

# The Spotted Owl in Southern California: Ecology and Special Concerns for Maintaining a Forest-Dwelling Species in a Human-Dominated Desert Landscape<sup>1</sup>

William S. LaHaye and R. J. Gutiérrez<sup>2</sup>

## Abstract

The California spotted owl is an uncommon forest-dwelling resident of southern California, found in most of the major mountain ranges in the region. We studied this species from 1987 to 1998 in the San Bernardino Mountains and collected empirical and demographic evidence that the population declined during this period. Numerous factors may affect the long-term viability of spotted owls in this region. Key factors include a naturally fragmented distribution, loss and degradation of nesting habitat, loss and degradation of dispersal habitat, severe drought, and (potentially) air pollution. Our insight into the persistence of this owl is limited because we do not know the cause of the population decline we observed in the San Bernardino Mountains. However, it is likely that the decline has resulted from a complex interaction among weather, habitat changes, prey dynamics, and other factors. We provide a regional update on this owl and discuss the problems that may be affecting the species in southern California.

*Key words:* California spotted owl, habitat degradation, population decline, *Strix occidentalis occidentalis*

## Introduction

The spotted owl (*Strix occidentalis*) ranges from southwestern British Columbia into Baja California Norte along the Pacific Coast. In addition, its distribution includes the southern Rocky Mountains from Utah and Colorado into the mountains of Mexico, where it reaches its southernmost occurrence near Mexico City (Gutiérrez and others 1995). It primarily occurs in mountainous terrain where it typically occupies closed-canopied forests (Gutiérrez and others 1995). However, the spotted owl also occupies steep, narrow canyons with relatively few trees in some portions of the southwestern United States (Rinkevich and Gutiérrez 1996).

The American Ornithologists' Union (1957) recognizes three subspecies: The northern spotted owl (*S. o. caurina*) is found in the Pacific Northwest and northwestern California, the California spotted owl (*S. o. occidentalis*) occurs in most California mountains other than those occupied by the northern subspecies, and the Mexican spotted owl (*S. o. lucida*) ranges from southern Utah and Colorado into

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<sup>2</sup> Research fellow, Department of Fisheries, Wildlife, and Conservation Biology, University of Minnesota, St. Paul, MN 55108; current address: P. O. Box 523, Big Bear City, CA 92314 (email: blahaye@gte.net); and Professor and Gordon Gullion Endowed Chair, Department of Fisheries, Wildlife, and Conservation Biology, University of Minnesota, St. Paul, MN 55108

Mexico (Gutiérrez and others 1995). The northern and Mexican subspecies are listed as “threatened” under the Endangered Species Act (U.S. Fish and Wildlife Service 1990, 1993) because of habitat loss and failure of existing regulatory mechanisms to protect the owl.

In southern California, forested habitat is restricted to the upper elevations of the higher mountain ranges and in canyon bottoms along streams and rivers. Thus, suitable spotted owl habitat is discontinuous and results in a series of semi-isolated owl populations within the region (*table 1*; LaHaye and others 1994, Noon and McKelvey 1992). The largest of these populations, located in the San Bernardino Mountains, declined between 1987 and 1998 (*table 2*; LaHaye and others 1999).

**Table 1**—*The estimated number of territories within each subpopulation of the southern California spotted owl metapopulation. Data from LaHaye and others (1994).*

Subpopulation	Estimated number of territories
Northern Monterey	50
Southern Monterey	30
Cerro Alto	3
Southern Santa Lucia	16
Sierra Madre	12
San Rafael	40
Santa Ynez	18
Mt. Pinos	15
Tecuya	10
Cobblestone	10
Tehachapi Mountains	12
Pelano	20
San Gabriel Mountains	95
San Bernardino Mountains	133
Santa Ana Mountains	12
San Jacinto Mountains	20
Thomas Mountain	10
Palomar Mountain	30
Black Mountain	5
Volcan Mountain	16
Cuyamaca Mountain	10
Laguna Mountain	15

The California Spotted Owl Technical Assessment Team (CASPO) evaluated the California spotted owl and presented “Areas of Concern” and “Recommendations” for maintenance of this subspecies in southern California (see Verner and others 1992: 7, 16). The purpose of this paper is to review these issues in the context of new information and to qualitatively evaluate the progress toward maintenance of this subspecies in southern California since CASPO.

