarily or solely of conifers, and some low-elevation territories (below 3,000 feet [915 meters]) are found in pure hardwood stands. Reproductive success and survivorship rates for individual members of the population may differ depending on which habitat type they occupy (Pulliam and others 1992). California spotted owl habitats are consistently characterized by greater structural complexity compared to available forest habitat.

Empirical evidence from the San Bernardino Mountains indicates that spotted owl productivity is significantly higher in lower montane bigcone Douglas-fir/canyon live oak forests than it is in high elevation montane conifer forests (LaHaye and others 1997). These lower elevation habitats are believed to be productive because of high woodrat densities in the surrounding chaparral. They also tend to be below the snowline of most late winter/spring storms, which potentially reduces the impact of such weather events during the breeding season. Large, late-season storms have been shown to have a major effect on northern spotted owl reproductive success in northwestern California (Franklin and others 2000) and appear to have a similar effect on California spotted owls in the Sierra Nevada (Stephenson and Calcarone 1999).

The apparent high quality of low-elevation habitats dominated by live oak and bigcone Douglas-fir may

explain the continued persistence of small spotted owl populations in each southern California mountain range. Maintaining these restricted habitats, which are often narrow stringers of dense, mature forest on north-facing slopes and in deep canyons, should be a high management priority. Such habitats are vulnerable to loss in stand-replacing fires that move in from the surrounding chaparral (Stephenson and Calcarone 1999). LaHaye and others (1997) found that 39 percent of the owls in the San Bernardino Mountains nest in high elevation mixed conifer, 41 percent in oak/bigcone Douglas-fir, and 20 percent in mixed hardwood/conifer habitat. They noted that with increasing urbanization, increased human disturbance in the lower elevation oak/bigcone Douglas-fir habitat will negatively affect what appears to be the most productive segment of the San Bernardino Mountains spotted owl population.

Laymon (1988, cited in Gutiérrez and others 1992) and Steger and Eberlein (pers. comm., cited in Gutiérrez and others 1992) measured winter foraging sites and foraging stand attributes in Sierran foothill riparian/hardwood forests. Point estimates suggest about the same range of values for percent canopy cover as observed in conifer forests at higher elevations. Basal areas of green trees and snags were considerably less, and shrub density was much higher, in the hardwood type than the conifer forest (Gutiérrez and others 1992). Based on Laymon's work and considerable on-site experience with these habitats, Gutiérrez and others (1992) reported that riparian hardwood forests dominated by oaks tended to have less canopy layering than most sites in the Sierran mixed-conifer and ponderosa pine/hardwood types. They found that multiple layers were present in the mixed hardwood forests of southern California, where spotted owls occur in narrow riparian corridors in steep-sided canyons as in the Los Padres National Forest.

Based on review of numerous studies, Gutiérrez and others (1992) made the following estimates of stand attributes that would satisfy the habitat needs of California spotted owls in the Sierra Nevada:

- Percent canopy cover of 70 to 95 percent for nesting and roosting, 50 to 90 percent for foraging.
- Total live tree basal area of 185 to 300 ft^2/acre for nesting and roosting, with 180 to 220 ft^2/acre for foraging.
- Total snag basal area of 20 to 30 ft^2/acre for nesting and roosting and 7 to 17 ft^2/acre for foraging.
- Downed woody debris of 10 to 15 tons/acre for nesting and roosting and the same for foraging.

Gutiérrez and others (1992) believed that relatively small snags have little value for spotted owl habitat. They considered snags at least 15 inches in diameter at breast height (DBH) and 20 feet tall to be near the smaller end of suitability for California spotted owls. They recommended 10 to 15 tons/acre of the largest logs available be retained, and that it is inadvisable to retain logs smaller than 11 inches in diameter to attain this level. They noted that this range is at the low end of the values observed in owl habitats Gutiérrez and others (1992).

The primary constituent elements identified for the Mexican spotted owl, which also occupies scattered mountain ranges, uses a variety of habitats, and consumes a variety of prey similar to the California spotted owl in southern California, were identified as:

- High basal area of large diameter trees.
- Moderate to high canopy closure.
- Wide range of tree sizes suggestive of uneven-aged stands.
- Multi-layered canopy with large overstory trees of various species.
- High snag basal area.
- High volumes of fallen trees and other woody debris.
- High plant richness, including hardwoods.
- Adequate levels of residual plant cover to maintain fruits, seeds, and regeneration to provide for the needs of prey species (U.S. Fish and Wildlife Service 2000).

These attributes may be more similar to those needed by California spotted owls in the mountains of southern California than those for owls in the Sierra Nevada.

Nesting and Roosting Habitat

Nesting and roosting habitat for California spotted owls is characterized by high canopy cover and high total live hardwood, softwood, and snag basal areas. For nesting, woodlands adjacent to cliffs, steep-sided wooded canyons, and shaded ravines are favored (Garrett and Dunn 1981, Grinnell and Miller 1944). California spotted owls nest in tree cavities or abandoned nests of other animals in areas of dense old-growth forest with more than 75 percent canopy closure (Bias and Gutiérrez 1992). Nest trees are very large for the area, averaging 37 inches (0.94 meter) DBH and more than 88 feet (27 meters) tall (Gutiérrez and others 1992). Steger and Eberline (pers. comm., cited in Gutiérrez and others 1992) found nest trees in foothill riparian/hardwood forests averaged 55 feet tall and 30 inches DBH. The minimum mean age of nest trees in the San Bernardino Mountains was 230 years (Gutiérrez and others 1992).

LaHaye and others (1992a) found that mean nest site cover and roost site cover were 76.9 and 83.6 percent, respectively. Nest sites at the highest elevations were in white fir forests in the San Bernardino Mountains, and no nests have been found in subalpine forests anywhere in California (Gutiérrez and others 1992). Nest and roost sites in the San Bernardino Mountains tended to be on steep slopes (means of 51 and 55 percent, respectively) (LaHaye and others 1992a). Roost sites used by California spotted owls reported in various studies were similar in composition to those used for nesting, although less is known about roosting habitat than nesting habitat (Gutiérrez and others 1992). Barrows (1980) found all of his roosting owls at low elevations on north-facing slopes, in habitats where dense-canopied stands selected by the owls would be most often found.

Although California spotted owls on the San Bernardino National Forest are known to occupy several different habitat types, a relatively consistent stand structure was found throughout the national forest in work conducted by LaHaye (reported in Stephenson 1989). Data collected around nest stands in the San Bernardino Mountains showed the following structural elements to be characteristic:

- Canopy closure of at least 60 and commonly greater than 70 percent.

- A mature overstory with average DBH exceeding 24 inches.
- A densely stocked stand with basal areas averaging in excess of 190 ft^2, with none less than 160 ft^2.
- Much of the basal area in the overstory and mid-story, with stands having an average of 10 trees exceeding 26 inches DBH and 29 trees of 16 to 26 inches DBH per acre.
- Multi-layered stands, often having hardwood understories.
- Decadent stands containing large diameter snags, trees with broken tops, diseased trees in which cavities frequently form, and large diameter fallen trees.

These characteristics are most commonly associated with old-aged stands. Stephenson (1989) concluded from this information that management of spotted owl habitat would require deviating from silvicultural prescriptions designed to optimize stand health and vigor; nest stands in owl habitat would need to remain overstocked and decadent in nature.

Foraging Habitat

Attributes of foraging habitats used by California spotted owls have been estimated in only two studies, both conducted in the Sierra Nevada (Call 1990, Laymon 1988). Laymon (1988, cited in Gutiérrez and others 1992) concluded that the majority of spotted owl foraging locations were on sites with medium to large trees greater than 24 inches DBH with canopy closure of 60 to 100 percent. He also reported that owls in his study selected "foraging sites with more and larger snags." Call (1990, cited in Gutiérrez and others 1992) found that spotted owls foraged in areas of large timber (20 to 35 inches DBH) significantly more than expected by a random distribution. The combined results from Laymon and Call's studies suggest that spotted owls in Sierran conifer forests tended to forage in stands of intermediate to older ages (Gutiérrez and others 1992). Percent canopy cover, softwood basal area, total live tree basal area and the amount of large, downed woody debris were generally greater at foraging sites than at random locations. California spotted owls forage in a wider variety of forest types than where they roost and nest, including more open forests with canopy cover as low as 40 percent (Verner and others 1992). As noted above, foraging habitat contains an estimated 7 to 17 ft^2/acre snag basal area (Gutiérrez and others 1992).

