

## **Terrestrial Birds Module**

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### **BACKGROUND and INTRODUCTION**

Coniferous forest is one of the most important habitat types for birds in California (CalPIF 2002). In the Sierra Nevada, a century of intensive resource extraction and forest management has led to major changes in the amount and quality of coniferous forest habitat. Problems that the forests have faced include loss of habitat to intensive logging operations; lack of replacement of old-growth stands due to harvest rotations of insufficient length in time; changes in forest structure due to fire suppression; elimination of snags and dead trees; and fragmentation (SNEP 1996, CalPIF 2002). Bird 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 for the Sierra Nevada Forest Plan Amendment (SNFPAA) directs the Forest Service to maintain and restore old forest conditions that provide crucial habitat for a number of plant and animal species. Certain taxa are emphasized in this strategy because of their dependence on old forest habitat attributes. Simultaneously, the Forest Service is taking steps to reduce risks of catastrophic fire by removing vegetation and reducing fuel loads in overstocked forests. Achieving all of these potentially competing goals as well as meeting other demands placed on Sierra Nevada forests is a challenging task.

The SNFPAA Record of Decision called for an administrative study to test the effects of various forest management techniques, intended to reduce fuels and re-introduce natural fire regimes, on California Spotted Owl populations and other components of old forests. In investigating this issue, valuable feedback can be gained by determining how the full complement of the avian community will respond 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?

Here we report on the progress of the landbird study module, one of an integrated series of studies 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).

## OBJECTIVES

### *Long-term objectives*

1. We intend to monitor the distribution and abundance of birds across the landscape in response to changes in forest structure and composition as determined by vegetation growth/succession and by human-induced treatments. Forests in the northern Sierra Nevada grow rapidly (Powell et al. 1992) and growth rates (characterized, for example, by changes in tree size class and canopy cover) will presumably impact habitat conditions. Treatments, such as forest thinning for fuels management or group selection for timber harvesting, will also impact habitat conditions on the site of treatments and surrounding areas in some way. When analyzed over time and across the spatial extent of landscapes (and in relation to treatment schedules) what is the response of bird communities? Will forest structure and composition resulting from a combination of continuous vegetative growth and specific management regimes create conditions capable of sustaining stable avian communities? This study is distinguished by its geographic domain or scale. We are principally interested in measuring response of variables over large geographic areas and over relatively long time periods. The reason for this is rooted in the rate and extent of treatments combined with the rate and extent of vegetation growth. This landscape-scale study endeavors to incorporate spatial and temporal factors that might influence the response variables.
2. In addition to assessing responses of landbirds to forest management and succession integrated over time (10 to 20 years) and space (all treatment units) we plan to simultaneously address the short-term, localized responses of landbirds to specific forest treatments. What are the site-specific changes in bird community composition and abundance in response to treatments and how does this change over time following treatments? This two-scale approach allows us to understand both the effects of specific management practices and the integrated effects of treatments and vegetation succession.
3. Finally, we also intend to build predictive models that can associate habitat conditions with expected avian species abundance. These habitat relationships models will enable us to predict how habitat changes measured in response to vegetation growth and management will influence the overall distribution and abundance of bird species across a landscape. In a modeling context, treatments

will be assessed in terms of how effective they are at moving stand and landscape vegetation structure and composition toward a desired condition.

*Objectives for 2002 – Pilot year*

1. To initiate data collection to the greatest extent possible with at least 50% of the landscape-scale sample size and at as many Defensible Fuel Profile Zone (DFPZ) sites as possible; see below for details.
2. To evaluate our study design and site selection methodology and adapt them to the on-the-ground realities of the study site.

METHODS

*General sampling method*

We are using standardized five-minute variable circular plot (VCP) point count censuses (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 along the transect, making the point, not the transect, the sampling unit. 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. Counts begin around local sunrise and are completed within four hours. Each transect is visited twice during the peak of the breeding season.

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. Using a variable radius point count should enable us to provide more precise estimates of density and detectability of individual birds (Rosenstock et al. 2002).