## Spotted Owl Ecology

Spotted owls are found in riparian/hardwood forest, live oak (*Quercus chrysolepis*)/bigcone Douglas-fir (*Pseudotsuga macrocarpa*) forest, and mixed conifer forest in southern California (Gutiérrez and others 1992). About one third of the known spotted owl sites are located in each forest type (Gutiérrez and others 1992). Spotted owl reproduction was found to be higher in live oak/bigcone Douglas-fir forest than in mixed conifer forest (LaHaye and others 1997); however, reproduction in riparian/hardwood sites was not considered. We speculate that owl reproduction in riparian/hardwood sites is similar to live oak/bigcone Douglas-fir sites because these forest types are similar in elevation and vegetation association (that is, they are typically surrounded by chaparral).

**Table 2**—Spotted owl survey effort and banding activity between 1987 and 1998 in the San Bernardino Mountains of southern California. Table from LaHaye and others (2001).

Year	Territories		Territorial owls		Juvenile owls	
	Number surveyed	Pct occupied	Number pairs	Number singles	Pct banded <sup>1</sup>	Number banded
1987	42	95	32	8	0	15
1988	78	95	56	18	42	16
1989	115	90	81	23	42	52
1990	127	86	90	19	72	47
1991	132	76	86	12	79	44
1992	136	65	78	11	91	49
1993	141	63	78	11	90	52
1994	143	68	84	13	86	70
1995	145	70	86	15	93	38
1996	146	67	89	9	93	54
1997	147	62	80	11	96	41
1998	148	59	76	11	95	23

<sup>1</sup> Percent of the territorial population banded prior to each field season, including newly recruited territorial owls.

Spotted owls prey on a variety of insects, birds, and mammals (Smith and others 1999). The dusky-footed woodrat is their primary prey and appears to be important to reproductive success in this owl (Smith and others 1999). Spotted owls in southern California rarely occur above approximately 2,400 m elevation (Gutiérrez and others 1995). This is most likely due to the decline in woodrat density at higher elevations (Grinnell 1908).

Little information has been collected on home-range sizes of spotted owls in southern California. However, reported home ranges in mixed-conifer habitat varied in size from approximately 400 hectares to 3,300 hectares (Zimmerman and others 2001). We suspect that these values are near the extremes for this species in this habitat type. Some lower elevation owl sites may be smaller than 400 hectares because suitable habitat is restricted to narrow strips of riparian vegetation.

## Areas of Concern

CASPO identified a set of potential threats (see Areas of Concern, Verner and others 1992: 7) that we used as the outline for our qualitative assessment.

### ***Natural Isolation of Habitat and the Regionally Restricted Distribution of Spotted Owls***

Areas capable of supporting the forested habitat used by this species are uncommon in southern California because forest is restricted to higher elevations. Thus, opportunities to expand the amount of spotted owl habitat are limited (Verner and others 1992). In addition, the continued urbanization of the southern California lowlands may exacerbate the difficulties of owl movement between mountain ranges by creating additional barriers to dispersal (see below).

### **Dispersal Habitat**

Spotted owl dispersal habitat includes the forest types mentioned above, as well as a variety of other forested and nonforested habitats (Gutiérrez and others 1985). Dispersal may be necessary to maintain populations of spotted owls within the region, and it is potentially critical to the continued existence of several of the smallest populations (LaHaye and others 1994, Noon and McKelvey 1992). However, no inter-mountain movements were recorded between 1987 and 1998 (LaHaye and others 1994, 2001). We do not know whether movements between mountain ranges have always been low or if this is a recent phenomenon reflecting reduced opportunities for successful dispersal caused by modifications to inter-mountain vegetation by humans.

Numerous riparian areas, which once existed at lower elevations and were potential dispersal corridors, have been degraded by water extraction or lost to channelization during the last century. In addition, numerous small coast live oak (*Q. agrifolia*) 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 (Heller 1893, Lillie 1891, WFVZ #21,133, WFVZ #69,985, WFVZ #84,150, WFVZ #121,717) and may have served as stepping-stones for dispersal among the region's mountain ranges.

### **Habitat Trends**

Most montane forests in southern California are administered by the USDA Forest Service. However, substantial acreage of forest also exists on private lands. CASPO was unsure of the trend in the amount of montane forest in this region, and we retain that uncertainty today. Similar concerns were expressed about the integrity of owl habitat (for example, quality and fragmentation, Verner and others 1992).