Reproduction

California spotted owls are generally solitary except for interactions with their mates (Gutiérrez and others 1995). The nest site is usually a natural tree cavity, broken treetop, or abandoned nest of another large bird species, unlined or composed of material already present. Stick nests predominate in southern California (Gutiérrez and others 1995). Nests are typically 30 to 180 feet (9 to 55 meters) above ground. The breeding season begins in early April and extends through early June. As is true of most owls, there is a strict division of duties: males provide food to the female and young, and females incubate eggs and brood the young. Clutch size ranges from one to three eggs (four-egg clutches are extremely rare), and incubation lasts for approximately 28 to 30 days. The owlets leave the nest at 34 to 36 days and are able to fly about a week later. The fledglings may continue to be fed by the parents for

up to 3 months (Baicich and Harrison 1997, Zeiner and others 1990).

Studies conducted between 1986 and 1994 in the central Sierra Nevada and San Bernardino Mountains showed that 62 percent (n=10-86) of pairs attempted to nest, and 50 percent (n=10-110) of all pairs checked fledged young. The mean number of young produced per pair was estimated to be 0.80 (n=10-110) (Gutiérrez and others 1995). In the San Bernardino Mountains, productivity (mean number of young fledged per successful nest) was significantly higher in oak/bigcone Douglas-fir forest than in mixed conifer or conifer/hardwood forest (LaHaye and others 1997).

Dispersal

Estimates of juvenile survival rates are relatively low (0.296), while those of adults are high (0.747), with no differences detected between sexes (Gutiérrez and others 1995, Noon and McKelvey 1992). Young become independent by late summer and disperse from natal areas in September-October. Of 423 juvenile California spotted owls banded, none had returned to breed on their natal sites (LaHaye and others 2001). They apparently disperse in all directions through their first winter, and may remain in an area several weeks before establishing a territory. A young bird may also choose to stay in another territory (i.e., become a "floater") until the same-sex partner of the resident pair dies, allowing the floater to assume the new territory (Gutiérrez and others 1995).

California spotted owls show strong fidelity to breeding sites and winter home range (Gutiérrez and others 1995). A pair may use the same breeding territory for 5 to 10 years, but may not breed every year (Zeiner and others 1990). LaHaye and others (2001) found mean dispersal distances of 6.2 miles (10.1 km) for males and 7.3 miles (11.7 km) for females in the San Bernardino Mountains. They assumed that some movement between adjacent mountain ranges must occur occasionally, but believed such events are rare and that the extensive environmental changes (e.g., urbanization, habitat conversion for agriculture, water diversion, wind driven electrical power generation, etc.) that have occurred in southern California during the past century may have reduced the rate of intermountain dispersal.

Riparian areas that once existed at lower elevations and were potential dispersal corridors for spotted owls have been degraded by water extraction or lost to channelization during the last century (LaHaye and Gutiérrez *in press*). In addition, many small coast live oak stands have been eliminated or modified by urbanization and are no longer usable by spotted owls. Some of these live oak stands were known to occasionally support nesting pairs and may have served as stepping stones for dispersal among the region’s mountain ranges (LaHaye and Gutiérrez *in press*).

Daily/Seasonal Activity

Spotted owls are mainly nocturnal, sleeping during the day and foraging at night. They tend to be most active two hours after sunset and before sunrise (Gutiérrez and others 1995). Spotted owls behaviorally thermo-regulate through choice of roost locations, tending to roost higher in the forest canopy during winter and lower in summer. They will move short distances during daylight hours to change roosting

location in response to changes either in temperature or in exposure to direct sunlight. California and Mexican spotted owls are less likely than northern spotted owl to vocalize at sunset, early evening, predawn, and dawn (Gutiérrez and others 1995).

California spotted owls are non-migratory in southern California (Gutiérrez and others 1995).

Diet and Foraging

When foraging, spotted owls generally select a perch and wait for prey, starting as early as one hour before sunset. Several foraging sites within the range will be used in a single night. When prey is detected by either sight or sound, the spotted owl pounces on it, capturing it with its talons. The prey is killed immediately on the ground or is carried to a nearby perch before severing the cervical vertebrae with the bill (Gutiérrez and others 1995).

In terms of biomass consumed, the most important prey items of the California spotted owl are dusky-footed woodrat (*Neotoma fuscipes*) and northern flying squirrel (*Glaucomys sabrinas*) (Williams and others 1992). In southern California, woodrats are the primary prey species taken. Other small mammals (including mice and voles), birds, and invertebrates make up the rest of the diet (Gutiérrez and others 1995). In the San Bernardino Mountains from 1987 to 1991, dusky-footed woodrats and Jerusalem crickets were the most frequently consumed taxa (42.2 and 20.7 percent respectively), but dusky-footed woodrats dominated spotted owl diets by biomass (74 percent). Spotted owls consumed primarily mammals by frequency (66.4 percent) and biomass (95.3 percent). Successful nesters consumed a greater percent biomass of woodrats than non-nesters (Smith and others 1999). Gutiérrez and others (1995) recommended that future management of forested habitat promote high woodrat density.

Evergreen or live oaks and other thick leaved shrubs are important habitat components throughout the dusky footed-woodrat range. Woodrats are most numerous where shrub cover is dense. Overhead branches and downed logs often provide woodrats with a means of traveling above ground; this appears to be an important structural component of the habitat for some populations (Williams and others 1992).

Woodrats, pocket gophers, and peromyscid mice are common prey in the range of the Mexican spotted owl (U.S. Fish and Wildlife Service 1995), as they are for the California spotted owl in southern California (Smith and others 1999). The Mexican Spotted Owl Recovery Plan notes that uneven-aged management would likely be used over large areas of the southwest, and it creates groups or clumps of trees (U.S. Fish and Wildlife Service 1995). Mosaics of habitat provide diverse plant communities and other conditions that collectively support a rich diversity of fauna. Habitat mosaics resulting from prescriptions such as single tree or group selection cuts may in some way mimic natural disturbance patterns and create canopy gaps. The Recovery Plan notes that research is needed to determine cause-effect relationships of tree removal on spotted owl prey populations and the mosaic patterns which best conserve spotted owl populations. In the range of the Mexican spotted owl, maintaining a diversity of habitats and prey species is considered important due to fluctuations in prey density from year to year

and within different habitat types (U.S. Fish and Wildlife Service 1995, Chapter 5). Shrub cover and log volume were strongly correlated with brush mouse and Mexican woodrat abundance. Gamble oak density is also greater within habitats of the woodrat and brush mouse than occurs randomly in the forest (U.S. Fish and Wildlife Service 1995).

Fires, shrub removal, logging and other human and natural disturbances generally reduce the suitability of woodrat habitat (Williams and others 1992). However, Williams and others (1992) suggested that in Sierra Nevada forests where woodrats dominate the diet of spotted owls, small-scale logging might benefit spotted owls by enhancing woodrat populations if done in areas adjacent to forest stands where owls are known to forage, although this needs further study. In such cases, woodrats that occasionally wander from their shrubby home ranges into the adjoining forest could become available as prey for spotted owls (Williams and others 1992). Selective cutting of trees that opens the canopy and promotes growth of shrubby understory probably enhances habitat after several years, as do other logging techniques that promote successional stages with a complex mix of over- and understory trees and shrubs (Hooven 1959, cited in Williams and others 1992). Williams and others (1992) note that the short-term effect, however would be to reduce the habitat suitability for woodrats.

Woodrats do not survive fire well, especially very hot burns, and they are slow to recolonize burned areas (Wirtz and others 1988, cited in Williams and others 1992). Williams and others (1992) conclude that aggressive fuels management programs in chaparral can benefit woodrat populations, especially where home ranges of owls in riparian and hardwood forests are closely surrounded by thick stands of chaparral. The same would probably be true for bigcone Douglas-fir stands surrounded by chaparral. Burning under controlled conditions would result in cooler fires with more live and dead vegetation retained. Generally prescribed burns in chaparral are designed to remove 40 to 80 percent of the live canopy.

Territory-Home Range

The California spotted owl is a territorial species with large acreage requirements (Gutiérrez and others 1992). Spotted owls aggressively respond to imitated vocalizations throughout the breeding season; however, territorial disputes between neighbors are rare (Gutiérrez and others 1995). The sizes of home ranges vary widely depending on habitat type, with territories becoming larger at higher elevation, conifer-dominated sites (Stephenson and Calcarone 1999). Home range sizes tend to be larger during the non-breeding season (Zabel and others 1992). Annual home range size estimates in the Sierra Nevada were 1.3 to 9.7 mi^2 (3.3 to 25.2 km^2) (n=15 pairs) and 1.0 to 29.2 mi^2 (2.8 to 75.7 km^2) (n=37 individuals); these estimates were based on radio-telemetry and use of 100 percent minimum convex polygon home-range estimates (Gutiérrez and others 1995).

