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AVIAN MONITORING OF THE INYO NATIONAL FOREST ASPEN ENHANCEMENT PROJECT

2011 REPORT

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Table of Contents

INTRODUCTION AND BACKGROUND 4
METHODS 5
Study Area 5
Site Selection 5
Survey Method 8
Habitat Assessments 8
Analysis 9
Breeding Status 10
RESULTS 12
Overview 12
Effect of Aspen Risk Level 12
Vegetation Characteristics and Risk Level 14
DISCUSSION 16
ACKNOWLEDGEMENTS 18
LITERATURE CITED 18
Appendix A. Point count locations, risk level, PRBO site codes and Inyo NF Stand ID UTM Nad83, Zone 11, 2011. 21
Appendix B. Transect name, number of points and dates of visit 2011. 24
Appendix C. PRBO ASPEN POINT COUNT VEGETATION FORM AND PROTOCOL 25
Appendix D. Breeding status of all species detected in 2010-2011 29

EXECUTIVE SUMMARY

In 2008 Inyo National Forest began an assessment of all aspen stands on the lands they administer. The results of this assessment will lead directly to manage prescriptions to enhance and restore stands where it is deemed necessary. In 2011, in collaboration with the Inyo National Forest, PRBO Conservation Science (PRBO) continued a forest-wide aspen bird monitoring project in order to provide a measure of success and help guide future aspen management efforts.

In this report we present results from the first two years of avian monitoring aspen habitat across the forest. As of 2011 no treatments have been implemented. Since project inception we have detected and determined breeding status for 89 avian species within the study area. For all transects the average avian diversity was 5.99 per point, total abundance was 5.91 and average species richness was 6.79. When examining avian indices according to risk level, we found species diversity was highest at medium risk level sites and lowest at high risk sites; total bird abundance and species richness showed a similar pattern.

Inyo National Forest aspen habitat provides relatively high quality breeding bird habitat compared to elsewhere in the Sierra Nevada – though a number of stands would benefit from changes in management that removes competing conifers and enhances aspen regeneration and associated understory plant assemblages.

INTRODUCTION AND BACKGROUND

The importance of quaking aspen (*Populus tremuloides*) to birds and other wildlife in western North America has been well documented (Salt 1957, Flack 1976, DeByle 1985). Aspen habitats typically support much greater bird diversity, richness, and abundance than adjacent habitats (Flack 1976, Winternitz 1980, Mills et al. 2000, Griffis-Kyle and Beier 2003) or other riparian habitat types (Heath and Ballard 2003).

Several bird species demonstrate a strong affinity with aspen, including Northern Goshawk (*Accipiter gentilis*), Red-naped and Red-breasted Sapsuckers (*Sphyrapicus nuchalis/ruber*), Dusky Flycatcher (*Empidonax oberholseri*), Warbling Vireo (*Vireo gilvus*), Swainson's Thrush (*Catharus ustulatus*), and MacGillivray's Warbler (*Oporornis tolmiei*) (Salt 1957, Flack 1976, Finch and Reynolds 1988, Heath and Ballard 2003, Richardson and Heath 2004). Ground-nesting birds benefit from an exceedingly thick herbaceous layer and deep leaf litter, which aid in potential for nest concealment (Flack 1976, DeByle 1985). Both primary and secondary cavity nesters benefit from aspen's susceptibility to heart rot and an associated abundance of cavity-bearing trees (DeByle 1985, Daily et al. 1993). It is also likely that birds benefit from the increased abundance and diversity of invertebrate prey in aspen stands (Winternitz 1980).

The importance of aspen habitats for breeding birds should be considered in the context of this habitat's documented degradation. Aspen stands in the western United States have been altered and in some cases completely eliminated (Mueggler 1985; Bartos & Campbell 1998; White et al. 1998, Jones et al. 2005). In the Sierra Nevada, declines in condition and a lack of regeneration has been reported for a significant number of aspen stands (Burton 2000, Jones et al. 2005). These studies cited several potential contributing factors, conifer encroachment as a result of fire suppression, livestock grazing, and wild ungulate browsing. As such, there is interest among California's land managers to restore aspen stands that have been degraded (Jones et al. 2005).

In 2008 Inyo National Forest began an assessment of all aspen stands on the forest. The results of this assessment will lead directly to manage prescriptions to enhance and restore stands where needed. Since 2010, in collaboration with the Inyo National Forest, PRBO

Conservation Science (PRBO) has conducted a forest-wide aspen bird monitoring project in order to provide a measure of success and help guide future aspen management efforts. Specifically, the objectives of the bird monitoring project are

1. Compare breeding bird indices in aspen stands before and after treatments.
2. Compare bird indices in treatment stands to those in aspen stands currently ranked as low risk reference stands
3. Determine vegetation characteristic associated with breeding bird indices at treatment and reference stands.
4. Document nest site habitat selection for INF Aspen Management Indicator Species Dusky Flycatcher and Warbling Vireo within aspen habitat.

In this report we present baseline results from the first two years of monitoring including comparing avian indices by risk level. We also provide recommendations for enhancing aspen habitat across the Inyo National Forest to benefit bird populations.

METHODS

Study Area

All avian monitoring was conducted on the Inyo National Forest with sites located in the Sierra Nevada, Glass and White Mountains of California. Elevation of survey sites ranged from 2150 – 2970 meters (7100 – 9800 feet).

