
Chapter 5: California Spotted Owl Module

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Introduction

Knowledge regarding the effects of fuels and vegetation management on California spotted owls (*Strix occidentalis occidentalis*; CSOs) and their habitat is a primary information need for addressing conservation and management objectives in Sierra Nevada forests. The specific research objectives of the California spotted owl module as identified and described in the Plumas-Lassen Study (PLS) Plan are:

- 1) What are the associations among landscape fuels treatments and CSO density, distribution, population trends and habitat suitability at the landscape-scale?
- 2) What are the associations among landscape fuels treatments and CSO reproduction, survival, and habitat fitness potential at the core area/home range scales?
- 3) What are the associations among landscape fuels treatments and CSO habitat use and home range configuration at the core area/home range scale?
- 4) What is the population trend of CSO in the northern Sierra Nevada and which factors account for variation in population trend?

5) Are barred owls increasing in the northern Sierra Nevada, what factors are associated with their distribution and abundance, and are they associated with reduced CSO territory occupancy?

6) Does West Nile Virus affect the survival, distribution and abundance of California spotted owls in the study area?

Current information on the distribution and density of CSOs across the HFQLG study area is required to provide the data necessary to build predictive habitat models and provide baseline population information against which we will assess post-treatment changes in CSO populations and habitat. Continued monitoring on the Lassen Demographic Study Area is critical for estimating CSO population trends and status. Our focus in 2007 was to conduct landscape inventories of CSO distribution and abundance, and continue banding to provide the required data and baseline information to meet the objectives of Research Questions 1-4 identified above. Complete landscape inventory surveys were conducted across 9 of 11 survey areas in 2007 (Figure 1). Surveys were not conducted in 2 survey areas in 2006 or 2007 (SA-5, SA-7, Figure 1). Surveys were not conducted in these 2 study areas in 2006 or 2007 because sufficient data for determining the number and distribution of CSO sites for initial habitat modeling efforts was collected in 2004-2005. Details on survey methods are described in the study plan. Efforts were made to monitor the pair and reproductive status of each owl, and to capture, uniquely color-mark, and collect blood samples from each individual owl across the study area. Capture and color-marking is necessary to estimate survival and population trend, and to assess exposure to West Nile Virus (WNV)(Research Question #5). We also recorded all barred and hybrid barred-spotted owls encountered in the study area and synthesized all existing barred owl records for the northern Sierra Nevada to address Research Question #6. Additionally, we initiated radio-telemetry studies on CSOs within SA-4 in the Meadow Valley project area to document home range size and configuration, and to assess habitat selection relative to the recently implemented treatments.

Results

CSO Numbers, Reproductive Success, Density and Population Trends:

A total of 71 territorial CSO sites were documented in 2007 across the study area (Figure 2). This total consisted of 62 confirmed pairs, 3 unconfirmed pairs (i.e., one member of pair confirmed as territorial single plus single detection of opposite sex bird), and 6 territorial single CSOs (single owl detected multiple times with no pair-mate detected). Thirty-six pairs successfully reproduced in 2007 (55% of confirmed/unconfirmed pairs). A total of 65 fledged young were documented in 2007 (1.81 young per successful nest) (Table 1). Across the recent four years of the study, CSO reproduction has been highest in 2004 and 2007 in terms of the percent of CSO pairs that successfully reproduced, and to lesser degrees in terms of the number of young fledged per successful nest. Approximately 50% of CSO pairs successfully reproduced in 2004 and 2007 while only 14% and 18% were successful in 2005 and 2006, respectively. CSO reproduction is known to vary with spring weather. Precipitation patterns were more similar in 2004 and

2007, with total precipitation relatively low during March-April of 2004 and 2007 as compared to 2005 and 2006 (Figure 3).

Table 1. California spotted owl reproduction on the Plumas and Lassen National Forests 2004-2007.

Year	Percent of confirmed/unconfirmed pairs with successful nests	Young fledged per successful nest
2004	49.4%	1.68
2005	17.7%	1.47
2006	13.8%	1.50
2007	55.4%	1.81

The Lassen Demographic Study Area (SA-1A, SA-11, SA-12, SA-13, SA-14, SA-15) and Plumas NF Survey Areas (SA-2, SA-3, SA-4, SA-5, SA-7) were fully integrated in 2005 to define the overall Plumas-Lassen Study project area and provide consistent CSO survey effort across the project area. (Figures 1 & 2). The crude density estimates in this report differ from those reported in the 2006 Annual Report for the same year because of updates and corrections to the GIS base survey maps and CSO survey results databases that were conducted in winter 2007-2008 to correct the original survey area boundaries and survey results to make them congruent with the actual watershed boundaries of each survey area. We estimated the crude density of CSOs based on the number of territorial owls detected across 9 survey areas during 2007 surveys at the Survey Area spatial scales (Tables 2 and 3). The estimated crude density across the overall study area in 2007 was 0.066 territorial owls/km². Overall study area crude densities are not directly comparable across years because different total areas were surveyed in each year. However, crude density estimates within individual survey areas indicate similar densities and number of territorial sites (pair sites plus territorial single sites) between 2004-2007 for the survey areas on the Plumas NF (SA-2, SA-3, SA-4), while numbers appear to have declined on the Lassen survey areas (SA-1A, SA-11, SA-12, SA-13, SA-14, SA-15) between 2005-2007 (Tables 2 and 3).

Table 2. Crude density of territorial California spotted owls across survey areas on the Plumas and Lassen National Forests 2004-2007. Locations of survey areas are identified in Figure 1.

Survey Area	Size (km ²)	Crude Density of Territorial Owls (#/km ²)			
		2004*	2005*	2006*	2007*
SA-2	182.4	0.126	0.143	0.115	0.115
SA-3	214.4	0.075	0.093	0.089	0.103
SA-4	238.2	0.059	0.050	0.046	0.071
SA-5	260.2	0.069	0.069	NS****	NS****
SA-7	210.3	0.071	0.062	NS	NS
SA-1A	190.4	NI***	0.042	0.042	0.053
SA-1B**	130.3	NI	0.023	NS	NS
SA-11	179.4	NI	0.045	0.033	0.033
SA-12	215.8	NI	0.097	0.070	0.074
SA-13	152.9	NI	0.105	0.085	0.065
SA-14	318.7	NI	0.053	0.044	0.035
SA-15	196.8	NI	0.086	0.036	0.056
Total Study Area	2489.8	0.078	0.073	0.060	0.066

*Total Area surveyed each year: 2004 = 1,106 km²; 2005 = 2,490 km²; 2006 = 1,889 km²; 2007 = 1,889 km²

**NI = not included. Project level area surveyed only in 2005. Included for comparative purposes.

***Lassen Demographic Study Area – incorporated into the overall study in 2005.

****Survey areas not surveyed in 2006 and 2007.

Table 3. Number of pairs (confirmed and unconfirmed) and territorial single California spotted owls across the Plumas-Lassen Study survey areas on the Plumas and Lassen National Forests, California, 2004-2007.