Based on a study of two owl pairs in mixed conifer forest habitat, Zimmerman and others (2001) estimated that pairs of owls in the San Bernardino Mountains had home ranges of 800 to 2016 acres (325 to 816 ha) during the breeding season. Zabel and others (1992) estimated home range size to be 4,200 acres (1,700 ha) during the breeding period in the Sierran mixed conifer forest and 98 to 243 acres

(40 to 98 ha) for riparian/hardwood forest in southern California. This was the smallest use area reported and was based not on telemetry, but known sizes of small stringers of dense riparian/hardwood forest in the Cleveland, Angeles and Los Padres National Forests. The large differences in home range sizes reported in the literature may be related to differences in the primary prey of the owls in different localities (Williams and others 1992). Consistently, California spotted owls with the smallest observed home ranges prey primarily on woodrats, but those with the largest home ranges specialize on flying squirrels. Woodrat densities generally tend to be much greater than flying squirrel densities, and woodrats weigh nearly twice as much as flying squirrels (Williams and others 1992).

Activity centers are areas within which owls find suitable nesting sites and several suitable roosts, and in which they do a substantial amount of their foraging (Gutiérrez and others 1992). The mean size of nest stands in the Sierra Nevada was 99.9 acres (40.4 ha). The mean size of nest stands and adjoining stands having greater owl use than its availability was 306.7 acres (124.1 ha). These adjoining stands may make important contributions to nest stands because the owls have direct access to them (Gutiérrez and others 1992).

In radio-tracking studies on the Sierra National Forest (Steger pers. observ., cited in Gutiérrez and others 1995), the area that included half of the locations of California spotted owls during the breeding period (an indicator of the area used for foraging around an activity center) averaged 317, 296, and 310 acres (128, 120, and 125 ha) from 1987 to 1989.

Predator-Prey Relations

Predators of California spotted owl include northern goshawk (*Accipiter gentilis*) and great horned owl (*Bubo virginianus*) and potentially include red-tailed hawk (*Buteo jamaicensis*) and Cooper's hawk (*Accipiter cooperii*). These species have been identified as predators of fledged young, dispersing juveniles and, rarely, adults. Common ravens (*Corvus corax*) have been observed preying on spotted owl eggs. Spotted owls react aggressively toward potential predators and are known to call in response to great horned owl calls (Gutiérrez and others 1995).

California spotted owls are mobbed by many species of diurnal birds, such as Allen's hummingbird (*Selasphorus sasin*), Anna's hummingbird (*Calypte anna*), pileated (*Dryocopus pileatus*) and acorn (*Melanerpes formicivorus*) woodpeckers, American robin (*Turdus migratorius*), Steller's jay (*Cyanositta stelleri*), and solitary vireo (*Vireo solitarius*) (Gutiérrez and others 1995).

Population and/or Habitat Status and Trends

California spotted owls in southern California are believed to function as a metapopulation, with separate subpopulations connected by infrequent but persistent interchange of individual owls (LaHaye and others 1994, Noon and McKelvey 1992). The largest subpopulation is the 200-plus territories in the adjacent San Bernardino and San Gabriel Mountains. Although Cajon Pass separates these two mountain ranges, there is not a major habitat discontinuity, and only 6 miles separate the easternmost

San Gabriel territory from the westernmost San Bernardino territory. Noon and McKelvey (1992) stressed the importance of this large subpopulation as a likely source area that provides immigrants to sustain the surrounding smaller, isolated subpopulations. However, the simulation modeling results of LaHaye and others (1994) found the southern California spotted owl metapopulation's stability to be insensitive to rates of dispersal between mountain ranges, suggesting that the subpopulations could be considered effectively isolated.

As of 1992, there were an estimated 578 verified and potential owl sites in the mountains of southern California, with individual subpopulations ranging in size from 250 in the San Bernardino Mountains to 12 in the Santa Ana Mountains (Beck and Gould 1992). Two populations in southern California, including the largest population in the area (San Bernardino Mountains), showed significant declining trends based on estimates of demographic parameters (Gutiérrez and others 1995; LaHaye and others 1992b, 1994).

A recently completed report on California spotted owl population dynamics (Franklin and others 2003) concluded that the population trend data for the entire range of the California spotted owl is inconclusive, and statistical trends do not indicate a decline in the overall California spotted owl population. However, they felt that concern may still be warranted for the San Bernardino population, based on results of the analysis, and recommend reinstating the San Bernardino demography study.

LaHaye (pers. comm.) believes the general population trend for California spotted owls in the San Bernardino Mountains to be downward. His records indicate the population was declining through 1998, and with five dry years following including some of the driest on record, the situation is likely not improving. LaHaye and others (1994) predicted a high risk of the southern California metapopulation going extinct in the next 30 to 40 years. If the observed decline was due to drought, and thus temporary, the model used indicated a substantial decline but low probability of total population extinction. Precipitation's effect on primary productivity and thus prey densities could be an important determinant of California spotted owl population growth rates.

Surveys conducted by LaHaye (2004) in the spring and summer of 2003 found spotted owl occupancy rates in the San Bernardino and San Jacinto Mountains to be relatively low. Occupancy rate of surveyed territories in the San Bernardino Mountains (n=63) was about 50 percent, and it was only 20 percent in the San Jacinto Mountains (n=13). Occupancy of such a low number of sites in the San Jacinto Mountains creates a chance that California spotted owls could disappear from the mountain range, requiring recolonization from adjacent mountain ranges to reestablish the population. However, movement of spotted owls between mountain ranges in southern California appears to be low (LaHaye and others 2001). Spotted owl reproduction was low in the San Bernardino Mountains and zero in the surveyed territories in the San Jacinto Mountains during 2003. This may be linked to the series of dry winters southern California has experienced during the past five years (LaHaye 2004).

Recent high levels of tree mortality in the conifer forests of the San Bernardino and San Jacinto Mountains create significant concern for the San Bernardino National Forest population of spotted owls

(LaHaye pers. comm.). At this time it is unknown what impact the large scale die-off of conifer trees will have on California spotted owls. Because the San Bernardino-San Gabriel Mountains owl population is the largest in southern California and a potential source of dispersal animals to other mountain ranges, any decline in California spotted owl population related to forest mortality there could have repercussions in the rest of the area.

Threats

California spotted owls face a wide range of threats in southern California. These include unnatural fuel build-up, resulting from fire suppression, and consequent wildland fire; fuels management activities such as thinning, mortality removal, and prescribed fire; woodcutting for fuelwood, sawlogs, hazard tree removal, and postfire salvage; water diversion and groundwater extraction; tree mortality due to forest pests and diseases; drought; air pollution; forest fragmentation due to land ownership patterns; mining activities; and human disturbance related to special uses, roads, and recreation. These threats are discussed in more detail below.

Wildfire is considered to be the primary risk factor to California spotted owl habitat and population persistence. Due to a disruption of natural fire cycles, many of the forests occupied by spotted owls have become overstocked with trees and are now primed for catastrophic fire, including those of southern California (Arno and Allison-Bunnel 2002, Minnich and others 1995). Owl sites are threatened by the buildup of fuels and vegetative composition and structure changes that have occurred as a result of fire suppression. The natural role of fire in southern California mixed conifer forests is believed to be similar to that of the Sierra Nevada, with slightly longer historic mean fire intervals explained by a lower incidence of lightning and smaller contiguous areas of forest vegetation (Weatherspoon and others 1992). The presettlement fire regime was typified by frequent low to moderate severity fires which burned over long periods under a variety of fuel and weather conditions (Minnich 1988). McBride and Laven (1976) estimated the fire return interval in mixed conifer forests to be 10 to 30 years in the San Bernardino Mountains prior to European settlement. Everett (2003) estimated the fire return interval to be 33 years in a mixed conifer forest in the San Jacinto Mountains and 50 years in a drier Jeffrey pine forest in the San Bernardino Mountains prior to effective fire suppression (around 1900).

