

the California spotted owl today. For thousands of years preceding European settlement of California, low to moderate intensity fires burned frequently in most Sierra Nevada vegetation types (University of California 1996). Median fire return intervals were typically less than 20 years, and as low as four years, in ponderosa pine (*Pinus ponderosa*) and mixed conifer zones. In the mixed conifer zone, where approximately 80 percent of Sierra Nevada California spotted owl sites occur (see Habitat Requirements, above), many plant species take advantage of, or depend on, fire for their reproduction or as a means of competing with other species. The effects of frequent surface fires largely explain the reports and photographs by early observers who described Sierra Nevada forests as typically open and park-like. However, other early observers reported dense conditions and dark or impenetrable forest. These records suggest that although open conditions were more prominent than they are today, Sierra Nevada forests were a mix of different degrees of openness, with an unknown proportion in dark, dense, nearly impenetrable vegetative cover and with variations in density with latitude, aspect, and elevation (University of California 1996, Gruell 2001).

Suppression of wildland fires had been established in California as State and Federal policy by the early 20th century. The area burned annually in recent times has been estimated to be only about three percent of that burned pre-European settlement in mixed conifer forest types (University of California 1996). As will be discussed further below, fire suppression has resulted in substantial growth of small understory trees in much of the range of the California spotted owl.

Timber harvest has been another obvious impact to California spotted owl habitat (Gutiérrez 1994, Verner *et al.* 1992a). McKelvey and Johnston (1992) used historical documents to describe the status of Sierran forests at the beginning of the 20th century, and detailed the harvest history from the late 19th century to 1990. Harvest steadily intensified from the railroad building and mining eras of the 1800s until the 1950s, then remained at relatively high levels through the 1980s. (Intermittent declines occurred during poor economic conditions of the 1930s and early 1980s.) Low elevations and accessible areas (McKelvey and Johnston 1992, Beardsley *et al.* 1999) and commercially important forest types such as west-side mixed conifer and east-side pine (Franklin and Fites-Kaufmann 1996)

have been the most heavily impacted. As a result, McKelvey and Johnston stated that "The mixed conifer zone of the Sierra Nevada * * * has few or no stands remaining that can be described as natural or pristine."

Verner *et al.* (1992a) discussed five major factors of concern for California spotted owl habitat that have resulted from historical timber harvest strategies: (1) Decline in the abundance of very large, old trees; (2) decline in snag density; (3) decline in large-diameter logs; (4) disturbance or removal of duff and topsoil layers; and (5) change in the composition of tree species. Of these concerns, they believed significant changes in diameter distributions of trees in the Sierra Nevada and rapid reductions in the distribution and abundance of large, old, and decadent trees posed the greatest threat to the California spotted owl. Thus, extensive commercial harvest of large old trees in late successional forest directly affected the key structural components of California spotted owl habitat.

Timber harvest in the Sierra Nevada peaked in the 1950s and remained at high levels into the late 1980s (McKelvey and Johnston 1992). Since the late 1980s, the volume of timber harvested in the Sierra Nevada has declined substantially. In particular, levels of timber harvest on national forest lands declined after implementation of the California Spotted Owl Sierran Province Interim Guidelines in 1993 (USFS 2001a). From Fiscal Year (FY) 1998 through FY 2002, the mean annual total harvest volume (279.4 million board ft (mmbf)) on the seven National Forests that support most of the Sierra owl population was about 28 percent of the mean annual total volume harvested on those forests during the period FY 1986 through FY 1990 (1,007 mmbf) (USFS 2002a). Whereas old-growth accounted for most of the volume in the past, more recent harvest practices have focused on thinning of young, smaller trees (McKelvey and Johnston 1992).

The decline in Federal harvest led an overall decline in the total Federal and private harvest in the Sierra Nevada. According to California timber tax data (California Board of Equalization 2002), total harvest from public lands in 18 Sierra Nevada counties during the late 1980s and early 1990s constituted about half of the total annual volume harvested in those counties, but following the 1993 implementation of protections for the California spotted owl on Forest Service lands, the public lands harvest did not exceed 25 percent of the total annual volume harvested from those counties in any year from

1994 through 2000. In the meantime, private harvest during the 15-year period from 1986 to 2000 remained between 650 and 775 mmbf per year, except for a 2-year spike of over 900 mmbf per year in 1990 and 1991. Mean annual volume from private lands in the 18 Sierra Nevada Counties in the period for the period 1986 to 1990 was about 811 mmbf, and mean annual volume from 1996 to 2000 was about 714 mmbf, a difference of 12 percent. Thus, in the Sierra Nevada, private lands harvest has declined somewhat while Federal harvest has declined sharply since the late 1980s.

Similar trends in timber harvest have occurred in the four southern California national forests, although timber harvest in this area was never as extensive as in the Sierra Nevada. According to McKelvey and Johnston (1992), harvest volume in Los Angeles and San Bernardino counties was about ten to twenty times higher in the 1960s than in the early 1980s, and the decline has continued since the 1980s. Southern California national forests have not had a commercial green timber sale program for over a decade. Harvest in recent years has primarily been salvage and hazard trees along roads and near administrative sites (M. Gertsch, USFS, pers. comm. 2002). Mean annual total harvest volume for the four forests in FY 1998 to 2002 (1.66 mmbf) was about 30 percent of the mean annual total harvested on the four forests during FY 1988 to 1992 (5.48 mmbf) (USFS 2002a).

Thus, timber harvest, the primary cause of habitat loss for the California spotted owls for decades, has been much reduced in recent years. Spotted owls today are occupying habitat that is a combination of the remnants of older stands and stands regenerating from timber harvest in past decades. The present habitat used by California spotted owls is further described below.

California spotted owls use a broader range of habitat types than the northern spotted owl (Call *et al.* 1992, Gutiérrez *et al.* 1992, Anderson and Mahato 1995, Moen and Gutiérrez 1997, North *et al.* 2000), in part due to the relatively more complex landscapes available to the California subspecies (Zabel *et al.* 1992b, Franklin and Fites-Kaufmann 1996, Helms and Tappeiner 1996, Beardsley *et al.* 1999). In the Sierra Nevada, this complexity reflects: (1) The variety of environmental conditions due to elevation, latitude, geology, precipitation, and temperature; (2) rich flora; and (3) influence of natural disturbance, especially fire (Andersen and Mahato 1995) and human disturbance (Franklin and Fites-Kaufmann 1996). The forests of the