Survey Area	2004		2005		2006		2007	
	Pairs	Singles	Pairs	Singles	Pairs	Singles	Pairs	Singles
SA-2	11	1	12	2	10	1	10	1
SA-3	7	2	10	0	9	1	11	0
SA-4	7	0	5	2	4	3	8	1
SA-5	8	2	9	0	NS***	--	NS***	--
SA-7	7	1	6	1	NS	--	NS	--
SA-1A	NI**	--	4	0	4	0	5	0
SA-1B*	NI	--	3	0	NS	--	NS	--
SA-11	NI	--	4	0	3	0	3	0
SA-12	NI	--	10	1	1	7	8	0
SA-13	NI	--	8	0	6	1	5	0
SA-14	NI	--	8	1	7	0	5	1
SA-15	NI	--	8	1	3	1	4	3

*NI = not included. Project level area surveyed only in 2005. Included for comparative purposes.

**Lassen Demographic Study Area – incorporated into the overall study in 2005.

***Survey areas not surveyed in 2006 and 2007.

The most recent information on CSO population trends is included in the January 2006 meta-analysis, conducted to estimate CSO population trends and to assess population status in response to a petition to list the CSO under the Endangered Species Act (Blakesley et al. 2006). These data continue to provide the best estimates of CSO population trends. Data collected between 1990-2005 from four CSO demographic studies across the Sierra Nevada and southern Cascades, including the Lassen Demographic Study Area, were analyzed as part of the meta-analysis workshop. The Lassen Demographic Study Area is contained within the overall PLS study area and consists of survey areas SA-1A, SA-11, SA-12, SA-13, SA-14 and SA-15 in Figure 1. Full details on meta-analysis methods and results are provided in Blakesley et al. (2006). In synopsis, across the four study areas, results indicated that the Lassen Study CSO population exhibited the strongest evidence for a population decline between 1990-2005. Mean lambda for the Lassen Demographic Study was 0.973, with 95% confidence limits ranging from 0.946-1.001 (Table 4).

Table 4. Mean estimated population lambda (population change) for California spotted owls on four study areas in the southern cascades and Sierra Nevada, 1990-2005 (Blakesley et al. 2006)

Study Area	Lambda	Standard Error	95% Confidence Interval
Lassen National Forest	0.973	0.014	0.946-1.001
Sierra National Forest	0.992	0.013	0.966-1.018
Sequoia-King Canyon National Park	1.006	0.031	0.947-1.068
Eldorado National Forest	1.007	0.029	0.952-1.066

Radio-Telemetry – Meadow Valley Project Area

Eight adult territorial CSOs were radio-tagged during April-June of 2007 within SA-4 in the Meadow Valley Project Area. CSOs were fitted with 12g backpack-mounted transmitters from Holohill Systems with projected radio life expectancy of 1.5 years. We attempted to locate each radio-tagged CSO 5 times over each 2-week sample period between April and September 2007. CSOs were tracked from the ground using vehicles and hand-held H-antennas. Approximately 30 locations were recorded for each individual. Data from the breeding period are currently being proofed and edited for analysis. These data will be used to investigate CSO home ranges sizes and configurations, as well as habitat selection within home ranges relative to available vegetation and fuels treatments. Radio-tagged birds are currently being followed at reduced effort during the nonbreeding period to determine wintering locations and post-breeding movements.

Habitat Assessment – Nest/Roost Plot Scale

We documented a total of 103 CSO territorial sites between 2004-2006. We overlaid the nest/primary roost site for each of the 103 CSO sites with the CWHR vegetation classes available within the VESTRA photo-interpreted vegetation map for the PLS to examine nest-site habitat association patterns. Approximately 53% of the nest sites were located within CWHR 5M, 5D and 6 size classes (Table 5, Figure 4). An additional 37% of the sites were located within CWHR size class 4M and 4D polygons. CWHR size class 4 is defined as stands with average tree sizes of 12-24 inch diameter-at-breast-height (dbh) trees. Of the 38 sites located in size class 4 polygons, 25 (66%) were in size class 4 polygons with a large tree component (i.e., presence of >24 inch dbh trees). Overall, about 90% of the site were located within CWHR 4M, 4D, 5M, 5D, and 6 size classes. The remaining 10 sites were located in more open, smaller-tree size polygons, with nests or roost located within remnant, scattered larger trees (Table 5, Figure 4).

Table 5. Distribution of California spotted owl nest/primary roost sites (n = 103) across CWHR tree size classes within the Plumas-Lassen Study on the Plumas and Lassen National Forests, 2004-2006.

CWHR Size Class*	CWHR Size Class Description	Number of Nests	Percent
Barren	Open, sparse tree coverage	1	1.0
3S	6-12 inch dbh, 20% CC	1	1.0
3M-LT	6-12 inch dbh, 40-60% CC, large trees recorded	1	1.0
3D	6-12 inch dbh, >60% CC	4	3.9
4P	12-24 inch dbh, 20-40% CC	3	2.9
4M	12-24 inch dbh, 40-60% CC	3	2.9
4M-LT	12-24 inch dbh, 40-60% CC, large trees recorded	12	11.7
4D	12-24 inch dbh, >60% CC	10	9.7
4D-LT	12-24 inch dbh, >60% CC, large trees recorded	13	12.6
5M	>24 inch dbh, 40-60% CC	25	24.3
5D	>24 inch dbh, >60% CC	9	8.7
6	>24 inch dbh, >60% CC, multi-layer canopy	21	20.1

*defined by average tree size (dbh = diameter at breast-height) and average percent canopy cover (CC).

While the distribution of nest site locations relative to broad vegetation classes provides insight into patterns of nest-site habitat, we also conducted vegetation sampling at nest or primary roost sites to describe vegetation structure and composition. Vegetation plot sampling was conducted at 80 CSO territories across 2005-2007. Vegetation plots were centered on CSO nest trees, or on a primary roost tree for sites where no nest has been documented, and were measured using the national Forest and Inventory Assessment (FIA) protocol. The FIA protocol is used nationally by the USDA Forest Service for inventorying and monitoring vegetation. FIA sampling consists of measuring vegetation structural and compositional variables within a 1-ha plot centered on a CSO nest or roost tree. Only one plot was collected from each CSO territory, with the most frequently used nest tree serving as the plot center location, or the most recent nest tree used at sites where no nest tree was used more frequently than another. CSO nest sites were characterized by mean total basal areas of 260.8 ft²/acre, 7.4 snags (>15 inch dbh)/acre, and 10.7 trees (>30 inch dbh)/acre (Table 6). Under the FIA protocol, canopy cover is modeled based on the tree list. The modeled canopy cover for these plots averaged 64.1%. Shrub cover averaged 7.7%. Fuel loads averaged 0.75 tons/acre for 1-hr fuels, 4.0 tons/acre for 10-hr fuels and 4.44 tons/acre for 100-hr fuels (Table 6). Use of the FIA sampling protocol will facilitate monitoring of vegetation and development of CSO habitat models that can be used as adaptive management planning tools. Habitat models are currently being evaluated that can be used to assess projected changes in CSO nesting habitat suitability under varying fuels and vegetation treatment scenarios.