Site Selection

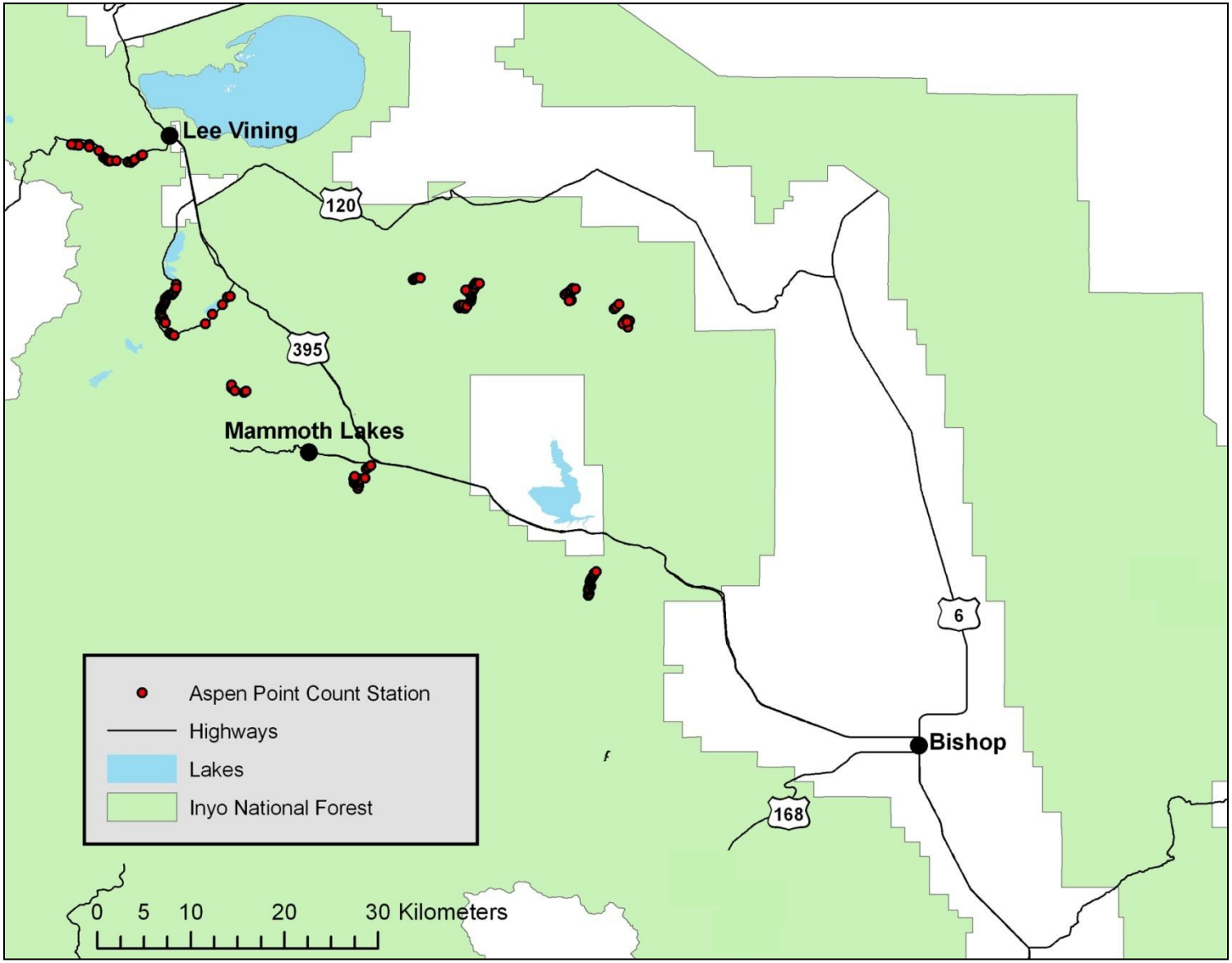
Site selection was conducted as a collaborative effort between PRBO and the Inyo National Forest and was constrained by a number of factors. We first determined available funding and estimated we could survey 150 points twice each per year. We then prioritized selection based on the assessed risk level of stands favoring sites with higher risk level and closer to roads. We also only selected stands that were at least 100 meters wide in order to ensure we were primarily sampling birds utilizing aspen habitat and not surrounding uplands. We also ensured a minimum of 250 meters between point count stations.

We determined the number of stands and acreage in moderate, high, and highest risk levels which was 86 stands with a total of 978 acres. We then selected all stands that had a 50 meter buffer from the edge which resulted in a total of 54 potential survey points.

Since the sample of higher risk categories was relatively small we then expanded our selection to stands in Low and No risk. We prioritized selection of these sites based on proximity to higher risk sites that had already been selected to maximize efficiency. After the 50-meter buffer was overlaid a total of 34 points were added to the sample. We then used the same criteria to select stands that had not been assessed that were in geographic proximity to already selected stands. See Figure 1 for an overview of the study area. GPS coordinates for all point count stations can be found in Appendix A.

In 2011 the total number of points surveyed was reduced to 105 points due to funding constraints. All points in the White Mountains were not surveyed and many of the points that had not been assessed for risk were not surveyed. Very few points within the Sierra and Glass Mountains that have been assigned risk levels were eliminated.

Figure 1. Location of PRBO Aspen Avian Monitoring stations in the Inyo National Forest in 2011.



Survey Method

We used multiple distance band point counts to survey the avian community at each site (Ralph et al. 1995, Rosenstock et al. 2002). Each station was surveyed two times during the peak of the bird breeding season (see Appendix B for dates), and visits were conducted at least 10 days apart. We used a LEICA LRF 800 range finder to assist in distances estimation and recorded detections in increments of 10 meters out to 50 meters, in 25 meters increments out to 100 meters, and combined all detections beyond 100 meters. We recorded all birds and type of initial detection (visual, song or call). To minimize observer bias, we used two different observers for the two surveys and all biologists trained in distance estimation and familiar with songs and calls of local birds conducted all surveys. Additionally, whenever possible, we conducted points in one direction (e.g., 1 through 12) for one survey and in the opposite direction (e.g., point 12 through 1) for the other in order to minimize the effects of time of day on detection rates. We conducted surveys from local sunrise until approximately 4 hours later, and did not conduct counts in windy or rainy conditions. All point count data are archived in the California Avian Data Center (www.prbo.org/cadc) under the project name "Inyo National Forest Aspen Enhancement Project ".

Habitat Assessments

PRBO biologists conducted vegetation assessments at 141 point count stations in 2010. All data was collected using a modified version of the Relevé method described by Ralph et al. (1993), we estimated vegetation in four cover layers within 50 meters of point count stations. These layers were "**Tree**" defined as any plant species whose highest point was greater than 5 meters tall. **Tree Shrub** which included all true tree species that were less than 5 meters tall. **Real Shrubs** which were all true shrub species and small trees that have a shrubby nature (e.g. dogwood, mountain alder, willow). Real Shrub layer cover was recorded regardless of height. In the **Herbaceous** category the total cover of all non-woody vegetation, regardless of height was noted. In addition to these four layer categories, we estimated total aspen cover as well as total conifer cover in the 50 meter circle. To further categorize aspen density, we ran two 50 meter belt transects at each point and recorded all aspen stems that were within one meter.

For each aspen hit we placed it within four size categories. We recorded all snags in three DBH categories and took one 10 factor basal area measurement from the center of the station. Furthermore, we recorded the dominant habitat type and what percent it occupied of the 50 meter circle for each point. If there were two distinct habitats within the 50 meter radius we estimated the percent each comprised of the circle. For vegetation forms and complete description of the protocol see Appendix D.

Geographic Data

All point count locations were geo-referenced using a Garmin GPSmap 60Cx in Universal Transverse Mercator (Zone 11) projection and NAD83 datum. All sites are stored on the California Avian Data Center (www.prbo.org/cadc) under the project name "Inyo National Forest Aspen Enhancement Project".

