Chapter 4:
Landbird Abndance, Distribution, and Habitat Relationships

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EXECUTIVE SUMMARY

In this document we report on the avian module of the Plumas Lassen Area Study (PLAS). 2005 was the third full year of avian monitoring in the PLAS study area. As of the end of the 2005 bird breeding season, none of the proposed treatments had been implemented, thus everything we report on herein reflects pre-treatment conditions.

Analysis and discussion in this report are intended to provide background information on the pre-treatment status of the avian community, provide information to help guide ongoing planning of treatments, and provide a preliminary analysis and discussion of concepts that are being further developed for publication.

Species richness and total bird abundance in 2005 was higher than in either of the two previous years in each treatment unit. We recorded an increase in these metrics at over 80% of transects surveyed. General patterns of abundance and richness were consistent across years and treatment units. Units 1, 4 and 5 had the highest total bird abundance and species richness while units 2 and 3 had significantly lower species richness in both 2004 and 2005. Proposed Defensible Fuel Profile Zones (DFPZ's) in Treatment Unit 1 and 4 have slightly higher species richness than the surrounding landscape. The two most abundant shrub nesting species, Fox Sparrow and Dusky Flycatcher, were significantly more abundant in proposed DFPZ treatments than areas not scheduled for treatment, while three late seral associated species – Hermit Warbler, Brown Creeper, and Hammond's Flycatcher – were all significantly more abundant in areas not slated for DFPZ treatment.

Preliminary analysis indicates that species richness is lower – though not significantly – adjacent to Spotted Owl nest and roost sites than areas outside of owl protected activity centers. Shrub and ground nesting species were significantly less abundant at owl sites while tree nesting species were significantly greater at owl sites. Cavity nesting species abundance showed no difference between owl and non-owl sites.

We have updated our interactive GIS tool to include the 2005 data. This tool can provide forest planners with information on avian species richness, total bird abundance, and the abundance of each species detected at each of the 1176 point count stations surveyed across the five treatment units for each year 2003 – 2005.

INTRODUCTION

Coniferous forest is one of the most important habitat types for birds in California (Siegel and DeSante 1999, CalPIF 2002). In the Sierra Nevada, a century of intensive resource extraction and forest management practices have put at risk the ecological stability and continued functionality of the system as a whole (SNEP 1996). Loss of habitat to intensive logging operations and human development, lack of replacement of old-growth stands due to harvest rotations of insufficient duration, changes in forest structure and species composition due to fire suppression, and removal of snags and dead trees are among the most detrimental impacts (SNEP 1996, CalPIF 2002). Birds and other wildlife populations have subsequently been altered by such changes; declines and extirpations have been observed in a number of species, some of which are now afforded special status at the federal or state level.

The Record of Decision (ROD) for the Sierra Nevada Forest Plan Amendment (SNFPA) and subsequent supplemental ROD (SNFPA 2001, SNFPA 2004) direct the Forest Service to maintain and restore old forest conditions that provide crucial habitat for a number of plant and animal species. The decision focuses attention and directs actions towards both protecting and creating habitat with old forest attributes, while providing substantial amount of harvestable timber. Simultaneously, the Forest Service is taking steps to reduce risks of catastrophic fire by reducing fuel loads in overstocked forests. Achieving all of these potentially competing goals will, at the very least, be a challenging task.

Here we report on the landbird study module of the Administrative Study, one of an integrated series of research efforts intended to evaluate land management strategies designed to reduce wildland fire hazard, promote forest health, and provide economic benefits within the area covered by the Herger-Feinstein Quincy Library Group Forest Recovery Act Pilot Project (HFQLG Pilot Project). Valuable feedback can be gained by determining how the full complement of the avian community responds to different forest management regimes, particularly at the landscape scale. If forest management practices encourage old forest development and forests across landscapes trend towards larger trees and higher canopy cover, how will birds other than the Spotted Owl respond to these conditions?

Specifically, the primary objective of the landbird module is to assess the impact of forest management practices in sustaining a long-term ecologically stable forest ecosystem at the local and landscape scales. We know, *a priori*, that the avian community is comprised of species that are associated with a wide range of forest seral stages, vegetative composition, and structures (Burnett and Humple 2003). This habitat, and hence avian diversity, is due in large part to the natural ecological dynamics of these forest systems. Though humans have altered these systems, they continue to undergo non-human mediated changes through biological, geological, and stochastic processes. Therefore, it is imperative for managers to consider how these changes influence management actions temporally and spatially, and how ecological stability can be achieved in an inherently dynamic system.

In order to meet our primary objective of assessing the impacts of forest management practices on landbirds at local and landscape scales, this module will address the following:

(1) Determine landbird habitat associations at the local scale.

(2) Determine landscape effects on bird habitat associations.

(3) Based on the results of objectives 1 and 2, develop predictive bird models to forecast how individual species may respond to forest management, particularly those planned as part of the HFQLG Pilot Project.

(4) Quantitatively assess the impacts of forest management treatments on avian abundance and species diversity.

(5) Determine population trends for landbirds to identify if populations are changing temporally.

(6) Evaluate population trends to assess factors responsible for observed trends.

This multiple objective approach will allow us to interpret both the effects of specific management practices, the extent to which they influence the greater landscape (in the short term), and the integrated effects of treatments and natural processes (again over the short term).

In addition to this study PRBO has been monitoring songbird populations in the Northern Sierra since 1997. Since 2001, these efforts have aimed to complement the avian research of the Administrative Study by focusing on monitoring the non-coniferous habitats within the HFQLG area (see Burnett et al. 2005a and Burnett et al. 2006). Specifically, these efforts have focused on avian response to meadow restoration and cessation of grazing, the viability of clear-cut regenerations in providing habitat for shrub dependent bird species, and avian response to aspen and black oak habitat enhancement. Working closely with the project planners from Forest Service ranger district staff, these studies are being implemented as adaptive management experiments. These efforts should be seen as not only providing valuable data to guide forest management but also as models of effective collaboration between science and managers in administering public lands in the Sierra Nevada and beyond.

METHODS

Avian Surveys

We are using standardized five-minute multiple distance band circular plot point count censuses (Buckland et al. 1993, Ralph et al. 1993) to sample the avian community in the study area. In this method, points are clustered in transects, but data is only collected from fixed stations, not along the entire transect.

Point count data allow us to measure secondary population parameters such as relative abundance of individual bird species, species richness, and species diversity. This method is useful for making comparisons of bird communities across time, locations, habitats, and land-use treatments.

All birds detected at each station during the five-minute survey are recorded according to their initial distance from the observer. These detections are placed within one of six categories: within 10 meters, 10-20 meters, 20-30 meters, 30-50 meters, 50-100 meters, and greater than 100 meters. The method of initial detection (song, visual, or call) for each individual is also recorded. Using a variable radius point count allows us to conduct distance sampling. Distance sampling should enable us to provide more precise estimates of density and detectability of individual birds as well as account for some of the observer variability inherent in the point count sampling method (Buckland et al. 1993).

Counts begin around local sunrise, are completed within four hours, and do not occur in inclement weather. Each transect is visited twice during the peak of the breeding season from mid May through the end of June.

Treatment Unit and Transect Nomenclature

In this report we use the former treatment units (TUs) – those defined in the original Admin Study plan – as functional units to analyze bird indices across aggregations of watersheds (see Appendices 1-7). These aggregations of watersheds no longer have any planned "treatment" that is consistent across them and are simply used here as a tool to describe geographically linked portions of the study area. Additionally, it is important to note that while we refer to DFPZ's as treated sites and our extensive sampling points as untreated sites, to date all of our data is pre-treatment.

Transect naming protocols were different in 2002 than in 2003 and 2004. Transects established in 2002 under the previous study design are numbered transects (e.g. 222). The first number is the TU and the second and third numbers are the cover class and size class of the randomly generated starting point respectively (e.g. 222 is in TU-2, cover class 2, and size class 2). In 2003 and 2004, under the existing study plan, transects are named after the CalWater Planning Watershed (CalWater 1999). For example, SNK1 is in the Snake Lake watershed and is the first transect established while CHG3 is in the China Gulch watershed and was the third transect established. The numeric ending is simply for designating between the different transects in the same watershed and does not have any additional significance.

Owl Point Count Site Selection

In 2005 we added an additional 72 point count locations adjacent to known Spotted Owl nest or roost sites that were inside of previously designated Protected Activity Centers (PAC's). Our initial goal was to place 3 to 4 point count stations surrounding five different nests in each of the five treatment units. All points were at least 200 meters apart and no new points established were within 100 meters of a designated nest. We first attempted to choose known nest sites when for logistical reasons we could not establish points at 5 nests in each unit we settled for probable nests, followed by known roosts of pairs. Where it was feasible we attempted to tie new points into existing transects to minimize additional survey effort. In multiple cases only 1 to 3 points were added, as points from existing transects were already located in close proximity to owl nests by chance thus meeting our 4 point criteria. Each owl point was surveyed using the same protocol as all other points described above.

2005 Survey Effort

In 2005 we surveyed 93 transects of 12 points each as well as the 72 additional owl territory points for a total of 1188 points (Table 1). Each site was surveyed twice for a total of 2376 point visits. Of these 1188 points, 1043 are located in areas not-currently slated for DFPZ treatment (extensive and owl sampling), with the remaining 145 located within DFPZ's scheduled for treatment. All of these DFPZ transects are located in TUs 1 and 4 (Table 1). As the location of additional DFPZ networks is solidified in (former) TUs 2, 3, and 5, and potentially elsewhere, we will add additional transects to those sites, as described in the study plan (Stine et al. 2004).

Field Crew Training

Point count crew members all have had previous experience conducting avian fieldwork and undergo extensive training onsite for three weeks prior to conducting surveys. Training consists of long hours in the field studying bird identification and conducting simultaneous practice point counts with expert observers. Each crew member is given an audio compact disc with the songs and calls of all of the local avifauna two months prior to their arrival at the study site to begin the training process early. Each person uses the CD to study the local birds and is then given quizzes each evening designed to test their knowledge of the songs and calls of the local birds. All observers must pass these tests and be 95% accurate on double observer point counts before being allowed to begin surveying alone. Significant time is also given to calibrating each person in distance estimation. In addition each observer uses a laser range finder to calibrate distances at each point before starting a survey. Distance and bird identification calibration continues throughout the field season.

Vegetation Sampling Methods

Vegetation is assessed using the relevé method, following procedures outlined in Ralph et al. (1993). In summary this method uses a 50-meter radius plot centered on each census station where habitat characteristics of the site are recorded (e.g. # of snags, basal area) and the cover, abundance, and height of each vegetation stratum (tree, shrub, herb, and ground) are determined through ocular estimation. Within each vegetation stratum, the species composition is determined and each species' relative cover recorded, as a percentage of total cover for that stratum (see Ralph et al. 1993 for complete description). In addition we collect fuel loads and conduct ladder fuel hazard assessments at each station following methods outlined in the fire and fuels module study plan (Menning and Stephens 2004). In 2005 we only collected vegetation data from sites that had not been surveyed in the past two years or have been treated since they were surveyed (e.g., points in the Kingsbury-Rush project area).

Statistical Analysis

We analyzed point count data in order to create by-point community indices for each transect. Community indices were created using a restricted list of species that excluded those that do not breed in the study area (Rufous Hummingbird, House Wren, Orange-crowned Warbler) or are not accurately surveyed using the point count method (e.g. raptors, waterfowl, grouse, nightjars, swallows, crows, ravens).

We present the mean by point (average per point per visit, per year, by transect) for the following three indices. This method allows for using the point as the individual sampling unit and

Table 1. Extensive and DFPZ point count transects surveyed in the Plumas – Lassen Study in 2005.

Treatment Unit	Watershed	Code	Extensive Survey Points	DFPZ Survey Points	New Owl Territory Points
5	Grizzly Forebay	GRZ	41	0	2
5	Frazier Creek	FRC	45	0	4
5	China Gulch	CHG	36	0	0
5	Bear Gulch	BEG	41	0	5
5	Haskins Valley	HAV	38	0	2
5	Red Ridge	RED	31	5	0
5	**Unit Total**		**232**	**5**	**13**
4	Silver Lake	SIL	57	10	2
4	Meadow Valley Creek	MVY	47	3	2
4	Deanes Valley	DVY	36	4	4
4	Snake Lake	SNK	37	11	0
4	Miller Fork	MIL	39	25	4
4	Lower Knox Flat	LKF	36	0	2
4	Pineleaf Creek	PLC	31	12	0
4	**Unit Total**		**283**	**65**	**14**
3	Soda Creek	SOD	36	0	0
3	Rush Creek	RUS	62	5	12
3	Halsted Flat	HAL	36	0	0
3	Lower Spanish Creek	SPC	31	5	0
3	Black Hawk Creek	BLH	24	0	0
3	Indian Creek	IND	12	0	3
3	**Unit Total**		**201**	**0**	**15**
2	Mosquito Creek	MSQ	43	0	6
2	Butt Valley Reservoir	BVR	36	0	0
2	Ohio Creek	OHC	39	3	1
2	Seneca	SEN	57	5	8
2	Caribou	CAR	25	10	0
2	**Unit Total**		**200**	**18**	**15**
1	Upper Yellow Creek	UYC	24	22	7
1	Grizzly Creek	GCR	29	19	5
1	Butt Creek	BCR	24	13	3
1	Soldier Creek	SCR	0	12	0
1	**Unit Total**		**77**	**66**	**15**
	Grand Total		**971**	**145**	**72**

therefore makes possible the stratification of points for analysis based on attributes other than the transect and comparison of uneven sample sizes.