Table 6. Nest-site (1 ha (2.47 acres)) habitat characteristics collected using the Forest Inventory and Analysis sampling protocol at California spotted owl nest sites (n = 80) on the Plumas and Lassen National Forests, California, 2005-2006.

Variable	Mean	SE
Total Basal Area (ft ² /acre)	260.8	6.47
# Trees >= 30 inch dbh (#/acre)	10.7	0.58
Basal Area Trees >= 30 inch dbh (ft ² /acre)	96.0	5.70
# Trees >= 24 inch dbh (#/acre)	19.9	0.90
Basal Area Trees >= 24 inch dbh (ft ² /acre)	131.7	6.29
# Trees <12 inch dbh (#/acre)	383.5	26.36
Basal Area Trees , <12 inch dbh (ft ² /acre)	50.1	2.71
# Snags >=15 inch dbh (#/acre)	7.4	0.80
Mean Duff Depth (inches)	3.0	0.16
Duff (tons/acre)	67.4	3.64
Mean Litter Depth (inches)	2.3	0.18
Litter (tons/acre)	23.7	1.81
1 Hour Fuels (tons/acre)	0.75	0.03
10 Hour Fuels (tons/acre)	4.0	0.21
100 Hour Fuels (tons/acre)	4.4	0.28
Shrub Cover (%)	7.7	1.16
Canopy Cover (%)*	64.1	1.24

* estimated through Forest Vegetation Simulator modeling of plot-based tree lists.

Habitat Assessment – Core Area/Home Range Scale

Core area habitat associations around 102 CSO sites was assessed by using a Geographic Information System (GIS) and the VESTRA photo-interpreted vegetation map to determine the vegetation patterns within a 500 acre (201 ha) circle centered on each of the CSO territory sites. To compare the CSO sites with the general availability of habitat across the study area we also assessed the same vegetation patterns around 130 points determined by placing a systematic grid across the study area. For this summary we assessed vegetation using the USDA Forest Service Region 5 classification system. Overall, CSO core areas averaged 75.7% suitable habitat (classes 3N, 3G, 4N, 4G) whereas the grid points averaged 61.9% (Table 7, Figure 5). Approximately 32% of CSO core areas was composed of large tree polygons (>24inch dbh, >=40% canopy cover) compared to 19.6% of the grid points (Table 7, Figure 6).

Table 7. Distribution of USDA Region 5 vegetation classes (Mean (SE)) within 500 acre (201 ha) circles centered on California spotted owl (CSO) territories (n = 102) and systematic grid (Grid) points (n = 130) within the Plumas-Lassen Study on the Plumas and Lassen National Forests, 2004-2006.

R5 Size Class*	R5 Size Class Description	CSO	Grid
Non-forest	Sum of non-forest land types	4.4 (1.0)	8.4 (1.2)
Total Size 1	Sum of 1G,1N, 1P, 1S: <6 inch dbh, all %CC classes	1.7 (0.3)	1.6 (0.3)
2P & 2S	6-12 inch dbh, 10-39% CC	3.4 (0.4)	4.1 (0.5)
2N	6-12 inch dbh, 40-69% CC	3.8 (0.6)	4.4 (0.9)
2G	6-12-24 inch dbh, >=70% CC	1.6 (0.5)	0.5 (0.1)
3P&3S	12-24 inch dbh, >10-39% CC	9.2 (0.8)	16.1 (1.3)
3N	12-24 inch dbh, 40-69% CC	37.2 (2.4)	38.5 (1.8)
3G	12-24 inch dbh, >=70% CC	6.2 (1.0)	3.8 (0.7)
4P&4S	>24 inch dbh, >10-39% CC	1.0 (0.3)	2.1 (0.4)
4N	>24 inch dbh, 40-69% CC	25.8 (2.0)	17.3 (1.6)
4G	>24 inch dbh, >=70% CC	6.5 (0.1)	2.4 (0.8)
Total 4N & 4G	Sum of 4N & 4G: >24 inch dbh, >=40% CC	32.4 (2.3)	19.6 (1.8)
Total Suitable habitat	Sum of classes 3N, 3G, 4N, 4G = >12 inch dbh, >40% CC	75.7 (2.19)	61.9 (1.75)

*defined by average tree size (dbh = diameter at breast-height) and average percent canopy cover (CC).

Banding, Blood Sampling, West Nile Virus Monitoring

Sixty-six owls were captured and banded in 2007. Blood samples were collected from 38 individuals and screened at the University of California, Davis for West Nile Virus antibodies. None of the 120 individual samples collected from 2004-2006 have tested positive for WNV antibodies. The 2007 samples have not been analyzed to date.

Barred and Sparred (spotted/barred hybrid) Distributional Records:

We detected the presence of 4 barred owl and 4 sparred owls during 2007 surveys within our intensive study area. Our synthesis and update of barred-sparred owl records through 2007 based on Forest Service and California Department of Fish and Game databases indicates that there are a minimum of 41 individual site records across the northern Sierra Nevada (Figure 7). This includes a total of 19 records that have been documented within our intensively surveyed study area. The first barred owl in the region was reported in 1989. The pattern of records suggests that barred/sparred owls have been increasing in the northern Sierra Nevada between 1989-2007.

California Spotted Owl Diet:

A single survey plot was established at a CSO nest or roost location at each CSO territory on the Plumas National Forest in 2003-2007. Systematic searches for pellets and prey remains were conducted in each plot during each year. During 2007, 552 pellets were collected. An additional 2767 pellets have been collected 2003-2006 (2003 = 606; 2004 = 807; 2005 = 838; 2006 = 516) bringing the project total to 3319 pellets. To date 1418 pellets have been sorted and all prey items identified to species or taxonomic group when species identification could not be ascertained. Mammals comprised the dominant taxonomic group identified in the diet. The three most frequently detected species were the dusky-footed woodrat (detected in 43% of pellets), northern flying squirrel (detected in 39% of pellets), and *Peromyscus* species (detected in 27% of pellets)(Table 5). The 838 pellets collected in 2005 have been sorted and identification of all prey species has been completed while the 2006 sample is currently being sorted.

