Chapter 7

Patterns of Habitat Use By California Spotted Owls in Logged Forests of the Northern Sierra Nevada

Cynthia J. Zabel, Kevin S. McKelvey, and James D. Johnston

The radio-tracking study area on the Lassen National Forest (NF) reported in Chapter 6 was coincidentally an area for which we were able to locate nearly complete records of logging. It was also an area for which we had much information about the vegetation. Based on these records, we have visually examined patterns of habitat use by radio-tagged spotted owls in relation to stand histories near the geographic center of our telemetry study area. We have assumed that a low density of owl locations in an area indicated an aversion by the owls to the habitat there. Conversely, a high density of locations was interpreted to indicate selection for a particular area.

We have not attempted any statistical analyses of use vs. availability for these data, as done in Chapter 6. Logging practices were unique enough on the various study sites that we could not stratify them into meaningful categories for rigorous use-versus-availability tests. Instead, we based our evaluations of spotted owl use patterns on visual inspections of owl locations in relation to known histories of logging in stands. Such case studies may serve to enlarg;our general understanding of how the owls are affected by dift :rent stand treatments.

Study Area

The Lassen NF study area was located in the northern Sierra Nevada, east of Lassen National Park. It was dominated by red and white fir at high elevations (approximately 5,800-6,900 feet) and pine (Jeffrey, ponderosa, sugar, and lodgepole) at lower elevations (approximately 5,000-5,800 feet). The predominant silvicultural method there has been selective logging. For this chapter, we focus on the high-elevation, true fir zone. The condition of this forest in the early part of the 20th century was markedly different before logging began in the 1930s. Sierran mixed-conifer forest covered the mid-mountain slopes and red fir dominated higher elevations, except for shrub fields on the south side of Swain Mountain. The forest was dominated by large trees-average diameter at breast height (d.b.h.) of the various species was 25-34 inches for white fir, 32-35 inches for Jeffrey pine, and 28-32 inches for red fir (Boerker 1912, Evans 1919).

Methods

The cutting history within the study area was determined using records and timber sale maps from the U.S. Department of Agriculture, Forest Service (FS) and private timber companies. This information was then transferred to U.S. Geologic Survey topographic maps. Cut-unit polygons were subsequently digitized and stored in a Geographic Information System (GIS). Each cut-unit polygon contained historical information, including year of cut, type of harvest (overstory removal, group selection, thinning, sanitation, salvage, partial cut), and species removed. Radio-telemetry points from daytime roosting and nighttime foraging locations of spotted owls (Chapter 6) were overlaid onto the cut-history maps using GIS. Vegetation types (table 6A), determined from large-scale color aerial photographs and 1:24,000 black-and-white orthophotoquads, were then overlaid onto the owl telemetry points and the cut-unit maps. Vegetation polygons were classified by diameter size-class of the dominant trees (structural size class) and canopy closure class of dominant trees. For this chapter, we classified structural size class into two categories: <21 inches in d.b.h. (size classes 0-3) and ≥21 inches d.b.h. (size classes 4 and 5). Similarly, canopy closure was categorized as <40 percent cover (open, sparse, or poor) or ≥40 percent cover (normal or good). Polygons were reclassified as suitable or unsuitable spotted owl habitat based on current FS definitions. Suitable stands were those in which the diameter size-class of dominant trees was ≥21 inches, canopy closure of dominant trees was ≥20 percent, and total canopy closure was ≥70 percent.

We present three figures for each area of interest with owl radio locations overlaid on each of three vegetation types--suitable spotted owl habitat according to the FS; structural size class ≥21 inches in d.b.h.; and canopy closure ≥40 percent. Cut units and areas of owl use have been numbered in the sequence in which they are discussed in the results. For one area, we also present a 1980 orthophotograph for a visual inspection of the landscape. Timber-sale boundaries delineated on the figure do not always align with boundaries on the orthophoto. The figure represents sale maps or planned cuts, but the orthophoto depicts actual cut boundaries after logging was done. Cut units delineated on the figures are minimum representations of actual areas that were logged. Many areas were entered with light removal outside of the units we mapped, but the FS generally did not keep detailed records of such light cuts.

Results

We examined four areas located near the center of our owl home-range and habitat-use study and where much logging had occurred (fig. 7A). These areas are designated here as Griffith Hill (fig. 7B), Swain Mountain (fig. 7C), Silver Lake (fig. 7D), and Star Butte (fig. 7E). Most logged areas on Swain Mountain were little used by owls, and some heavily logged areas at Griffith Hill, Silver Lake, and Star Butte were avoided by the owls, but other logged areas were used extensively.

Griffith Hill

The Griffith Hill area was dominated by a strip of FS land approximately 3/4 of a mile wide and 2 miles long, lying between two areas of private land (figs. 7B and 7F). Canopy cover on FS land was mostly ≥40 percent. The FS land was characterized by selectively logged true fir and mixed-conifer forests. Several sites (numbers 1, 2, 3, and 4) were selectively logged in the mid-1960s by overstory removal and group selection. Private land south of this section (site 5), on the other hand, has been logged much more heavily, and canopy cover there was <40 percent. Site 5 was rarely used by the owls. Pine and fir were harvested there in 1960; in 1973 trees >24 inches were removed and the site was salvage-logged for merchantable timber; and trees of all species <20 inches in d.b.h. were thinned in the 1970s-1980s (McCrory pers. comm.). Site 5 currently has sparsely scattered trees ≥21 inches in d.b.h. in the eastern section. The adjacent private land (site 6) is owned by the same company but, according to their records, it has not been entered. The Susan River drainage, which runs through this area to the south of Lake Road (site 7), was logged by overstory removal and group selection in 1966 and 1968. It now has canopy cover ≥40 percent, but trees there are small and the site is classified as unsuitable owl habitat.