Analysis

Avian community point count analysis was restricted to observations within 50 meters of observers and a subset of the species encountered. We excluded species that do not breed in the study area as well as those that are not adequately sampled using the point count method (e.g., waterfowl, Common Raven, and raptors). We also excluded European Starling and Brown-headed Cowbird from analysis of species richness and total bird abundance because they are invasive species regarded as having a negative influence on the native bird community.

We present three avian community metrics throughout the report: species richness, total bird abundance, and Shannon Weiner Diversity index. We define species richness as the average number of species detected within 50 meters per point across visits within a year. Again, only those species adequately sampled using the point count method were included. The index of total bird abundance is the mean number of individuals detected per station per visit. We present a transformed version of the Shannon Weiner index of Diversity which weights species richness by the evenness of species. The transformed version of the index (N_1) expresses the data in terms of number of species and thus is more easily interpreted. Expressed mathematically:

$$N_1 = e^{H'} \text{ and } H' = \sum_{i=1}^{i=S} (p_i)(\ln p_i)(-1)$$

Where S = total breeding species richness and p_i is the proportion of the total numbers of individuals for each breeding species (Nur et al. 1999). High index scores indicate both high breeding species richness and more even distribution of individuals among species.

We used an index of the abundance of the five most abundant species across all sites. We used the average number of detections of a species per point count station per visit within 50 meters of the observer.

Table 1. Number of points per risk level and mountain range surveyed in 2011

Risk Level	Sierra Nevada	Glass Mountains	Risk Level totals
Highest	9	0	**9**
High	9	6	**15**
Moderate	14	5	**19**
Low	17	7	**24**
None	2	0	**2**
Not-assessed	25	11	**36**
Totals	**76**	**29**	**105**

Due to relatively small sample sizes we lumped the five risk levels in three categories for the analysis of risk. We combined highest and high into "high", moderate remained alone, and Low and none were combined. All point count stations in stands that had not been assessed were excluded from the effects of risk on avian community analysis (Table 1). In 2011 we used 105 point count stations with 76 in the Sierra Nevada and 29 in the Glass (Table 1).

Breeding Status

We determined breeding status for all species encountered on the study site in 2010 before, during, and after point count censuses. We ranked species by site following four criteria of the Riparian Habitat Joint Venture breeding scale, modified from breeding bird atlas criteria (see http://www.prbo.org/calpif/criteria.html.):

No evidence of breeding: Species not detected during breeding season, or species known not to breed within the general study area.

Possible breeder: Species encountered singing or acting territorial only once during the breeding season (in suitable habitat).

Probable breeder: Singing individual encountered on 2 or more different days of standardized censuses (at least one week apart); territorial behavior noted more than once at the same location; pair observed in courtship behavior.

Confirmed breeder: distraction display; nest building, nesting material or fecal sack being carried by adult; dependent juveniles with adults; active territory observed on at least three days (at least one week apart); active nest observed.

RESULTS

Overview

We detected and assigned breeding status for 89 avian species at aspen point count surveys in 2010 and 2011 (Appendix D). New species for 2011 include; Willow Flycatcher (*Empidonax trailli*), Bewick's Wren (*Thryomanes bewickii*), Cedar Waxwing (*Bombycilla cedrorum*), Lincoln's Sparrow (*Melospiza lincolnii*), and Yellow-headed Blackbird (*Xanthocephalus xanthocephalus*).

We determined avian community metric indices of Shannon diversity, species richness, and total bird abundance per point count station across all transects and for each transect. For all transect Shannon diversity was 5.59 per point. Total abundance was 5.08 and species richness was 6.23. Rush Creek had the highest Shannon diversity (7.22), total abundance (7.22), and species richness (8.2) while Deadman creek had the lowest diversity (2.77), total abundance (2.1), and species richness (3.0).

Effect of Aspen Risk Level

Avian community metrics varied by risk level but showed consistent patterns across the three metrics when examining 2010 and 2011 combined. Avian community metrics were highest in moderate risk level stands and lowest in high risk level stands. Shannon diversity was 6.59 at moderate risk level sites compared to 6.37 at low risk level and 4.9 at high risk level (Figure 2). Total bird abundance at moderate risk level sites was 6.48 while 6.55 at low and 4.84 at high. Species Richness showed a similar result with moderate and low risk sites supporting higher values than high risk sites. Differences between both moderate and low risk sites and high risk sites were statistically significant ($p<0.05$) but differences between moderate and low risk sites were not ($p>0.10$).

To see how species were distributed across risk levels we looked at the five most abundant species based on detections within 50 meters of observers in the 2010 and 2011 data. Dusky Flycatcher, Western Wood-Pewee and Warbling Vireo are all aspen focal species while Oregon Junco and Mountain Chickadee are focal species for conifer forest (Figure 3).