Summary 2004-2007

Our efforts to date have focused on collecting the initial data to address our primary research objectives and provide the baseline data for monitoring HFQLG implementation. In conjunction with the now fully integrated Lassen Demographic Study we have collected landscape-scale information on the distribution and abundance of CSOs across approximately 650,000 acres of land. Determining the accurate number and distribution of CSO sites requires multiple years of survey and marking of individual CSOs to delineate separate territories and identify individual birds that move among multiple sites within and across years. These baseline data are fundamental for developing empirically based habitat models for understanding CSO habitat associations and developing adaptive management tools and models. The near completion of the Meadow Valley area projects in 2007 marks the first landscape series of HFQLG treatments to be implemented within the study area, providing the first opportunity to address treatment effects within a case study framework. Our baseline information on CSO distribution and habitat associations, coupled with our 2007 radio-telemetry work, will allow us to assess associations between CSOs and vegetation changes.

Dedicated monitoring of CSOs on the Lassen Demographic study continues to provide critically valuable demographic and population trend information for determining the status of CSOs. The declining population trend estimated through the meta-analysis of the Lassen Demographic Study data and the apparent decline in numbers of CSOs observed between 2005-2007 within the Lassen NF survey areas warrant close continued monitoring of the status of CSOs within the study area, along with continued management focus on providing high-quality CSO habitat during the planning and implementation of HFQLG treatments. We lack similar long-term demographic data for the Plumas NF study areas, but our baseline information on CSO distribution and abundance suggests that numbers of territorial CSOs and sites have been similar across 2004-2007.

Our focused diet analyses have broadened and deepened our understanding of CSO diets and sources of variation in CSO diets among pairs and across environmental gradients.

Monitoring of WNV exposure coupled with demographic monitoring has provided an opportunity to assess if WNV may ultimately be a factor influencing CSO viability. To date we have not had a positive detection for WNV within CSOs. Finally, through our research into historical and current occurrence records, in conjunction with our field surveys, we have been able to document the colonization of the northern Sierra Nevada by barred owls. Our results indicate that barred owls are increasing in the northern Sierra Nevada and may become an increasing risk factor to CSOs.

Current Research: 2008

In 2008 we will continue monitoring owl distribution, abundance, demography, and population trend across the Study Area. We will also continue our radio-telemetry investigation of habitat use within the Meadow Valley project area. Beginning in March 2008 we will initiate surveys and follow-up visits to determine CSO distribution, abundance and habitat associations within the Antelope Complex and Moonlight fire areas. This work will provide an opportunity to assess the effects of wildfire on CSOs and their habitat and will provide a valuable complement to our current research investigating CSO habitat associations and response to fuel treatments. In addition to continuing field surveys in 2008 designed to address our six research questions, we have broadened our emphasis on the development of predictive habitat relationship models as described in the module study plan. We have continued to work closely with biologists on the Plumas and Lassen National Forests, and the R5 Regional Office, to identify and define the types of analyses and tools that would best address management needs. Baseline information collected during this study forms the foundation for this phase of the research. The combination of broad-scale landscape CSO distribution data, in conjunction with detailed demographic information available from the Lassen Demographic Study, will facilitate exploration and development of predictive habitat models for use in an adaptive management framework and to directly monitor implementation of the HFQLG project.

Literature Cited

Blakesley, J.A., M.E. Seamans, M.M. Connor, A.B. Franklin, G.C. White, R.J. Gutierrez, J.E. Hines, J.D. Nichols, T.E. Munton, D.W.H. Shaw, J.J. Keane, G.N. Steger, B.R. Noon, T.L. McDonald, S. Britting. 2006. Demography of the California Spotted Owl in the Sierra Nevada: Report to the US Fish and Wildlife Service on the January 2006 Meta-Analysis. February 2006.

