

Sierra Nevada have a complex logging history dominated by selection methods (McKelvey and Johnston 1992, Beardsley *et al.* 1999) varying by number of entries, types of species harvested, size distribution of harvested trees, and total volume logged (Zabel *et al.* 1992b). The heterogeneity of forests occupied by California spotted owls make quantifying its habitat difficult and sensitive to scale. Several studies have found that analysis of habitat at a coarse, small scale (e.g., using timber type polygons developed for timber management) masks fine grained attributes used or selected by owls (Bias and Gutiérrez 1992, Zabel *et al.* 1992a, Moen and Gutiérrez 1997).

Despite the complexity of California spotted owl habitat, several authors have concluded the subspecies is a habitat specialist (Andersen and Mahato 1995, Moen and Gutiérrez 1997, LaHaye *et al.* 1997), selecting habitat at several scales. California spotted owls, like the other subspecies of spotted owls, use or select habitats for nesting, roosting, or foraging that have structural components of old forests, including large (typically greater than 61 cm (24 in) diameter at breast height (dbh); breast height has been standardized at 137 cm (4.5 ft) above the ground) (Call 1990, Gutiérrez *et al.* 1992, Zabel *et al.* 1992a, Moen and Gutiérrez 1997, USFS 2001a), decadent trees (trees with cavities, broken tops, etc.); high density of trees (Laymon 1988, Call 1990, Bias and Gutiérrez 1992, Gutiérrez *et al.* 1992, LaHaye *et al.* 1997, Moen and Gutierrez 1997); multi-layered canopy/complex structure (Call 1990, Gutiérrez *et al.* 1992, LaHaye *et al.* 1997, Moen and Gutiérrez 1997); high canopy cover (greater than 40 percent and mostly greater than 70 percent; Laymon 1988, Bias and Gutiérrez 1992, LaHaye *et al.* 1992, Gutiérrez *et al.* 1992, Zabel *et al.* 1992a, Moen and Gutiérrez 1997, North *et al.* 2000); snags (Laymon 1988, Call 1990, Bias and Gutiérrez 1992, Gutiérrez *et al.* 1992, LaHaye *et al.* 1997); and logs (Call 1990). Gutiérrez *et al.* (1992) noted that these characteristics applied to mixed conifer forests, because riparian/hardwood forests occupied by California spotted owls did not necessarily have these characteristics.

Late successional forests provide habitat attributes selected by California spotted owls, including large trees, high canopy closure, multi-layered canopies, snags, and logs (University of California 1996). The current extent of old forests in the Sierra Nevada is believed to be substantially less than in pre-historic times. Estimates of the current extent have been made by several authors. The

University of California (1996) reported that in national parks in the Sierra Nevada, which contain the best representation of pre-European settlement conditions because only minor areas have been subject to timber harvest, 55 percent of forests are in late successional conditions, but on all Federal lands in the Sierra Nevada, late successional conditions are now found on only 19 percent of forest lands. The Forest Service (USFS 2001a) reported that old forest conditions have declined from 50 to 90 percent in various vegetation types compared to the range of historical conditions. Beardsley *et al.* (1999) estimated that approximately 15 percent of coniferous forests in the Sierra Nevada remain in high quality old growth/late successional stages; most of these stands are in high elevations and national parks (Franklin and Fites-Kaufmann 1996). Most of the remaining high quality late successional/old growth habitat in the Sierra Nevada is in public ownership; less than two percent of 1,214,000 ha (3 million ac) of private land was classified as high quality late successional/old growth habitat (Franklin and Fites-Kaufmann 1996).

California spotted owls in the Sierra Nevada may have undergone at least three periods of decline: (1) Elimination of prey species by intensive livestock grazing and burning in the 1800s; (2) logging beginning in the late 1800s, which removed basic structural elements of owl habitat; and (3) recent California spotted owls in the Sierra Nevada may have undergone at least three periods of decline: (1) Elimination of prey species by intensive livestock grazing and burning in the 1800s; (2) logging beginning in the late 1800s, which removed basic structural elements of owl habitat; and (3) recent logging of stands that regenerated following initial entry (Gutiérrez 1994).

In the early 1990s, researchers expressed concern regarding potential lag effects in population decline, in which the negative effects of habitat modification might not be observed until subsequent years (Noon *et al.* 1992, Gutiérrez 1994, LaHaye *et al.* 1994). However, it seems reasonable to presume that the causal mechanisms of negative effects ascribed to the high levels of timber harvest circa 1990 were substantially reduced as timber harvest levels dropped and increased protection measures were instituted in the mid- and late-1990s. In the opinion of the Forest Service (USFS 2001a), it is unlikely that recent timber harvest on national forests has caused declines in spotted owl populations, although the possibility exists that declines are due

in part to latent effects of past timber harvest. However, because the regeneration of habitat may take several decades, modification of habitat components that resulted from past timber harvest is probably still affecting the subspecies to various degrees.

Although late-successional forests with large old trees are believed to provide the best habitat for California spotted owls, descriptions of suitable habitat derived from habitat use studies often also include smaller size classes, and thus, include a greater proportion of the landscape than that included in the above estimates of older forest extent. In the early 1990s, Verner *et al.* (1992a) estimated the amount of suitable California spotted owl habitat on public land. They defined suitable habitat as having canopy cover exceeding 40 percent and dominant trees 30 to 36 cm (12 to 14 in) dbh or larger, or areas with the potential to reach those values relatively rapidly. Their estimates of California spotted owl habitat in the Sierra Nevada by jurisdiction were as follows: 1,416,400 ha (3,500,000 ac) on national forests; 186,560 ha (461,000 ac) on national parks; 27,721 ha (68,500 ac) on BLM lands; and 10,522 ha (26,000 ac) on State lands. Their estimates for the Coast ranges and southern California were: 218,530 ha (540,000 ac) on national forests; 3,076 ha (7,600 ac) on BLM; and 10,117 ha (25,000 ac) held by State and local governments. Thus, the total estimated habitat was 1,872,926 ha (4,628,100 ac). An undetermined amount of suitable habitat also existed on private and Native American lands (Verner *et al.* 1992a).

*Habitat in the Sierra Nevada.* The Final Environmental Impact Statement (FEIS) for the Sierra Nevada Framework Amendment (SNFPA) (USFS 2001a) estimated the amount of suitable habitat for California spotted owls on national forest lands in the Sierra Nevada to be 1.7 million ha (4.3 million ac). This estimate was about 14 percent higher than that of Verner *et al.* (1992a). The new estimate was based on more refined analysis, rather than an actual increase in habitat. This constitutes about 59 percent of the forested lands on the Sierra Nevada national forests.

Amounts of habitat on private lands have not been quantified. Generally, industrial landowners regard information relevant to timber inventories as proprietary. Based on Forest Service data, there were about 485,600 ha (1.2 million ac) of industrial timberland in the Sierra Nevada as of 1994 (derived from Waddell and Bassett 1997a, Waddell and Bassett 1997b, Waddell and Bassett 1997c). National forests in the Sierra Nevada include