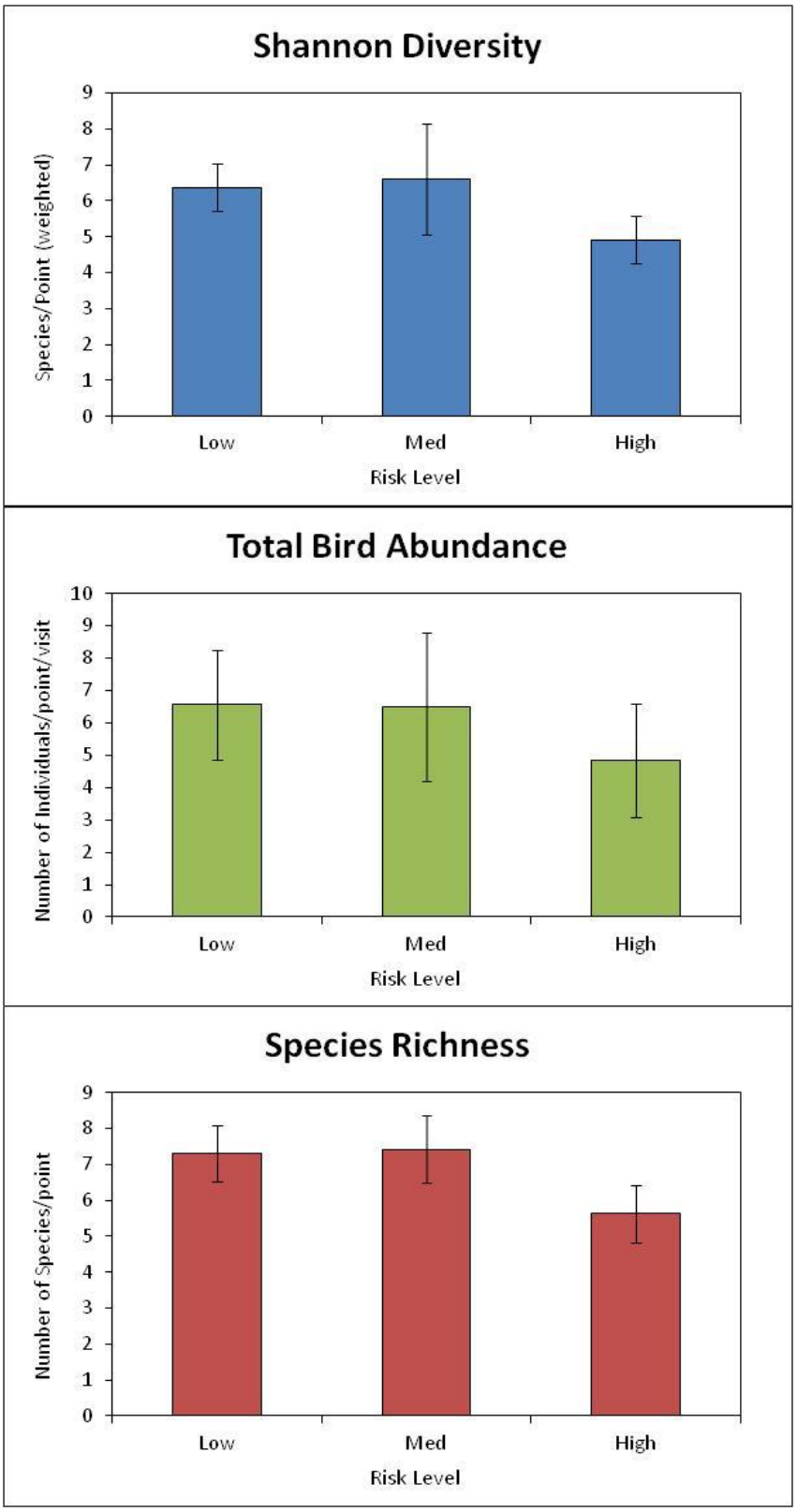


Figure 2. Avian community metrics (Shannon diversity, total bird abundance, and species richness) by risk level at Inyo National Forest aspen sites in 2010/11 with 95% confidence interval.

Of the five species we investigated in 2010 and 2011, each reached their greatest abundance in medium risk stands (Figure 5). The generalist, Dark-eyed Junco and Mountain Chickadee, were both least abundant in low risk stands – suggesting their affinity for some conifer component in aspen habitat. Warbling Vireo was also least abundant in low risk stands, but showed relatively high detection rates across sites. Dusky Flycatcher and Western Wood-Pewee were both more common in low risk stands than high risk.

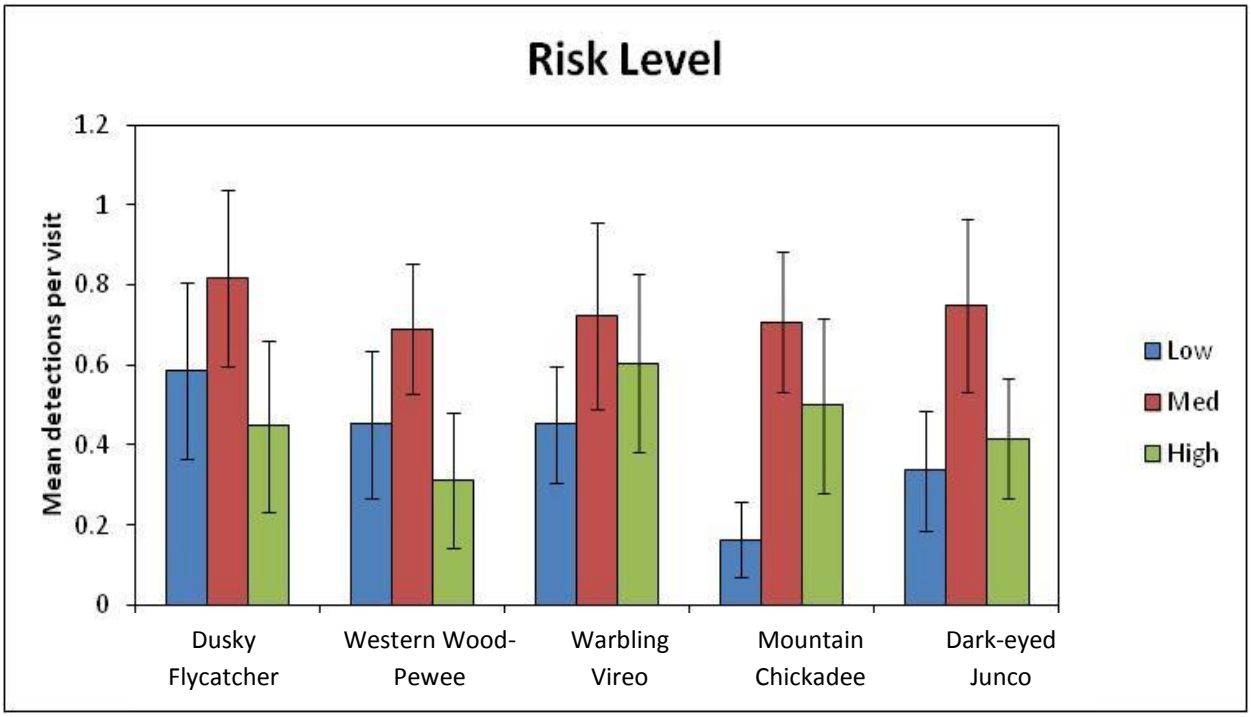


Figure 3. Index of abundance (mean detections per point count station per visit within 50 meters of observer) by risk level for the five most abundant species in Inyo National Forest aspen habitat in 2010 and 2011, with standard error.

Vegetation Characteristics and Risk Level

To further describe and understand how the avian metrics are correlated with stand risk levels, we examined some basic vegetative characteristics associated with the risk levels (fig 4). Aspen cover is highest in medium and low risk levels and conifer cover is greatest in high risk stands. We recommend that aspen and conifer covers be considered an index of cover and not absolute values since they were collected using ocular estimates. Herbaceous cover, which is typically associated with ground nesting birds, is fairly evenly distributed, but highest in low and medium risk stands.

