

approximately 560,000 ha (1.4 million ac) of private land within their administrative boundaries. Private land inholdings are much greater in extent in the northern national forests (especially the Lassen, Plumas, and Tahoe) than in the southern Sierra Nevada forests. Much of the private land within the boundary of the Lassen and Plumas National Forests is in contiguous blocks, leaving national forest lands also fairly contiguous. Most private land on the Tahoe National Forest is in checkerboard ownership, and the Eldorado National Forest has a combination of checkerboard ownership and large contiguous blocks of inholdings. We acknowledge that considerable amounts of suitable habitat exist on private lands, especially in the smaller size classes. This is reflected in the occurrence of over 300 spotted owl activity centers (about 17 percent of the Sierra Nevada total) on private lands.

The mixed-conifer forest type (sugar pine (*Pinus lambertiana*), ponderosa pine, white fir (*Abies concolor*), Douglas-fir (*Pinus lambertiana*), giant sequoia (*Sequoiadendron giganteum*), incense-cedar (*Calocedrus decurrens*), black oak (*Q. kelloggii*), and red fir (*Abies magnifica*) is the predominant type used by spotted owls in the Sierra Nevada: about 80 percent of known sites are found in mixed-conifer forest, 10 percent in red fir forest (red and white fir, lodgepole pine (*Pinus contorta*), and quaking aspen (*Populus tremuloides*), seven percent in ponderosa pine/hardwood forest type (ponderosa pine, interior live oak (*Quercus wislizenii*), canyon live oak (*Quercus chrysolepis*), black oak, incense-cedar, white fir, tan oak (*Lithocarpus densiflorus*), and Pacific madrone (*Arbutus menziesii*)), and the remaining three percent in foothill riparian/hardwood forest (cottonwood (*Populus ssp.*), California sycamore (*Platanus racemosa*), interior live oak, Oregon ash (*Fraxinus latifolia*), and California buckeye (*Aesculus californica*) and east-side pine (ponderosa and Jeffrey pine (*P. jeffreyi*)) (Verner *et al.* 1992a, USFS) 2001).

Six major studies (Gutiérrez *et al.* 1992) have described habitat relations of the owl in four areas spanning the length of the Sierra Nevada. These studies examined spotted owl habitat use at three scales: landscape; home range; and nest, roost, or foraging stand. Based on comparisons of time spent by owls in various habitat types to amounts of habitat available, owls preferentially use areas with at least 70 percent canopy cover, use habitats with 40 to 69 percent canopy cover in proportion to their availability, and spend less time in areas with less than 40 percent canopy

cover than might be expected if habitat were selected randomly.

California spotted owls in the Sierra Nevada prefer stands with significantly greater canopy cover, total live tree basal area, basal area of hardwoods and conifers, and snag basal area for nesting and roosting. Owls use stands dominated by trees with dbhs between 30 and 61 cm (12 and 24 in) and canopy covers between 40 and 100 percent for nesting significantly more than expected, based on the proportion of those forest types (Gutiérrez *et al.* 1992). Stands suitable for nesting and roosting have: (1) Two or more canopy layers; (2) dominant and codominant trees in the canopy averaging at least 61 cm (24 in) in dbh; (3) at least 70 percent total canopy cover (including the hardwood component); (4) higher than average levels of very large, old trees; and (5) higher than average levels of snags and downed woody material (Gutiérrez *et al.* 1992, USFS 2001a).

Analysis of vegetation characteristics of plots surrounding 292 California spotted owl nest and roost sites on the Lassen, Eldorado, and Sierra National Forests, and in Sequoia and Kings Canyon National Parks provides further information on habitat types favored by the species (USFS 2001a). Thirty-two percent of the plots were in stands with multilayered canopies exceeding 60 percent closure and with average trees exceeding 61 cm (24 in) in dbh. Eighteen percent were in stands with 40 to 59 percent canopy closure and with average trees exceeding 61 cm (24 in) in dbh. Fourteen percent were in stands with over 60 percent canopy cover and with average trees between 28 and 61 cm (11 to 24 in) in dbh. Eleven percent were in stands with 40 to 59 percent canopy closure and average trees between 28 and 61 cm (11 to 24 in) in dbh. Nine percent were in stands with over 60 percent canopy closure and average trees exceeding 61 cm (24 in) in dbh. Seven percent were in stands with 25 to 39 percent canopy cover and average trees exceeding 61 cm (24 in) in dbh. Five percent were in stands with 25 to 39 percent canopy cover and average trees between 28 and 61 cm (11 to 24 in) in dbh. North *et al.* (2000) suggested that canopy cover, tree density, and foliage volume represent conditions consistent across different forest types and therefore could indicate the basic nest site conditions selected by California spotted owls. California spotted owl nests were consistently located in sites with 75 percent canopy cover, 300 trees/ha (122 trees/ac), and 40,000 cubic m/ha (571,860 cubic ft/ac) of foliage volume.

Moen and Gutiérrez (1997) analyzed California spotted owl habitat at the landscape, habitat patch, and microsite levels on a 355 square kilometer (137 square mile) study area on the El Dorado National Forest. They used remote sensing to analyze vegetation in 457 ha (1,129 ac) circular plots surrounding spotted owl activity centers, and compared those plots with randomly selected plots of equal size. Owl plots were significantly more homogeneous than random sites, indicating that owls select against patchy or fragmented habitats; owl sites contained significantly more area with canopy closure exceeding 70 percent than random plots; and California spotted owl roosts were significantly more likely to be located in mixed conifer habitat containing trees greater than 30 cm (12 in) dbh than would be expected by chance. In addition, of 82 roost sites examined, 56 (68 percent) were in habitat with greater than 40 percent canopy closure and trees greater than 30 cm (12 in) dbh, and 97 percent of roost sites had trees over 100 cm (39 in) dbh. Microsite comparison between sixteen 0.04 ha (0.10 ac) vegetation plots surrounding nest sites and random plots of equal area showed that nest plots had significantly higher structural diversity, more total trees, larger trees, and more trees over 100 cm (39 in) dbh.

Bias and Gutiérrez (1992) attributed low use of private timberlands by roosting and nesting California spotted owls to sanitation (removal of damaged or diseased trees or species of low commercial value) and high-grade logging (harvest of large trees of high commercial value) that removed potential nest trees. However, as stated above, California spotted owls do occur on private timberlands. Habitat use by California spotted owls has been studied on a private timber production area in the Sierra Nevada, 48 kilometers (km) (30 mi) east of Chico, California (Larry L. Irwin *et al.*, National Council for Air and Stream Improvement, Incorporated, *in litt.* 2002). Seven pairs of California spotted owls were repeatedly located using radiotelemetry. Habitat use was similar to that observed in other studies on Federal lands. Owls were located in areas with canopy closure averaging 70 percent, dominated by trees 30 to 36 cm (12 to 14 in) in dbh but with a few larger (over 66 cm (26 in) dbh) trees, and with tree densities ranging from 930 to 1,360 trees/ha (372 to 544 trees/ac). To our knowledge, there are no studies providing information on demographic performance of owl populations on private lands in the range of the California spotted owl.