Fire suppression has reduced the number of large fires in southern California mixed conifer forests. An estimated 66 percent of the montane conifer forest habitat has not burned in the last 90 years (Stephenson and Calcarone 1999). As a result, shade tolerant and fire sensitive tree species, especially white fir, have increased dramatically in abundance, especially in the small to medium size classes (Weatherspoon and others 1992). In the early 1930s, mixed ponderosa pine stands in the San Bernardino Mountains contained an average of 60 trees per acre (144 trees $ha^{?1}$) larger than 4 inches (12 cm) diameter at breast height; in 1992 those same stands contained 100 trees per acre (250 ha^{-1}) (Minnich and others 1995). Most of the increased density was due to small ponderosa pines and especially white fir and incense cedar (Minnich and others 1995). In addition, fuels on the forest floor, including coarse woody debris, have accumulated far beyond their pre-European levels with fire suppression. The increased prevalence of white fir in the understory has created hazardous fuel ladders

linking surface fuels to the upper canopy layers (Weatherspoon and others 1992). Stephenson and Calcarone (1999) predicted that 30 percent of mixed conifer and pine stands in the mountains of southern California were at risk of stand densification, and consequent increased crown fire threat, due to fire suppression.

In 2003, wildfires substantially reduced the overstory canopy in approximately 14 spotted owl territories in the San Bernardino Mountains and 5 in the San Diego Ranges. In 2002 and 2003, an estimated nine territories were seriously affected by wildfires in the San Gabriel Mountains. During the last 10 years, another 10 territories in the San Bernardino and San Jacinto Mountains are thought to have had habitat quality substantially reduced by wildfires (LaHaye 2004, Loe pers. comm.).

Plans are being developed to greatly accelerate treatment of fuels in southern California as part of the National Fire Plan and The Healthy Forest Restoration Act of 2003. Focus of this work will be primarily on protection of communities, with some work designed to protect critical natural resources such as water supplies and threatened, endangered and sensitive species habitat. This work is planned both in chaparral and in forests and woodlands. At this time it is unknown whether thinning forests and woodlands and removing dead trees and down woody material will result in reduced habitat suitability for California spotted owls. There is also concern that prescribed fires used to reduce fuels could destroy owl habitat if fires escape control.

The potential for loss of large patches of occupied habitat in a single, catastrophic fire event is the primary threat to California spotted owls that can be addressed through management. Two major issues arise concerning vegetation treatments in and around spotted owl nest stands. One, as noted above, is the uncertainty that exists regarding the trade-off between treating owl habitat, with the goal of reducing its susceptibility to stand-replacing fire, versus the potential negative effects of treatments on California spotted owl occupancy and habitat quality. It seems reasonable to hypothesize that light to moderate severity fires, similar to those likely to have occurred prior to the late 1800s, would not typically result in territory abandonment by spotted owls. Bond and others (2002) evaluated the effects of wildland fire on short-term spotted owl survival, site fidelity, mate fidelity, and reproductive success. Based on their results, they concluded that prescribed burning could be an effective tool in restoring habitat to natural conditions with minimal short-term impact on resident owls. However, no studies have been conducted that specifically address the effects of fuels treatment on California spotted owl occupancy, survival, and reproduction in southern California.

The second issue is uncertainty about how different treatments or combinations of treatments would affect fire risk and severity within California spotted owl protected activity centers (PACs – 300 acre owl territory core areas defined below under Conservation Considerations) or in areas surrounding PACs. This uncertainty stems from differences in the ability of mechanical thinning and prescribed fire to reduce surface fuel loads and the subsequent risk of stand-replacing wildland fire. Given both types of uncertainty, it is difficult to evaluate the potential benefits and consequences of the different proposed treatments or lack of treatment (USDA Forest Service 2001).

Weatherspoon and others (1992) recommended prescribed burning as the most appropriate fuel reduction method in spotted owl roosting and nesting habitat. Outside of PACs, they recommended a combination of understory thinning and mechanical treatment of fuels prior to burning if needed to insure that fire intensities remain within an acceptable range. In many cases California spotted owls occur in canyons and north-facing slopes in the mixed conifer zone, areas that burn less frequently than south-facing slopes (Weatherspoon and others 1992). These areas may not be as far outside the natural range of variability, in terms of forest density and understory fuel load, as are drier south-facing slopes and flats. Therefore, it may not be as important to treat PACs in these areas right away, but instead to wait until research and monitoring of spotted owls in the Sierra Nevada and owls affected by wildland fire and essential treatment of PACs in Wildland/Urban Interface (WUI) Defense zones is done for this planning period (LaHaye pers. comm., Stephenson pers. comm.). Treatments should focus first on south-facing slopes and ridges surrounding or adjoining nesting and roosting areas; spring burning is recommended to reduce consumption of duff and large woody fuels while still treating litter and small woody debris (Weatherspoon and other 1992).

Weatherspoon and others (1992) do not recommend prescribed burning within live oak/bigcone Douglas-fir stands that are home to California spotted owls. They note that this vegetation will probably not support stand-destroying crown fire except under extreme burning conditions, during which the results of prescribed fire or other surface fuel reduction will make little difference in fire behavior. A better strategy to protect live oak/bigcone Douglas-fir stands may be to concentrate prescribed burning in chaparral near these stands. Highest priority should be given to older chaparral with high dead-to-live fuel ratios, which would support more intense wildland fires and thus be more likely to carry a crown fire into adjacent trees. Similarly, high priority should be given to chaparral near live oak/bigcone Douglas-fir stands that have more continuous surface fuels and those stands on gentle to moderate slopes (as opposed to very steep, broken slopes and canyons). Movement of fire into these stands should be minimal if prescribed burns are planned for moderate burning conditions and in such a way that slope and wind direction favor movement of the fire away from the live oak/bigcone Douglas-fir stand. Prescribed burning of older chaparral should improve owl foraging habitat because of increased production of woodrats (more succulent and nutritious foliage in the new growth) and improved access to the woodrats for owls (Weatherspoon and others 1992).

Accumulations of dead and downed woody fuels are generally low in southern California riparian/ hardwood stands (Weatherspoon and others 1992), making this type of spotted owl habitat less prone to catastrophic fire. Fire behavior depends on understory composition, which can be variable. Areas with a grass understory burn rapidly with low to moderate intensities. Effects are generally benign. Stands with a shrub understory show great variability in fire behavior and effects, depending on species composition and abundance of shrubs. Management of spotted owl habitat in riparian/hardwood stands should focus on maintaining a closed canopy of trees. In some stands, prescribed burning or other fuels treatment may be needed to prevent overstory mortality from wildfire. Fire also may be necessary in some situations to regenerate overstory trees, such as oaks.

Commercial harvest of timber has not been a big program in southern California. However, salvage logging, primarily for fuels reduction in the wake of drought, insect and disease outbreaks, wildfire or

out-of-prescription burning and for hazard tree removal, does take place. Salvage logging has increased substantially with the recent tree mortality in the San Bernardino and San Jacinto Mountains and the San Diego Ranges. Sanitation salvage (focusing on the removal of large old trees) was still being practiced on the San Bernardino National Forest as late as the 1980s. This long-term practice has resulted in easily-accessible areas having fewer large trees, which are important to California spotted owls, than naturally occurred.

The majority of the large trees that are currently removed from the southern California national forests are dead trees taken out for fuel reduction or as hazard trees. Some logging still occurs on private land under a State Timber Harvest Plan. This activity has increased significantly with the recent drought and pest-related mortality. In general these logging operations have consisted primarily of thinning, but have included a number of large trees to make treatment economical. Fuelwood harvest of small diameter live trees and dead trees continues to take place in the southern California Forests. A problem exists with illegal fuelwood cutters removing trees in nest stands at times (night, weekends) when Forest Service law enforcement personnel are not working.

Insects and disease have always been a mortality factor in the forests and woodlands of southern California. Long-term stand densification and recent extreme drought have greatly increased tree mortality related to forest pests, particularly in the San Bernardino, San Jacinto, and San Diego ranges. This could cause a substantial reduction in the extent of suitable spotted owl habitat and lead to a permanent reduction of spotted owl numbers regionally (LaHaye 2004). The drought could also be seriously affecting the prey base, and this could account for reduced owl productivity (LaHaye pers. comm.). The San Bernardino National Forest recently experienced the worst drought period in over 150 years (Loe pers. comm.). Huge acreages of live oak died back, and in many areas greater than 60 percent tree mortality has occurred in the conifer zone (Sommers pers. comm.).