In general, spotted owl use at Griffith Hill occurred mostly on FS land. The more open private land to the north and south were used relatively little. Several owl telemetry fixes were in site 6, characterized by trees ≥21 inches in d.b.h. and a canopy closure ≥40 percent. An owl pair nested in the fir stand covering the eastern half of site 1. The owls apparently did not use the western half of site 1, which had been heavily logged and was very open. The eastern half of site 1 was "group cut" (in small areas <1 acre), and the western half was cut using overstory removal (J. D. Johnston pers. observ.).

Swain Mountain

This area covers Swain Mountain Experimental Forest (SMEF) and adjacent forests (fig. 7C). Most of SMEF lies above 5,800 feet in elevation and is dominated by forests of red and white fir. Numerous small patch cuts were made across SMEF in 1958 and from 1970 to 1972. Several stands were also selectively logged during the early 1970s. The large south-facing slope of Swain Mountain burned frequently in the past and was planted with Jeffrey pine in 1978. Today the area is dominated by a thick cover of ceanothus, chinquapin, manzanita, and small Jeffrey pines. Much of SMEF was shelterwood-logged from 1982 to 1985. Those cuts underwent intensive site preparation following logging-units were either broadcast burned or tractor-piled and burned. Most of the residual trees there today are large, old-growth firs, with densities ranging from 5 to 15 trees per acre. Several intact stands of old-growth still remain on SMEF.

Spotted owls did not use the large areas of shelterwood cuts (site 8) or the large pine plantation on the south side of Swain (site 9). Figure 7C shows that most owl locations were in habitat classified as suitable (sites 10, 11, 12, and 13), and many were in the intact old-growth stands. Most owl locations on SMEF occurred during the nonbreeding period. One owl pair had a linear home range along a road just southwest of the pine plantation (site 14). The forest along this road, and to the west of it, has been selectively logged but is still dominated by trees ≥21 inches in d.b.h. and canopy cover ≥40 percent.

Silver Lake

The Silver Lake area (fig. 7D) lies just west of the Griffith Hill area and northwest of SMEF. Its eastern part includes private land that was heavily logged in the past (fig. 7B, site 5). The area currently has a very open canopy and few stands with large trees remain. Relatively few owl locations occurred there. To the northwest and southwest were FS lands that had been selectively logged to varying degrees. Owls used this heterogeneous landscape extensively, avoiding the most open areas--sites 15, 16, and 17. Those sites formed a continuous, broad strip of land that has been logged heavily. Stands between the private land (site 5) and logged sites 15 and 17 contained suitable habitat with large trees. Cutting occurred there in small blocks, but the owls regularly used the area. Several owl locations were in high-elevation (>6,400 feet) stands that were relatively open but dominated by large-diameter firs (site 18).

Star Butte

The Star Butte area (fig. 7E) has also been selectively logged to varying degrees using overstory removal and group-selection methods. Most of this area was extensively used by spotted owls, even though much of it was not classified as suitable spotted owl habitat. The only relatively undisturbed stand of old-growth fir in the Star Butte area was used for nesting by a pair of owls in 1990 (site 19). The more heavily logged areas (site 21) and the area around Star Butte (site 22) were both used infrequently by the owls. Site 21, on private land, was logged repeatedly in the 1930s, 1940s, 1950s, and 1970s. It was logged for culls in 1980, and it has been thinned in the past 3 years (Briggs pers. comm.). Star Butte (site 22) had small pockets of large trees but was unsuitable owl habitat. It contains a 6,700-foot peak with shrubfields along its upper slopes and small firs on its lower slopes. The area southeast of Star Butte had been heavily logged and appeared to be avoided by owls.