Species Richness

Species richness is defined as the total number of species detected within 50 meters of each point in a year divided by the number of visits to the site (two in all cases).

Diversity

Species diversity is defined as the mean number of species detected within 50 m (species richness) weighted by the mean number of individuals of each species. A high diversity score indicates high ecological (species) diversity, or a more equal representation of the species. Species diversity was measured using a modification of the Shannon-Wiener index (Krebs 1989). We used a transformation of the usual Shannon-Weiner index (symbolized H′), which reflects species richness and equal distribution of the species. This transformed index, introduced by MacArthur (1965), is N_1, where $N_1 = 2^{H'}$. The advantage of N_1 over the original Shannon-Wiener metric (H′) is that N_1 is measured in terms of species instead of bits of information, and thus is more easily interpretable (Nur et al. 1999).

Abundance

The index of abundance is the mean number of individuals of all species detected per station per visit. This number is obtained by dividing the total number of detections within 50 meters by the number of visits.

Spotted Owl Nest Avian Community Analysis

We are in the process of analyzing differences in the avian community inside and outside of different Spotted Owl habitats, considering differences at multiple scales ranging from the area immediately surrounding nests and roost sites, to the larger protected activity centers (PACs) and the even larger core areas. The preliminary analysis presented here only compares the avian community in close proximity to owl nests and roost sites (<500 meters) to areas outside of Spotted Owl PACs. In this analysis we removed points that were within PACs but not within 500 meters of nests or roosts.

RESULTS

Overview

A total of 93 species were detected during point count surveys in 2005, the same as in 2004 and one more than was detected in 2003. A total of 102 species have been detected across all 4 years of the study (Appendix 9). We determined breeding bird species richness and abundance at all sites surveyed in 2005 (Table 2), and included indices for these same transects from all previous years they were surveyed (i.e. 2002 -2004). For the location of each transect we refer you to the supplemental GIS project available on compact disc. In 2005, abundance (the average number of individuals detected within 50 meters of each point per visit) ranged from a 1.38 on the SOD3 transect to 7.33 on HAL3. Species richness ranged from 2.13 on the SOD3 transect to 8.13 on the HAL3 transect. The mean index of abundance was higher in 2005 than 2004 for 79 of the 93 transects, and richness was higher in 2005 for 80 of the 93 transects. The mean abundance for all non-DFPZ transects in 2005 was 4.83 compared to 3.50 in 2004 and 4.25 in 2003, and species richness was 6.17 in 2005 compared to 4.77 in 2004 and 5.73 in 2003.

Of all the DFPZ transects surveyed, the highest mean per point abundance in 2005 was recorded at both D401 and D407; the lowest was 3.38 at D409. The highest per point mean species richness was 7.25 recorded at D407 while the lowest was at 4.42 at D409. The mean total bird abundance and species richness from all DFPZ transects combined were higher for TU-1 DFPZ transects combined than for TU-4 transects – as in 2004 – though the differences were not statistically significant (Table 2).

Table 2. Mean abundance, ecological diversity, and species richness for all point count transects surveyed by PRBO in the Plumas/Lassen area study in 2005 (including all data from all years they were surveyed). Locations of all transects can be obtained in the CD supplement.

		Abundance				Richness			
Transect	**Unit**	**2005**	**2004**	**2003**	**2002**	**2005**	**2004**	**2003**	**2002**
Extensive									
114	1	6.38	5.67	3.58	7.63	6.50	6.00	4.58	8.42
BCR1	1	4.54	2.41	NS	NS	6.33	3.73	NS	NS
UYC1	1	3.58	5.18	NS	NS	5.41	6.33	NS	NS
GCR1	1	5.00	2.75	NS	NS	5.83	4.17	NS	NS
GCR2	1	3.71	3.71	NS	NS	5.58	4.92	NS	NS
HSRF	1	6.00	3.88	NS	NS	8.16	5.75	NS	NS
Subtotal	**1**	**4.87**	**3.93**			**6.30**	**5.06**		
213	2	4.54	2.38	5.13	1.89	6.17	2.92	6.17	2.29
214	2	4.71	1.42	1.63	3.92	6.42	2.08	2.25	5.58
222	2	3.95	3.50	5.25	4.46	5.25	5.17	7.58	6.08
223	2	5.83	3.63	6.29	6.04	6.25	4.50	7.33	8.58
224	2	3.92	2.67	3.21	4.50	4.83	4.17	4.33	6.08
MSQ1	2	4.75	2.17	2.79	NS	5.58	3.16	4.08	NS
MSQ2	2	3.67	2.17	2.75	NS	4.50	3.33	3.50	NS
BVR1	2	4.83	4.08	5.17	NS	6.50	5.42	5.42	NS
BVR2	2	5.96	5.96	3.63	NS	7.33	7.17	5.33	NS
BVR3	2	4.92	3.54	4.67	NS	6.25	4.75	6.25	NS
OHC1	2	6.88	3.17	3.00	NS	7.67	4.00	4.33	NS
OHC2	2	4.13	1.64	4.08	NS	6.33	2.55	5.58	NS
SEN1	2	2.88	2.25	3.00	NS	4.08	3.75	4.08	NS
CAR1	2	5.75	4.17	3.42	NS	6.50	5.67	4.42	NS
CAR2	2	5.54	3.63	2.50	NS	7.00	5.33	3.83	NS
CAR3	2	4.17	1.91	NS	NS	4.50	2.82	NS	NS
Subtotal	**2**	**4.78**	**3.02**			**5.95**	**4.17**		
313	3	5.50	6.08	7.58	3.67	7.50	8.25	10.00	5.08
314	3	5.17	3.88	4.42	4.08	6.50	5.50	6.42	3.75
322	3	5.25	5.58	3.38	4.63	7.67	7.00	5.17	6.58
323	3	3.92	2.46	2.79	5.33	5.67	4.00	4.67	7.92

		Abundance				Richness			
Transect	**Unit**	**2005**	**2004**	**2003**	**2002**	**2005**	**2004**	**2003**	**2002**
324	3	5.21	4.63	3.83	4.54	6.00	5.25	5.17	6.83
BLH1	3	3.92	2.09	2.42	NS	5.08	3.36	3.25	NS
BLH2	3	2.71	3.55	NS	NS	4.00	4.73	NS	NS
HAL1	3	4.08	2.50	3.46	NS	5.83	3.92	5.58	NS
HAL2	3	4.50	3.00	3.92	NS	5.08	3.58	5.17	NS
HAL3	3	7.33	3.25	6.96	NS	8.17	4.67	7.67	NS
IND1	3	4.96	2.83	4.13	NS	6.83	4.50	5.50	NS
RUS1	3	5.04	5.79	5.83	NS	6.42	6.92	7.75	NS
SOD1	3	3.67	3.92	NS	NS	4.83	5.75	NS	NS
SOD2	3	4.04	2.75	NS	NS	6.58	4.17	NS	NS
SOD3	3	1.38	0.63	NS	NS	2.16	1.17	NS	NS
SPC1	3	3.79	3.13	3.29	NS	5.08	4.33	4.75	NS
SPC2	3	5.04	2.21	4.25	NS	6.00	3.50	5.75	NS
Subtotal	**3**	**4.47**	**3.43**			**5.88**	**4.74**		
413	4	5.29	4.83	2.83	5.83	6.83	6.33	2.58	7.83
414	4	4.42	4.75	4.38	6.79	6.25	6.08	6.50	8.58
422	4	5.36	3.71	4.54	4.29	6.42	4.58	5.42	5.92
423	4	5.04	3.58	3.29	4.58	5.92	4.92	4.50	6.75
424	4	4.25	3.54	5.46	5.75	5.75	5.33	7.42	8.00
MIF1	4	5.79	3.29	4.00	NS	6.75	4.25	5.50	NS
MIF2	4	5.50	3.00	5.67	NS	7.50	4.25	7.42	NS
MIF3	4	7.21	3.54	5.21	NS	7.25	4.50	6.17	NS
D404	4	5.00	3.35	6.50	4.96	6.25	5.00	8.33	7.08
D405	4	4.67	3.35	4.79	4.46	6.50	4.90	7.00	6.50
LKF1	4	5.04	2.96	NS	NS	6.58	3.42	NS	NS
LKF2	4	3.42	3.83	NS	NS	4.50	4.92	NS	NS
LKF3	4	4.21	5.13	NS	NS	5.58	6.75	NS	NS
MVY1	4	6.08	3.29	4.75	NS	7.42	4.33	6.92	NS
MVY2	4	5.92	3.79	5.58	NS	6.83	5.17	7.08	NS
PLC1	4	5.46	3.71	NS	NS	7.25	5.67	NS	NS
SIL1	4	6.96	3.08	5.17	NS	8.00	4.42	6.67	NS
SIL2	4	6.04	6.83	5.13	NS	7.17	7.08	7.17	NS
SIL3	4	3.25	2.46	2.29	NS	4.25	3.17	3.75	NS
SNK1	4	5.04	2.38	4.25	NS	6.58	3.75	5.50	NS
SNK2	4	4.08	2.33	4.54	NS	5.17	3.33	6.33	NS
SNK3	4	5.25	1.71	NS	NS	6.17	2.67	NS	NS
Subtotal	**4**	**5.15**	**3.57**			**6.41**	**4.77**		
513	5	4.79	6.79	3.00	5.38	6.58	7.67	4.33	6.92
514	5	4.38	4.08	5.75	2.46	6.58	5.58	5.17	4.25
522	5	5.25	3.17	5.63	5.50	6.00	4.42	7.25	7.67
523	5	5.50	2.42	3.33	3.54	7.00	4.00	5.75	5.25
524	5	5.17	3.04	2.79	4.42	6.33	4.92	4.08	6.42
BEG1	5	4.21	1.96	3.42	NS	5.75	3.25	4.42	NS
CHG1	5	3.58	2.46	3.46	NS	4.92	3.58	5.08	NS
CHG2	5	4.88	3.17	6.67	NS	6.08	4.33	8.25	NS
CHG3	5	4.38	5.79	3.54	NS	6.00	7.25	5.17	NS
FRC1	5	4.88	2.96	5.25	NS	6.50	4.67	7.08	NS
GRZ1	5	3.29	2.58	3.92	NS	4.25	3.50	4.92	NS

Transect	Unit	Abundance 2005	2004	2003	2002	Richness 2005	2004	2003	2002
GRZ2	5	4.25	3.96	3.58	NS	5.75	5.75	5.67	NS
GRZ3	5	6.96	3.38	4.71	NS	6.00	5.08	7.08	NS
RED1	5	4.96	4.42	4.75	NS	6.83	5.67	5.92	NS
RED2	5	5.58	3.38	3.00	NS	7.50	4.92	5.08	NS
RED3	5	4.71	3.92	4.13	NS	7.00	5.83	6.25	NS
D501	5	5.50	2.35	4.21	NS	6.67	3.40	5.75	NS
HAV1	5	5.17	3.42	5.75	NS	7.00	4.92	7.67	NS
HAV2	5	4.33	3.42	4.92	NS	6.92	5.08	7.25	NS
Subtotal	**5**	**4.83**	**3.51**	**4.31**		**6.30**	**4.94**	**5.90**	
Extensive Total	**1-5**	**4.83**	**3.50**	**4.25**		**6.17**	**4.77**	**5.73**	
DFPZ									
D102	1	5.08	2.42	3.54	5.29	6.42	2.75	5.00	5.92
D107	1	5.83	3.63	3.50	4.25	6.92	5.50	5.25	6.17
D108	1	5.25	6.09	NS	5.89	6.83	7.25	NS	4.67
D110	1	4.63	2.79	NS	NS	6.25	4.08	NS	NS
D111	1	4.88	3.42	NS	NS	6.58	5.33	NS	NS
D112	1	4.58	5.46	NS	NS	5.67	7.08	NS	NS
Subtotal	**1**	**5.04**	**4.27**	**4.58**	**5.17**	**6.46**	**5.61**	**6.29**	**6.90**
D401	4	6.04	2.30	4.21	6.79	7.67	3.33	5.00	8.75
D402	4	4.26	3.05	4.13	4.71	5.83	4.50	5.58	6.75
D403	4	4.21	1.85	3.79	3.71	5.75	2.45	5.58	5.42
D407	4	6.04	3.00	3.46	4.42	7.75	4.83	5.33	6.33
D408	4	4.67	3.70	5.88	4.50	6.08	5.08	7.58	6.75
D409	4	3.38	2.00	1.92	NS	4.42	2.73	3.00	NS
Subtotal	**4**	**4.77**	**2.65**	**3.90**	**4.83**	**6.25**	**3.82**	**5.35**	**6.80**

Species Richness by Treatment Unit

We compared per point mean species richness between treatment units and years (Figure 1). Treatment unit one was the most species rich in both years followed closely by unit five; the two highest elevation units. Richness in units 1, 4, and 5 did not differ significantly ($p>.10$) from each other though all three were significantly higher than units 2 and 3. Annual variation was significant for all units between 2004 and 2005 ($p<0.01$). The greatest difference in richness between years was in unit 2 which increased from 4.17 to 5.95 from 2004 to 2005.