The Healthy Forest Management Act of 2003 directs the Secretary of Agriculture to reduce wildfire risk to communities. To do so will, in some cases, result in habitat modification to the extent that treated areas may no longer support California spotted owls. A simple habitat model, developed as part of the southern California forest plan revision process and based on definitions of high value California spotted owl habitat described below (table 1), predicted that up to 86 of a total 345 historic spotted owl PACs on the national forests would be potentially affected by intensive fuels treatments in WUI Defense zones. The model predicts that up 12 precent of the acres in those 86 PACs would fall within the maximum 1,200 foot WUI Defense zone width; about 4 percent would be within 300 feet of communities where treatments would be most intense. Most of the potentially-affected PACs are on the San Bernardino National Forest, near mountain communities in the San Bernardino and San Jacinto Mountains, but they also include non-forested PACs elsewhere.

Sudden Oak Death, caused by the recently-discovered fungus *Phytophthora ramorum*, has the potential to alter California spotted owl habitat by reducing populations of oak trees. At present the disease occurs in the wild only in coastal counties in northern and central California, south through Monterey County almost to the San Luis Obispo County border (California Oak Mortality Task Force 2004). Tanoak (*Lithocarpus densiflorus*) and several oak (*Quercus*) species are most susceptible to the

pathogen and may be killed by it. However, a growing number of other species have been found to harbor the disease without dying, including many native shrubs and trees as well as nonnative horticultural plants (California Oak Mortality Task Force 2004). Patches of dead oaks and tanoaks occur on the Los Padres National Forest in Monterey County, though mortality is not yet widespread. In April 2004 nursery stock infected with *Phytophthora ramorum* was found in Monrovia, near Los Angeles, creating potential for the disease to spread to wildland plants far south of its current range. Two fungicides have been approved by the California Department of Pesticide Regulation (DPR) to treat individual oak and tanoak trees at high-risk of contracting *Phytophthora ramorum* (California Oak Mortality Task Force 2004). This disease has the potential to sharply reduce tree canopy in oak woodlands that provide productive habitat for California spotted owls. The seriousness and eventual extent of the threat posed by Sudden Oak Death to spotted owl habitat in southern California cannot be predicted reliably at this time.

The impacts of air pollution on spotted owls are not known, but birds are more directly susceptible to pollution than other taxa, which may be a problem for owls in southern California (LaHaye pers. comm.). Air pollution may also affect owls indirectly via effects on their prey and habitat.

Water diversions have significantly altered numerous drainages in southern California, reducing the extent and vigor of riparian forests upon which spotted owls depend. Some major riparian areas have been totally dewatered by past diversions for power generation or irrigation. Many of these diversions now divert water for downstream domestic purposes. The national forests still get applications for new diversions and wells, and they work with the state and local governments to control new diversions and wells that would adversely affect downstream riparian habitat on the national forests.

A substantial amount of private forest land has been and could still be developed in the mountains of southern California. The national forests have an active land acquisition program in place, but with the recent real estate boom, private forested habitat is rapidly being developed. Developed areas seem to be generally avoided by nesting California spotted owls, as evidenced by the location of nests and activity centers (Loe pers. comm.). Continuing development of private lands will result in further fragmentation of spotted owl habitat.

Several California spotted owl territories are located in the carbonate mining areas on the north side of the San Bernardino Mountains. The biggest threat to owls from mining is the impact to streams and riparian areas in steep canyons from side-casting off of mining access roads. Improved administration and cooperation from large mining companies has resulted in much better protection of these areas.

Human activity within spotted owl habitat can lead to direct habitat loss, noise, and disturbance. Recreation residence cabins and developed recreation sites represent a loss of natural habitat. These areas are also continuing sources of noise and human and companion animal presence when they occur near spotted owl nest stands or roosts. Use of recreation residences and developed sites tends to be concentrated in the summer months, which overlaps the nesting season for California spotted owls. Ski area development eliminated spotted owl habitat in the past, and expansion of existing areas would

further reduce it, as ski areas in the San Bernardino and San Gabriel Mountains are all located on north-facing slopes preferred by California spotted owls. Special uses of the national forests that require vegetation modification, such as communication sites or utility corridors, also contribute to loss of spotted owl habitat.

Dispersed recreation within spotted owl habitat can cause noise and disturbance to nesting owls. Shooting may result in direct mortality as well. Use and maintenance of roads, off-highway vehicle (OHV) trails, and hiking trails may disturb spotted owls, especially during the nesting season. Mexican spotted owls flushed from their daytime roosts when approached by hikers within 29 feet (12 m) for juveniles or 79 feet (24 m) for adults (Swarthout and Steidl 2001), leading to the recommendation that a buffer be placed around nesting and roosting stands of at least 29 feet (12 m). Female Mexican spotted owls were observed to change their behavior in response to frequent presence of hikers near their nests in another study (Swarthout and Steidl 2003), decreasing the amount of time spent handling prey and doing maintenance activities in and near the nest. California spotted owls may respond similarly to disturbance, suggesting that the presence of large numbers of hikers or other recreationists could reduce nesting success of owl pairs located in easily accessible areas.

Conservation Considerations

A conservation strategy for the California spotted owl on the four southern California national forests was completed in 2004. In accordance with the strategy, the following list of conservation practices should be considered for the California spotted owl:

- Maintain or enhance habitat conditions in all territories. All spotted owl territories identified in the statewide Fish and Game database (numbered owl sites) and new sites that meet the State criteria (see below) should be protected from habitat degradation and loss to the greatest extent practicable while protecting life and property.
    - Territories are defined by the presence of an active nest with a breeding pair of owls, a non-nesting pair, or a territorial single owl. Observation of young owls is sufficient to indicate the presence of a breeding pair, even if the parents are not observed.
    - The criteria that the State of California uses to identify territories are 1) a territorial defense response to a human or taped call, indicating that an owl is defending the area, and 2) that the territory is a mile from the next nearest territory, unless information exists to suggest a separate defended territory is present closer than one mile. The San Bernardino National Forest has some very densely packed territories (6 or 8) that are spaced within 1/2 mile of each other, and they were occupied at the same time that adjacent sites were occupied. Gordon Gould, Spotted Owl Database Administrator for the California Department of Fish and Game (CDFG), has assigned them separate site numbers. Because territory sites are known to have been reoccupied after being abandoned for several years, sites need not be occupied every year to remain in the database. Areas may be occupied only once in a 5-10 year period, but still may be important to long-term survival of owl populations.
- In areas without good surveys, all suitable habitat of moderate habitat value and above (see table

1) should be protected from degradation or loss. In areas that have been surveyed thoroughly (e. g., San Bernardino Mountains) the national forests can protect known territories. In areas that have not been thoroughly surveyed, such as more remote portions of the Los Padres National Forest, suitable habitat should be protected even if occupancy has not been documented. In the absence of good data, all suitable habitat is considered occupied and important. Inventories should be conducted before implementing any management action that will alter habitat structure.

- Delineate and focus protection on spotted owl management areas of up to 600 acres, each comprised of a Home Range Core (HRC) containing a Protected Activity Center (PAC) and Nest Stand. Identify PACs, HRCs and Nest Stands according to the guidance below:
    - Rank suitable habitat value according to Table 1. Table 1 is based largely on a table in John Stephenson's draft Masters Thesis (unpublished), modified through discussion with spotted owl experts and local Forest Service biologists.

Table 1. Habitat categories organized in terms of relative value as California spotted owl habitat.

Habitat Value Rating	**Vegetation Type and Canopy Cover Class**
Highest Habitat Value	Bigcone Douglas-fir/canyon live oak or live oak/riparian forest with 70 to 100 percent canopy cover; coast or canyon live oak forest with 80 to 100 percent canopy cover.
High Habitat Value	Mixed conifer, ponderosa or Jeffrey pine forest with 70 to 100 percent canopy cover; Coulter or gray pine forest with 80 to 100 percent canopy cover; bigcone Douglas-fir or live oak/riparian forest with 60 to 70 percent canopy cover.
Moderate Habitat Value	Mixed conifer forest with 50 to 70 percent canopy cover; Jeffrey or ponderosa pine forest with 60 to 70 percent canopy closure; bigcone Douglas-fir/canyon live oak or live oak/riparian forest with 40 to 60 percent canopy cover; black oak forest with greater than 60 percent canopy closure.
Low Habitat Value	Mixed conifer forest with less than 50 percent canopy cover; bigcone Douglas-fir/canyon live oak woodland with less than 40 percent canopy cover; Jeffery or ponderosa pine forest with less than 60 percent canopy cover; Coulter, knobcone, or gray pine forest with less than 80 percent canopy cover; black oak woodland with less than 60 percent canopy closure.
Suitable Dispersal Habitat	Pinyon pine woodland; subalpine conifer forest; oak savanna; urban areas with mature landscaping

Poor Dispersal Habitat	Desert scrub; agricultural lands (croplands or orchards); urban areas; chaparral; coastal scrub; grassland; water bodies (lakes or ocean)