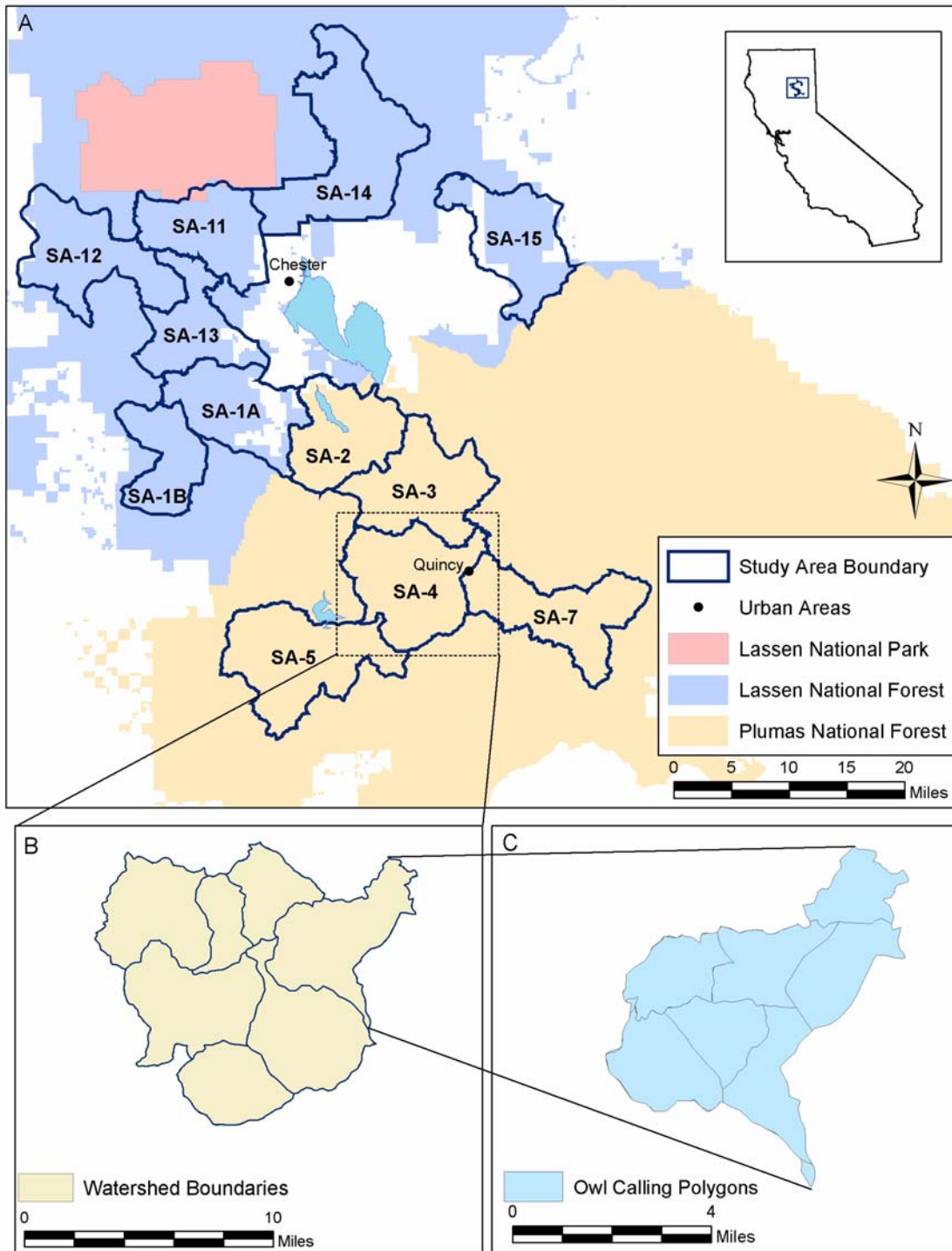


Figure 1. (A) Location of CSO Survey Areas surveyed in 2004-2007. (B) Example of original survey plot consisting of multiple Cal-Planning watersheds. (C) Example of Primary Sampling Units for surveying for CSOs. See text and study plan for further details .

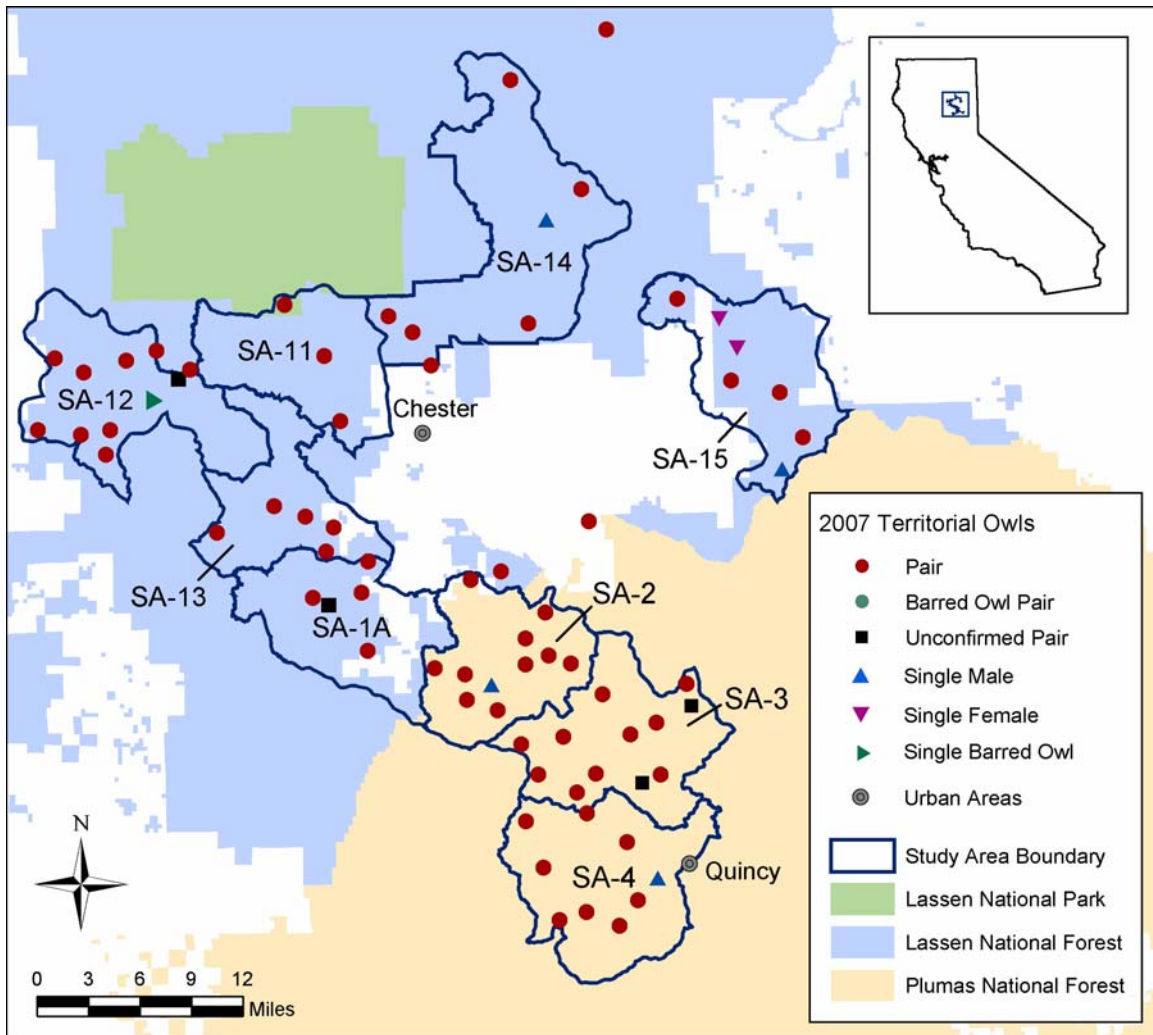


Figure 2. Distribution of California spotted owl territories within CSO survey plots across the Plumas and Lassen National Forests, 2007.