Transect	Unit	Abundance 2005	2004	2003	2002	Richness 2005	2004	2003	2002
RED1	5	4.96	4.42	4.75	NS	6.83	5.67	5.92	NS
RED2	5	5.58	3.38	3.00	NS	7.50	4.92	5.08	NS
RED3	5	4.71	3.92	4.13	NS	7.00	5.83	6.25	NS
D501	5	5.50	2.35	4.21	NS	6.67	3.40	5.75	NS
HAV1	5	5.17	3.42	5.75	NS	7.00	4.92	7.67	NS
HAV2	5	4.33	3.42	4.92	NS	6.92	5.08	7.25	NS
Subtotal	**5**	**4.83**	**3.51**	**4.31**		**6.30**	**4.94**	**5.90**	
Extensive Total	**1-5**	**4.83**	**3.50**	**4.25**		**6.17**	**4.77**	**5.73**	
DFPZ									
D102	1	5.08	2.42	3.54	5.29	6.42	2.75	5.00	5.92
D107	1	5.83	3.63	3.50	4.25	6.92	5.50	5.25	6.17
D108	1	5.25	6.09	NS	5.89	6.83	7.25	NS	4.67
D110	1	4.63	2.79	NS	NS	6.25	4.08	NS	NS
D111	1	4.88	3.42	NS	NS	6.58	5.33	NS	NS
D112	1	4.58	5.46	NS	NS	5.67	7.08	NS	NS
Subtotal	**1**	**5.04**	**4.27**	**4.58**	**5.17**	**6.46**	**5.61**	**6.29**	**6.90**
D401	4	6.04	2.30	4.21	6.79	7.67	3.33	5.00	8.75
D402	4	4.26	3.05	4.13	4.71	5.83	4.50	5.58	6.75
D403	4	4.21	1.85	3.79	3.71	5.75	2.45	5.58	5.42
D407	4	6.04	3.00	3.46	4.42	7.75	4.83	5.33	6.33
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Species Richness by Treatment Unit

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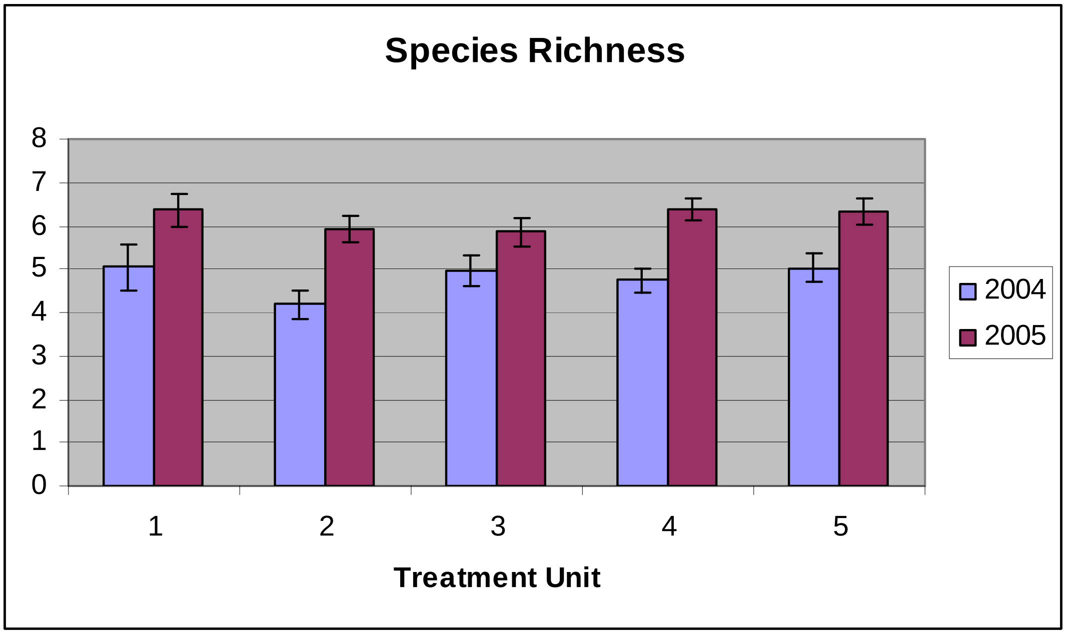
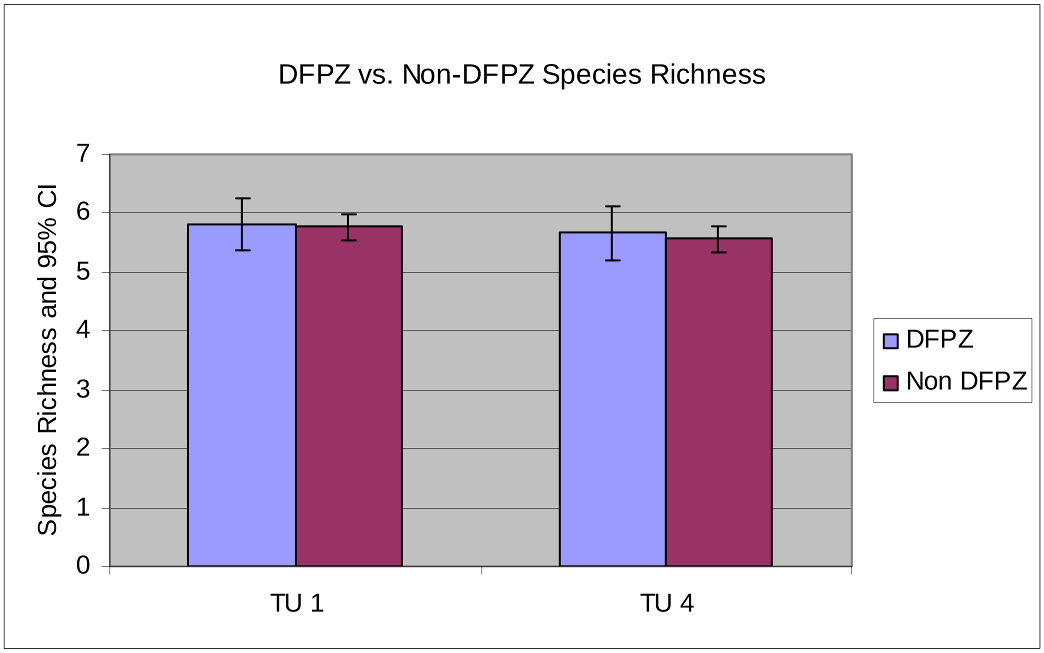
Figure 1. Avian species richness per point average by treatment unit in 2005 in the Plumas Lassen Study, with 95% confidence intervals.



DFPZ vs. Non-DFPZ Abundance and Species Richness

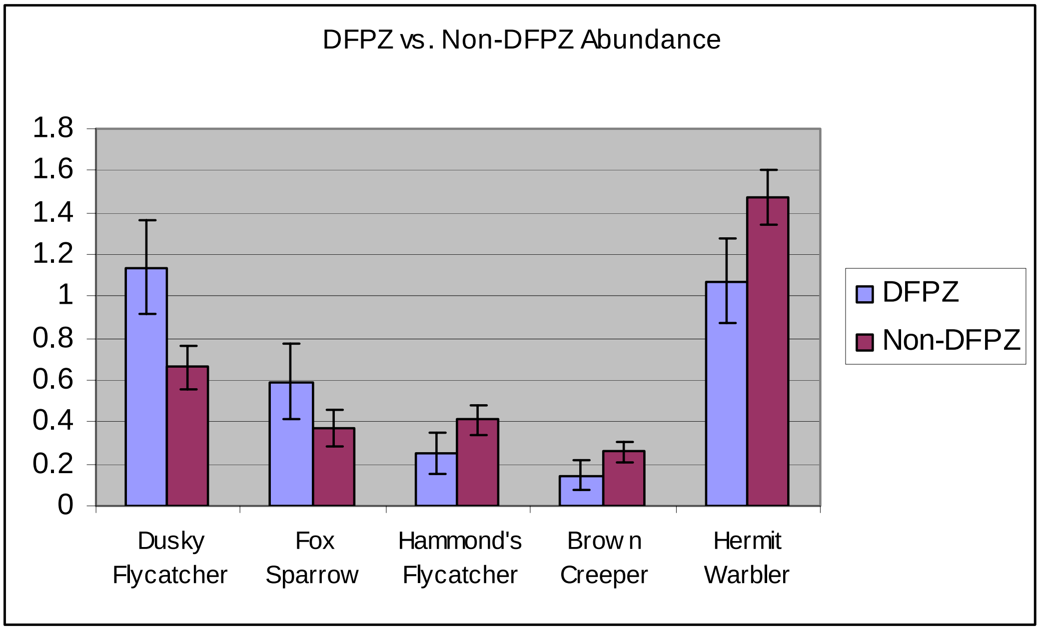
We compared species richness between pre-treatment DFPZ and extensive sites (non-DFPZ's) in TUs 1 and 4 using data from 2004 and 2005 (Figure 2). In both TU-1 and 4 species richness was very similar between DFPZ sites and extensive sites as well as between the units.

Figure 2. Avian species richness per point average (2004-2005 combined) comparing all DFPZ and extensive point count stations in Treatment Units (TU) 1 and 4 with 95% confidence intervals.



We compared the abundance of the 20 most detected species between DFPZ and non-DFPZ point count locations in TU-4 using data from 2004 and 2005. Of those 20 species we found significant differences in the abundance of five species: Fox Sparrow, Dusky Flycatcher, Hermit Warbler, Brown Creeper, and Hammond's Flycatcher (Figure 3). The two species most closely aligned with shrub dominated habitats (Fox Sparrow and Dusky Flycatcher), were both more abundant in areas slated for DFPZ treatment, while the three species significantly less abundant in DFPZ's are all associated with late seral stage forest (Hermit Warbler, Brown Creeper, and Hammond's Flycatcher).

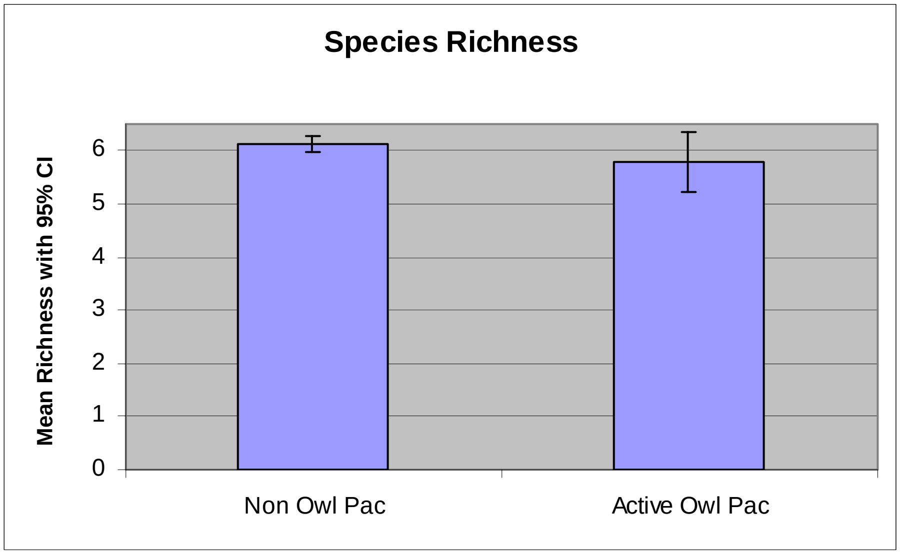
Figure 3. Mean abundance per point (detections <50m) of five avian species at pre-treatment DFPZ and non-DFPZ (extensive) point count stations in Treatment Unit 4 in the PLAS study area, 2004-2005 combined.