*Landscape-scale sampling design*

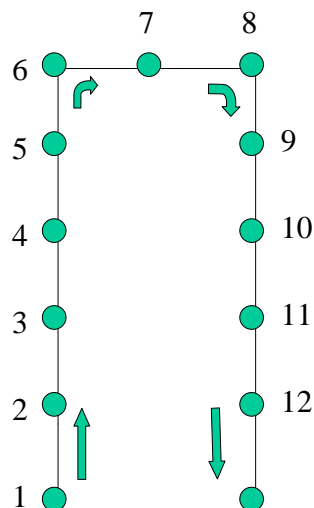
The larger scale or landscape level sampling is primarily intended to meet objective 1 (see long-term objectives above). Forest structure is probably the most important variable of forest condition with respect to habitat selection by terrestrial birds. Thus, to ensure coverage of the array of forest structural types within the study area, we are stratifying the forested areas into ten classes. These classes, when combined, create a three by three matrix of forest structural conditions; three classes of tree size (size class 2 = 6' to 12' crown diameter, 3 = 12' to 24' crown diameter, and 4 = >24' crown diameter) and three classes of canopy cover (<40% canopy cover, 40-60% canopy cover, and > 60% canopy cover). These, along with a tenth class for shrub habitat creates ten classifications that are then used to stratify random starting points for each transect using a random point generator program (ESRI 1999). Due to accessibility issues, starting

points are constrained to areas further than 100 meters but no more than 200 meters from roads for accessibility purposes. Ten random starting points are generated per stratum even though only one point is used. In the event that the first point of ten is not manageable in the field due to topography, bodies of water, proximity to treated areas, etc., the next point in the list is used, until a satisfactory location is found for that particular stratum. Once points are deemed suitable, a random bearing is then generated by spinning a compass. The transect is then established by placing 5 additional points going out along this bearing at 250 meter intervals, turning 90 degrees from original bearing, going 250 meters to point 7, and then point 8, then returning 180 degrees from original bearing back towards the starting point, until 12 points are established (Figure 1). If non-forested habitats are encountered, stations are placed 250 meters ahead, in successive 250-meter increments, until forested habitats are again encountered.

#### *Stand-scale sampling design*

In addition to the landscape level monitoring, we are monitoring a sample of treated stands before and after treatment. We are using a modified BACI (Before/After Control/Impact) experimental design with replicated control and “impact” sites. Controls for each treatment site will be a subsample of the landscape points described above that have similar pre-treatment conditions to the treated sites, that are located within the same treatment unit. Eight to twelve point count stations will be established in each treatment site.

**Figure 1. Layout of point count stations along landscape-scale transects.**



Specific forest stands in each treatment unit will be subject to one of three treatment types: DFPZ thinning, group selection, and area thinning. All treatment units will contain DFPZ's and 8 of the 11 will include group selection sites. Within each treatment unit, two replicates of each type of treatment (i.e., either a DFPZ or a group selection site) will

be randomly selected for before and after sampling. At this time we are not going to be sampling area treatment sites. Because the treatments will be implemented gradually over time, our initial efforts have focused on the treatment units scheduled first for treatment activities.

#### *Vegetation sampling methods*

Ultimately, vegetation will be described in detail at each point count station every 3 years during the study. Intensive vegetation sampling was not conducted in 2002, because we are in the process of designing a coordinated sampling approach together with the other study modules.

#### *Statistical Analyses*

We analyzed point count data in order to create preliminary 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 or are not accurately surveyed using the point count method such as raptors, waterfowl, and shorebirds. (For a complete list of the species used in this analysis see Appendix 3). It is important to bear in mind that this data should be considered a preliminary result. It would be inappropriate to use one year of data to rank the importance or quality of any individual site over another. With future years of data collection and more complex analysis techniques we will be better able to assess the importance of particular sites as well as habitat types and features for songbird populations in the study area.

We present the mean by point (average per point per visit by transect) for the following three indices. This method allows for using the point as the individual sampling unit and 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 mean number of species detected within 50 meters of each point per visit.

#### *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 detected per station per visit. This number is obtained by dividing the total number of detections within 50 meters by the number of stations and the number of visits.

### 2002 PROGRESS and RESULTS

In 2002, we established and surveyed 75 point count transects in the study area. Of the 75 transects, 55 are landscape level transects, five in each of the eleven treatment units, and 20 are DFPZ transects (Appendix 1 and 2). The DFPZ transects were established in treatment units 1, 4, and 6, the three units that were furthest along in the planning and implementation of DFPZ's as of the start of the 2002 field season. Eight DFPZ transects were established in treatment unit 4 and six each were established in treatment units 1 and 6. Following re-consideration of study design and available resources following the 2002 field season, we plan on decreasing the number of DFPZ transects per treatment unit in future years (see methods section above).