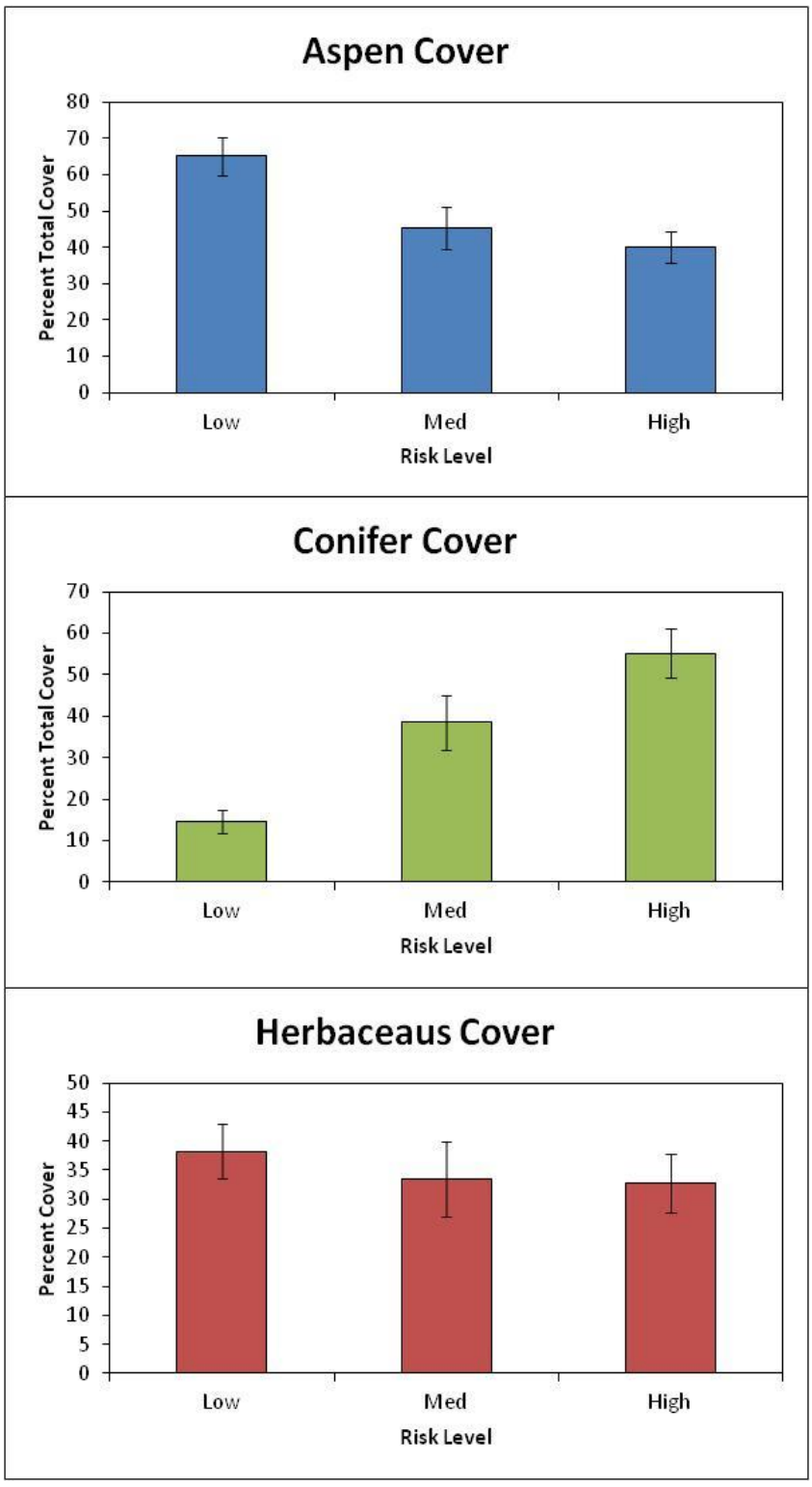


Figure 4. Vegetation community metrics (aspen, conifer, and herbaceous cover) by risk level at Inyo National Forest aspen sites in 2010/11 with 95% confidence interval.

DISCUSSION

Our results continue to reinforce others findings that aspen habitat supports a diverse and abundant avian community in the Sierra Nevada (Richardson & Heath 2004, Burnett et al. 2011).

Species diversity, richness and total abundance all show the highest numbers at moderate and low risk levels. These results could be attributed to the fact that these points have the highest aspen and herbaceous covers, along with the lowest percentage of conifer cover which are believed to promote avian diversity in Aspen habitat in the Eastern Sierra (Richardson & Heath 2004). They concluded that mature aspen stands with healthy herbaceous communities and limited or no conifer intrusion are optimal habitats for aspen-breeding birds in the Sierra Nevada of California. However, our results suggest that some conifer cover may increase the abundance of focal species and overall richness of the avian community in Inyo National Forest aspen sites. Specifically, Warbling Vireo appeared to favor aspen habitat with moderate conifer cover which is also supported by findings from the Northern Sierra that removal of conifers can reduce this species abundance in the short term (Burnett et al. 2009). These stands have a higher percentage of aspen in the overstory, yet still have a considerable conifer component – on average approximately 40% conifer cover. However, our ocular estimates may have over-estimated conifer cover. Regardless, our results suggest that conifer cover that does not inhibit other important aspen habitat features may be a positive attribute. We suggest retaining large conifers with characteristics that suggest they were on the landscape prior to fire suppression in any aspen restoration treatments. Retaining 5 - 15% conifer cover in these stands is unlikely to reduce aspen vigor or negatively impact aspen breeding species and will likely increase overall species richness.

Three aspen focal species (Burnett 2011) - Warbling Vireo, Dusky Flycatcher, and Western Wood-Pewee - reached their greatest abundance in medium and low risk aspen stands on the Inyo National Forest. This suggests they are good indicators of aspen health. We also included two additional species in our analyses due to the large number of detections and their association with other habitat attributes in eastern sierra conifer/aspen habitats – Mountain Chickadee and Dark-eyed Junco. Both of these species were more abundant in high risk stands

with higher canopy cover than low risk stands. Mountain Chickadee are the most abundant cavity nesting species in Inyo national forest aspen stands thus they may provide an indication of cavity availability (a critical resource for aspen breeding birds) both before and after treatment.

Based on risk assessments (Aspen Delineation 2002) aspen habitat on the Inyo National Forest appears to be at lower risk of being lost than elsewhere in the Sierra Nevada (Jones et al. 2005). This is likely due to reduced conifer densities – and thus encroachment - in the drier Eastern Sierra and Glass mountains. Thus, removal of conifers from stands may not be the most important management technique used to enhance aspen habitat here. As our previous results have shown (Burnett et al. 2010, Richardson & Heath 2004, Etzel et al. 2011), enhancing the understory in aspen habitat both herbaceous and through vigorous aspen regeneration may be the most important factor for improving aspen bird habitat. We suggest evaluating current grazing pressures on all aspen habitat on the forest. Where necessary, altering grazing regimes or fencing susceptible stands may be necessary to enhance understory aspen communities (Jones et al. 2011). While aspen habitat on the Inyo does not appear to be as negatively impacted by conifer encroachment as elsewhere in the Sierra Nevada, there are clearly some stands where aspen vigor and regeneration are being inhibited by high canopy cover (generally over 40%). In these locations removal of conifers is likely warranted. Based on results from the Lassen National Forest, ensuring aspen suckers are protected from browsing and grazing pressure will be important to ensuring expansion and increasing structural diversity of these stands following treatment (Jones et al. 2005, Burnett & Fogg 2010). Maximizing retention of mature stems, even those dead and dying, is important for providing the necessary cavity resources for the large number of cavity nesting species. Retention of mature stems is also likely to provide energy to promote regeneration following release from conifer and grazing effects. We also recommend incorporating the use of fire in the long-term management of aspen habitat on the Inyo National Forest to help with conifer thinning and promote aspen regeneration.