Spotted Owl Nest Site Avian Community Composition

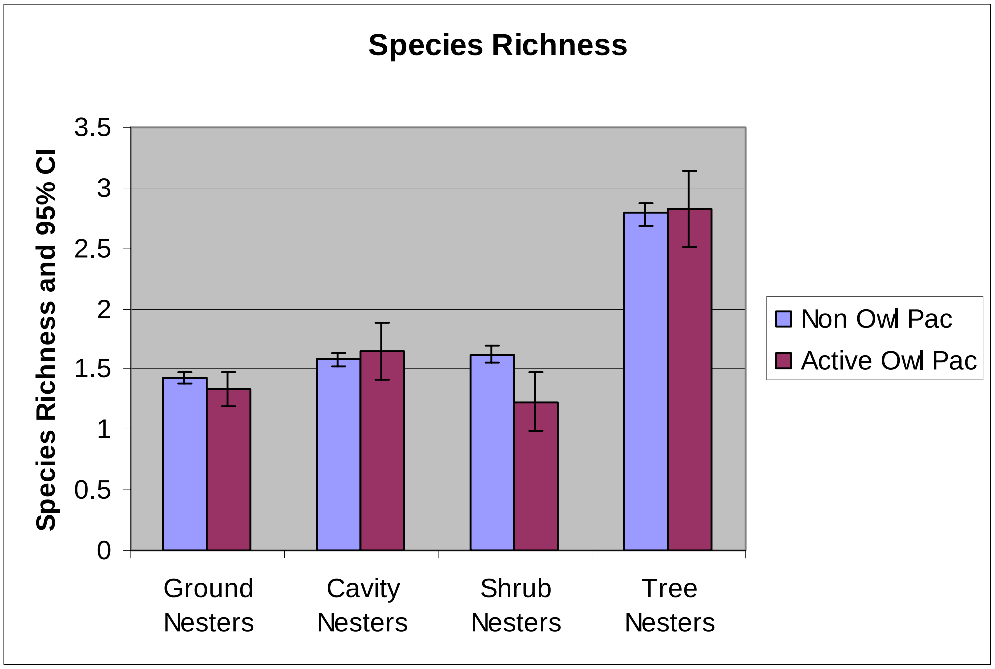
We compared avian community composition between areas in close proximity of known owl nests and roost sites to areas completely outside of owl protected activity centers for 2005 (Figure 4). Mean per point species richness at non-owl points was 6.12 compared to 5.78 at owl sites; this difference was not statistically significant (p=0.11).

Figure 4. Mean per point avian species richness around owl nest and roost sites compared to the surrounding PLAS study area landscape, 2005.



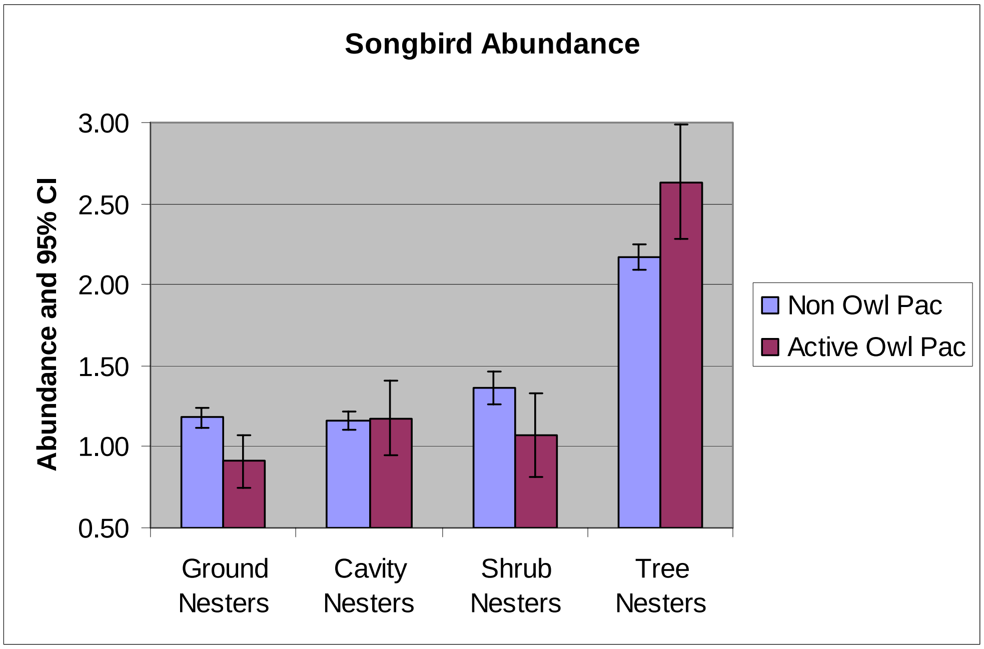
Using the same set of owl and non-owl points we compared the richness and abundance of the four primary nesting guilds in the study area (Figure 5). There was a greater richness of shrub nesting species (1.62 vs. 1.23; $p<0.05$) at non-owl sites than at owl sites. The species richness of the remaining three guilds (ground, cavity, and tree) was not significantly different between sites.

Figure 5. Mean abundance per point of species in four nesting guilds around owl nest and roost sites compared to areas outside Spotted Owl PACS, 2005.



When comparing total abundance we found significant differences with three of the four nesting guilds (Figure 6). Ground (1.18 vs. 0.91; $p<0.05$) and shrub nesters (1.36 vs. 1.07; $p<0.05$) were significantly more abundant at non-owl sites while tree nesters (2.17 vs. 2.64; $p<0.05$) were significantly more abundant at owl sites. Cavity nesters (1.17 vs. 1.18; $p>0.10$) were not significantly different.

Figure 6. Mean abundance per point of species in four nesting guilds around owl nest and roost sites compared to the PLAS study area as a whole in 2005.



GIS Project for Creating Species Maps

We created a GIS project incorporating all bird data collected from 2003 - 2005 (CD Supplement A). This tool can be used by land managers to generate distribution maps for all species breeding within the PLAS study area (see Appendices 9 and 10 for examples). In addition the project can be queried to produce avian species richness, total bird abundance, and the abundance of any species by point. These data are then presented on a map with relevant habitat and treatment layers. Appendix 11 outlines directions for creating additional maps for any species of interest or for bird community indices, and describes all aspects of this GIS project and associated database tables. In future years we will continue to update this project to incorporate the most current and relevant information on the distribution and abundance of birds in the study area. If you do not have a copy of the GIS project CD and would like one please contact the author at rburnett@prbo.org

DISCUSSION

Annual Variation in Indices

Mean indices of species richness and total bird abundance were higher in 2005 than in either of the previous two years. Based on our seven years of monitoring in the region, fairly substantial annual variation appears to be the rule and not the exception for the avian community. Annual variation at the level we have documented in the PLAS study area complicates a study attempting to discern effects of treatments. However, with three to four years of pre-treatment data we should still have ample statistical power to detect the signal from treatment effects. Additionally, with enough years of data collection we will be able to analyze the factors influencing annual variation in bird abundance – interesting in its own right – but more importantly it will allow us to control for those factors to discern the effects of treatments.

Abundance and Species Richness by Treatment Unit

While there was considerable annual variation between years, generally transects that had high indices were consistently high across years while transects with low indices were consistently low. Despite annual variation it is clear that treatment units 1, 4 and 5 have significantly higher species richness and total bird abundance than units 2 and 3. It appears that higher elevation sites harbor a greater diversity of avian species per point. However, it is important to consider that species richness and total bird abundance are only on part of managing for a healthy avian community. Ensuring habitat for species of management concern or declining species is critical to ensure that management practices are not leading other species towards threatened status.

DFPZ vs. Non-DFPZ Abundance and Species Richness

Ideally, planned forest thinning would occur in general in areas with lower quality avian habitat. We found species richness in pre-treatment DFPZ's in TU-1 (Creeks project) and TU-4 (Meadow Valley project) to be slightly higher than the surrounding forest.

Though many factors go into determining the placement of DFPZ's, we believe proposed forest treatments would have less negative and more positive effects on the avian community if they were focused in the size class three densely stocked forest that dominates the landscape. Dense thickets of pole sized trees are probably the lowest quality avian habitat in the forest. They have low avian species richness, total bird abundance, and abundance of declining species, such as Olive-sided Flycatcher, Chipping Sparrow, woodpeckers, and Nashville Warbler.

Based on our analysis of species composition it appears planned DFPZ's in TU-4 are more focused on shrub dominated habitats. The two avian species that were significantly more abundant inside of pre-treatment DFPZ's were Fox Sparrow and Dusky Flycatcher. These two species are seldom found breeding away from shrubs. Nesting sites for these species averaged 60% or greater shrub cover in the Almanor Ranger District, and the abundance of both in the PLAS study area was strongly correlated with total shrub cover (Burnett et al. 2005a and b). In the Sierra Nevada region, Dusky Flycatcher decreased 3.63% per year from 1988 to 2003 (P=0.03) while Fox Sparrow had a non-significant declining trend over the same period (-0.33%, p=0.72) (Sauer et al. 2005). We found nest success for Dusky Flycatcher in the Almanor Ranger District to be among the highest ever reported for the species (Burnett et al. 2005a). Thus, we suggest that the observed decline is likely due to a decrease in available nesting habitat as a result of fire suppression coupled with movement away from more management practices that removed the majority of the overstory.

In recent years, there has been considerable discussion on the importance of removing understory ladder fuels to reduce fire hazard in the study area. In the one example of an implemented DFPZ treatment in the study area – the Kingsbury Rush project – a large portion of the treated area was shrub dominated habitat, and the treatment involved near complete mastication of several shrub fields. If the majority of areas outside of planned treatments are being managed for late seral forest conditions and DFPZ's are targeting habitats with high shrub cover, it is paramount to consider the importance of the shrub habitat for birds and other wildlife in these prescriptions. If DFPZ treatments continue to remove the vast majority of shrubs and are managed to minimize shrub regeneration (conifer release, herbicide, mastication) we would expect a precipitous decline in shrub nesting species in the study area in the coming years. Shrub habitats are a vital component of the Sierra forest ecosystem as there are numerous species fully dependent upon them for existence.

Proper management of Sierra Nevada forests involves ensuring that a mosaic of habitat types and conditions are represented on the landscape. While we are strong advocates of open forest and shrub habitats, we don't believe them any more important than old seral forest. However, we believe that current strategies may not be properly managing for these open forest and shrub habitat types. Our results from this and other studies in the region clearly illustrate the value of these habitat types to the avian community. If treated areas are managed for little to no understory structure, they are unlikely to provide for the majority of open forest dependent species. Based on our knowledge, these "park-like" habitats would have suppressed species richness and total bird abundance. More importantly they may not support open forest dependent species that are currently known to be declining and are predicted to be negatively impacted under the Sierra Nevada Forest Plan Amendment (SNFPA 2001, Sauer et al. 2005). We believe it is possible to manage for a balanced ecosystem that includes sufficient old growth and shrub habitat and the myriad of habitat conditions in between.

Spotted Owl Nest Site Avian Community Composition

Initial analysis of the avian community adjacent to owl nesting and roosting sites showed overall species richness to be slightly lower in owl sites. When broken down into different nesting guilds, the abundance and species richness we found significant differences. With the dense canopy and large trees characteristic of owl nest and roost sites, it is not unexpected to find shrub and ground nesters significantly less abundant. We suggest these results are further evidence of the importance of managing areas outside of owl habitat for understory plant diversity and volume that supports shrub and ground nesting species. We will further investigate the differences in avian community composition within several different scales of owl habitat. As Spotted Owls play a major role in forest management and protection, understanding what other avian species may benefit from owl management and which species are likely not to benefit is critical for ensuring the needs of the total complement of avian species that depend upon the Sierra Nevada ecosystem are being met.

CONCLUSION

In order to determine the short term response of the avian community to forest treatments it appears it will be necessary to collect several years of post-treatment data in order to separate out the effects of annual variation from the treatment effects. In order to properly evaluate the impact of forest treatments it will be necessary to monitor the avian community 10 to 20 years post treatment in order to determine the integrated effects of treatment and succesional processes.