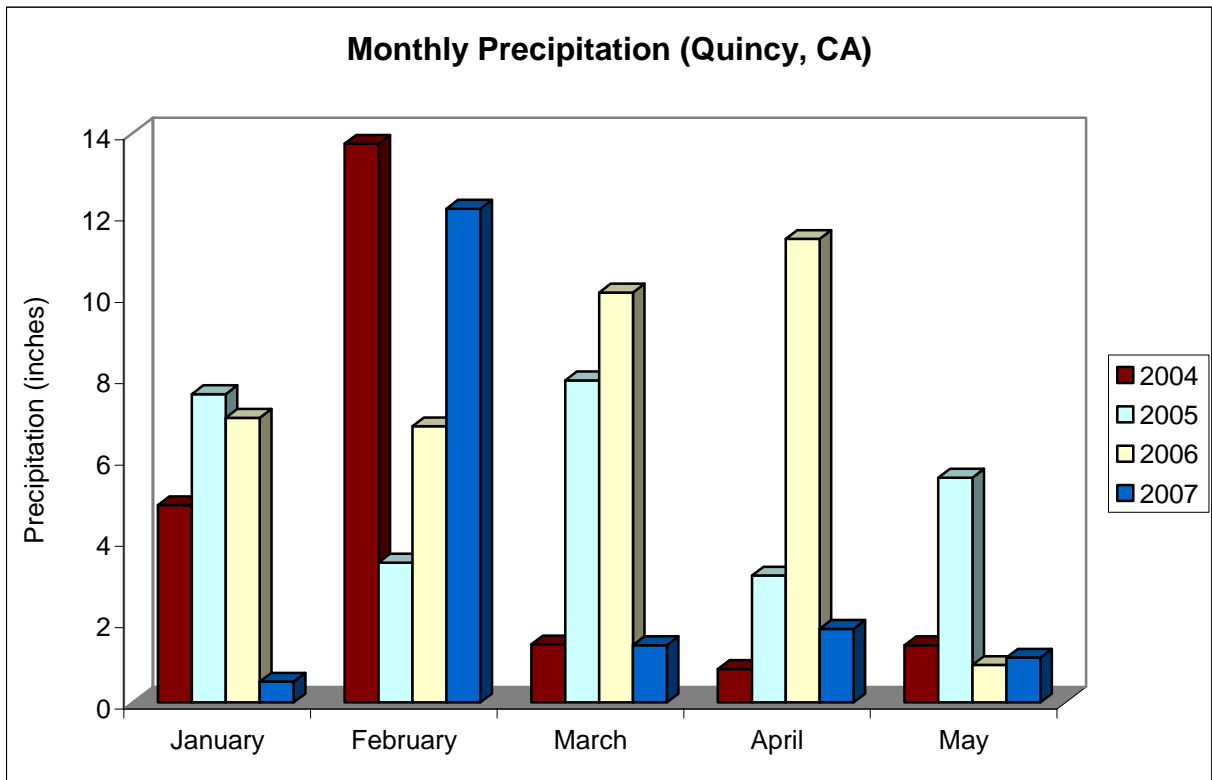


Figure 3. Monthly precipitation totals for Quincy, California, during January-May, 2004-2007 (data from Western regional Climate Center).

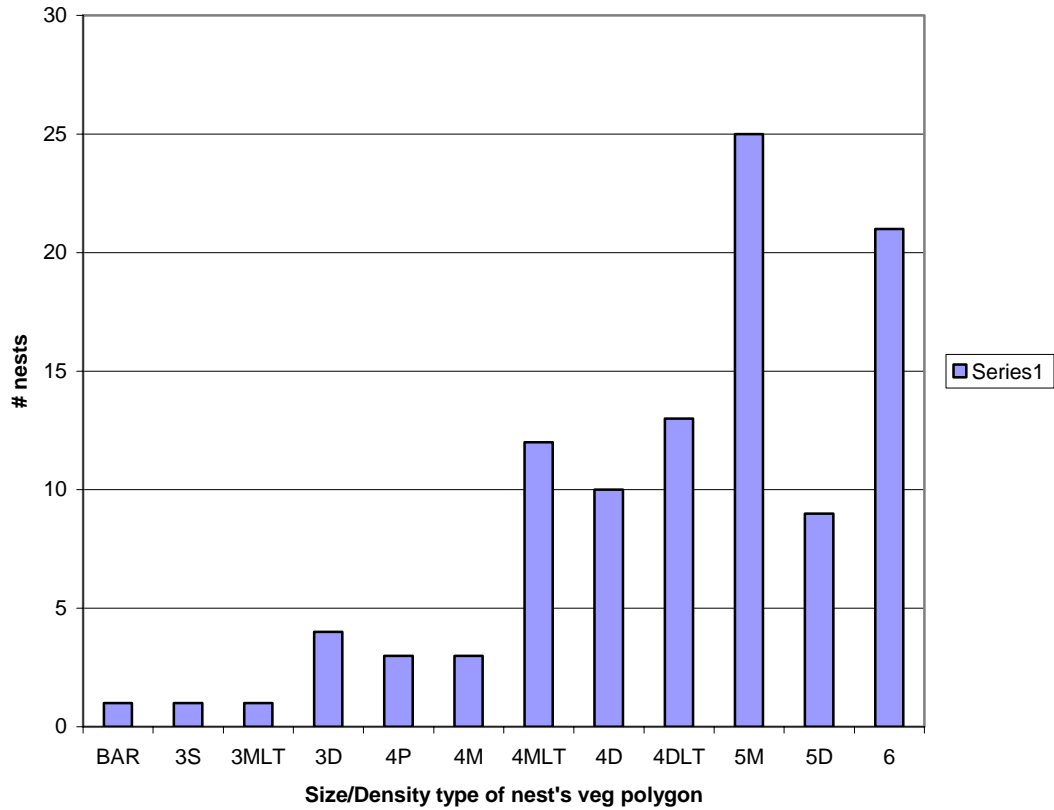


Figure 4. Distribution of California spotted owl (n = 103) nest sites by California Wildlife Habitat Relationship (CWHR) database vegetation classes on the Plumas and Lassen national Forests, California, 2004-2007. Descriptions of the CWHR classes are provided in Table 5 within the text of this document.