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Appendix A. Point count locations, risk level, PRBO site codes and Inyo NF Stand ID UTM Nad83, Zone 11, 2011.

Name	PRBO codes	Inyo NF Stand_ID	UTM_E	UTM_N	Risk Level	Region
Deadman Creek	INFDECR01	050451_0040	318730	4175828	HIGHEST	Sierra Nevada
	INFDECR02		318755	4176099	HIGHEST	
	INFDECR03		319035	4175480	HIGHEST	
	INFDECR04	050451_0126	319799	4175269	HIGH	
	INFDECR05		319985	4175430	HIGH	
June Lake	INFJULA01	050451_0011	313612	4181761	HIGH	
	INFJULA02		313787	4181601	HIGH	
	INFJULA03		314009	4181500	HIGH	
	INFJULA04	050451_0088	316679	4182668	MODERATE	
	INFJULA05	050451_0096	317291	4183690	MODERATE	
	INFJULA06	050451_0041	318179	4184668	MODERATE	
	INFJULA07	050451_0014	318615	4185471	MODERATE	
	INFJULA08		318840	4185549	MODERATE	
Lee Vining Canyon	INFLVCA01	050451_0082	306066	4202025	MODERATE	
	INFLVCA02		306289	4202071	MODERATE	
	INFLVCA03		306433	4201939	MODERATE	
	INFLVCA04	050451_0081	305803	4202048	LOW	
	INFLVCA05	050451_0064	308099	4201346	HIGH	
	INFLVCA06	Not assessed	308476	4200624	NOT ASSESSED	
	INFLVCA07		308632	4200493	NOT ASSESSED	
	INFLVCA08		308772	4200313	NOT ASSESSED	
	INFLVCA09		308960	4200190	NOT ASSESSED	
	INFLVCA10		309091	4200239	NOT ASSESSED	
	INFLVCA11		309555	4200251	NOT ASSESSED	
	INFLVCA12		310535	4200075	NOT ASSESSED	
	INFLVCA13		310773	4200009	NOT ASSESSED	
	INFLVCA14		310978	4200198	NOT ASSESSED	
	INFLVCA15		311084	4200321	NOT ASSESSED	
	INFLVCA16		311628	4200702	NOT ASSESSED	
	INFLVCA17		311788	4200810	NOT ASSESSED	
	INFLVCA18	050451_0083	307312	4202001	MODERATE	
	INFLVCA19		307305	4201749	MODERATE	
Mammoth Creek	INFMACR01	050452_0149	329994	4166922	LOW	
	INFMACR02	050452_0150	330150	4167064	NONE	
	INFMACR03		330394	4167267	NONE	
Rock Creek	INFROCR01	050453_0033	348582	4153069	LOW	
	INFROCR02	050453_0034	348648	4153285	MODERATE	
	INFROCR03		348599	4153578	MODERATE	
	INFROCR04	050453_0035	348632	4153820	MODERATE	
	INFROCR06		348741	4154262	NOT ASSESSED	
	INFROCR07		348749	4154504	NOT ASSESSED	

~ Table cont. next page~

Appendix A. Cont.

Rock Creek	INFROCR08	Not assessed	348807	4154755	NOT ASSESSED	Sierra Nevada
	INFROCR09		348908	4154963	NOT ASSESSED	
	INFROCR10		349049	4155155	NOT ASSESSED	
	INFROCR11		349125	4155389	NOT ASSESSED	
	INFROCR12		349283	4155581	NOT ASSESSED	
Rush Creek	INFRUCR01		314317	4186939	NOT ASSESSED	
	INFRUCR02		314187	4186326	LOW	
	INFRUCR03		314073	4186056	LOW	
	INFRUCR04		313927	4185852	LOW	
	INFRUCR05		313675	4185807	LOW	
	INFRUCR06		313486	4185637	LOW	
	INFRUCR07		313341	4185440	LOW	
	INFRUCR08		313343	4185197	NOT ASSESSED	
	INFRUCR09		313259	4184952	NOT ASSESSED	
	INFRUCR10		313151	4184730	NOT ASSESSED	
	INFRUCR11		313023	4184496	LOW	
	INFRUCR12		312927	4184264	LOW	
	INFRUCR13		312890	4184011	LOW	
	INFRUCR14		312917	4183867	LOW	
	INFRUCR15		312973	4183605	LOW	
	INFRUCR16		313110	4183360	LOW	
	INFRUCR17		313191	4183076	LOW	
	INFRUCR18		313284	4182842	LOW	
	INFRUCR19		314281	4186558	NOT ASSESSED	
Sherwin Creek	INFSHCR04	050452_0153	329226	4164852	HIGHEST	
	INFSHCR05		329320	4165126	HIGHEST	
	INFSHCR06		329471	4165830	HIGHEST	
	INFSHCR07		329284	4165458	HIGHEST	
	INFSHCR08		329331	4165702	HIGHEST	
	INFSHCR09		329848	4165934	HIGHEST	
	INFSHCR10	050452_0155	328938	4165397	MODERATE	
	INFSHCR11		328950	4165633	HIGH	
	INFSHCR12	050452_0156	328907	4165876	HIGH	
	INFSHCR13		328977	4166108	HIGH	
McGee Meadow	INFMCGM01	050451_0122	347190	4185161	MODERATE	Glass Mountains
	INFMCGM02		347386	4185342	MODERATE	
	INFMCGM03	Not assessed	347649	4185336	NOT ASSESSED	
	INFMCGM04		347637	4185597	NOT ASSESSED	
	INFMCGM05		347819	4185821	NOT ASSESSED	
	INFMCGM06		348079	4185780	McGee Meadow	
	INFMCGM07		347716	4184593	NOT ASSESSED	
	INFMCGM08		347527	4184753	NOT ASSESSED	
	INFMCGM09		347539	4184502	NOT ASSESSED	

~Table cont. next page~

Appendix A. cont.