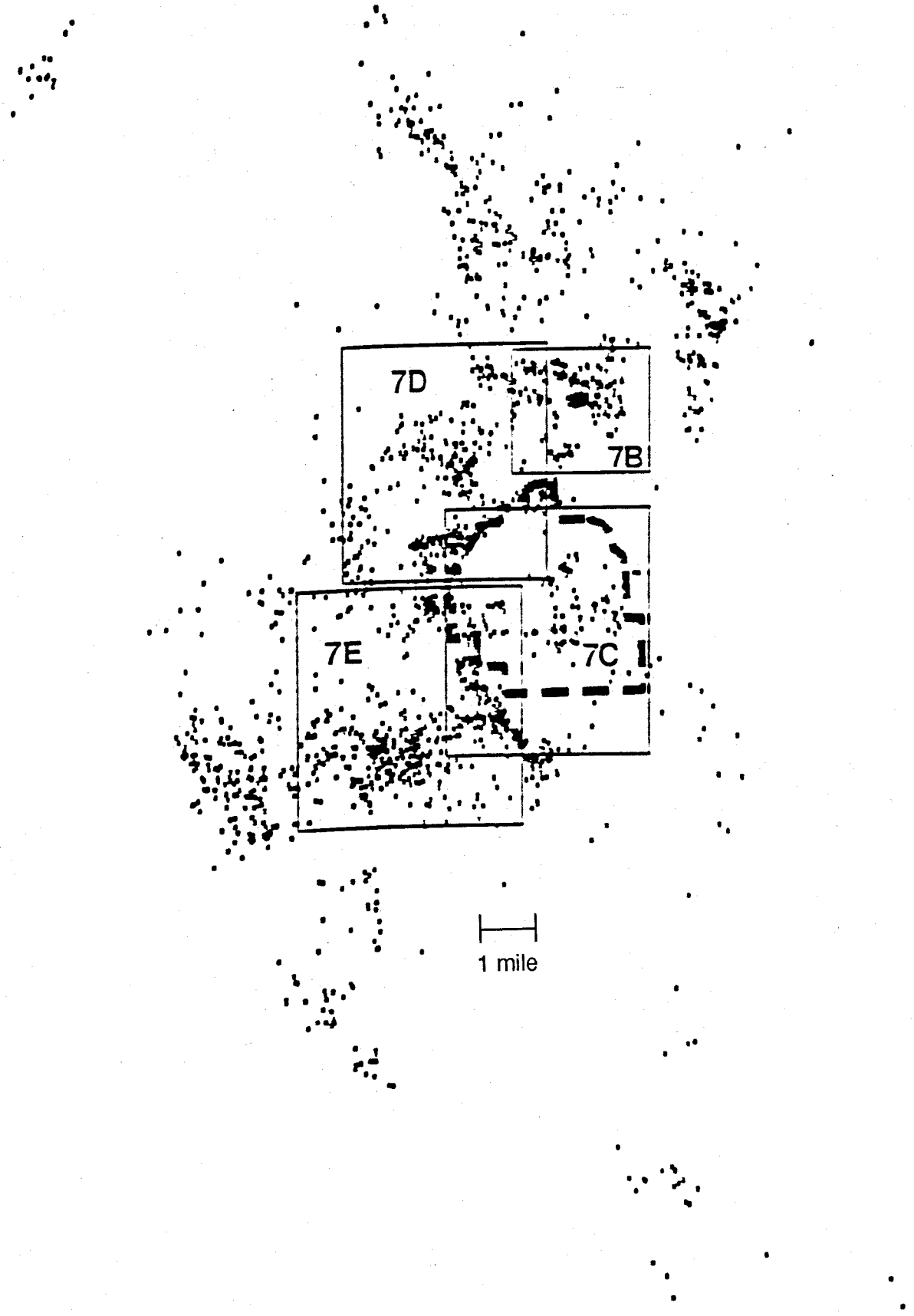

Figure 7A-Locations of study areas (7B, 7C, 7D, and 7E) on the Lassen National Forest. Radio-telemetry points from daytime roosting and nighttime foraging locations of California spotted owls are indicated. The boundary of Swain Mountain Experimental Forest is delineated as a dashed line. Study area numbers correspond to descriptive figures 7B-7E, similarly numbered.

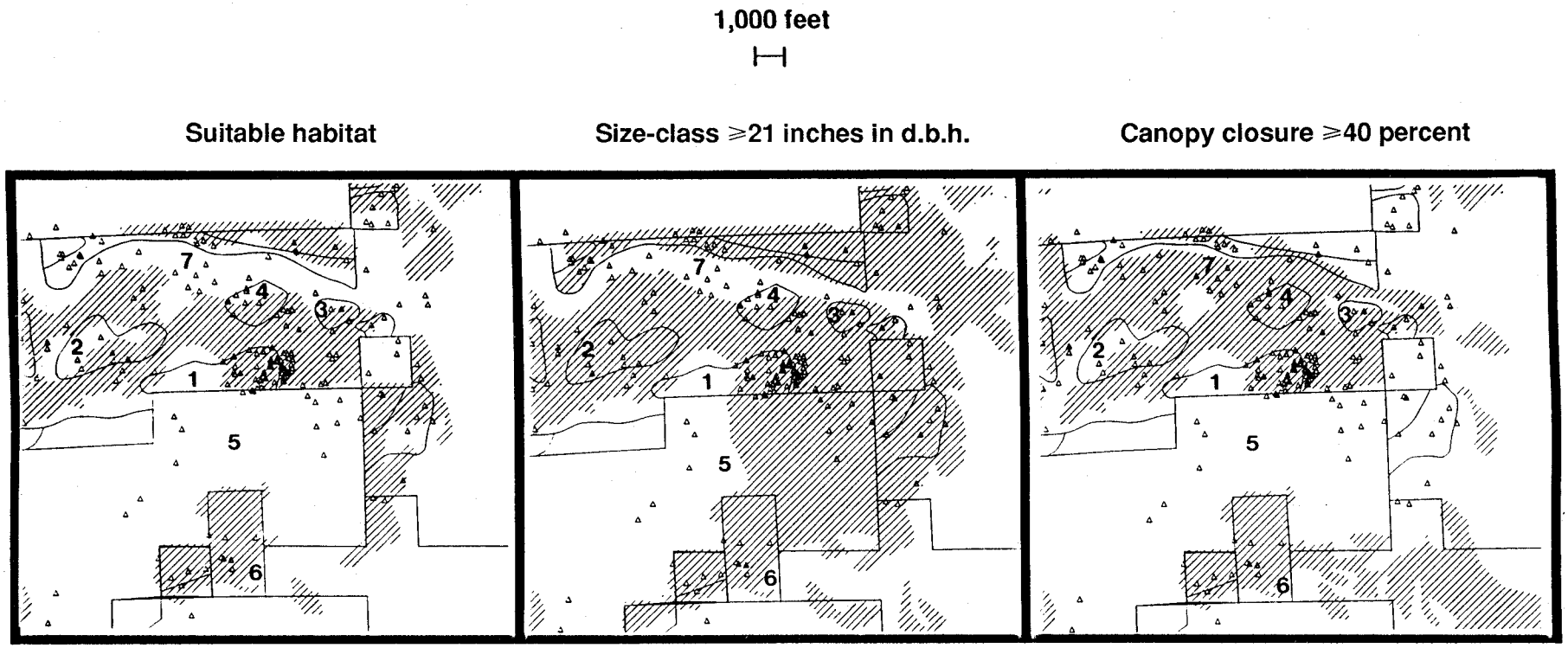

Figure 7B—Griffith Hill study area. Timber sale boundaries and section boundaries between private and National Forest lands are delineated. California spotted owl radio-telemetry locations (open triangles) are overlaid onto three vegetation types indicated by diagonal lines: (1) suitable spotted owl habitat, based on current Forest Service (Region 5) definitions; (2) stands in which diameter size-class of dominant trees was ≥21 inches; and (3) stands in which canopy cover of dominant trees was ≥40 percent. Numbers on each study area map refer to specific logging sites and areas of owl use.