- Identify a PAC by selecting the first 300 acres of most highly ranked habitat containing, or adjacent to, the nest or territory center (as delineated in the California Department of Fish and Game owl territory database or determined on the ground via surveys) within a 1.5 mile radius of the known nesting site or territory center. Identify a HRC, which includes the PAC, by adding to the PAC the next 300 acres of most highly ranked habitat within the same radius. Existing territory maps should be used as a starting point where available (e.g., San Bernardino National Forest). The entire 1.5-mile radius circle is termed the Home Range and encompasses approximately 4,400 acres.
- The Nest Stand is the best 30 to 60 acres of contiguous forested habitat around the nest tree. If the territory includes more than one nest tree, the Nest Stand should encompass all of the known nest trees. For many territories, the nest stand may be linear, rather than a rounded polygon, especially where the territory follows drainages or riparian areas.
- When delineating PACs and HRCs, consider topography and proximity to the nest stand. California spotted owl home ranges and territories appear to be significantly smaller in bigcone Douglas-fir/canyon live oak stands and riparian woodlands. Territories and home ranges in these vegetation types may consist of long linear stringers of habitat along drainages and in adjacent drainages. These factors may override the strict habitat value ratings in delineating PACs and HRCs.
- As general guidance, take the best available habitat within close proximity to the nest stand. For PACs, the best contiguous habitat around the nest, or if no nest is site is known, areas where the owls have most often been observed, should be selected rather than scattered pieces of the best habitat. Highly rated habitat on the edge of the Home Range is probably not as important to the owl as lower rated habitat near the nest. The remaining 300 acres of suitable habitat (HRC) should be identified within the 4,400 acre circular home range. These areas need not be contiguous, but must be provided in "habitat blocks" of at least 30 acres each, which are well distributed around the PAC or core area (Stephenson 1989).

- Suitable habitat on steep slopes or in drainages should be included in PACs and HRCs when possible. If suitable slopes and drainages are extensive, well distributed, and include the nest and areas where the owls have been most often observed, then the entire 600-acre owl management area may be placed in these habitats.
- Where 600 acres of suitable nesting and roosting habitat does not exist within the 4,400-acre circle, the emphasis should be on finding 300 acres for a PAC. The remaining 300 acres should be selected from areas that are capable of becoming suitable in the shortest time. Opportunities to accelerate development of suitable habitat in HRC areas should be pursued where appropriate. Thinning of dense understory growth could be a useful tool for hastening the development of large diameter trees.
- In some areas, spotted owls occupy riparian corridors which are surrounded by slopes

vegetated by chaparral or pinyon/juniper stands. In these areas, it is evident that riparian corridors are the only sites that provide suitable nesting and roosting habitat. If all available riparian corridor habitat within a radius of 1.5 miles of the nest site is identified as spotted owl habitat and the 600 acre requirement is still not met, then 600 acres of habitat need not be required. The 30-acre minimum block size requirement also need not be adhered to in these cases (Stephenson 1989).

- PACs are maintained regardless of California spotted owl occupancy status. However, after a stand-replacing event, evaluate habitat conditions within a 1.5-mile radius around the activity center to identify opportunities for re-mapping the PAC. If there is insufficient suitable habitat for designating a PAC within the 1.5-mile radius, the PAC may be removed from the network.

- Create a map and database of all PACs and HRCs on each southern California National Forest. Update the maps and databases regularly as presence/absence surveys are conducted, projects are implemented, and/or stand conditions change.
- Where nest locations or activity centers have not yet been identified, conduct surveys in suitable habitat and map PACs and HRCs as soon as possible.
- Maintain a limited operating period (LOP) prohibiting activities within approximately ¼ mile of the nest site, or activity center where nest site is unknown, during the breeding season (February 1 through August 15) unless surveys confirm that California spotted owls are not nesting. The LOP does not apply to existing road and trail use and maintenance or continuing recreation use, except where analysis of proposed projects or activities suggests that either existing or proposed activities are likely to result in nest disturbance. When evaluating the need to implement a limited operating period, the following site- and project- specific factors need to be considered (USDA Forest Service 1994):
  - Proximity of activity (Does the activity occur within 0.25 mile of known or suspected activity center).
  - Duration of the activity (How long will the activity occur).
  - Timing of the activity (When in the year does the activity occur? What time of day [daytime versus nighttime] does the activity occur?)
  - Type of activity (Does the activity result in human intrusion or produce loud noises which may influence the behavior of the owl?)
  - Intensity of the activity (Does the activity result in noise levels which exceed ambient levels of the area?)
  - Status of the owl (Is the site occupied by a nesting pair? Pair? Single? Did the owls attempt to nest but failed?)
  - Physiographic feature (Given the location of the proposed project and owl activity center, does the landscape [e.g., ridges] and vegetation provide screens or barriers to disturbance likely to result from the activity?)
- Protection of owl habitat cannot be viewed as prohibiting any treatment in many cases. Excessive fuels conditions threaten communities and owl and other imperiled species habitat. In order provide flexibility for treating fuels in high mortality areas adjacent to communities, these guidelines provide for excluding treatment where possible in the best 30-60 acre nest stand only, in hopes that the owls can continue to reproduce even though the PAC is treated. This approach

is based on direction in the Mexican Spotted Owl Recovery Plan and on recommendations by California spotted owl expert William LaHaye.

- Manage habitat for California spotted owls through indirect fuels management rather than direct treatment of PACs where stand conditions within PACs do not include unacceptably high accumulation of fuels. A biologist will consult with a fuels management specialist and a silviculturalist to determine treatment needs and prescriptions.
- When planning community protection projects, evaluate the potential to protect or enhance owl habitat as a part of the project.
- Strive to develop landscape features, or enhance existing features, to use prescribed fire and effectively manage wildland fires in a manner that will maintain or improve habitat conditions.
- When planning for treatments in owl habitat, priority should be given to areas that support a concentration of PACs or to PACs on the edges of mountain ranges, because of their importance as source populations for adjacent mountain ranges. Within these priority areas, mitigate stand and fuel conditions that threaten long-term maintenance of California spotted owl habitat.
- Limit fuels treatments within PACs to no more than 5 percent of the PAC acreage in a given mountain range per year and 25 percent of the mountain range PAC acreage per decade. This limitation is designed to prevent the widespread application of a treatment that is not effective or does not work as planned.
- Monitor spotted owl occupancy and productivity where vegetation and fuels management are taking place to see if protection measures are working and to assess whether spotted owls are adversely affected by changes in stand structure. Consider monitoring untreated sites as well to elucidate cause and effect. Monitor as soon as projects are planned and continue for a minimum of two years after treatment.
- Adhere to regional direction for annosus root disease prevention when conducting fuels treatment projects.
- Vegetation treatments in PACs and HRCs should be designed with the primary goal of improving spotted owl habitat. A wildlife biologist, silviculturalist and fuels management specialist should jointly develop prescriptions.
- Apply the specific guidelines in Table 2 to fuels management projects within the range of the California spotted owl.

Table 2. Guidelines for applying fuels and Forest Health treatments in California spotted owl habitat.

WUI Defense Zone (intensive fuel treatment zone) and the Central Zone of Shaded Fuelbreak (0 to 1500 ft from private/land developed areas); in pine/mixed conifer forest, bigcone Douglas-fir/ oak woodland, riparian forest/woodland, and redwood forest in chaparral matrix