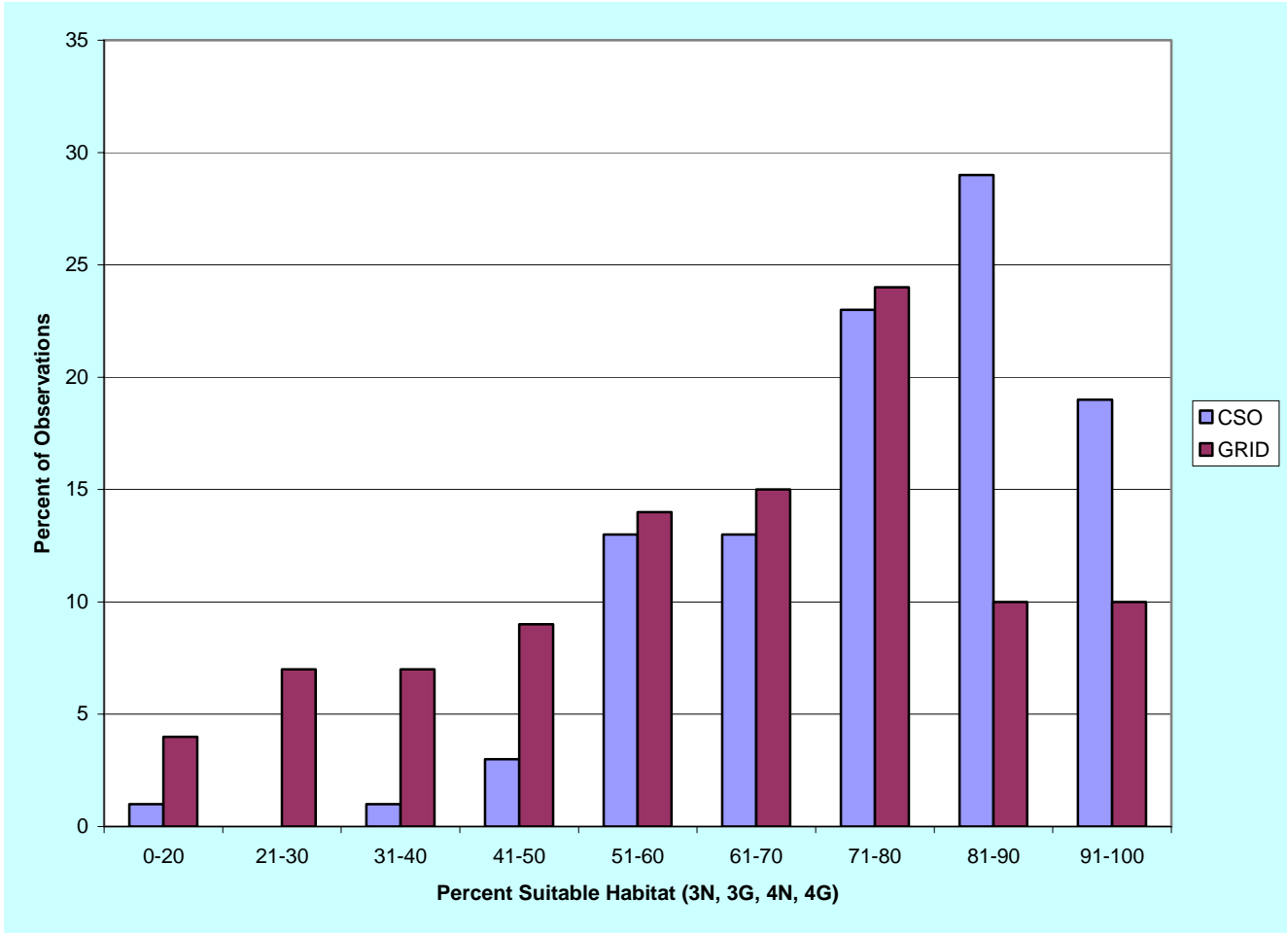


Figure 5. Percent suitable habitat (≥ 12 inch dbh trees with $\geq 40\%$ canopy cover) within 500 acre (201 ha) circles centered on California spotted owl (CSO, $n = 102$) and systematic grid points (Grid, $n = 130$) on the Plumas and Lassen National Forests, California, 2004-2007.

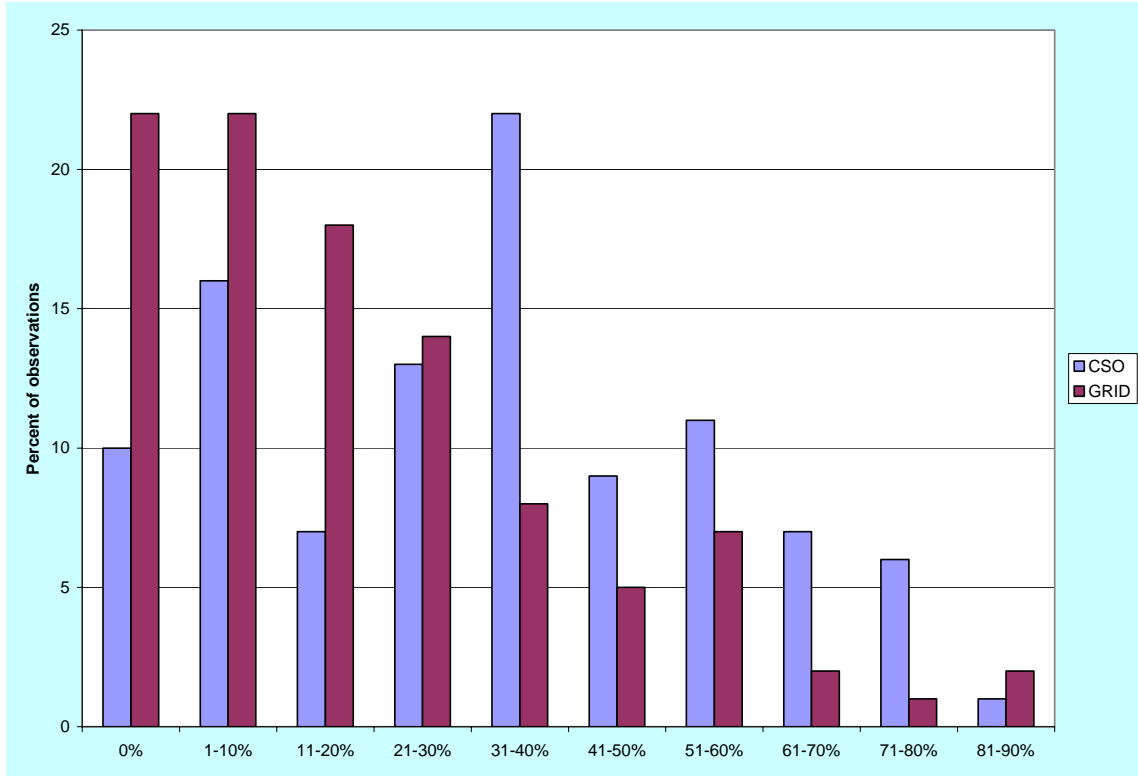


Figure 6. Percent large tree habitat (R5 classes 4N & 4G: ≥ 24 inch dbh trees with $\geq 40\%$ canopy cover) within 500 acre (201 ha) circles centered on California spotted owl (CSO, n = 102) and systematic grid points (Grid, n = 130) on the Plumas and Lassen National Forests, California, 2004-2007. Descriptions of R5 classes are provided in Table 7 within the text of this document.