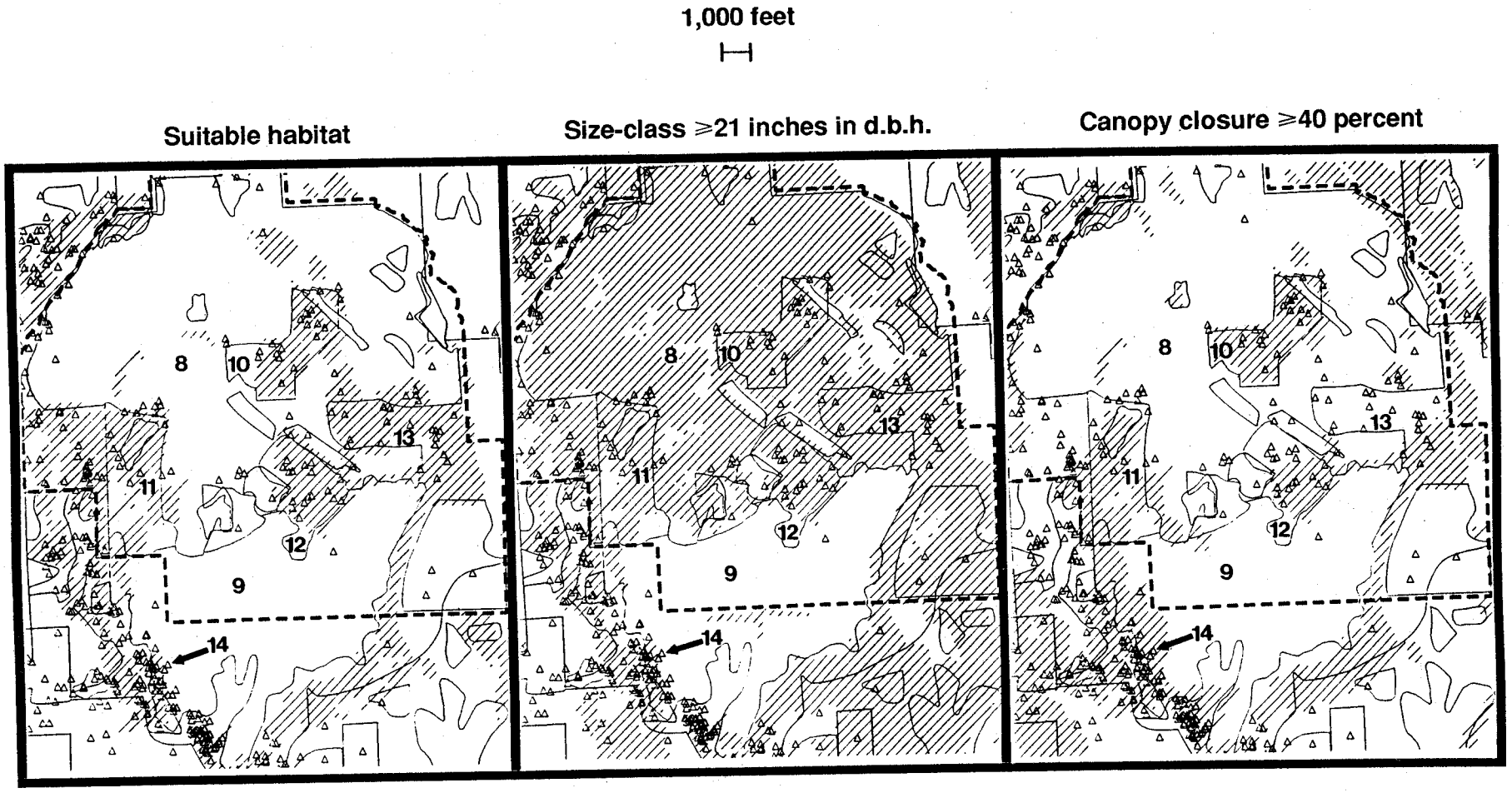

Figure 7C—Swain Mountain study area. The boundary of Swain Mountain Experimental Forest is indicated as a dashed line. Timber sale boundaries and section boundaries between private and National Forest lands are delineated. California spotted owl radio-telemetry locations are overlaid onto three vegetation types indicated by diagonal lines: (1) suitable spotted owl habitat, based on current Forest Service (Region 5) definitions; (2) stands in which diameter size-class of dominant trees was ≥21 inches; and (3) stands in which canopy cover of dominant trees was ≥40 percent. Numbers on each study area map refer to specific logging sites and areas of owl use.

