Nevada Bird Count: 2003 Status Report

Great Basin Bird Observatory Technical Report No. 04-01

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Cover photo: Wheeler Peak in White Pine County, Nevada, is located at the transition of the two largest ecoregions of Nevada, the Great Basin and Mojave Desert.

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I. Summary

The Nevada Bird Count (NBC) program was initiated in 2002 by implementing statewide, volunteer-based point count surveys of breeding landbirds. In May and June of 2002 and 2003, 228 bird species were recorded along 316 ten-point transects in fifteen distinct habitat types of Nevada. In this status report, basic abundance patterns among habitat types are discussed for 35 bird species identified as conservation priorities for Nevada. Results suggested that in some cases, even basic habitat associations of priority birds were slightly different than previously assumed for the Nevada region, demonstrating that quantitative measurement of bird-habitat use is needed as a first step in effective habitat conservation planning. Changes in habitat use across different climatic conditions, e.g. droughts and normal water years, need to be assessed as the program becomes implemented in the longer-term. Also, for some species, especially in the Mojave region of Nevada, additional data are needed to clarify habitat associations. The next two years of implementing the NBC program will focus on these objectives and on generating multi-species habitat suitability models for priority species associated with aspen, lowland riparian, mesquite-catclaw, sagebrush, and pinyon-juniper habitats.

II. Acknowledgments

The first two years of Nevada Bird Count program were funded by the Bureau of Land Management (BLM), the U.S. Forest Service (USFS), and the Nevada Department of Wildlife (NDOW; USFS Agreement #02-CS-11041730-033; BLM Agreement #FAA030034), by The Nature Conservancy (Contract #NVFO05202003) and by the Newmont Mining Corporation. Development of the Coordinated Bird Monitoring plan, of which the Nevada Bird Count is part, was primarily funded by the U.S. Geological Service (USGS Award #03WRAG0047). GBBO is grateful for technical and scientific oversight provided by the Nevada Partners in Flight working group, from the Biological Resource Research Center at University of Nevada, Reno (especially Dick Tracy and Bob Elston), and from Jon Bart and Susan Earnst of the USGS Snake River Field Station. Many individuals were instrumental in the early planning phase of the Nevada Bird Count, particularly Larry Neel of NDOW, Genny Wilson of USFS, Erick Campbell of BLM, and David Arsenault of Lahontan Audubon Society. GBBO also thanks other reviewers of the NBC protocol, including Lew Oring of University of Nevada, Reno, Aaron Holmes and Sacha Heath of Point Reyes Bird Observatory, John Swett of the Bureau of Reclamation, Louis Provencher of The Nature Conservancy, Don McIvor of Lahontan Audubon Society, and Cris Tomlinson of NDOW. GBBO is particularly grateful to volunteer and agency staff surveyors contributing to the Nevada Bird Count, including J. Ballard, B. Baumann, P. Bradley, B. and B. Clark, G. Clune, J. Coe, L. Cunningham, K. Donohue, J. Eidel, B. Furtek, D. Gighlieri, A. Gubanich, N. and M. Hall, H. Hundt, P. Jelinek, K. Kontio, B. Lund, J. Lytle, J. Hiatt, N. McDonal, K. McKintyre, K. Murphy, L. Neel, B. Nielsen, K. Oakes, K. Orr, M. Renfro, W. Richards, D. Serdehely, M. Siero, R. Strickland, C. Tomlinson, K. Trever, B. Wagner, J. Williams, D. Wong, and J. Woodyard.

III. Background

The Nevada Bird Count is the outcome of several years of planning by the Nevada Partners-in-Flight working group (NVPIF), who developed the idea of statewide, coordinated bird monitoring as a scientific framework for conservation planning and monitoring for Nevada birds. After completion of the Nevada Bird Conservation Plan (Neel 1999), NVPIF recognized the need for an all-bird monitoring program that determines long-term population trends, identifies conservation issues for birds, provides guidelines for bird habitat management, and evaluates the success of conservation strategies and actions. Long-term bird monitoring also forms a natural progression after completion of the Nevada Breeding Bird Atlas, the first comprehensive inventory of Nevada's breeding birds due to be published in spring 2005.