A total of 89 species were detected during point count surveys within the study area in 2002 (Appendix 3). We determined breeding bird diversity, richness, and abundance among all sites surveyed in 2002 (Table 1). Abundance ranged from a 2.08 on the A13 transect to 7.67 on the 114 transect. Richness ranged from a low of 2.04 on the 122 transect to 8.91 on the D401 transect. Diversity ranged from a low of 2.35 on the 213 transect to a high of 8.16 on the D401 transect. It should be noted that any given point along a transect does not necessarily have the same size and canopy cover class as the random starting point for which the transect is named. While this is preliminary data there is considerable variation between transects in these indices, more than in our data from the nearby Almanor Ranger District of the Lassen National Forest over the past five years (Burnett and Geupel 2001). This may be due at least in part to the vastness of the area from which we are sampling.

**Table 1. Mean Abundance, Species Richness, and Diversity for all point count transects surveyed in the Plumas/Lassen area study in 2002.**

<b>Transect</b>	<b>Mean Abundance</b>	<b>Mean Species Richness</b>	<b>Mean Ecological Diversity</b>
113	4.25	6.08	5.72
114	7.67	8.33	7.33
122	3.29	2.04	3.80
123	4.33	2.83	5.17
124	5.21	6.92	6.12
213	2.56	2.45	2.35
214	3.96	5.58	5.14
222	4.46	6.17	5.64
223	6.04	8.58	7.77
224	4.54	6.08	5.64
313	3.71	5.25	4.81
314	4.08	3.75	3.70
322	4.67	6.67	6.09

<b>Transect</b>	<b>Mean Abundance</b>	<b>Mean Species Richness</b>	<b>Mean Ecological Diversity</b>
323	5.33	7.92	7.28
324	4.54	6.83	6.45
413	5.83	8.25	7.56
414	6.92	8.75	8.03
422	4.33	6.08	5.64
423	4.54	6.75	6.38
424	5.71	8.08	7.34
513	5.42	7.17	6.54
514	2.50	4.33	4.19
522	5.50	7.67	6.89
523	3.54	5.33	5.04
524	4.42	6.42	5.95
613	5.96	7.00	6.43
614	3.50	3.33	3.28
622	4.25	6.50	6.16
623	4.88	7.42	6.94
624	4.67	7.42	7.01
713	2.63	3.83	3.62
714	3.79	5.58	5.17
722	2.38	3.67	3.55
723	3.58	5.33	4.93
724	4.76	4.17	4.05
813	5.13	8.00	7.45
814	4.13	5.42	5.04
822	4.58	5.83	5.13
823	4.50	3.92	3.83
824	3.42	5.25	4.94
913	5.25	7.42	6.88
914	5.29	6.75	6.12
922	3.18	4.55	4.21
923	5.00	4.50	4.37
924	2.16	3.95	3.83
1013	2.08	3.50	3.35
1014	2.92	4.42	4.11
1022	4.38	6.17	5.66
1023	3.28	3.00	2.94
1024	4.38	6.50	6.01
1113	2.38	3.50	3.27
1114	4.33	5.58	5.14
1122	5.46	7.83	7.34
1123	3.83	5.75	5.38
1124	4.44	3.82	3.70
D101	3.63	4.00	3.66
D102	5.21	5.75	5.06
D107	4.25	6.17	5.81

Transect	Mean Abundance	Mean Species Richness	Mean Ecological Diversity
D108	4.67	6.42	5.89
D109	6.13	8.67	7.96
D110	7.63	8.83	7.72
D401	6.88	8.91	8.16
D402	4.71	6.75	6.24
D403	3.70	5.42	5.09
D404	5.00	7.17	6.73
D405	4.54	6.58	6.05
D406	4.46	6.42	5.98
D407	4.50	7.00	6.52
D408	5.13	7.75	7.12
D602	4.33	6.17	5.77
D603	3.83	5.5	5.11
D604	3.92	6.00	5.59
D605	4.79	6.17	5.75
D606	5.46	7.25	6.59
D607	4.08	2.82	2.66