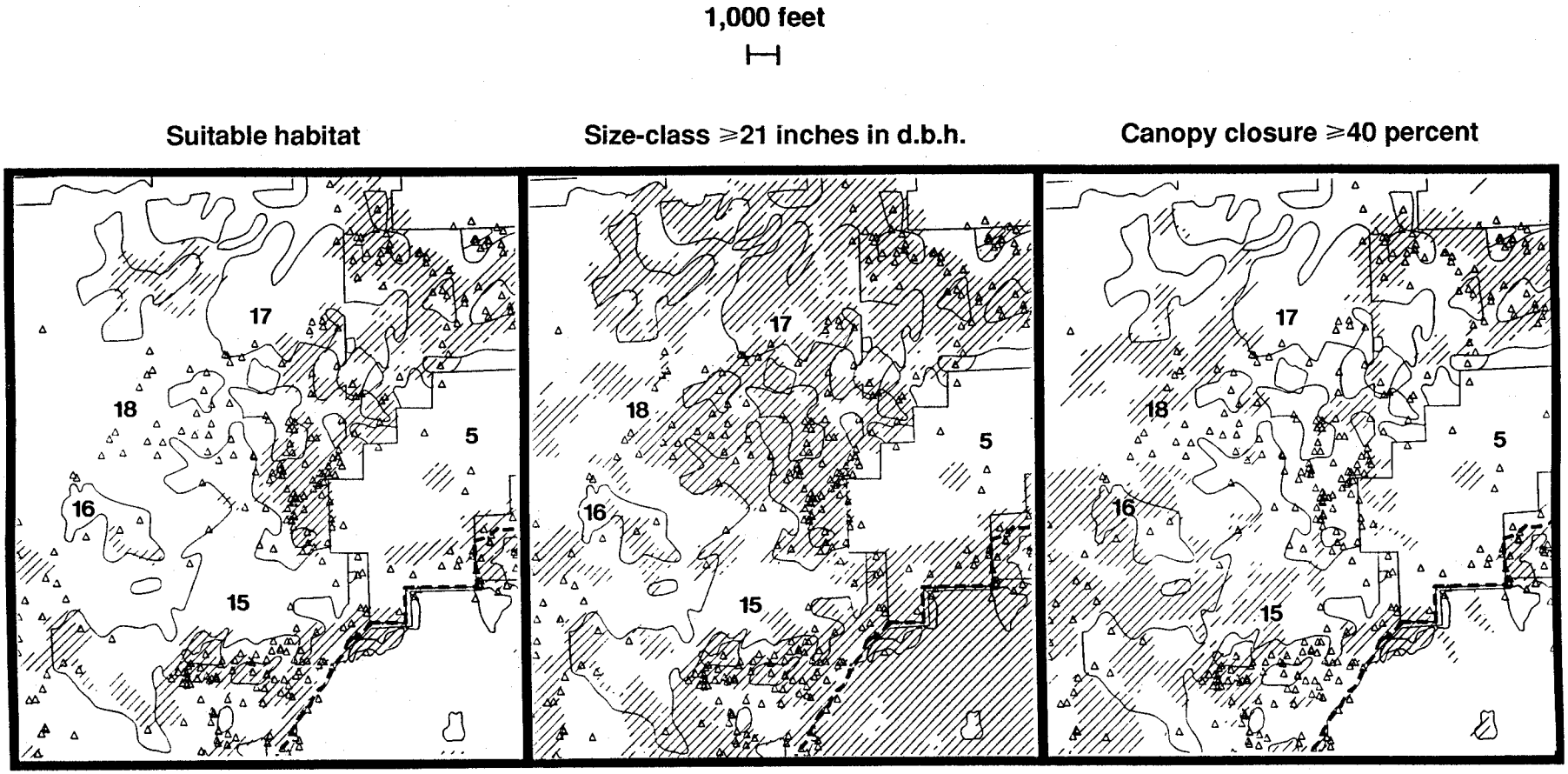

Figure 7D—Silver Lake study area. Timber sale boundaries and section boundaries between private and National Forest lands are delineated. California spotted owl radio-telemetry locations are overlaid onto three vegetation types indicated by diagonal lines: (1) suitable spotted owl habitat, based on current Forest Service (Region 5) definitions; (2) stands in which diameter size-class of dominant trees was ≥21 inches; and (3) stands in which canopy cover of dominant trees was ≥40 percent. Numbers on each study area map refer to specific logging sites and areas of owl use.