Long-term, landscape based ecological monitoring will be critical to determining when an acceptable balance has been struck. Avian monitoring is one of the only practical tools capable of providing the necessary feedback to make these complex and difficult decisions before the scale has been tipped too far and regulatory hurdles significantly limit management options. In recent years fire suppression and timber harvest practices (among others) have tipped the balance of these systems in favor of overstocked forests with small to medium sized trees. Here we present several management recommendations to increase habitat attributes that have been reduced as a result of forest management practices over the past century or more and ones we perceive might disfavored under new management direction.

MANAGEMENT RECCOMENDATIONS

Snags

Our analysis, as well as that of many others, has shown that snags are a critical component of forest ecosystems. A myriad of avian species in these forests are completely dependent upon snags. Retaining four snags per acre should be an absolute minimum guideline; we recommend maintaining as many snags as possible with priority given to the largest ones.

Shrubs

Shrub habitats are a critical component of the forest ecosystem with many avian species fully dependent on them. Allowing group selection treatments and, where appropriate, DFPZ's to naturally regenerate would ensure this habitat type does not dramatically decline in the next 25 years. Additionally, shrub understory within forested habitats should be valued and managed as an important habitat attribute.

Hardwoods

Thinning projects (both DFPZ and groups) can provide a dual benefit when incorporated into Black Oak and Aspen enhancement projects (e.g. Almanor and Eagle Lake ranger Districts of the Lassen National Forest). Hardwoods in general have suffered from fire suppression resulting in a dramatic decrease in the amount of these habitat types or attributes. Hardwoods and other shade intolerant species can benefit from strategically placing and designing DFPZ and group treatments.

Old Seral Forests

Many bird species are positively correlated with large tree habitat attributes in the study area. Undoubtedly this habitat has been drastically reduced here in the last century. With the abundance of size class 3 and the dearth of size class 4 and 5 forest currently on the landscape, every effort should be given to avoiding placement of groups or DFPZ's in size class 4 or 5 forests that contain old forest habitat attributes. Area thinnings appropriately placed in size class 4 forest that help reduce fuel loads and encroaching white fir could improve avian habitat quality.

Burned Forest

While controversy over salvage logging continues, it is clear from the scientific data that burned forest, including stand replacing burns, provide important bird habitat. The abundance and diversity of woodpecker species generally reaches a peak in recently burned forest. The Black-backed Woodpecker, a rare resident of northern Sierra forest, predominantly occurs in recently burned forest. Olive-sided Flycatcher, a species declining throughout the Sierra Nevada, has been shown to be strongly associated with burned forest as well. Thus we promote the view that burned forest is important wildlife habitat.
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PERSONNEL

This project is coordinated and supervised by PRBO staff biologist Ryan Burnett. Kim Maute was the field crew supervisor. Field work in 2005 was conducted by those listed above as well as Gabriel Cahalan, Jennipher Karst, Tim Ludwick, Shannon Page, Andrew Rothman, and Jim Tietz. Computer programs used to manage and summarize data were created by PRBO staff biologists Grant Ballard and Diana Humple. The study was carried out under the guidance of PRBO Terrestrial Program Director Geoffrey R. Geupel and PRBO Population Ecologist Nadav Nur.

ACKNOWLEDGEMENTS

Funding for this project is provided by the Pacific Southwest Research Station, National Fire Plan, and Region 5 of the U.S. Forest Service. We are grateful to Jim Schaber of the University of California, Meadow Valley Field Camp for his kindness and generosity in providing housing and logistical support. This is PRBO contribution 1339.

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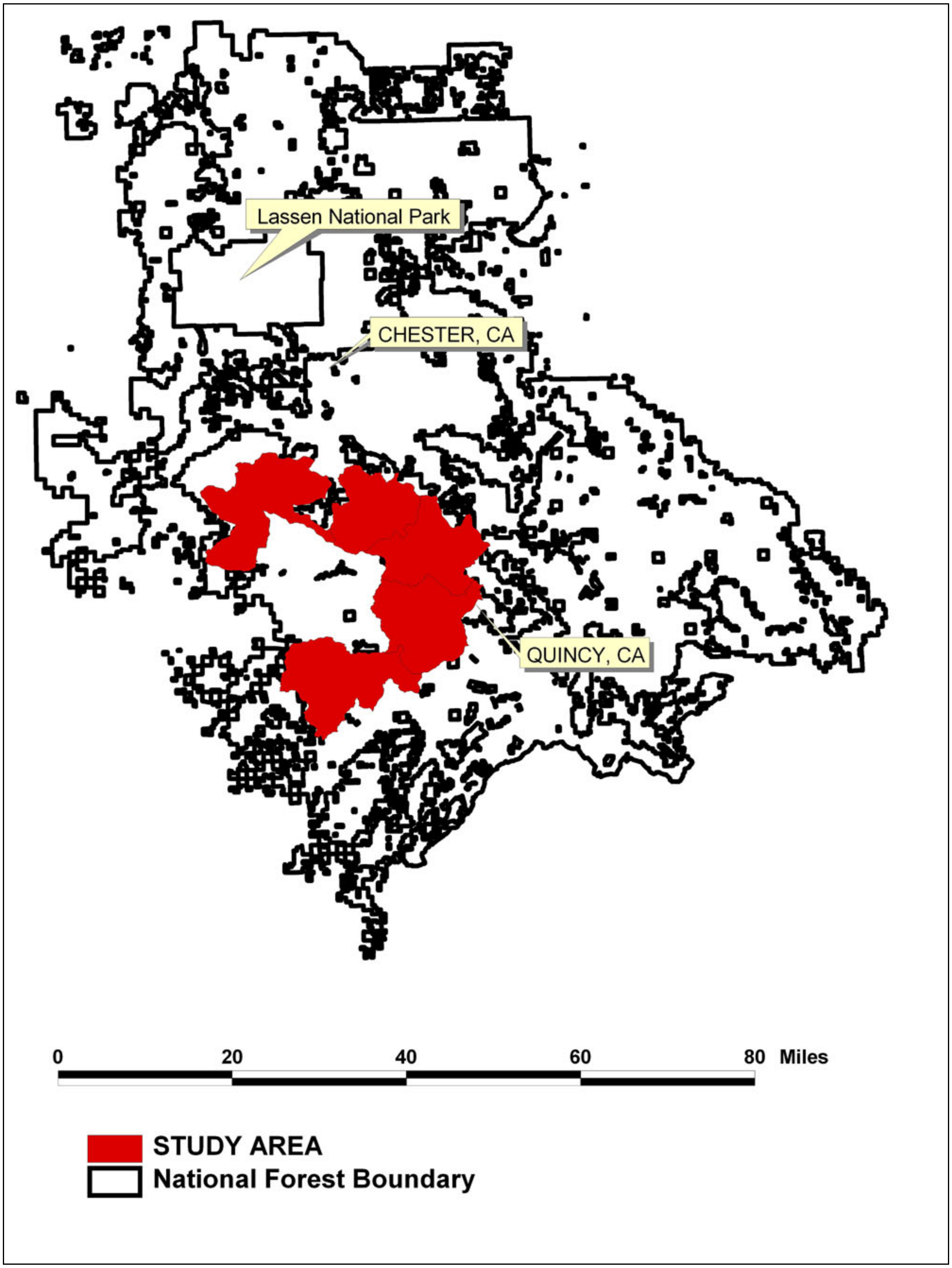
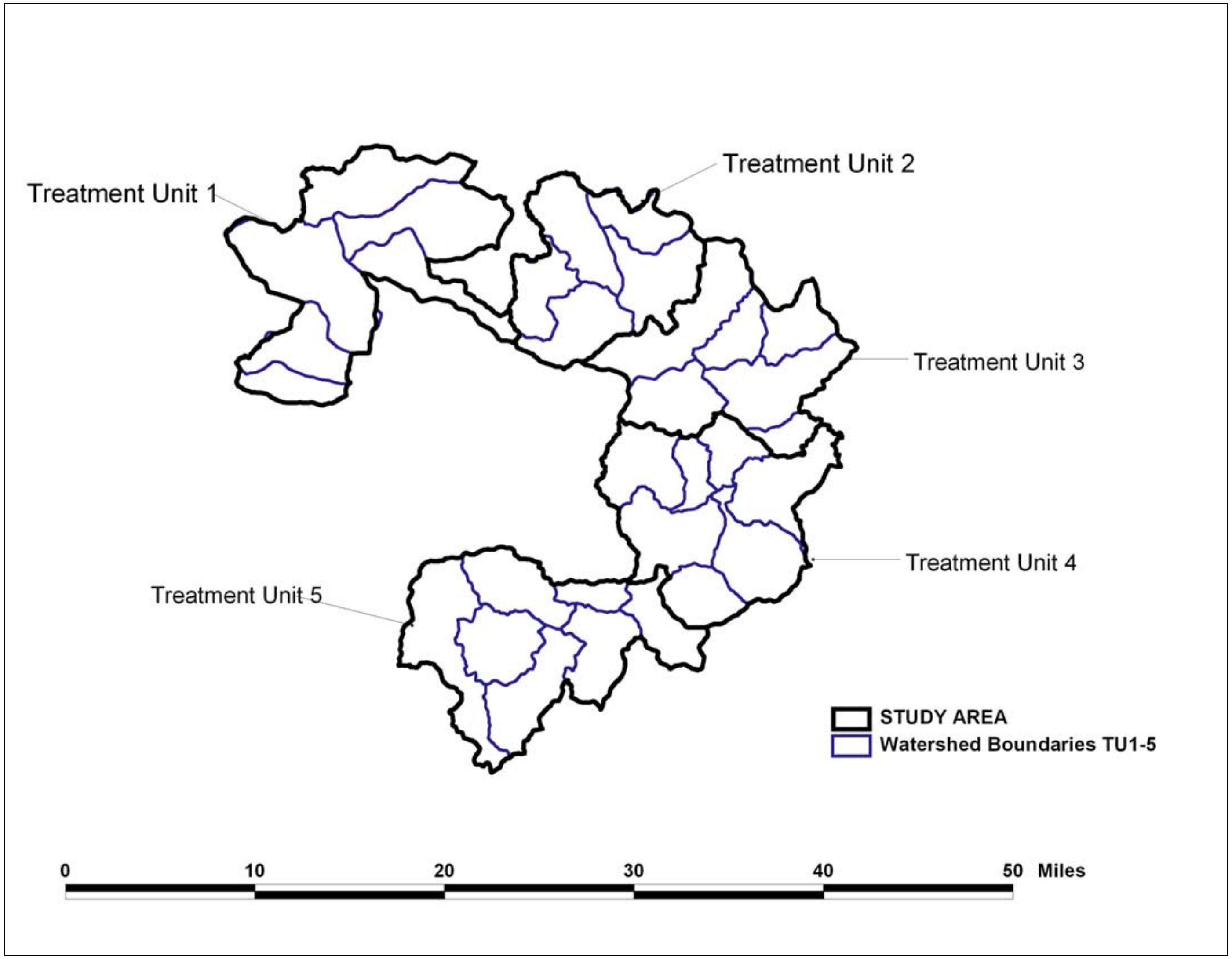
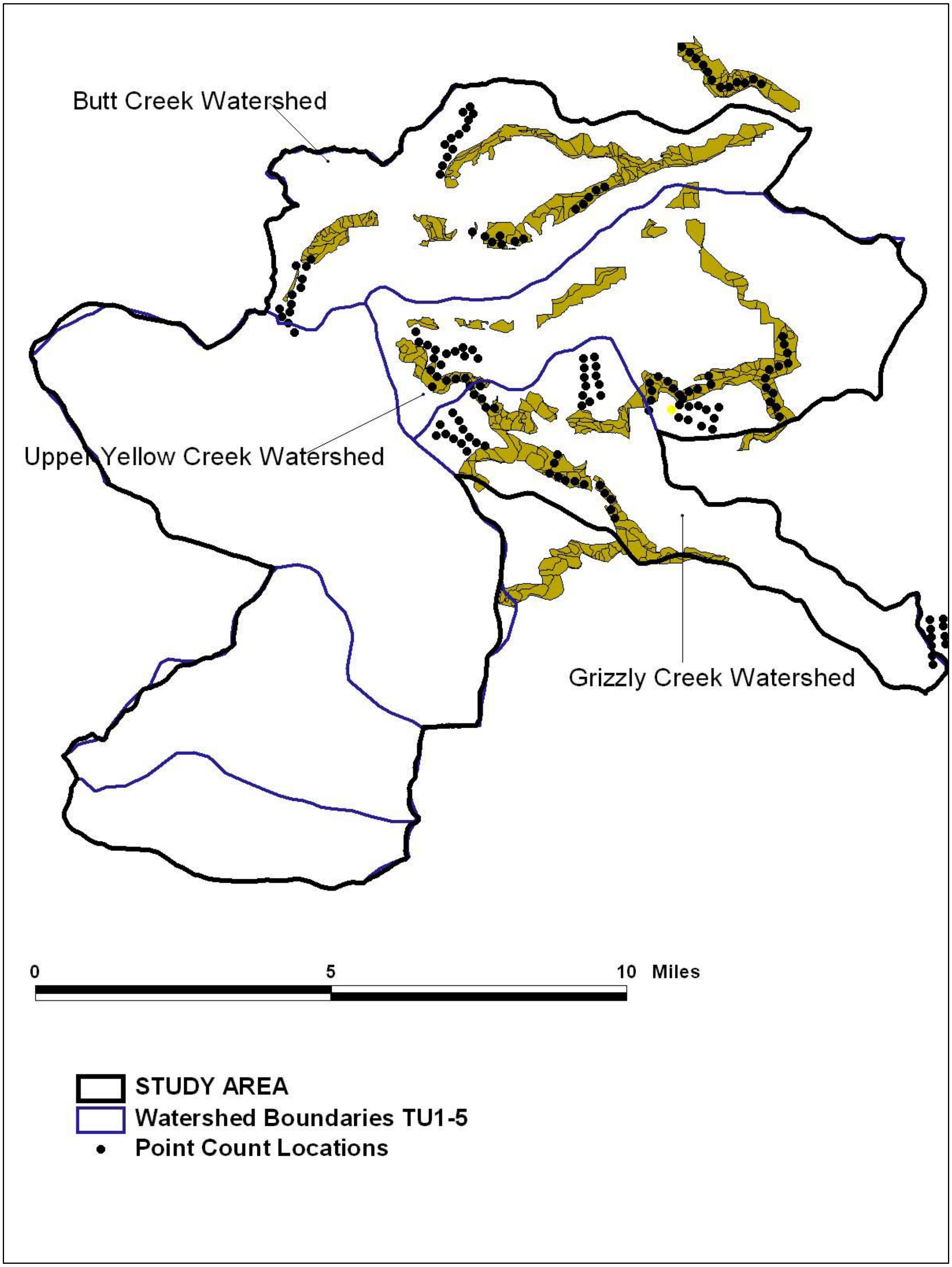
Appendix 1. Study area overview map of the PRBO Plumas Lassen module of the Administrative Study.