### *Assessing Site Selection Design*

One of the major objectives for 2002 was to evaluate our sampling methods. Using GIS vegetation information along with GPS locations for all landscape level points established in 2002 we were able to determine the forest cover type and structural class for each point (Table 2). We then stratified the available area, defined as USFS land with a slope <30%, within the study area (Table 3). By comparing these two tables we were able to determine if our site selection methodology did an adequate job of sampling the study area based on the relative abundance of certain structural categories as well as cover types (dominant tree species). Based on this analysis we have determined that our sampling method employed in 2002 is an effective way of creating samples based on the relative abundance of those stratum in the study area. We did however expect our methodology to result in a slight bias in favor of the size and cover class combinations that are less common, and biased against those that are more common, since we are selecting one starting point from each category regardless of relative representation. For example, class 1,3 is the most common structure class in the study area (by area), 46%, but only 40% of our points fall in this category, while the 1,4 category is much less common representing approximately 8% of the study area and 15% of our points fall in this category. We deemed this bias necessary in order to achieve large enough sample sizes in the uncommon stratum.

**Table 2. Estimate of the distribution of landscape point count locations based on size and cover class from USFS GIS vegetation layers.**

Forest Cover Type	Cover class, Size Class						Total	Proportion of Total
	1,2	1,3	1,4	2,2	2,3	2,4		
Doug Fir - Mixed Conifer	1	5	3	2	11	10	32	0.08
Black Oak	0	0	1	1	1	0	3	0.01

True Mixed Conifer	0	3	0	0	0	1	4	0.01
Pnd.Pine - Mixed Conifer	6	39	23	2	13	12	95	0.24
Pnd. Pine	1	3	1	1	0	0	6	0.02
Red fir	0	1	0	0	0	0	1	0.003
True Fir	1	26	0	9	18	0	54	0.14
White fir - Mixed Conifer	2	83	33	15	29	40	202	0.51
TOTAL	11	160	61	30	72	63	397	
Proportion of total	0.03	0.40	0.15	0.08	0.18	0.16		

**Table 3. Classification of available habitat (hectares of USFS land with slope <30%) within the Plumas-Lassen Study area from USFS GIS vegetation layers.**

Forest Cover Type	Cover Class, Size Class						Total	Proportion of Total
	1,2	1,3	1,4	2,2	2,3	2,4		
Black Oak	587	683	39	472	819	168	2768	0.024
Doug Fir - Mixed Conifer	878	4786	878	763	7306	4838	19449	0.085
Lodgepole Pine	21	151	0	1	0	0	173	0.001
True Mixed conifer	16	255	137	0	239	960	1607	0.008
Ponderosa Pine	1210	1353	128	80	0	0	2771	0.013
Pnd. Pine-Mixed Conifer	2099	14533	3821	445	3197	4011	28106	0.138
Red Fir	138	915	14	397	1541	24	3029	0.017
True fir	1423	9976	578	1950	5055	93	19075	0.110
White Fir – Mixed conifer	1396	19809	3303	524	8241	3720	36993	0.241
Other (non-conifer)	262	691	27	134	194	19	1327	0.011
TOTAL	8030	53152	8925	4766	26592	13833	115298	
Proportion of total	0.070	0.461	0.077	0.041	0.231	0.120		

Per point estimates of abundance were made for all species detected within 50 meters at each point. Abundance results calculated from 2002 point count data (Table 4) will be used to perform an analysis of data power before the onset of the next field season. Power analysis is a helpful tool to determine if our study design will result in sample sizes adequate enough to detect changes in the abundance of species over time. For example, it is already fairly clear that our sampling method will not adequately survey Black-backed Woodpecker or Wrentit populations in the study area, sample sizes for these species are simply too small to be able to detect significant changes in species numbers over time.

**Table 4. Mean abundance and standard deviation of species detected within 50 meters of all point count stations (n=900) in the PLAS.**

Species	Mean	Standard Deviation (±)
Audubon's Warbler	0.508	0.51
Mountain Chickadee	0.496	0.59
Golden-crowned Kinglet	0.404	0.48
Hermit Warbler	0.381	0.49
Oregon Junco	0.364	0.49