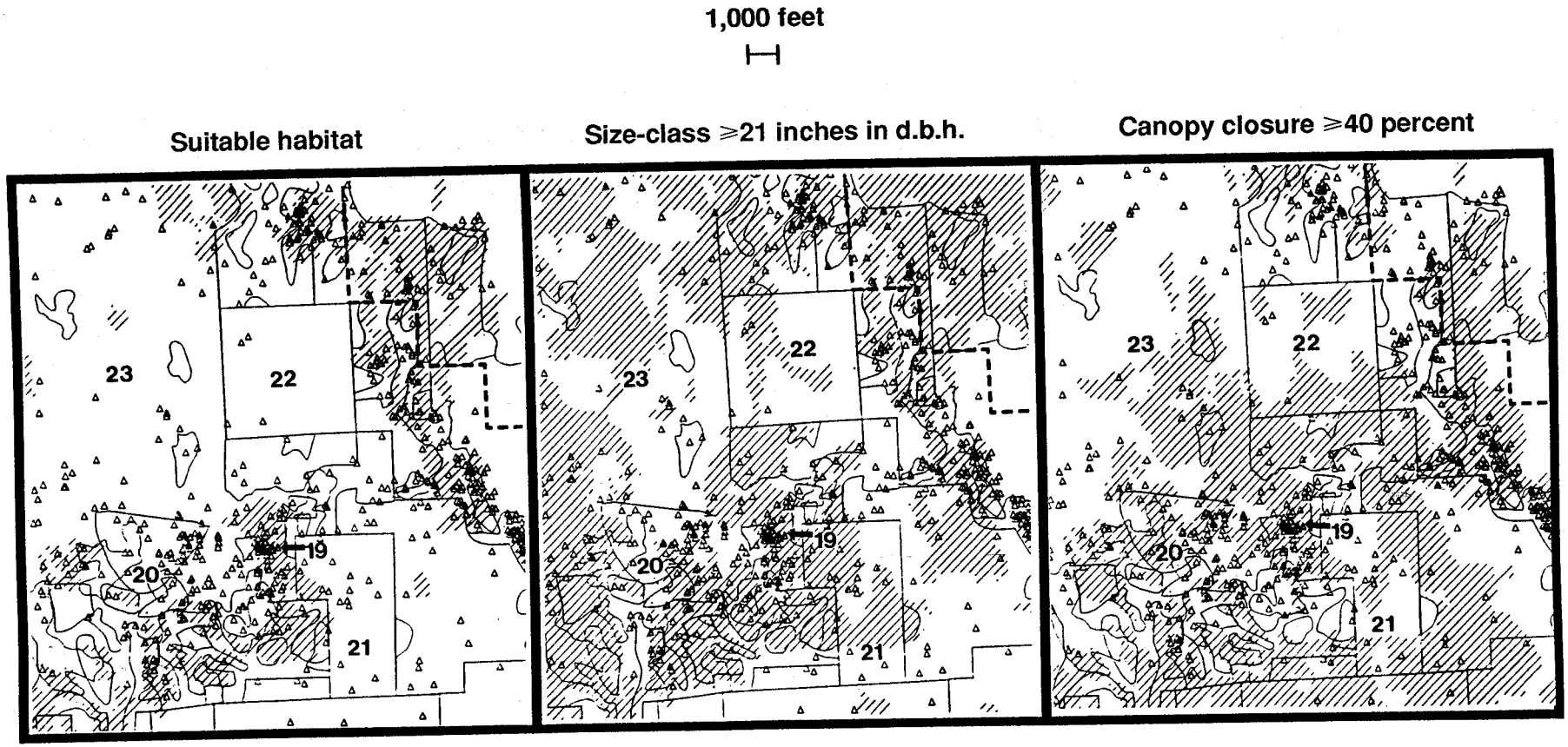

Figure 7E—Star Butte study area. Timber sale boundaries, and section boundaries between private and National Forest lands are delineated. California spotted owl radio-telemetry locations are overlaid onto three vegetation types indicated by diagonal lines: (1) suitable spotted owl habitat, based on current Forest Service (Region 5) definitions; (2) stands in which diameter size-class of dominant trees was ≥21 inches; and (3) stands in which canopy cover of dominant trees was ≥40 percent. Numbers on each study area map refer to specific logging sites and areas of owl use.