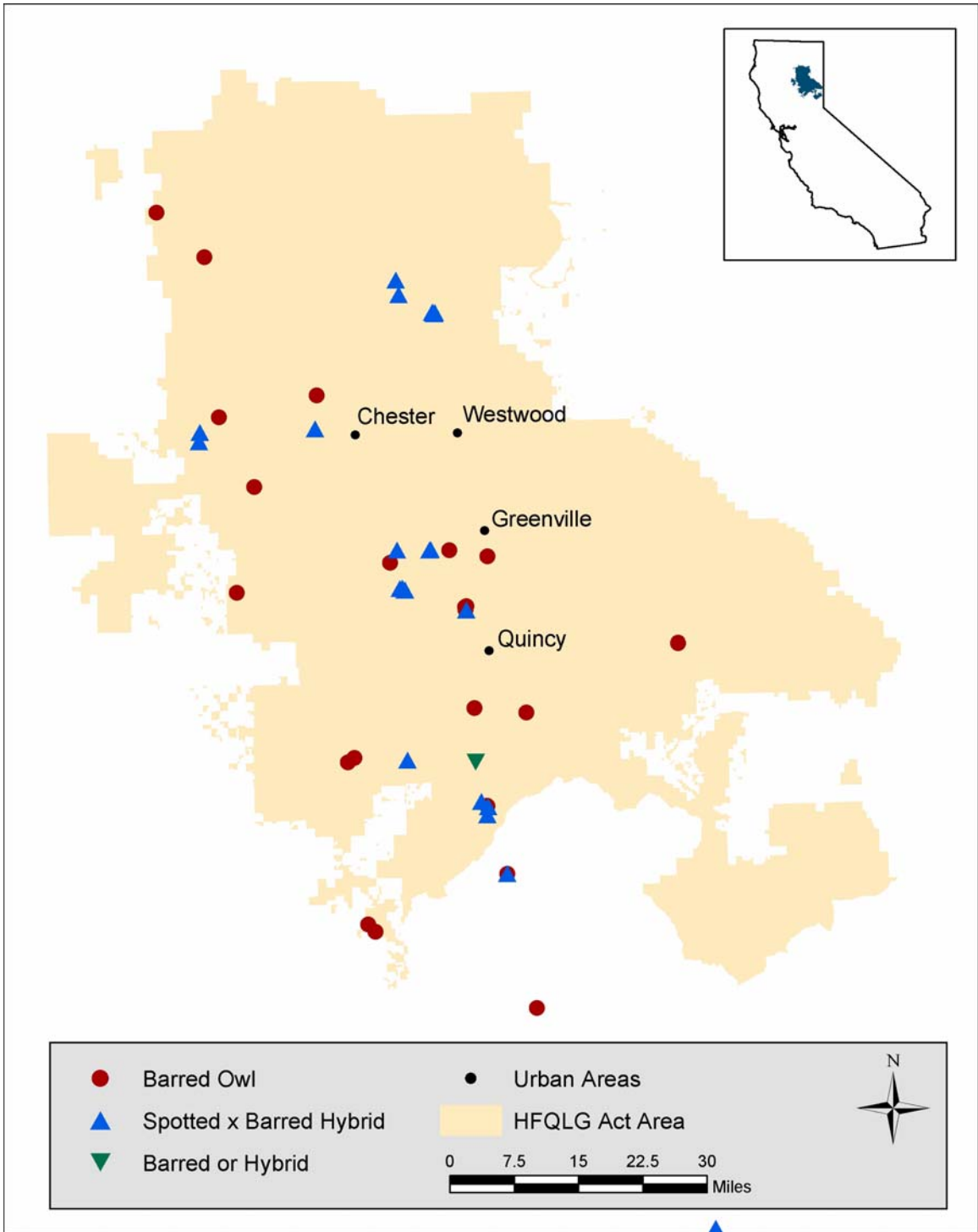


Figure 7. Distribution of Barred and Sparrred (Spotted-Barred hybrids) Owls between 1989-2007 within the HFQLG Project area.

Table 5. Prey species occurrences in California spotted owl pellets collected on the Plumas National Forest 2003-2004.

Prey Species	Number of 2003 Pellets Containing Taxon (n=606)	Percentage of 2003 Pellets Containing Taxon	Number of 2004 Pellets Containing Taxon (n=812)	Percentage of 2004 Pellets Containing Taxon	Total Number of Pellets Containing Taxon (n=1418)	Total Percentage of Pellets Containing Taxon
Mammals	581	95.87	797	98.15	1378	97.18
Dusky-footed woodrat (<i>Neotoma fuscipes</i>)	287	47.36	318	39.16	605	42.67
Northern flying squirrel (<i>Glaucomys sabrinus</i>)	254	41.91	298	36.70	552	38.93
Deer mouse (<i>Peromyscus</i> spp.)	145	23.93	237	29.19	382	26.94
Unidentified mouse (<i>Peromyscus</i> spp. or <i>Mus musculus</i>)	16	2.64	32	3.94	48	3.39
California red-backed vole (<i>Clethrionomys californicus</i>)	11	1.82	11	1.35	22	1.55
Meadow voles (<i>Microtus</i> spp.)	12	1.98	32	3.94	44	3.10
Unidentified vole	6	0.99	6	0.74	12	0.85
Pocket gopher (<i>Thomomys bottae</i>)	26	4.29	73	8.99	99	6.98
Chipmunk (<i>Tamias</i> spp.)	6	0.99	32	3.94	38	2.68
Western harvest mouse (<i>Reithrodontomys magalotis</i>)	0	0.00	1	0.12	1	0.07
Shrew (<i>Sorex</i> spp.)	22	3.63	40	4.93	62	4.37
Broad-footed mole (<i>Scapanus latimanus</i>)	23	3.80	89	10.96	112	7.90
Large bat (e.g., <i>Eptesicus</i> spp.)	8	1.32	13	1.60	21	1.48
Small bat (e.g., <i>Myotis</i> spp.)	10	1.65	8	0.99	18	1.27

Table 5. (Continued)

Prey Species	Number of 2003 Pellets Containing Taxon (n=606)	Percentage of 2003 Pellets Containing Taxon	Number of 2004 Pellets Containing Taxon (n=812)	Percentage of 2004 Pellets Containing Taxon	Total Number of Pellets Containing Taxon (n=1418)	Total Percentage of Pellets Containing Taxon
Unidentified rabbit or hare (family <i>Leporidae</i>)	1	0.17	11	1.35	12	0.85
Unidentified large rodent (comparable to a woodrat)	15	2.48	28	3.45	43	3.03
Unidentified small rodent (comparable to a mouse)	30	4.95	56	6.90	86	6.06
Unidentified mammal	3	0.50	2	0.25	5	0.35
Unidentified vertebrate (may include non-mammals)	8	1.32	15	1.85	23	1.62
Birds	59	9.74	104	12.81	163	11.50
Unidentified bird (unknown size)	4	0.66	4	0.49	8	0.56
Unidentified large bird (e.g., American robin)	23	3.80	38	4.68	61	4.30
Unidentified medium bird (e.g., western tanager)	15	2.48	31	3.82	46	3.24
Unidentified small bird (e.g., pine siskin)	12	1.98	20	2.46	32	2.26
Steller's jay (<i>Cyanocitta stelleri</i>)	2	0.33	5	0.62	7	0.49
Northern flicker (<i>Colaptes auratus</i>)	3	0.50	6	0.74	9	0.63
Insects	82	13.53	145	17.86	231	16.29
Long-horned beetle (<i>Ergates</i> spp.)	46	7.59	61	7.51	107	7.55
Giant lacewing (<i>Polystoechotes lineata</i>)	11	1.82	25	3.08	36	2.54
Jerusalem cricket (<i>Stenopelmatus</i> spp.)	25	4.13	45	5.54	70	4.94
Carpenter ant (<i>Camponotus</i> spp.)	1	0.17	11	1.35	12	0.85
Cicada	2	0.33	25	3.08	27	1.90
Unidentified insect	3	0.50	14	1.72	17	1.20