<b>Species</b>	<b>Mean</b>	<b>Standard Deviation (±)</b>
Red-breasted Nuthatch	0.236	0.38
Dusky Flycatcher	0.239	0.41
Western Tanager	0.231	0.4
Brown Creeper	0.166	0.32
Fox Sparrow	0.168	0.45
Nashville Warbler	0.155	0.34
Hammond's Flycatcher	0.096	0.24
Cassin's Vireo	0.093	0.25
Stellar's Jay	0.084	0.30
American Robin	0.079	0.23
MacGillivray's Warbler	0.080	0.24
Warbling Vireo	0.053	0.19
Pine Siskin	0.043	0.23
Spotted Towhee	0.042	0.16
Hairy Woodpecker	0.036	0.14
White-headed Woodpecker	0.033	0.15
Hermit Thrush	0.032	0.13
Evening Grosbeak	0.028	0.16
Chipping Sparrow	0.026	0.13
Red-breasted Sapsucker	0.023	0.13
Black-throated Gray Warbler	0.022	0.13
Green-tailed Towhee	0.023	0.13
Townsend's Solitaire	0.018	0.12
Cassin's Finch	0.018	0.10
Black-headed Grosbeak	0.022	0.13
Western Wood-Pewee	0.014	0.10
Brown-headed Cowbird	0.014	0.09
Olive-sided Flycatcher	0.014	0.10
Red-shafted Flicker	0.012	0.09
Wilson's Warbler	0.011	0.10
Calliope Hummingbird	0.008	0.06
Yellow Warbler	0.007	0.07
Mountain Quail	0.006	0.07
Anna's Hummingbird	0.006	0.07
Lazuli Bunting	0.005	0.06
Pileated Woodpecker	0.006	0.06
Pacific-slope Flycatcher	0.004	0.06
White-breasted Nuthatch	0.003	0.04
Clark's Nutcracker	0.002	0.03
Hutton's Vireo	0.003	0.05
Winter Wren	0.002	0.03
Western Scrub Jay	0.002	0.04
Wrentit	0.002	0.03
Black-backed Woodpecker	0.002	0.04

## **COLLABORATION WITH OTHER MODULES**

We have held numerous meetings and field visits with the other modules in this project in order to maximize efficiencies across the entire project. We have agreed to collect data from common locations with the small mammal, fire, and vegetation modules. We are currently working with each module to maximize our field crews with potential to share personnel at some level in coming years.

## **CONTACT WITH INTERESTED PARTIES**

PRBO has been conducting songbird monitoring in the Lassen region for the past six years. We have established contact and in many cases working relationships with many of the local interested parties. We currently collaborate with the Almanor Ranger District of the Lassen National Forest, Lassen Volcanic National Park, The Nature Conservancy, Audubon Society, as well as several other local interest groups. We believe strongly in the importance of building partnerships and collaborations in maximizing the effectiveness of our work.

## CONCLUSIONS

The 2002 pilot year was a very important part of finalizing study plans, determining sample sizes, and redefining objectives. Before the onset of the 2003 field season, we will evaluate the location of our transects in light of new information gained from power analysis, and the placement and implementation of DFPZ's, group selection treatments, and area treatments, in order to determine the number of transects that need to be added in treatment sites as well as untreated areas (landscape level). Evaluation of 2002 results has led to our preliminary plan to add approximately 55 additional landscape transects for a total of 110 transects, 10 in each treatment unit. DFPZ, group, and area treatment transects will be added in units that have finalized the site selection of these treatments in order to make sure we have sufficient samples from treated and untreated sites. In addition, data collected in 2002 have helped us determine the optimal window under which counts can be conducted within the study area in order to maximize data collection during a limited time frame. With several more years of data we will be able to create a complete breeding species list for each Treatment Unit and the study area as a whole as well as to develop habitat associations for many of the key songbird species in the study area.

## PERSONNEL

This project was coordinated by PRBO staff biologist Ryan Burnett. Field work was supervised by Greg Levandoski and Ryan Burnett. Field work in 2002 was conducted by Ryan Burnett, Glen Davis, Greg Levandoski, Mike Palladini, Adena Rissman, and

Michael Wickens. PRBO staff biologists Diana Stralberg and Lazarus Pomara organized GIS resources, created maps, random starting points, and generated tables presented in this report. Computer programs used to manage and summarize data were created by PRBO staff biologists Grant Ballard, Dan Barton, and Mike Lynes. The study was carried out under the guidance of PRBO Terrestrial Program Director Geoffrey R. Geupel, PRBO Science Coordinator Mary K. Chase, and Peter Stine of the PSW Sierra Nevada Research Center.