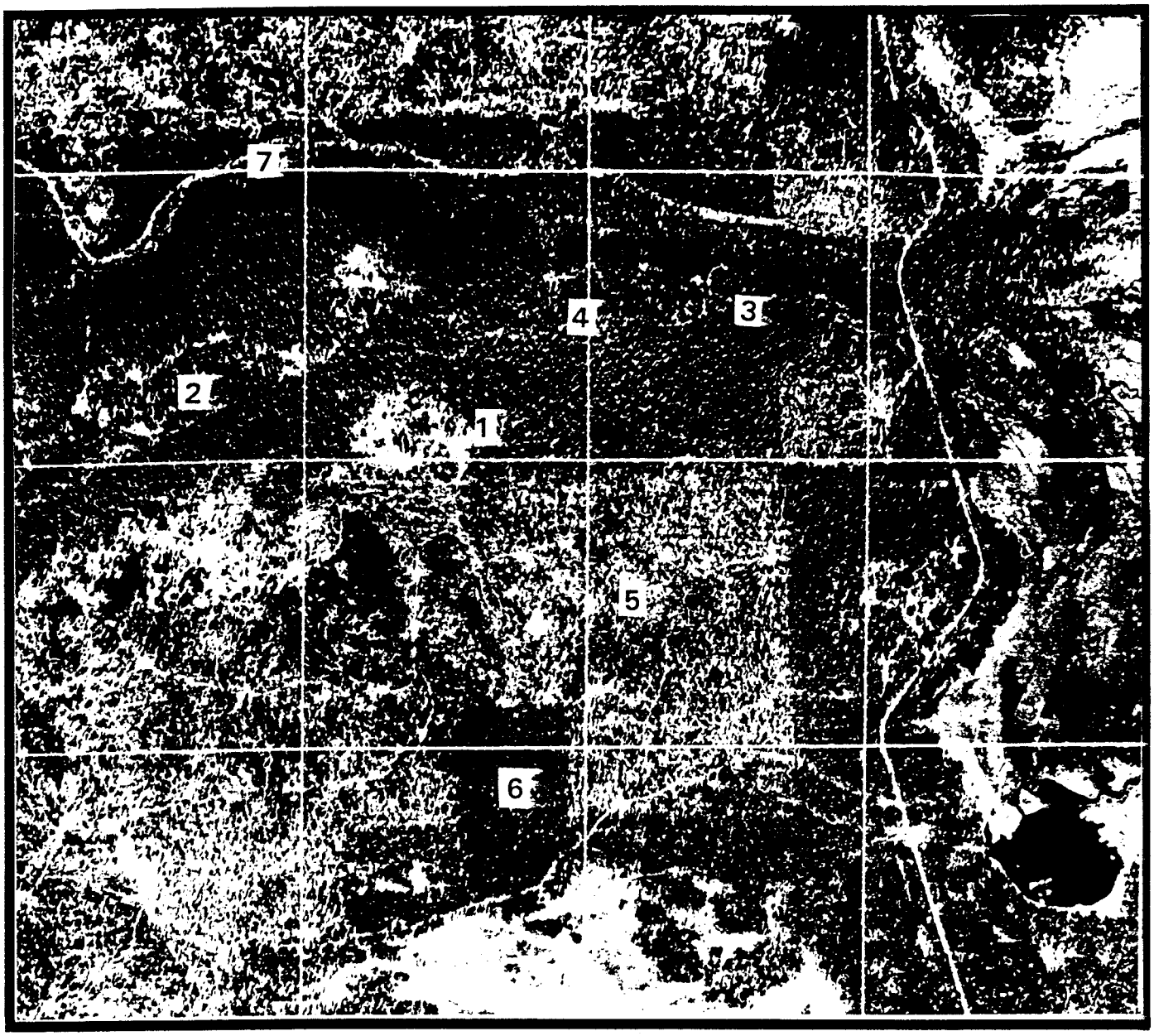

Figure 7F-Orthophotograph of Griffith Hill study area (fig. 7B). Cut units and areas used by California spotted owls are numbered in the sequence in which they are discussed in the results section of this chapter.

Site 14, near the southwest corner of SMEF, is an extension of an owl pair's linear home range referred to in the discussion of Swain Mountain. It has been selectively logged, but it was still suitable habitat and was heavily used by a pair of owls. Site 23, like site 18 (fig. 7D), is an uncut, high-elevation site that was used by owls even though it was unsuitable habitat. It also had areas of sparse, large trees where owl locations tended to occur, and pockets of high canopy cover were present.

Discussion

Decades of selective logging and wildfire on the Lassen NF have resulted in a complex and heterogeneous landscape. Unlike landscapes in the Pacific Northwest, where even-aged management has produced stands that differ primarily in stand age and size, uneven-aged management on the Lassen NF and throughout most of the Sierra Nevada has produced landscapes in which stands vary according to several factors. They vary in the number of times they have been entered for logging, the species of

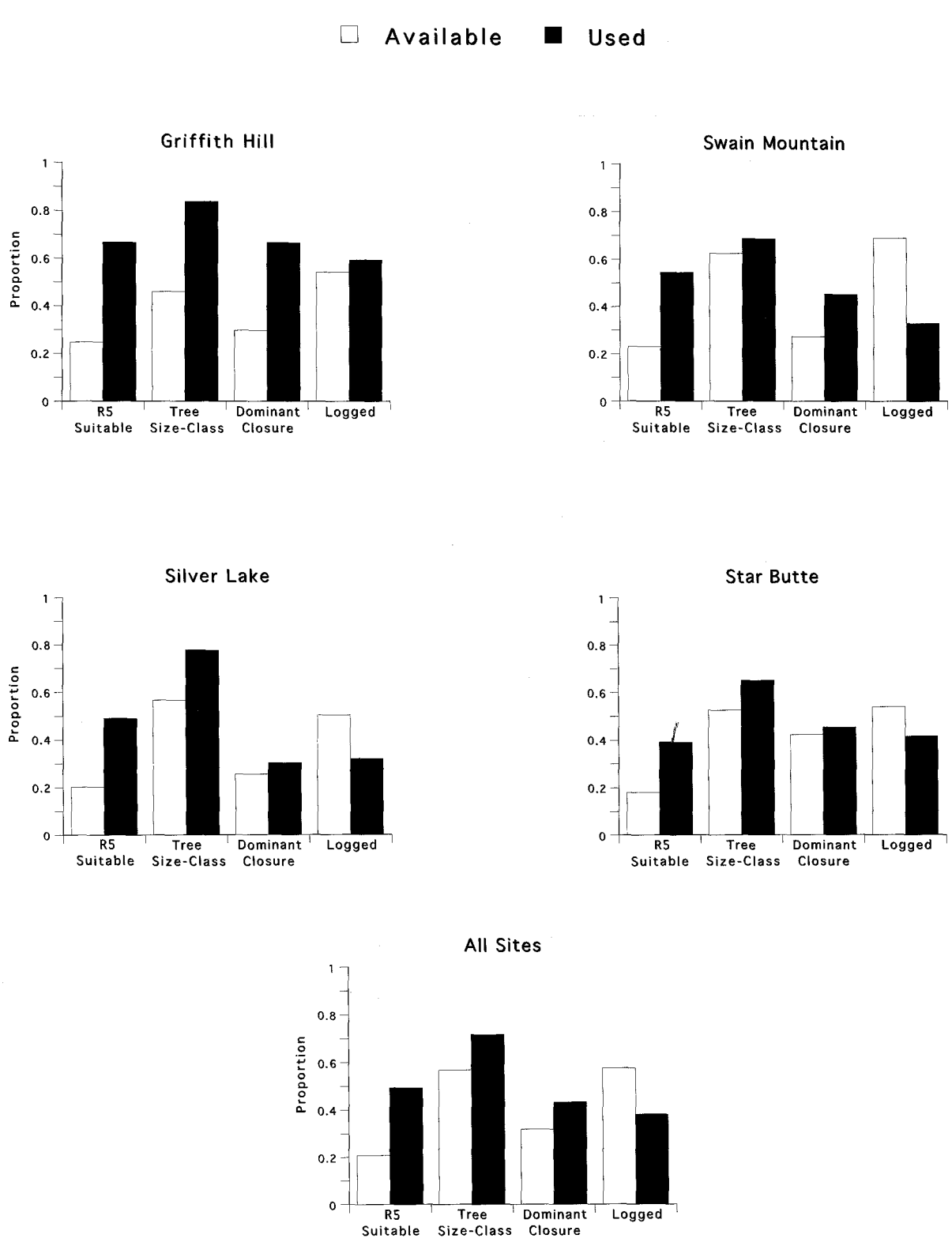

Figure 7G-Proportions of habitat types available in relation to the proportions used by radio-tagged California spotted owls at four study areas in the Lassen National Forest. Four categories of habitat were tested: (1) R5 suitable = Forest Service (Region 5) definition--medium or large sawtimber (≥21 inches in diameter at breast height), dominant canopy closure poor or higher, and total closure >69 percent; (2) structural size-class ≥21 inches in diameter at breast height; (3) dominant canopy closure ≥40 percent; and (4) logged stands.