Historic logging, which occurred during the 19<sup>th</sup> century and from 1950 to 1980 (Johanneck 1975, Robinson 1989), undoubtedly reduced the amount and quality of owl habitat in several mountain ranges in the region. Recent (to 2001) logging activity has been limited to infrequent commercial timber sales and localized fuelwood extraction. Although, spotted owls have reoccupied some logged sites, the current suitability of previously logged forest and the extent of reoccupation of these

forests by spotted owls are unknown. No analysis has been conducted on the effect of fragmentation on spotted owls in southern California (Franklin and Gutiérrez 2002).

Urbanization in the form of primary and vacation homes has degraded or consumed some forest in most mountain ranges. The results of spotted owl surveys conducted between 1987 and 1998 in the San Bernardino Mountains indicated that a large area of potentially-suitable spotted owl habitat, enough to support 10-15 pairs, existed between Running Springs and Crestline (LaHaye and others 1999). However, only four pairs have been found in this area, and owls were found only in undeveloped sites. Thus, residential development within montane forests may preclude spotted owl occupancy, even when closed-canopy forest remains on developed sites.

Forests in southern California have been subjected to major changes in disturbance regime during the past 150 years. Logging, urbanization, water diversions, wildfire, and mining have produced dramatic local impacts. Intensive grazing during the late 1800s (Minnich 1988), fire suppression since 1900 (McBride and Laven 1976), and air pollution since the 1930s (Miller and McBride 1998) have affected most forests in the region. These impacts have altered the growth and regeneration of forest vegetation (Minnich and others 1995) within owl habitat and could be influencing the dynamics of spotted owl prey. While we are unsure how these changes have affected this owl, if they negatively affect prey abundance or availability, maintaining a regional population of spotted owls will require thoughtful planning and management.

### ***Water Diversion and Stream Channelization***

Spotted owl habitat associated with riparian areas is subject to direct effects such as removal of riparian forests due to channelization and other land-clearing activities and indirect effects such as vegetation degradation caused by water extraction and human recreation. Both may ultimately result in loss of suitable habitat. Riparian forests and other woodlands at low elevations have been modified at a faster rate than montane forests because they occur in areas targeted for development, flood control, or domestic water production. However, the extent of this habitat decline and the proportion of the southern California spotted owl population that historically resided in these forests are unknown.

### ***Wildfire***

Wildfire is a constant threat in southern California (Keeley and others 1999, Minnich 1983), and the effects of wildfires are becoming more severe (that is, fires are larger and hotter, Minnich 1983). In addition, Minnich (1980) suggested that the total area of live oak/bigcone Douglas-fir forest has declined during the last century due to changes in fire regime. Stand-replacing fires may become more commonplace. Most resource agencies recognize this problem, but public concerns about air quality, safety, and liability often prevent application of large-scale prescribed fire programs (Biswell 1989). Thus, managers recognize the threat of fire to wildlife habitat and humans, but little progress has been made toward implementing effective fuels reduction programs through controlled burning and other methods.

### ***Recreational Activities***

Human recreation may be a contributing factor to spotted owl habitat degradation. With approximately 15 million people in the southern California area, the demand for recreational opportunities is constantly increasing. Much of the focus for this demand is on public lands in the mountains and riparian areas. Direct impacts, such as killing owls, are probably uncommon. However, indirect impacts such as trampling vegetation and habitat lost to development of new parks, campgrounds, trails, and roads may have significant cumulative effects on spotted owl habitat. We are unaware of a region-wide assessment of these impacts.

### ***Drought***

To the areas of concern listed by CASPO, we add the negative effects of drought and air pollution (see below). It is well known that weather can affect demographic processes in spotted owls (for example, Franklin and others 2000, North and others 2000). We hypothesize that drought can also have negative long-term effects on their habitat.

The majority of the demographic data for the San Bernardino Mountains spotted owl population were collected when annual precipitation was below average. The results of demographic analyses showed that reproduction was strongly dependent on precipitation patterns (LaHaye and others unpublished data<sup>3</sup>). However, survival was not related to weather. In addition to the direct effect of weather on reproduction, the current extended drought is degrading montane forest in many areas (that is, increased tree mortality in forests occupied by owls) due to water stress, which will likely alter the quality and distribution of spotted owl habitat in the region.

### ***Air Pollution***

Air pollution affects large areas of southern California, especially on the cismontane sides of the major mountain ranges (Miller and McBride 1998). Pollutants such as ozone and nitrogen oxides may affect vegetation growth and subsequent densities of spotted owl prey. In addition, there may be direct effects on the portion of the owl populations that receive the highest concentrations of air contaminants, because birds lack a DNA repair mechanism for lung tissue (Rombout and others 1991).