- Within PACs, strive to limit the width of the defense zone/fuelbreak to 300 ft unless absolutely necessary to provide an adequate defensible space. If necessary, compensate for using the narrow width by treating more heavily outside the PAC.
- In PACs and HRCs, treat forest stands to meet fuels management objectives to protect life and property. Remove grass, shrubs, small trees and ladder fuels to distances specified by standards for defense zones, while reducing forest canopies to no less than 40 percent live crown cover if available.
- Within ¼ mile of nest or activity center, conduct fuels treatments outside of the nesting season unless the territory is unoccupied.
- Where PACs and HRCs intersect a defense zone or fuelbreak, mitigate by remapping the PAC to add an equal acreage of suitable nesting and roosting habitat (if available) outside of the defense zone/fuelbreak.
- Within PACs and HRCs, retain the largest trees within the treatment area, including all live trees greater than 24 inches DBH unless they are at unnaturally high densities. Exceptions allowed for operability.
- Try to avoid treatments within the Nest Stand. Exceptions would include sites where fuels within the Nest Stand pose an unmitigatable threat to the defense zone or fuelbreak. In those cases, the treatment for the Nest Stand would be developed in a coordinated effort between a silviculturalist, biologist, and fuels specialist.
- Where treatments in Nest Stands cannot be avoided, 1) avoid habitat disturbance within 200 ft of the nest tree; but 2) conduct limited ladder fuel treatment within the 200 ft zone around nest trees if the biologist and fuels specialist determine that it would be beneficial, including hand line construction, tree pruning, and cutting small trees; 3) if necessary, treat more heavily outside the nest stand to compensate for protecting the nest tree; and 4) tree felling outside the 200 ft zone should be done directionally away from the nest tree and the 200 ft zone.
- Within the 0 to 300 ft treatment zone, no standing dead trees or downed logs will be left unless they can be left without threatening the fuels reduction objectives. Between 300 ft and the limit of the defense zone (maximum of 1500 ft), strive to retain at least 5 to 10 snags per 5 acres and 6 logs per acre.
- Retain all woodrat nests in PACs and HCRs in the zone between 300 ft and the limit of the defense zone/fuelbreak. Retain woodrat nests within the 0 to 300 ft zone where they do not threaten the integrity of the fuelbreak or defense zone

WUI Threat Zone or the Outer Zone of Shaded Fuel Breaks (300 ft to 1.5 miles from private land/ developed areas); in pine/mixed conifer forest, bigcone Douglas-fir/oak woodland, riparian forest/ woodland, and redwood forest in chaparral matrix

- Within PACs, retain existing overstory and midstory canopy cover except where reduction is needed to bring fire to the ground in support of defense zone.
- Within HRCs meet fuel loading goals while retaining a minimum of 50 percent canopy cover except where 1) reduction is needed to bring fire to the ground in support of the defense zone or central zone of fuelbreak; or 2) the canopy has been drastically altered by concentrations of dead trees, and removal of dead trees would reduce the canopy closure below 50 percent.
- Retain the largest trees within PACs and HRCs, including all live trees greater than 24 inches DBH unless they are at unnaturally high densities. Exceptions allowed for operability.
- Avoid treatments within the Nest Stand.
- Within PACs and HRCs, retain at least 9 down logs per acre of the largest logs available.
- Within PACs and HRCs, retain 4 to 8 of the largest snags available per acre, or at least 20 ft^2 basal area per acre of snags greater than 15 inches DBH and 20 feet tall.
- When conducting mechanical fuels treatments, retain woodrat nests in PACs and HCRs.

Areas outside of WUI Defense and Threat Zones and Fuel Breaks in pine and mixed conifer forest

- Use an indirect fuels treatment strategy to protect PACs. Focus treatments in areas between PACs to reduce threats to the PACs from wildfire.
- Leave PACs untreated except where fuel conditions within the PAC pose a high level of risk for catastrophic crown fire.
- Where treatment within a PAC is necessary to protect it from fire, the treatment prescription would be developed by a biologist in coordination with a silviculturalist and fuels specialist.
- Where treatments have to occur in PACs and HRCs, retain existing canopy closure in the PAC and 40 to 50 percent canopy closure in the HRC. In PACs, use understory treatments to remove ladder fuels rather than altering canopy closure.
- Avoid treatments within the Nest Stand.
- Retain the largest trees within PACs and HRCs, including all live trees greater than 24 inches DBH, unless they are at unnaturally high densities. Exceptions allowed for operability.
- Within PACs and HRCs, retain 4 to 8 of the largest snags available per acre, or at least 20 ft^2 basal area per acre of snags greater than 15 inches DBH and 20 feet tall.
- Within PACs and HRCs, retain at least 9 down logs per acre of the largest logs available, ideally at least 12 inches in diameter and at least 20 feet long (at least 180 lineal feet of logs).
- During mechanical fuel treatment activities, retain all woodrat nests in spotted owl habitat; avoid disturbing/destroying them. Exceptions allowed for operability.
- Conduct analysis to identify key geographic areas where fuels treatments can be strategically placed to reduce the risk of stand-replacing fire in PAC clusters. Utilize thinning, small group selection, and prescribed burning in these strategic locations.
- Within forest areas within 1.5 miles of a spotted owl nest, utilize vegetation treatments such as thinning, small group selection, and prescribed burning to reduce surface and ladder fuels, especially in overly dense stands, to promote forest health in foraging habitat.
- Outside of PACs, manage spotted owl habitat for large trees, a diversity of tree species

(including hardwoods), multi-storied stands, high canopy cover, small openings or gaps that will encourage shrub and herbaceous cover as well as reproduction of shade-intolerant species such as pines and oaks, and decadence in the form of downed logs and snags.

Areas outside of WUI Defense and Threat Zones and Fuel Breaks in bigcone Douglas-fir/oak woodland, riparian forest/woodland, and redwood forest in chaparral matrix

- Treatments can range from prescribed burning of surrounding chaparral, to firing chaparral from edge of stands, to no treatment.
- Where possible, burn surrounding chaparral in segments, narrow strips, or with cool, irregular backing fire on the edges of the stand to retain 25 to 50 percent of the suitable woodrat habitat (mature chaparral) adjacent to the owl habitat. A fuels specialist and wildlife biologist will work together to determine a prescription to ensure a broad enough treatment area to protect the stand while still providing a continuous source of woodrats.
- Low intensity fire burning out from the edges of the stands may help protect the stands from high intensity crown fires.

- Strive to use suppression strategies that minimize fire intensities, such as backing fire, to aid in the treatment of HRCs and areas adjacent to PACs when containment of the wildfire will not be jeopardized.
- Unless containment of the wildfire would be jeopardized, avoid burning out islands of vegetation within spotted owl habitat.
- Postfire salvage logging in PACs, outside of WUI Defense Zones and fuel breaks, should be allowed only if sound ecological justification is provided and if the proposed action meets the intent of this conservation strategy. Salvage logging should be considered in PACs only when a fire is extensive in size and results in the mortality of a substantial proportion of trees. The prescription for salvage treatments in PACs should be developed by a biologist in conjunction with a silviculturalist and fuels management specialist. Strive to avoid salvage logging within the Nest Stand.
- Actively restore habitat that is degraded by fire, drought, insects and disease, and stand densification. Include measures such as planting, thinning, prescribed burning, creation of small openings to achieve natural regeneration, and other practices needed move vegetation condition toward that identified as moderate or higher value spotted owl habitat (from Table 1).
- Prohibit type conversion of suitable or potentially suitable (i.e., successional stands) owl habitat. Does not apply to fuel breaks or WUI Defense Zones needed to protect human life and property.
- Loss of owl habitat to development should be mitigated up to a three to one basis considering quality of habitat lost, number of territories affected, reproductive history of pair(s) displaced, location, and related factors. Development includes ski area creation or expansion, new roads or trails, special use sites and corridors, new recreation or administrative facilities, land exchanges, etc. Mitigation land should be sought first within the mountain range where the impacts occur; if this is not possible, mitigation land should be acquired within the San Gabriel or San Bernardino

Mountains.

- Make every effort possible to keep the southern California spotted owl population intact by maintaining the amount and spatial connectivity of suitable habitat. Avoid creating additional barriers to dispersal.
- Acquire habitat where possible. Priority should be on areas with potential for commercial or residential development that contain PACs and HRCs.
- Planned new activities or uses that have potential to adversely affect owls or suitable owl habitat will be surveyed to protocol prior to conducting the activity or authorizing the use. Suitable habitat will be identified and activity centers or nests will be identified if occupied. Potentially impacted territories should be monitored for 2 years following the activity or use. Utilize the 1993 survey protocol for the spotted owl in California as modified by the Spotted Owl Biologist Team (USDA Forest Service 1993, 1994; Appendix 1, 2):
    - Revise the survey procedures for determining activity centers to increase the number of minutes spent calling at a calling station to 15 minutes.
    - Revise Table 1 (Recommended dates for conducting surveys to determine activity centers) as follows:
        - Complete station visits from March 1 to July 31 of each year.
        - Complete nesting visits from March 15 to June 1 of each year.
        - Complete reproductive visits from May 15 to August 31 of each year.
- Prohibit personal fuelwood cutting and gathering in PACs unless carefully managed and controlled.
- Improve enforcement of fuelwood cutting regulations inside PACs (prohibitions or limitations when allowed).
- Prohibit new water diversions and ground water extraction that would adversely affect spotted owls.
- Evaluate existing water diversions within or affecting PACs for their effects on spotted owl habitat (including prey habitat), and provide for maintenance of suitable habitat. Modify permits as appropriate to provide for spotted owl needs.
- Within ¼ mile of activity centers, clean up trash daily at recreation sites when dumpsters reach overflow conditions (concern is the attraction of crows and ravens, which could prey on spotted owl young).
- Locate new developed recreation sites, roads, OHV trails, and other facilities or improvements outside of PACs.
- If construction of a new developed recreation site, road or OHV trail is proposed within an HRC, conduct analysis to locate site/road/OHV trail in least sensitive part of the HRC.
- Locate new hiking/bicycle/equestrian trails out of direct line of sight of spotted owl nests or nest groves. If new trails are constructed, apply Limited Operating Period guidelines.
- Apply Limited Operating Period guidelines to special use permits. Do not issue permits for special uses or events within ¼ mile of a nest site or activity center that would cause disturbance during nesting season, including organized motor vehicle events on Forest System roads/trails or helicopter use for movies.
- The Forest Service should actively coordinate with California Department of Forestry on the treatment of fuels around communities. Joint treatment plans should be developed that include

delineation and special treatment for PACs.