Pilot spring	INFPISP01		334367	4187014	HIGH	
	INFPISP02	050451_0053	334563	4187116	HIGH	
	INFPISP03		334768	4187230	HIGH	
	INFPISP04		334973	4187152	HIGH	
	INFPISP05		338257	4183911	LOW	
	INFPISP06		338503	4183978	LOW	
	INFPISP07		338705	4183848	LOW	
Additional PILOT SPRINGS (McLaughlin Springs)	INFPISP08	050451_0069	338138	4184082	LOW	
	INFPISP09		338340	4184216	LOW	
	INFPISP10		338576	4184200	LOW	
	INFPISP11	050451_0069	338850	4184059	LOW	
Sawmill Meadow and West-Sawmill	INFSAME01	050451_0121	352321	4182422	HIGH	
	INFSAME02		352163	4182217	HIGH	
	INFSAME03		352576	4182267	NOT ASSESSED	
	INFSAME04	Not assessed	352423	4181606	NOT ASSESSED	
	INFSAME05		352034	4181966	NOT ASSESSED	
	INFSAME06		352384	4182116	NOT ASSESSED	
	INFSAME07		351329	4183578	MODERATE	
	INFSAME08	050451_0017	351493	4183732	MODERATE	
	INFSAME09		351729	4184047	MODERATE	

Appendix B. Transect name, number of points and dates of visit 2011.

Transect	Code	Number of points	Visit 1	Visit 2
Deadman Creek	INFDECR	5	June 25	July 7
Lee Vining Canyon	INFLVCA	18	June 9	June 21
June Lake	INFJULA	8	June 12	June 27
Mammoth Creek	INFMACR	3	June 16	June 28
McGee Meadow	INFMCGM	9	June 15	July 1
Pilot Springs	INFPISP	11	June 14	June 30
Rock Creek	INFROCR	12	June 13	June 27
Rush Creek	INFRUCR	19	June 3	June 21
Sawmill Meadow	INFSAME	9	June 14	June 28
Sherwin Creek	INFSHCR	10	June 13	June 27

Appendix C. PRBO ASPEN POINT COUNT VEGETATION FORM AND PROTOCOL

C	A													

State   Region   Station   Point   Month   Day   Year (20__)

Surveyor's Name and Initials:

Habitat1________________Hab1%_____Habitat2____________________Hab2%_______

Aspect:____° (Mag)   Slope:_____% Water: Running ___ Standing ___(YorN) Snags10-30_______

Snags 30-60________ Snags>60____ Road____% Total Aspen_______% Total Conifer_______%

Layer*	Tot Cov %	Height (m)				DBH (cm)			
		Low	Spec	High	Spec	Min	Spec	Max	Spec
Tree									
Tree Shrub									
Real Shrub									
Herb									

Sublayer		Species	Cover
T	1		

Sublayer		Species	Cover
T	S		

Sublayer		Species	Cover
R	S		

Aspen Hits along 50m transect

South

0- 137cm height	>137cm height 0 to 10cm DBH	>137cm 11 -30cm DBH	>137cm >30cm DBH
Total	Total	Total	Total

East

Total	Total	Total	Total

10 Factor Basal Area

Species							Total
# of stems							

PRBO ASPEN POINT COUNT VEG PROTOCOL 2010

(Modified by Stella Moss 7/13/2010)

All data is collected within a 50 meter radius circle centered on the point count station.

1st Section General Information:

Station = 7 letter code (e.g. INFLVCA)

Date = The date you are collecting this data.

Point # = The actual point number of the PC.

Habitat 1 = The dominant (i.e., most abundant) habitat type and Sawyer/Keeler-Wolf series a general classification.

Habitat 2 = Only record this if there is a distinct habitat edge (i.e. point is bisected by a clear cut/forest edge) or there are two distinct habitats with in the 50 m.

Aspect = The direction of the slope given in degrees (the direction a drop water would flow if poured onto the point). Collect magnetic direction.

Slope = The average slope of the plot with 90 degrees being vertical and 0 degrees being flat, from the highest point to the lowest.

Water = Is there any water in the plot running or standing Yes or No.

Snags 10_30cm = Total number of the snags in the plot less than 10cm DBH (this includes things that still have dead branches on it but it must be appear to be completely dead, leaning snags that are uprooted but not on the ground or almost on the ground count).

Snags 30-60cm = The number of snags greater than 10 cm DBH but less than 30 cm DBH (see above for more details).

Snags >60cm = The total number of snags greater than 30 cm DBH.

Road = What percentage of the 50 m circle is covered in roads?

Total Aspen = Percentage of aspen on plot no matter what height or if visible from above, total aspen cover if all other vegetation was removed.

Total conifer = Same as aspen but for all conifer species combined.

Cover Layers

These are divided up into 4 layers (Tree, Tree Shrub, Real Shrub, and Herbaceous)

The **Tree Layer** is defined by **height** category alone. Any plant species whose upper bounds (highest point) is greater than 5 meters tall is included in this category (a 6 m tall willow would be included in this category, however a 4m tall White Fir would not be).

The **Tree Shrub** is all tree species that are less than 5 meters tall regardless of height, this means a 25cm tall White Fir counts in this category.

Real Shrubs this is the true shrub species as well as a few shrubby trees that rarely get above 5 meters tall (Dogwood, Mountain Alder, Manzanita, Willow etc.) record the total cover of these species regardless of height.

Herbaceous Layer – this is the total cover of all non-woody vegetation, regardless of height.

Note: the maximum cover is 100% for each of these categories but practically that would be impossible to achieve.

Height Bounds

High - estimate is to the nearest ½ meter of the average height of the upper bounds of the vegetation layer (tree, tree shrub, real shrub). This is not the tallest outlier it is the average high of the tallest plants in that layer. (e.g. of the tallest trees in the plot what is the average high height).

Low – the average (as defined in the high) of the lowest living branches of the tree layer only.

Lower and Upper Species – record the plant species that dominates the lower and upper bounds for all of the categories you collected low and high height data for.

DBH = record the DBH of the smallest and largest tree within 50 meters, and record what species it is.

Species List

Record these as T1 (tree layer), TS (true shrub), RS (real shrub), and H1 (herbaceous)

Record for each of these layers the % each species comprises of the total (this number should add up to 100% regardless of the % total cover). List as many species as can easily be recorded in a timely manner. Chasing down that lone shrub off in the corner of the plot is not worth the effort. However, we are interested in counting any aspen that is present so even if it is 1% or less of the plot please include aspen.

Aspen Density Transects

Lay 50 meter tape out from center of point to one end point (transects are east and south unless uncrossable barrier is met). If barrier is met and transect can be adjusted by < 45° from South or East lay tape in that direction and record your direction, if that still runs into a barrier move South transect North and East transect West.