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**Appendix 1. Landscape Transects established and counted in the Plumas-Lassen Study Area in 2002 (Transect names are based on classification of the random starting point. The first digit in transect number refers to treatment unit, second digit refers to size class, third digit refers to closure class).**

<b>Treatment Unit</b>	<b>Transect</b>	<b>First Visit</b>	<b>Second Visit</b>
1	113	5/29/2002	6/26/2002
1	114	5/28/2002	6/26/2002
1	122	6/6/2002	6/26/2002
1	123	5/28/2002	6/26/2002
1	124	5/29/2002	6/26/2002
2	213	6/10/2002	NA
2	214	6/10/2002	6/25/2002
2	222	6/10/2002	6/29/2002
2	223	6/23/2002	6/29/2002
2	224	6/10/2002	6/29/2002
3	313	6/15/2002	6/28/2002
3	314	6/25/2002	NA
3	322	6/15/2002	6/28/2002
3	323	6/16/2002	6/28/2002
3	324	6/15/2002	6/28/2002
4	413	5/27/2002	6/24/2002
4	414	5/23/2002	6/24/2002
4	422	5/23/2002	6/24/2002
4	423	5/27/2002	6/25/2002
4	424	5/23/2002	6/24/2002
5	513	6/11/2002	6/28/2002
5	514	6/13/2002	6/27/2002
5	522	6/13/2002	6/27/2002
5	523	6/15/2002	6/27/2002
5	524	6/12/2002	6/27/2002
6	613	6/2/2002	6/30/2002
6	614	6/13/2002	NA
6	622	6/2/2002	6/30/2002
6	623	6/1/2002	7/11/2002
6	624	6/1/2002	6/30/2002
7	713	6/12/2002	7/8/2002
7	714	6/12/2002	7/1/2002
7	722	6/16/2002	7/1/2002
7	723	6/13/2002	7/1/2002
7	724	6/12/2002	NA
8	813	6/22/2002	7/6/2002
8	814	6/22/2002	7/6/2002
8	822	6/22/2002	7/6/2002
8	823	6/23/2002	NA
8	824	6/22/2002	7/6/2002
9	913	6/21/2002	7/4/2002
9	914	6/20/2002	7/4/2002

<b>Treatment Unit</b>	<b>Transect</b>	<b>First Visit</b>	<b>Second Visit</b>
9	922	6/21/2002	7/4/2002
9	923	6/21/2002	NA
9	924	6/21/2002	7/4/2002
10	1013	6/20/2002	7/3/2002
10	1014	6/21/2002	7/3/2002
10	1022	6/20/2002	7/3/2002
10	1023	6/20/2002	NA
10	1024	6/20/2002	7/5/2002
11	1113	6/18/2002	7/2/2002
11	1114	6/18/2002	7/2/2002
11	1122	6/18/2002	7/2/2002
11	1123	6/18/2002	7/9/2002
11	1124	6/18/2002	NA

Appendix 2. Defensible Fuel Profile Zone transects established in the Plumas-Lassen Study Area and dates counted in 2002.

<b>Treatment Unit</b>	<b>Transect</b>	<b>First Visit</b>	<b>Second Visit</b>
1	D101	6/16/2002	7/10/2002
1	D102	5/29/2002	7/9/2002
1	D107	5/28/2002	7/9/2002
1	D108	5/28/2002	7/9/2002
1	D109	5/29/2002	7/10/2002
1	D110	5/29/2002	7/9/2002
4	D401	5/22/2002	7/8/2002
4	D402	5/21/2002	7/7/2002
4	D403	5/21/2002	7/7/2002
4	D404	5/21/2002	7/8/2002
4	D405	5/22/2002	7/7/2002
4	D406	5/21/2002	7/7/2002
4	D407	5/23/2002	7/2/2002
4	D408	5/22/2002	7/8/2002
6	D602	6/1/2002	7/10/2002
6	D603	6/2/2002	7/10/2002
6	D604	5/25/2002	7/11/2002
6	D605	5/25/2002	7/11/2002
6	D606	5/25/2002	7/11/2002
6	D607	6/2/2002	NA

Appendix 3. List of all species detected on point count surveys (common, AOU code, scientific name) in the PLAS in 2002. (Species in bold are those included in point count analysis).