The majority of bird species which reside in Nevada at one time or another in their life history are breeding landbirds that are best monitored by point counts and related survey methods (Table 1). As a result, the first phase in implementing all-bird monitoring in Nevada was the Nevada Bird Count (NBC), a habitat-based point count network across the state.

Table 1. Number of Nevada species and dependent variables that may be monitored by each major survey method (each species may be listed under more than one survey type). From Ammon et al. (2003).

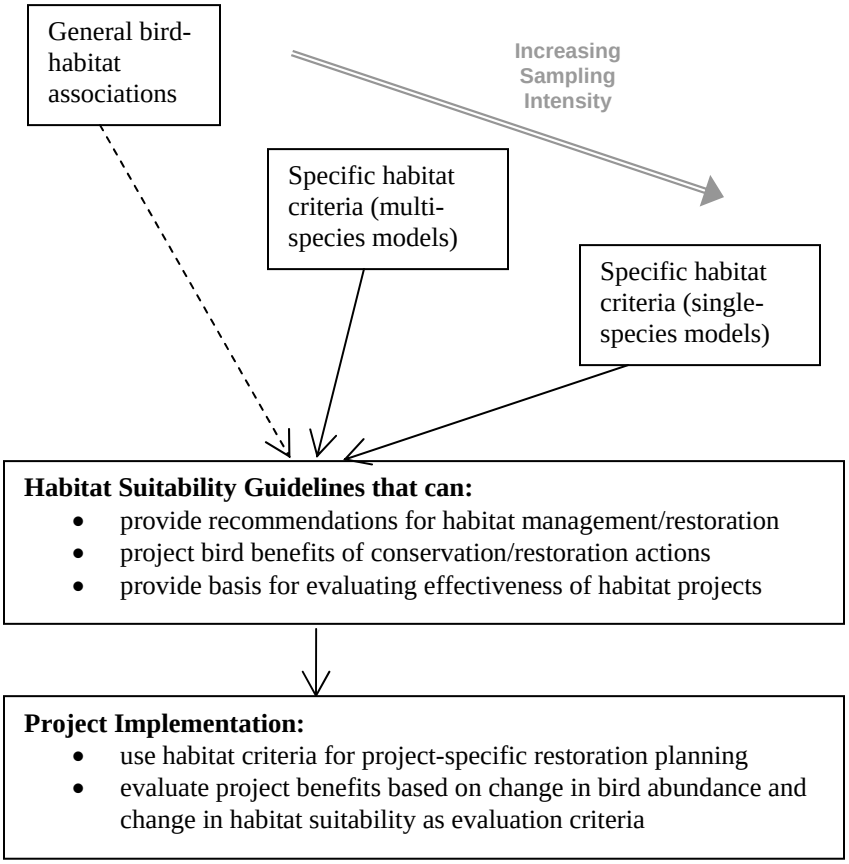
		Population Measure Monitored		
Survey Type	**Season**	**Trend**	**Abundance**	**Fitness**
1. Point counts and related programs	**Breeding**	217	217	41
2. Area-searches for landbirds	**Year-round**	37	193	6
3. Area searches for aquatic birds	**Year round**	51	71	43
4. Migration monitoring programs	**Migration**	51	5	49
5. Nest success programs	**Breeding**	1	4	140
6. Colony counts	**Breeding**	22	10	9
7. Aerial surveys	**Year round**	23	11	0
8. Nocturnal surveys	**Breeding**	9	10	0
9. Upland gamebird surveys	**Breeding**	11	11	11
10. Other surveys	**Year round**	38	40	41

Population trends can be measured reliably only over a long period of time (> 10 - 20 years). Trend monitoring for large numbers of species also typically involves a large geographic region. In contrast, measures of fitness, or the "health" of bird populations, require intensive sampling, such as nest monitoring, assessment of population recruitment, and measuring condition of individual birds. Fitness monitoring is, thus far, rarely implemented in regional monitoring programs (but there are exceptions, such as waterfowl brood counts conducted by Nevada Department of Wildlife). Measuring fitness, or performance, of a population should be considered for future phases of program implementation, at least for species for which more intensive management action is deemed necessary. For the initial phase of the NBC, most findings will be derived from bird abundance patterns among habitat types and gradients of habitat condition using data from extensive, rather than intensive, surveys.

Conceptually, there are two aspects to the NBC program, long-term population trend monitoring and short-term land management oriented research. Population trend monitoring is a particularly important objective of the NBC, because the Nevada region has been notoriously underrepresented in national monitoring programs designed for non-game birds.