- The Forests should coordinate with the Department of Fish and Game to add new owl sites to the statewide database and new activity center information for existing sites.
- The Forests should work with local agency planning departments to influence development plans to the extent possible for the protection of owl sites that are shared between National Forest System lands and private land.

Evaluation of Current Situation and Threats on National Forest System Lands

The greatest threat to the California spotted owl is the loss of habitat and subsequent population loss due to large stand-replacement wildfires. In addition, spotted owls are subject to loss of habitat from fuels management for community protection, community development and associated infrastructure on and off the national forests, as well as human disturbance and habitat loss from a variety of uses and activities.

The California spotted owl population is relatively small due to the small amount of forested habitat in southern California, and the populations are naturally isolated. The recent fires and the five year severe drought and tree mortality in the San Bernardino, San Jacinto, San Gabriel and Santa Rosa Mountains as well as the San Diego Ranges has had a substantial effect on the habitat for the owl. There is a continuing threat of additional catastrophic fires as a result of stand densification and excessive dead fuels. Experts have been concerned about the viability of the southern California spotted owl population for many years, and this concern has only increased with the damaging drought, recent wildfires, and rapid development in the mountains. The cumulative effects of these factors further reduce and isolate owl populations.

Based upon the above analysis this species has been assigned the following threat category:

6. Widespread in Plan area with substantial threats to persistence or distribution from Forest Service activities.

Viability Outcome for National Forest System Lands

Predicted Outcomes by Alternative

1	2	3	4	4a	5	6
C	C	C	C	C	D	C

The California spotted owl is a USDA Region 5 Forest Service Sensitive Species. This assures that any new project proposed in or near its habitat must undergo careful analysis of effects through the

development of a biological evaluation at the site-specific level.

California spotted owl populations appear to be declining in southern California, and this is made worse by the effects of the recent five-year drought. Alteration and loss of habitat due to tree mortality and dead tree removal will continue for many years, as will the increased risk of catastrophic fire created by high levels of tree and shrub die-off and generally overly dense stands resulting from years of fire suppression. Small populations in isolated mountain ranges could decrease or even be lost due to these factors. Because of the extent of forest mortality and habitat degradation within the core spotted owl population area in the San Gabriel and San Bernardino Mountains, the ability of this population to supply new animals to outlying locations may be reduced for some time to come. Only the less well-studied spotted owl populations on the Los Padres National Forest have not been substantially affected by drought-related habitat alteration. The populations on the northern Los Padres National Forest may be affected by the loss of oak and other tree and shrub canopy due to Sudden Oak Death Syndrome.

Standard S19 calls for protection of all territories and the use of the spotted owl conservation strategy. Standard S21 calls for mitigation up to a two-one basis when habitat is lost to development. These standards apply to Alternatives 2 through 6 and are similar to current forest plan direction and practice in Alternative 1.

Under all alternatives, fuels treatment work will be accelerated. In the short term all alternatives will emphasize treatment of Wildland/Urban Interface (WUI) areas affected by high levels of vegetation mortality that has resulted from recent drought and insect outbreaks. Over the longer term, treatments would focus primarily on community protection under all alternatives. Although community protection in the WUI zones (Standard S8) has potential to adversely impact spotted owl PACs, the impacts that are more than 300 feet from structures will be mitigated by standards S8, S11, S19, and S20. Standard S8 provides for mitigation of impacts to the extent possible for impacts beyond the minimum 300 feet from structures. Standard S11 specifies the use of this species account and the Conservation Strategy for the California Spotted Owl on the National Forests of Southern California, which was approved on June 30, 2004, in the design of all projects. Standard S19 gives direction to protect all territories and to maintain or enhance habitat conditions over the long term to the greatest extent practicable while protecting life and property. S20 provides for a limited operating period within 0.25 miles of nest sites or activity centers where needed.

As a result of the direction described above, some nesting and roosting habitat is expected to be lost in the 300 foot WUI Defense zone treatments. However, the amount of acreage is expected to be minor, because when PACs are actually mapped on the ground, the proximity of the community would generally lead a biologist to not include much of that area in a PAC. This is based on the findings of the studies and monitoring which have been done on the San Bernardino National Forest over the years. California spotted owls generally avoid communities for nesting and roosting. Information on foraging in relation to communities is not as well known.

Beyond the 300-foot minimum WUI Defense zone, projects will be designed to the extent possible to

mitigate impacts on spotted owls from community protection treatments. This could involve heavier treatments outside the PACs to meet the fuels objective, stand treatment around the PACs designed to provide them protection from wildland fire, fuel reduction immediately around nest groves and nest trees to protect them from wildland fire, or off-site mitigation such as improving the likelihood that bigcone Douglas-fir stands could withstand wildfire.

The community protection treatments will also have a beneficial effect on reducing the chance of fire starts within the communities escaping into surrounding owl habitat.

Alternatives 3 and 6 would have more emphasis on vegetation treatments designed for resource protection and enhancement of habitat for species-at-risk, including the California spotted owl. However, due to funding, this work would still primarily be in support of WUI protection. Alternatives 3, 4a, and 6 would limit or reduce the amount of access within spotted owl habitat and reduce the effects on snags and down wood removal for firewood. Planting to enhance habitat would have a priority.

Acquiring habitats threatened with development would be a priority under Alternatives 3 and 6.

Alternatives 2, 3, 4a, and 6 have more land use zoning and special designations (recommended wilderness, Critical Biological zones, Wild and Scenic River recommendations, Research Natural Areas, etc.) that would inherently protect a portion of the land base and species from human use, disturbance and extractive demands due to management emphasis and less vehicle access. Alternatives 3, 4a, and 6 have a substantial acreage in public non-motorized land use zoning. Accidental fire starts would be decreased under alternatives with less public vehicle access, and this would reduce the threat of catastrophic fire from human ignitions.

Alternatives 3 and 6 are likely to mitigate effects from existing uses at a faster pace than other alternatives due to their emphasis on biodiversity protection. Alternative 4 emphasizes sustainable recreation opportunities with a focus on developed facilities and would provide the greatest level of public education on responsible wildlands use. Alternative 4a is similar to Alternative 4, but has an increased amount of public non-motorized land use zoning and a focus on managing dispersed use to maintain the natural setting.

Alternative 5 emphasizes increased motorized recreation opportunities, commodity development, and support of community infrastructure. This would result in a more reactive approach to protecting species-at-risk, with the possibility of higher risks to the species and habitat because of the effects of more overall development, motorized uses, and extractive activities occurring concurrently. Conservation objectives would be met at a lower rate than in any other alternative. With so much area opened to motor vehicle access, unauthorized uses would probably increase due to the lack of Forest Service presence. This could result in substantial unauthorized vehicle use and disturbance. Because most fires in the southern California national forests start near roads, this alternative would create the greatest risk of increased fire starts and loss of California spotted owl habitat to catastrophic fire.

Viability Outcome for all Lands within Range of Taxon

Predicted Outcomes by Alternative

1	2	3	4	4a	5	6
C	C	C	C	C	D	C

Although the California spotted owl occurs predominately on National Forest System lands, some important habitat occurs on private land that is subject to development. The greatest threats on private land are stand-replacing wildland fire, development, and water diversion. Acquisition of the private lands by the Forest Service and other conservation agencies would increase the likelihood of survival. The cumulative adverse effects of all the ongoing activities and land uses are significant in southern California (LaHaye pers. comm.). Since so much of the spotted owl habitat and use is on the national forest, the viability outcome for all lands is the same as for National Forest System lands.

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California Least Tern **Calliope Hummingbird**