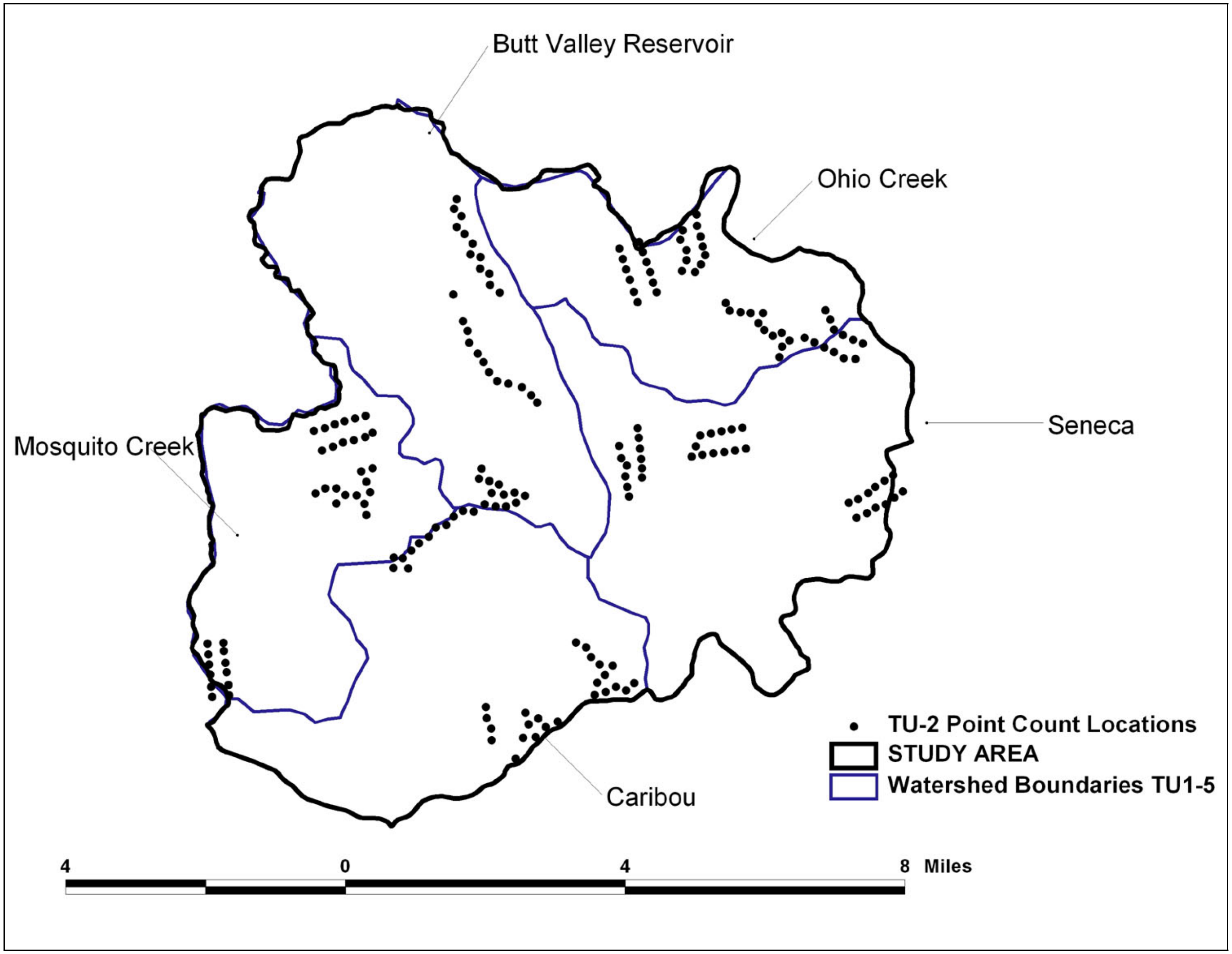
Appendix 2. Treatment Units and Watershed boundaries of the PRBO Plumas Lassen Avian Study Area.



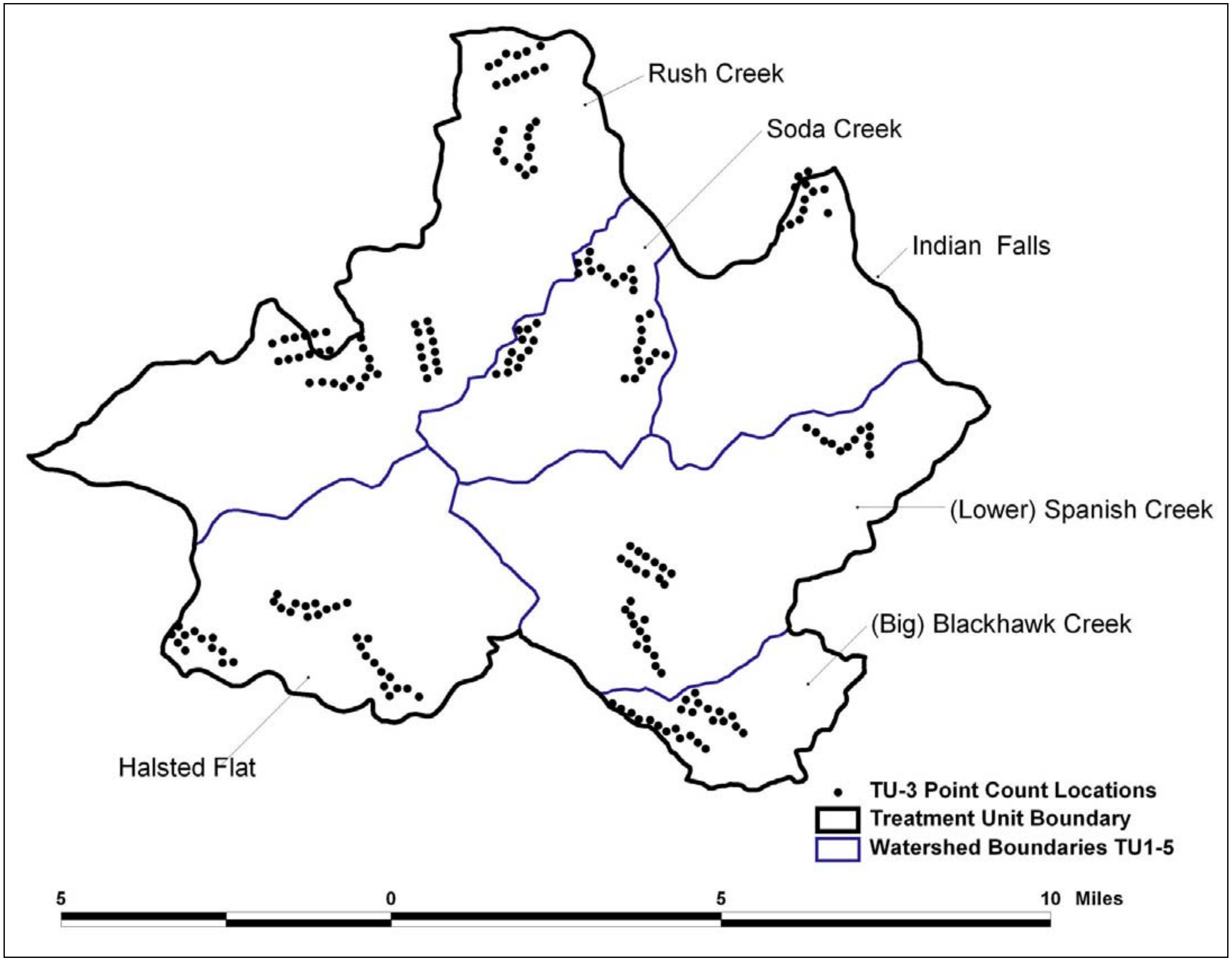
Appendix 3. Treatment Unit 1 Map with watersheds, DFPZ outlines, and locations of point count transects surveyed in 2005 for the PRBO Plumas Lassen Administrative Study.



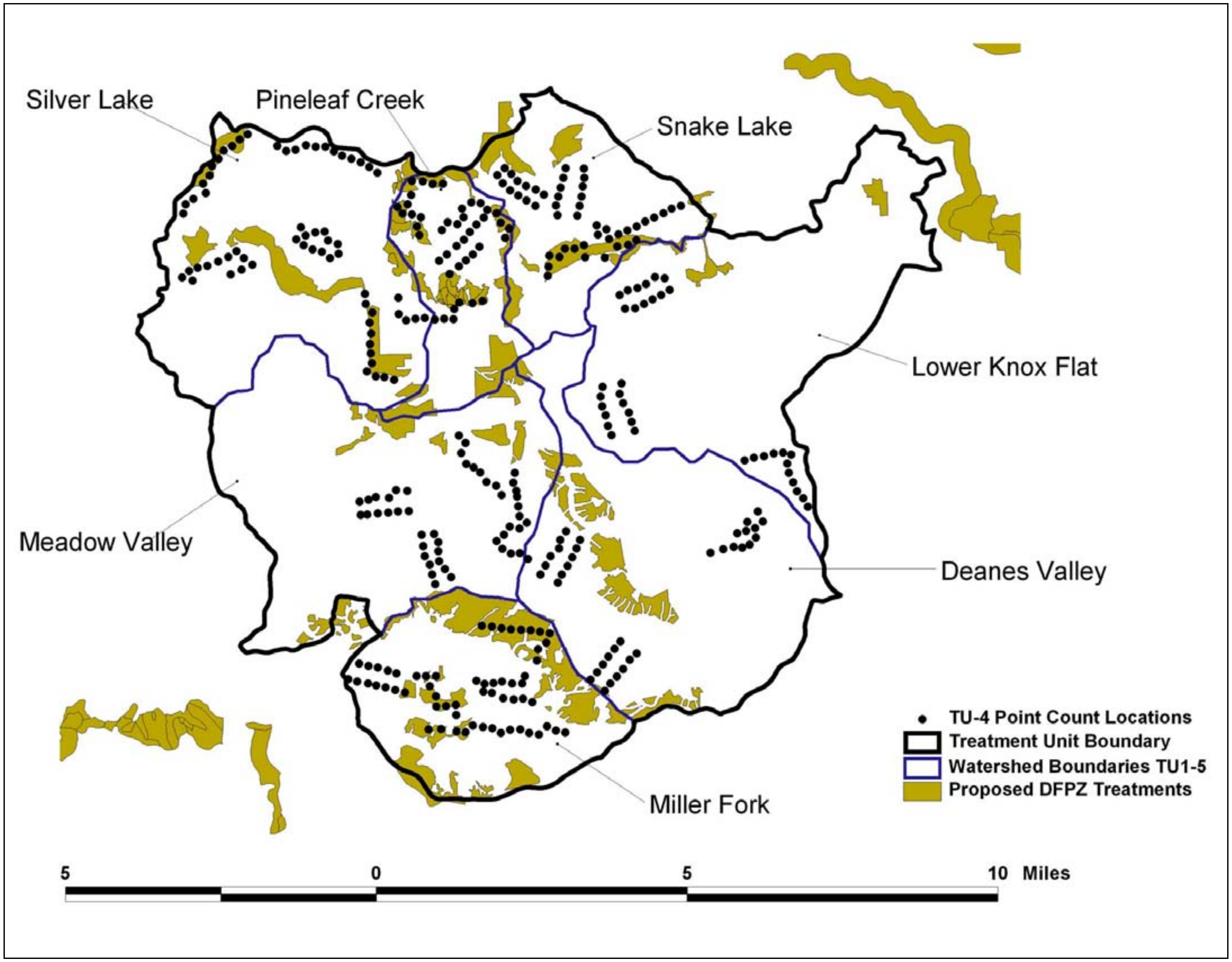
Appendix 4. Treatment Unit 2 map with watersheds, DFPZ outlines, and locations of point count transects surveyed in 2005 for the PRBO Plumas Lassen Administrative Study.