trees taken, the diameter distribution of trees removed, and in the total volume logged. As a result, it is more difficult to compare stand structure and composition in landscapes dominated by uneven-aged management than is the case where even-aged management has occurred.

The areas we examined were predominantly logged by overstory removal and group-selection techniques in the late 1960s. It is apparent from these results that spotted owls tend to avoid altogether some forest conditions resulting from logging, but that they will use other types for foraging. Logged areas used by owls contained predominantly large trees (≥21 inches), and most of them had retained enough structure and canopy closure to be classified as suitable owl habitat (for example, site 14). Owl use of sites with large trees, dense canopy cover, and with suitable habitat (R5 definition), was greater than expected from the availability of such sites at all four study areas (fig. 7G). Some areas of low canopy cover were used where large trees were present and stands of high and low cover were interspersed (sites 2, 3, and 13). Pockets of large trees were also used when they were in areas of high canopy cover (sites 4, 20, and 21). It appears as if spotted owls will use logged sites if pockets of suitable habitat are interspersed among stands with low canopy or small trees. We cannot, however, quantify the total acreage or proportion of a site that must be in such stands before owls will use the site. These results indicate that logging by overstory removal and group selection can be compatible with spotted owl management in the red fir zone, if logged areas are small and interspersed with varying size classes and levels of canopy closure.

Use of logged sites was less than expected from the availability of such sites at three of four study areas (fig. 7G). Logged sites that were avoided by owls included large areas of sparsely distributed, big trees with low canopy cover (sites 5, 8, and 17), and large areas with dense canopy cover but small trees (sites 15 and 16). Most of the logged areas that were not used by owls had not returned to suitable owl habitat.

Spotted owls in the true fir zone used some naturally occurring sites classified as unsuitable owl habitat (see Chapter 6). These included areas at high elevations with large trees that were sparsely distributed (for example, Silver Lake site 18 and Star Butte site 23). In contrast, areas that were unsuitable habitat as a consequence of logging were often not used by owls. Examples include shelterwood-logged stands at SMEF (site 8) and private land that was heavily thinned north of Swain Mountain (site 5). Areas near site 18 and site 23 were used by owls even though they were far from the center of any concentration of owl locations. Yet, heavily logged areas (sites 5 and 8) were not used, even though they were adjacent to sites with concentrations of owl locations.

Unsuitable habitat in the Silver Lake area (site 18) was used by five individual owls during the nonbreeding period. These owls moved upslope into the higher elevations during the fall and remained there throughout the winter. Similarly, four owls used the high-elevation, uncut stands in SMEF (sites 10, 11, 12, and 13) during the fall and winter. These owls did not fly across the shelterwood-logged stands during the summer, but they did so during the winter to access uncut, old-growth stands (sites 10, 11, and 12).

This is a first attempt to determine cut patterns that spotted owls will use. Strong patterns of aversion were apparent in the data, but preference patterns were not so clear. The silvicultural prescriptions described here did not adequately convey what was removed from cut units. All the units we examined had overstory removal and group selection, yet aerial photographs indicated that different volumes of timber were removed. Some units now have dense stands of large trees, while others have sparsely distributed, large trees. A micro-scale approach, with precise measurements of stand characteristics, may be needed to better understand what logging prescriptions are compatible with spotted owls. Attributes that may have been impacted by site preparation but were not considered in the analyses presented here, such as amounts of coarse woody debris, may also be important. Such attributes may influence prey abundance and distribution, and indirectly influence use of harvested areas by spotted owls (Chapter 4).

These results indicate that cutting patterns other than clearcuts, such as heavy overstory removal, can make sites unsuitable for spotted owl foraging in the red fir zone. We do not know how these patterns may extend into Sierran mixed-conifer forests. Home-range sizes of California spotted owls were larger in the high-elevation, red fir zone (Chapter 6), which was underused for nesting (Chapter 5) compared to mixed-conifer forests. High-elevation red fir may be marginal for California spotted owls, and owls living there may be more sensitive to logging than owls in mixed-conifer forests. These results may not be applicable to other forests types. A similar study with good quantitative information on what was logged, and how, needs to be done in mixed-conifer forests.

References

Boerker, Richard A. 1912. A reconnaissance working plan, Lassen National Forest, the Susanville Block. Mineral, CA: Lassen National Forest, Forest Service, U.S. Department of Agriculture; 110 p.

Briggs, Gaylord, Forester, Roseburg Resources Company, Anderson, CA. [Personal communication]. January 1992.

Evans, O. M. 1919. Timber survey report, 1918, Rock Creek Unit, Lassen National Forest. Mineral, CA: Lassen National Forest, Forest Service, U.S. Department of Agriculture; 5 p.

McCrory, David, Forester, Fruit Growers Supply Company, Burney, CA. [Personal communication]. January 1992.