Record all aspen stems that are within 1m of the tape (1m on both side of the tape for a total of 2m width). For each Aspen hit place it within one of 4 categories as listed on the bottom of the sheet (<breast height, >breast height 0 – 10cm DBH, >breast height 11-30cm DBH, >breast height >30cm DBH). Conduct this for both 50 meter transects (east and south from plot center).

Basal Area

Using the Cruz-All basal area key, stand at the point count center and holding the cruz all chain end at your mouth stretch it the full length (make sure there are no knots or kinks in the chain) and looking through the key with one eye count all of the stems that fill the entire 10 factor opening in the key (no light can be seen on either side of the opening). Record these by species and then a total for all species combined at the far right.

Appendix D. Breeding status of all species detected in 2010-2011

Confirmed Breeding- 1; Possible Breeding- 2; Probable Breeding- 3, detected but no breeding status determined - 0.

Common Name	*Scientific Name*	Sierra	Glass	Whites
Canada Goose	*Branta canadensis*	2		
Mallard	*Anas platyrhynchos*	2		
Common Merganser	*Mergus merganser*	2		
Mountain Quail	*Oreortyx pictus*	2	2	
California Quail	*Callipepla californica*	2		
Sooty Grouse	*Dendragapus fuliginosus*	2		2
Western Grebe	*Aechmophorus occidentalis*	0		
Black-crowned Night-Heron	*Nycticorax nycticorax*	2		
Sharp-shinned Hawk	*Accipiter striatus*	1		
Red-tailed Hawk	*Buteo jamaicensis*	2	2	
Spotted Sandpiper	*Actitis macularius*	2		
California Gull	*Larus californicus*	0		
Eurasian Collared-Dove	*Streptopelia decaocto*	2		
Mourning Dove	*Zenaida macroura*	2	2	
White-throated Swift	*Aeronautes saxatalis*			2
Broad-tailed Hummingbird	*Selasphorus platycerus*			2
Red-naped Sapsucker	*Sphyrapicus nuchalis*			1
Red-breasted Sapsucker	*Sphyrapicus ruber*	1	2	2
Downy Woodpecker	*Picoides pubescens*	2	2	
Hairy Woodpecker	*Picoides villosus*	1	2	2
White-headed Woodpecker	*Picoides albolarvatus*	2		
Black-backed Woodpecker	*Picoides arcticus*	2		
Northern Flicker	*Colaptes auratus*	1	2	2
Olive-sided Flycatcher	*Contopus cooperi*	2	0	2
Western Wood-Pewee	*Contopus sordidulus*	1	2	2
Dusky Flycatcher	*Empidonax oberholseri*	1	1	3
Western Flycatcher	*Empidonax difficilis/occid.*	2		
Willow Flycatcher	*Empidonax traillii*	2		
Say's Phoebe	*Sayornis saya*		2	
Cassin's Vireo	*Vireo cassinii*	2		
Warbling Vireo	*Vireo gilvus*	1	3	1
Steller's Jay	*Cyanocitta stelleri*	2	2	2
Clark's Nutcracker	*Nucifraga columbiana*	0	0	2
Common Raven	*Corvus corax*	1	2	2
Tree Swallow	*Tachycineta bicolor*	1		
Violet-green Swallow	*Tachycineta thalassina*	2		2

---Table cont. next page---

Appendix D. Continued

Mountain Chickadee	*Poecile gambeli*	1	1	2
Bushtit	*Psaltriparus minimus*	2		2
Red-breasted Nuthatch	*Sitta canadensis*	2	2	2
White-breasted Nuthatch	*Sitta carolinensis*	2	1	2
Pygmy Nuthatch	*Sitta pygmaea*	2	2	
Brown Creeper	*Certhia americana*	1	2	2
Bewick's Wren	*Thryomanes bewickii*	3		
Rock Wren	*Salpinctes obsoletus*	2	2	2
Canyon Wren	*Catherpes mexicanus*	2		
House Wren	*Troglodytes aedon*	1	2	2
American Dipper	*Cinclus mexicanus*	1		
Golden-crowned Kinglet	*Regulus satrapa*	2		
Ruby-crowned Kinglet	*Regulus calendula*	0	0	0
Mountain Bluebird	*Sialia currucoides*	2	3	1
Townsend's Solitaire	*Myadestes townsendi*	2	2	
Hermit Thrush	*Catharus guttatus*	2	2	2
American Robin	*Turdus migratorius*	1	1	3
Sage Thrasher	*Oreoscoptes montanus*		2	
European Starling	*Sturnus vulgaris*	2		
American Pipit	*Anthus rubescens*			2
Cedar Waxwing	*Bombycilla cedrorum*	0		
Orange-crowned Warbler	*Vermivora celata*	0	0	0
Nashville Warbler	*Vermivora ruficapilla*	0		
Virginia's Warbler	*Vermivora virginiae*			2
Yellow Warbler	*Dendroica petechia*	1	0	2
Yellow-rumped Warbler	*Dendroica coronata*	2	1	2
Black-and-white Warbler	*Mniotilta varia*	0		
MacGillivray's Warbler	*Oporornis tolmiei*	3	2	2
Wilson's Warbler	*Wilsonia pusilla*	0		
Green-tailed Towhee	*Pipilo chlorurus*	2	2	2
Spotted Towhee	*Pipilo maculatus*	3	2	2
Chipping Sparrow	*Spizella passerina*	2	2	
Brewer's Sparrow	*Spizella breweri*	3	2	2
Vesper Sparrow	*Pooecetes gramineus*		0	1
Fox Sparrow	*Passerella iliaca*	3	2	2
Lincoln's Sparrow	*Melospiza lincolnii*	0		
Song Sparrow	*Melospiza melodia*	3	0	1
White-crowned Sparrow	*Zonotrichia leucophrys*	2	2	2
Dark-eyed Junco	*Junco hyemalis*	1	1	2
Western Tanager	*Piranga ludoviciana*	1	3	2
Black-headed Grosbeak	*Pheucticus melanocephalus*	1	2	

---Table cont. next page---

Appendix D. continued

Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	0		
Red-winged Blackbird	*Agelaius phoeniceus*	3		
Brewer's Blackbird	*Euphagus cyanocephalus*	1		
Brown-headed Cowbird	*Molothrus ater*	3	0	
Bullock's Oriole	*Icterus bullockii*	3		
Pine Grosbeak	*Pinicola enucleator*	2		
Cassin's Finch	*Carpodacus cassinii*	3	2	1
House Finch	*Carpodacus mexicanus*	2		
Red Crossbill	*Loxia curvirostra*	0	2	2
Pine Siskin	*Spinus pinus*	0	2	2
Lesser Goldfinch	*Spinus psaltria*	2	0	
Evening Grosbeak	*Coccothraustes vespertinus*	3		
Total number of species		**81**	**48**	**44**