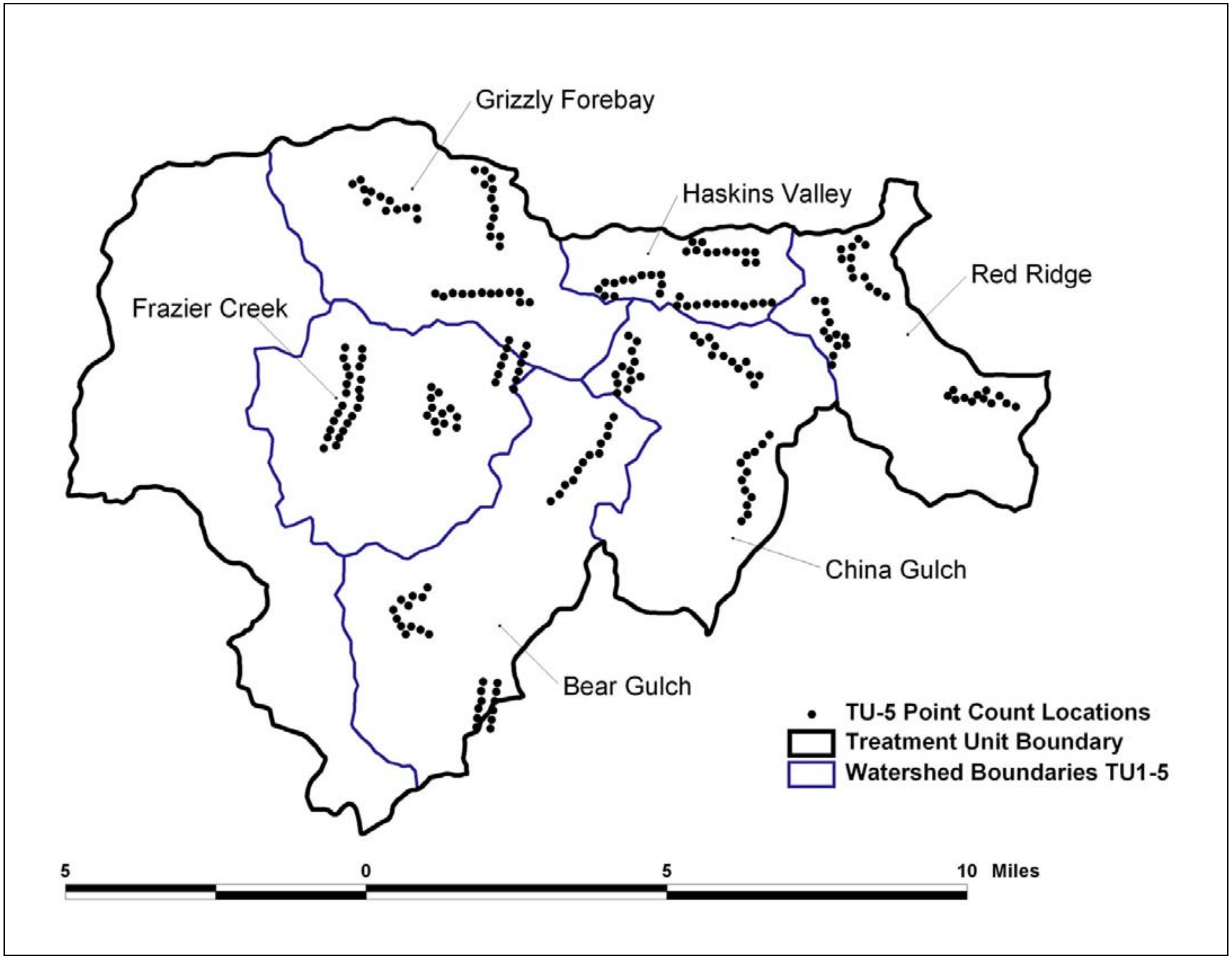
Appendix 5. Treatment Unit 3 map with delineating watersheds and locations of point count transects surveyed in 2005 for the PRBO Plumas Lassen Administrative Study.



Appendix 6. Treatment Unit 4 map delineating watersheds, DFPZ outlines, and locations of point count transects surveyed in 2005 for the PRBO Plumas Lassen Administrative Study.



Appendix 7. Treatment Unit 5 map delineating watersheds and locations of point count transects surveyed in 2005 for the PRBO Plumas Lassen Administrative Study.



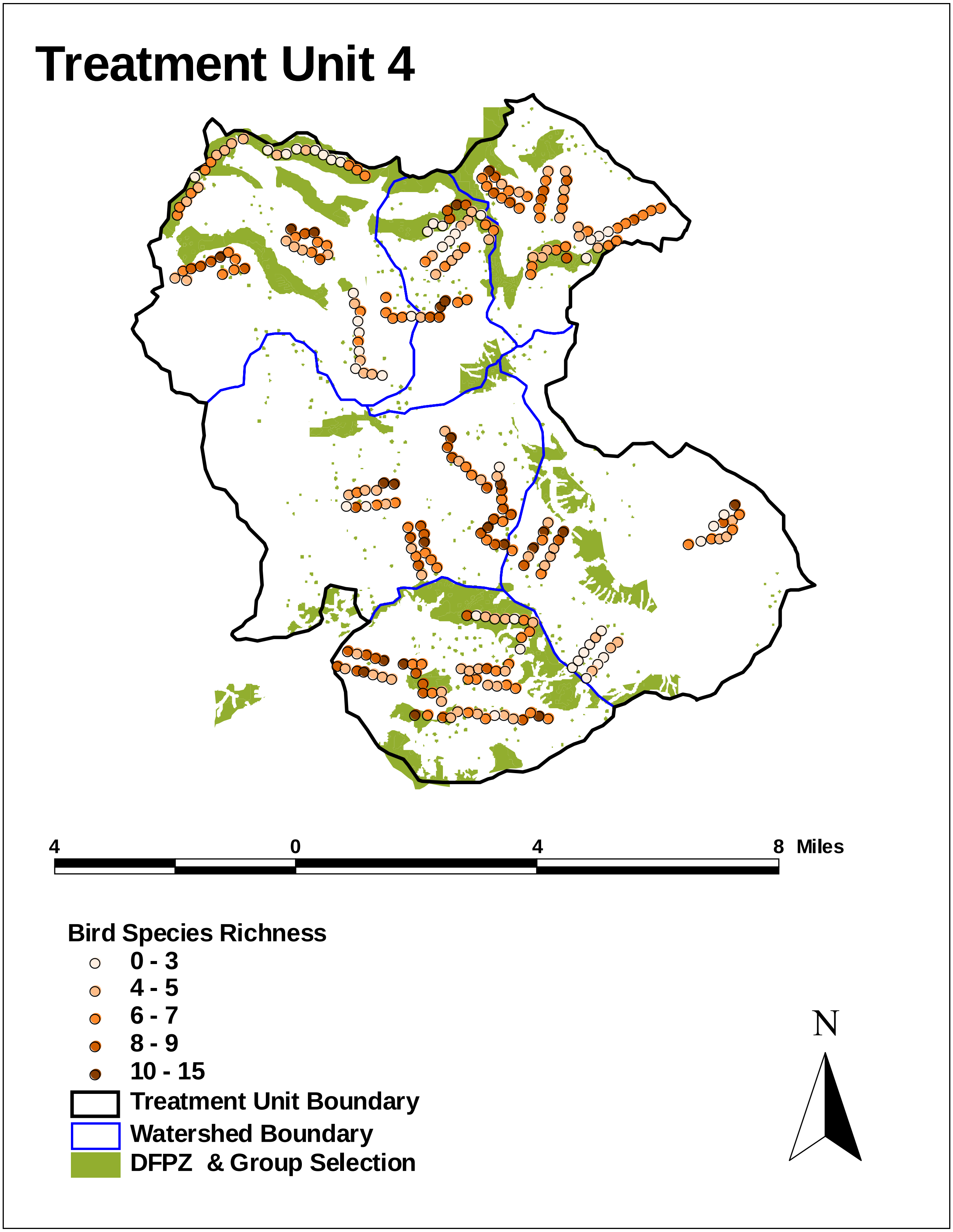
Appendix 8. List of all bird species detected by PRBO on point count surveys (common, AOU code, scientific name) in the PLAS in 2002 - 2005.

Common Name	AOU Code	Scientific Name
Acorn Woodpecker	ACWO	*Melanerpes formicivorus*
American Crow	AMCR	*Corvus brachyrhynchos*
American Dipper	AMDI	*Cinclus mexicanus*
American Kestrel	AMKE	*Falco sparverius*
American Robin	AMRO	*Turdus migratorius*
Anna's Hummingbird	ANHU	*Calypte anna*
Audubon’s Warbler	AUWA	*Dendroica coronata audubonii*
Bald Eagle	BAEA	*Haliaeetus leucocephalus*
Band-tailed Pigeon	BTPI	*Columba fasciata*
Belted Kingfisher	BEKI	*Ceryle alcyon*
Bewick’s Wren	BEWR	*Thryomanes bewickii*
Black Phoebe	BLPH	*Sayornis nigricans*
Black-backed Woodpecker	BBWO	*Picoides arcticus*
Black-headed Grosbeak	BHGR	*Pheucticus melanocephalus*
Black-throated Gray Warbler	BTYW	*Dendroica nigrescens*
Blue Grouse	BGSE	*Dendragapus obscurus*
Blue-gray Gnatcatcher	BGGN	*Polioptila caerulea*
Brewer’s Blackbird	BRBL	*Eupphagus cyanocephalus*
Brewer’s Sparrow	BRSP	*Spizella breweri*
Brown Creeper	BRCR	*Certhia Americana*
Brown-headed Cowbird	BHCO	*Molothrus ater*
Bushtit	BUSH	*Psaltriparus minimus*
California Quail	CAQU	*Callipepla californica*
Calliope Hummingbird	CAHU	*Stellula calliope*
Canada Goose	CAGO	*Branta Canadensis*
Cassin's Finch	CAFI	*Carpodacus cassinii*
Cassin's Vireo	CAVI	*Vireo casinii*
Cedar Waxwing	CEDW	*Bombycilla cedrorum*
Chestnut-backed Chickadee	CBCH	*Parus rufescens*
Chipping Sparrow	CHSP	*Spizella passerine*
Clark’s Nutcracker	CLNU	*Nucifraga Columbiana*
Common Nighthawk	CONI	*Chordeiles minor*
Common Raven	CORA	*Corvus corax*
Cooper’s Hawk	COHA	*Accipiter cooperii*
Downy Woodpecker	DOWO	*Picoides pubescens*
Dusky Flycatcher	DUFL	*Empidonax oberholseri*
European Starling	EUST	*Sturns vulgaris*
Evening Grosbeak	EVGR	*Coccothraustes vespertinus*
Fox Sparrow	FOSP	*Passerella iliaca*
Golden-crowned Kinglet	GCKI	*Regulus satrapa*
Gray Flycatcher	GRFL	*Empidonax wrightii*
Gray Jay	GRJA	*Perisoreus Canadensis*