### ***Recommendations***

Below, we review CASPO's recommendations for the spotted owl in southern California (Verner and others 1992: 16) and provide additional evaluation and comment when appropriate.

### ***Spotted Owl Inventories***

CASPO's first recommendation was to inventory all potential habitats in southern California to provide an accurate estimate of the size of each population. These

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<sup>3</sup> Unpublished data on file at the Department of Fisheries, Wildlife, and Conservation Biology, University of Minnesota, St. Paul, MN

estimates are essential and have considerable influence on the results of modeling subpopulation and metapopulation persistence (LaHaye and others 1994, Noon and McKelvey 1992). Although thorough inventories have not been completed, Stephenson (1991) estimated the amount of suitable habitat available within all of the major mountain ranges and provided estimates of the potential number of owls that each mountain range could support. Given the recently acquired information on demographic variability associated with this species (Franklin and others 2000, Seamans and others 2002), we suspect that some of the smaller owl populations may not currently exist (see *table 1*). Indeed, the San Bernardino Mountains and San Jacinto Mountains spotted owl populations seem to have declined substantially during the past decade based on recent surveys (LaHaye and others 1999, Gutiérrez and others unpublished data<sup>4</sup>, respectively).

### ***Monitoring Demography***

CASPO also felt it was essential to monitor the demography of the owl throughout the region. When their evaluation was released there were two spotted owl demography projects in progress (Gutiérrez and Pritchard 1990, LaHaye and others 1992). CASPO recommended that two additional demographic projects be initiated to estimate correlation of population dynamics and to provide estimates of movement rates among subpopulations. These new projects were not initiated. Thus, estimates of these parameters are still unavailable.

In addition, CASPO recommended continued funding for the existing demography studies. However, funding was discontinued in 1994 for the San Jacinto Mountains' population study and in 1999 for the San Bernardino Mountains' owl study, despite evidence that both populations were declining.

### ***Maintain Habitat for all Known Pairs***

CASPO argued that the overall numbers of spotted owls in southern California and the small sizes of many of the known populations required maintenance of habitat for all known pairs. This recommendation was generally accepted and implemented by the USDA Forest Service (USDA Forest Service 1993). However, due to incomplete surveys and private ownership of some areas containing spotted owl habitat, it is not clear how effective this policy has been. A small number of spotted owls were known or suspected to exist on private lands in several of these mountain ranges. We could not determine the degree of protection afforded these owls. To the best of our knowledge, the San Bernardino National Forest was the only national forest in southern California to develop a formalized plan for protecting spotted owl habitat (USDA Forest Service 1989). This plan described the criteria by which a site qualified as a designated owl territory, the amount of protected forest to be included within a designated territory, the desired characteristics of forest to be protected, the potential disturbance factors, and seasonal closures designed to minimize disturbance to nesting owls.

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<sup>4</sup> Unpublished data on file at the Department of Fisheries, Wildlife, and Conservation Biology, University of Minnesota, St. Paul, MN

## **Formulating Regional Guidelines**

CASPO believed that it was necessary to develop southern California regional guidelines for effective protection of this species. They recommended assembling a team of specialists to formulate these guidelines. This recommendation has not been accomplished as of 2002. (Editor's note: the four southern California national forests completed a California spotted owl management strategy in 2004.)

## **Conclusions**

Since CASPO (Verner and others 1992), considerably more has been learned about the ecology of the spotted owl in southern California (Carlson and others 1998, LaHaye 1997, LaHaye and others 1992, 1994, 1997, 2001; Smith and others 1999, 2002). However, the status of the overall population of this species in the region is still unclear. Demographic estimates continue to indicate the largest spotted owl population in southern California is declining (LaHaye and others unpublished data<sup>5</sup>). Policy and management of this species do not appear to be clear or consistently implemented. Further, little effort is devoted towards monitoring the species and its habitat.

As the human population in southern California continues to expand, the need for additional space and resources is likely to increase pressure on the remaining habitat supporting the spotted owl. Continued habitat degradation, in conjunction with the unknown cause(s) of the species' regional decline, leads to an uncertain future for the spotted owl in southern California, particularly for the small, isolated populations.

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<sup>5</sup> Unpublished data on file at the Department of Fisheries, Wildlife, and Conservation Biology, University of Minnesota, St. Paul, MN

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