<b>Common Name</b>	<b>AOU Code</b>	<b>Scientific Name</b>
American Crow	AMCR	<i>Corvus brachyrhynchos</i>
American Dipper	AMDI	<i>Cinclus mexicanus</i>
American Kestrel	AMKE	<i>Falco sparverius</i>
<b>American Robin</b>	<b>AMRO</b>	<b><i>Turdus migratorius</i></b>
<b>Anna's Hummingbird</b>	<b>ANHU</b>	<b><i>Calypte anna</i></b>
<b>Audubon's Warbler</b>	<b>AUWA</b>	<b><i>Dendroica coronata audobonii</i></b>
Band-tailed Pigeon	BTPI	<i>Columba fasciata</i>
Belted Kingfisher	BEKI	<i>Ceryle alcyon</i>
<b>Bewicks Wren</b>	<b>BEWR</b>	<b><i>Thryomanes bewickii</i></b>
<b>Black-backed Woodpecker</b>	<b>BBWO</b>	<b><i>Picoides arcticus</i></b>
<b>Black-headed Grosbeak</b>	<b>BHGR</b>	<b><i>Pheucticus melanocephalus</i></b>
<b>Black Phoebe</b>	<b>BLPH</b>	<b><i>Sayornis nigricans</i></b>
<b>Black-throated Gray Warbler</b>	<b>BTYW</b>	<b><i>Dendroica nigrescens</i></b>
<b>Blue-gray Gnatcatcher</b>	<b>BGGN</b>	<b><i>Polioptila caerulea</i></b>
Blue Grouse	BGSE	<i>Dendragapus obscurus</i>
<b>Brewer's Sparrow</b>	<b>BRSP</b>	<b><i>Spizella breweri</i></b>
<b>Brown-headed Cowbird</b>	<b>BHCO</b>	<b><i>Molothrus ater</i></b>
<b>Brown Creeper</b>	<b>BRCR</b>	<b><i>Certhia Americana</i></b>
Calliope Hummingbird	CAHU	<i>Stellula calliope</i>
Canada Goose	CAGO	<i>Branta canadensis</i>
<b>Cassin's Finch</b>	<b>CAFI</b>	<b><i>Carpodacus cassinii</i></b>
<b>Cassin's Vireo</b>	<b>CAVI</b>	<b><i>Vireo casinii</i></b>