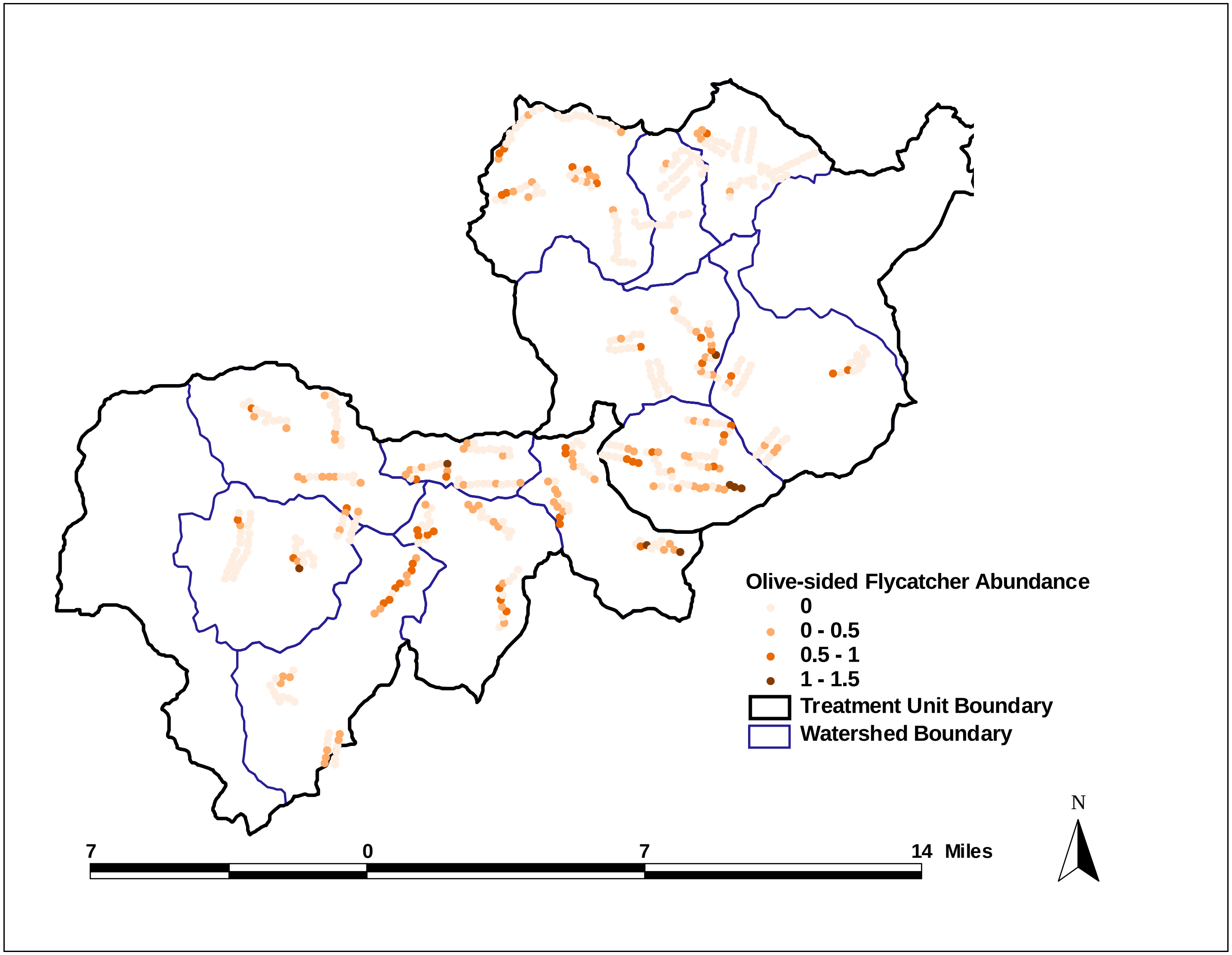
Common Name	AOU Code	Scientific Name
Great Blue Heron	GTBH	*Ardea herodias*
Green Heron	GRHE	*Butorides virescens*
Green-tailed Towhee	GTTO	*Pipilo chlorurus*
Hairy Woodpecker	HAWO	*Picoides villosus*
Hammond's Flycatcher	HAFL	*Empidonax hammondii*
Hermit Thrush	HETH	*Catharus guttatus*
Hermit Warbler	HEWA	*Dendroica occidentalis*
House Wren	HOWR	*Troglodytes aedon*
Hutton’s Vireo	HUVI	*Vireo huttoni*
Lazuli Bunting	LAZB	*Passerina amoena*
Lesser Goldfinch	LEGO	*Carduelis psaltria*
Lewis’s Woodpecker	LEWO	*Melanerpes lewis*
Lincoln’s Sparrow	LISP	*Melospiza lincolnii*
MacGillivray's Warbler	MGWA	*Oporornis tolmiei*
Mallard	MALL	*Anas platyrhynchos*
Mountain Bluebird	MOBL	*Sialia currucoides*
Mountain Chickadee	MOCH	*Poecile gambeli*
Mountain Quail	MOQU	*Oreotyx pictus*
Mourning Dove	MODO	*Zenaida macroura*
Nashville Warbler	NAWA	*Vermivora ruficapilla*
Northern Goshawk	NOGO	*Accipiter gentiles*
Northern Pygmy-Owl	NPOW	*Glaucidium gnoma*
Northern Saw-whet Owl	NOSO	*Aegolius acadicus*
Olive-sided Flycatcher	OSFL	*Contopus cooperi*
Orange-crowned Warbler	OCWA	*Vermivora celata*
Oregon Junco	ORJU	*Junco hyemalis*
Osprey	OSPR	*Pandion haliaetus*
Pacific-slope Flycatcher	PSFL	*Empidonax difficilis*
Pileated Woodpecker	PIWO	*Dryocopus pileatus*
Pine Siskin	PISI	*Carduelis pinus*
Purple Finch	PUFI	*Carpodacus purpureus*
Red Crossbill	RECR	*Loxia curvirostra*
Red-breasted Nuthatch	RBNU	*Sitta Canadensis*
Red-breasted Sapsucker	RBSA	*Sphyrapicus rubber*
Red-shafted Flicker	RSFL	*Colaptes auratus*
Red-tailed Hawk	RTHA	*Buteo jamaicensis*
Red-winged Blackbird	RWBL	*Agelaius phoeniceus*
Rock Wren	ROWR	*Salpinctes obloletus*
Rufous Hummingbird	RUHU	*Selasphorus rufus*
Sandhill Crane	SACR	*Grus Canadensis*
Sage Thrasher	SATH	*Oreoscoptes montanus*
Sharp-shinned Hawk	SSHA	*Accipiter striatus*
Song Sparrow	SOSP	*Melospiza melodia*
Spotted Owl	SPOW	*Strix occidentalis*
Spotted Towhee	SPTO	*Pipilo maculates*

Common Name	AOU Code	Scientific Name
Steller's Jay	STJA	*Cyanocitta stelleri*
Swainson’s Thrush	SWTH	*Catharus ustulatus*
Townsend's Solitaire	TOSO	*Myadestes townsendi*
Townsend’s Warbler	TOWA	*Dendroica towsendi*
Tree Swallow	TRES	*Tachycineta bicolor*
Turkey Vulture	TUVU	*Cathartes aura*
Vaux’s Swift	VASW	*Chaetura vauxi*
Violet-green Swallow	VGSW	*Tachycineta thalassina*
Warbling Vireo	WAVI	*Vireo gilvus*
Western Bluebird	WEBL	*Sialia mexicana*
Western Scrub-Jay	WESJ	*Aphelocoma californica*
Western Tanager	WETA	*Piranga ludoviciana*
Western Wood-Pewee	WEWP	*Contopus sordidulus*
White-breasted Nuthatch	WBNU	*Sitta carolinensis*
White-headed Woodpecker	WHWO	*Picoides albolarvatus*
Williamson’s Sapsucker	WISA	*Sphyrapicus thyroideus*
Wilson's Warbler	WIWA	*Wilsonia pusilla*
Winter Wren	WIWR	*Troglodytes troglodytes*
Wrentit	WREN	*Chamea fasciata*
Yellow Warbler	YWAR	*Dendroica petechia*

Appendix 9. Sample map from GIS CD supplement of bird species richness in treatment unit 4 of the PLAS study area in 2003.



Appendix 10. Sample Map from GIS CD Supplement of Olive-sided Flycatcher Abundance (all detections) in Treatment Units 4 and 5 in the PLAS study area in 2003.



Appendix 11. Details on GIS CD Supplement Project for building species maps

I. Summary

With this GIS project and these tables, additional maps can be generated (e.g., abundance maps for individual species showing where they are most and least common; maps showing differences in diversity, richness or overall abundance; and maps showing presence/absence of species of interest that are not well surveyed with this method, but encountered during point counts) for 2003, 2004 and 2005 data. Included in the ArcView project (see below for details) are examples of such maps: abundances of Hammond's Flycatchers within 50 meters of every point in 2003 and 2004; abundances of Band-tailed Pigeons detected at each of the points in 2004; abundances of Black-backed Woodpeckers at each of the points in 2004; and species richness at each of the points in 2003. The directions and metadata below will allow the user to create such maps for any species or index in either of the two years.

II. PRIMARY ARCVIEW FILES

PRBO_PSWreportsupplement05.apr – ArcView project file. Double click this file to open the project.

PLASabsum05_allGIS.dbf – table which contains one line of data per point with all associated bird data from the 2005 point count season, including diversity, species richness, and abundance of all species combined, as well as abundance of individual species. Only includes data within 50m and for restricted species only (breeders in area and species well surveyed by the point count method; see *Methods*) This has been imported into an ArcView project file. It means "Point count abundance summary for birds less than 50 m from the observer in 2005".

PLASabsum05_l50GIS.dbf – table which contains one line of data per point with all associated bird data from the 2005 point count season, includes ALL data (birds within 50m, birds greater than 50m, and flyovers, combined) and is for all species, including non-breeders as well as species not well surveyed with the point count method. Has been imported into ArcView project file. It means "Point count abundance summary for birds of all detections in 2005."

PLASabsum04_l50GIS.dbf – same as above (less than 50 m) but for 2004 point count data.

PLASabsum04_allGIS.dbf – same as above (for all data) but for 2004 point count data.

PLASabsum03l50.dbf – same as above (less than 50 m) but for 2003 point count data.

PLASabsum03all – same as above (for all data) but for 2003 point count data.

III. GIS DATABASE FIELDS EXPLAINED

Below are the definitions for each field within the pcabsuml50.dbf and pcabsumall.dbf (see above) tables.

YEAR = **year that data was collected**

STATION = **abbreviated point count transect name (4-letters)**

SITE = **point count station number within a given transect**

X_COORD = **latitude in UTMs for the point**

Y_COORD = **longitude in UTMs for the point**

VISITS **(2003 database) = number of total point count visits done per point; all sites were visited 2 times.**

SW = **bird diversity at that point (see *Methods: Statistical Analysis*)**

SPECRICH = **bird species richness at that point (see *Methods: Statistical Analysis*)**

ABUNDANCE = **average number of individuals detected at that point per visit (total individuals/number of visits; see *Methods: Statistical Analysis*)**

“SPEC”AB = **multiple fields, detailing number of individuals of each species at each point (averaged across visits). Uses AOU 4-letter codes for each bird species, combined with "AB" for abundance (e.g., Audubon’s Warbler abundance is delineated as *AUWAAB*). See Appendix 8 for explanation of all 4-letter bird species codes. This is done for 61 species within 50 meters (PLASabsum03L50.dbf) and 92 species when including all detections (PLASabsum03all.dbf).**

IV. HOW TO GENERATE ABUNDANCE MAPS BY SPECIES

1. Save all files on the CD onto hard drive
2. Open **PRBO_PSWreportsupplement05.apr** in ArcView
3. Since it has been moved, you will have to direct ArcView to each file location (all wherever you have saved them) for the first time, and then save the project so you won’t need to do so again.
4. Open view 1.
5. Once inside view 1 click on VIEW on the pull down menu and choose “add event theme”
6. Choose table you want to take data from (PLASabsum05L50.dbf, PLASabsum05all.dbf, or 2003/2004 tables); click OK.
7. Double click on the newly created event theme in left margin
8. Under legend subfolder inside the project folder choose ***speciesabundance.avl*** if you are going to create a map for individual species abundance; or **choose richdivab_legend.avl** if you are going to create a map of community indices. This way all the legends for all species are identical, and done to the same scale.
9. Then under *load legend: field* pick the species abundance you wish to map (i.e., choose *wiwrab* if making a map of Winter Wren abundance based on point count stations) and click OK.
10. Hit APPLY (and close legend window).
11. While that event theme is still selected, under *theme,* click on *properties.* You can then modify the theme name here (e.g., *Winter Wren <50 m*)
12. You will likely choose to make each species map a *layout* if you wish to print them out with a legend (View → layout)