<b>Chipping Sparrow</b>	<b>CHSP</b>	<i>Spizella passerina</i>
<b>Clark's Nutcracker</b>	<b>CLNU</b>	<i>Nucifraga columbiana</i>
Common Nighthawk	CONI	<i>Chordeiles minor</i>
Common Raven	CORA	<i>Corvus corax</i>
<b>Dusky Flycatcher</b>	<b>DUFL</b>	<i>Empidonax oberholseri</i>
<b>Evening Grosbeak</b>	<b>EVGR</b>	<i>Coccothraustes vespertinus</i>
<b>Fox Sparrow</b>	<b>FOSP</b>	<i>Passerella iliaca</i>
<b>Golden-crowned Kinglet</b>	<b>GCKI</b>	<i>Regulus satrapa</i>
<b>Gray Flycatcher</b>	<b>GRFL</b>	<i>Empidonax wrightii</i>
<b>Gray Jay</b>	<b>GRAJ</b>	<i>Perisoreus canadensis</i>
<b>Green-tailed Towhee</b>	<b>GTTO</b>	<i>Pipilo chlorurus</i>
<b>Hammond's Flycatcher</b>	<b>HAFL</b>	<i>Empidonax hammondii</i>
<b>Hairy Woodpecker</b>	<b>HAWO</b>	<i>Picoides villosus</i>
<b>Hermit Thrush</b>	<b>HETH</b>	<i>Catharus guttatus</i>
<b>Hermit Warbler</b>	<b>HEWA</b>	<i>Dendroica occidentalis</i>
House Wren	HOWR	<i>Troglodytes aedon</i>
<b>Huttons Vireo</b>	<b>HUVI</b>	<i>Vireo huttoni</i>
<b>Lazuli Bunting</b>	<b>LAZB</b>	<i>Passerina amoena</i>
<b>Lesser Goldfinch</b>	<b>LEGO</b>	<i>Carduelis psaltria</i>
<b>MacGillivray's Warbler</b>	<b>MGWA</b>	<i>Oporornis tolmiei</i>
<b>Mountain Chickadee</b>	<b>MOCH</b>	<i>Poecile gambeli</i>
<b>Mountain Quail</b>	<b>MOQU</b>	<i>Oreotyx pictus</i>
<b>Mourning Dove</b>	<b>MODO</b>	<i>Zenaida macroura</i>
<b>Nashville Warbler</b>	<b>NAWA</b>	<i>Vermivora ruficapilla</i>
Northern Goshawk	NOGO	<i>Accipiter gentilis</i>
Northern Pygmy-Owl	NPOW	<i>Glaucidium gnoma</i>
Orange-crowned Warbler	OCWA	<i>Vermivora celata</i>
<b>Oregon Junco</b>	<b>ORJU</b>	<i>Junco hyemalis</i>
<b>Olive-sided Flycatcher</b>	<b>OSFL</b>	<i>Contopus cooperi</i>
Osprey	OSPR	<i>Pandion haliaetus</i>
<b>Pine Siskin</b>	<b>PISI</b>	<i>Carduelis pinus</i>
<b>Pileated Woodpecker</b>	<b>PIWO</b>	<i>Dryocopus pileatus</i>
<b>Pacific-slope Flycatcher</b>	<b>PSFL</b>	<i>Empidonax difficilis</i>
<b>Purple Finch</b>	<b>PUFI</b>	<i>Carpodacus purpureus</i>
<b>Red-breasted Nuthatch</b>	<b>RBNU</b>	<i>Sitta canadensis</i>
<b>Red-breasted Sapsucker</b>	<b>RBSA</b>	<i>Sphyrapicus ruber</i>
<b>Rock Wren</b>	<b>ROWR</b>	<i>Salpinctes obloletus</i>
Rufous Hummingbird	RUHU	<i>Selasphorus rufus</i>
<b>Red Crossbill</b>	<b>RECR</b>	<i>Loxia curvirostra</i>
Red-tailed Hawk	RTHA	<i>Buteo jamaicensis</i>
<b>Red-shafted Flicker</b>	<b>RSFL</b>	<i>Colaptes auratus</i>
<b>Sage Thrasher</b>	<b>SATH</b>	<i>Oreoscoptes montanus</i>
Sharp-shinned Hawk	SSHA	<i>Accipiter striatus</i>
<b>Song Sparrow</b>	<b>SOSP</b>	<i>Melospiza melodia</i>
Spotted Owl	SPOW	<i>Strix occidentalis</i>
<b>Spotted Towhee</b>	<b>SPTO</b>	<i>Pipilo maculatus</i>

<b>Stellar's Jay</b>	<b>STJA</b>	<i>Cyanocitta stelleri</i>
<b>Swainson's Thrush</b>	<b>SWTH</b>	<i>Catharus ustulatus</i>
<b>Townsend's Solitaire</b>	<b>TOSO</b>	<i>Myadestes townsendi</i>
Tree Swallow	TRES	<i>Tachycineta bicolor</i>
Turkey Vulture	TUVU	<i>Cathartes aura</i>
Violet-green Swallow	VGSW	<i>Tachycineta thalassina</i>
<b>Warbling Vireo</b>	<b>WAVI</b>	<i>Vireo gilvus</i>
<b>White-breasted Nuthatch</b>	<b>WBNU</b>	<i>Sitta carolinensis</i>
<b>White-headed Woodpecker</b>	<b>WHWO</b>	<i>Picoides albolarvatus</i>
<b>Williamson's Sapsucker</b>	<b>WISA</b>	<i>Sphyrapicus thyroideus</i>
<b>Western Scrub-Jay</b>	<b>WESJ</b>	<i>Aphelocoma californica</i>
<b>Western Tanager</b>	<b>WETA</b>	<i>Piranga ludoviciana</i>
<b>Western Wood-Pewee</b>	<b>WEWP</b>	<i>Contopus sordidulus</i>
<b>Wilson's Warbler</b>	<b>WIWA</b>	<i>Wilsonia pusilla</i>
<b>Winter Wren</b>	<b>WIWR</b>	<i>Troglodytes troglodytes</i>
<b>Wrentit</b>	<b>WREN</b>	<i>Chamaea fasciata</i>
<b>Yellow Warbler</b>	<b>YWAR</b>	<i>Dendroica petechia</i>