GBBO's approach toward using the NBC to assist in land management decisions in the short-term is to begin with a broad picture of bird abundance patterns across habitat types. A broad picture can be generated fairly quickly using extensive survey methods such as point counts. The steps following this broad habitat-relationship assessment are illustrated in Figure 1.

Figure 1: GBBO's step-down plan for using the Nevada Bird Count program to provide bird-habitat recommendations that may be used in land management decisions in the short-term (2 – 5 years).



This report presents results for the first step, "General Bird-Habitat Associations", based on the first two years of NBC program implementation. After this 2002/2003 effort, additional surveys will confirm and continually refine our understanding of bird-habitat associations and build multi-species and single-species models of suitable bird habitats. Priorities for

focusing the effort is set by NVPIF's Bird Conservation Plan and the priority species identified therein (Neel 1999), and by the six highest-priority resource management issues that have recently been identified for Nevada bird conservation (Ammon et al. 2003): (1) riparian habitat degradation; (2) changes to wetlands; (3) upland gamebird habitats; (4) aspen management; (5) sagebrush management; and (6) pinyon-juniper management.

III. Methods

Survey Areas

NBC survey sites are categorized by landcover (hereafter "habitat type" or "habitat") and whether or not a site has been pre-selected as a high priority for monitoring. These categories involve two selection strata, (1) bird habitat type using the GAP-cover based classification system of NVPIF's Bird Conservation Plan, and (2) random vs. non-random selection of a site. Furthermore, distributions of some bird species follow boundaries of the three primary ecoregions of Nevada, the Great Basin, the Mojave Desert, and the Sierra Nevada. Therefore, ecoregion can be used as variable in at least some habitat models that will be generated from the data.

Thirteen bird-habitat types identified in the Nevada Bird Conservation Plan were used for habitat-based site selection, including aspen (*Populus tremuloides*), montane riparian, lowland riparian, coniferous forest, pinyon-juniper (*Pinus edulis* and *Juniperus* spp.), montane shrubland, Mountain Mahogany (*Cercocarpus ledifolius*), sagebrush (*Artemisia* spp.), salt desert, Mojave scrub, mesquite-catclaw (*Prosopis* spp. and *Acacia* spp.), agricultural, and wetland. Sagebrush was further split into montane and lowland sagebrush, and Joshua Tree (*Yucca brevifolia*) was split off from Mojave scrub. All except one (Joshua tree) habitat types were mapped by combining GAP vegetation cover types into aggregates using ArcGIS. The rule for aggregation was to include all GAP covers that included the same dominant tree species into one habitat type. For example, all covers that included pinyon pine or juniper were combined into "pinyon-juniper", purposely including all successional stages, tree densities, or other gradients in tree cover. In mixed stands, for example Mountain Mahogany and pinyon-juniper, the predominant tree species determined the habitat type. For shrub-dominated habitat types, the predominant shrub species determined the habitat type.

Random selection of NBC monitoring sites entailed a random point scatter generated for each habitat type using GIS. In cases where land ownership or inaccuracies of the GAP covers prevented surveys of the randomly selected site, surveyors were asked to relocate the transect in a straight-line distance to the nearest site that was accessible and fit the desired habitat type. For more details, see the NBC survey protocol on http://www.gbbo.org.

Non-random site selection included sites that have already been identified as important for bird monitoring, either because they support critical populations of birds, for example under Audubon's Important Bird Areas (IBA) program, or because they are undergoing changes in land management or habitat restoration affecting birds. Also, some habitat types are very

restricted in Nevada or fall primarily on private lands, for example lowland riparian areas, which makes a GIS approach to random site selection difficult. In these cases, access was obtained first and random placement of the survey transect was done in the field within the boundaries of the accessible area.

Field Methods

Point count surveys are NBC's primary approach to data collection for breeding landbirds (after Ralph et al. 1993). Survey routes consisted of habitat-specific, mostly off-road walking transects of 10 survey points (300 m apart in open, expansive habitats; 250 m apart in forested, restricted habitats). Most surveys were conducted by a trained volunteer crew. During a count, all birds detected by visual or auditory cues were recorded. Using electronic range finders to measure distances, surveyors recorded birds separately for 0 – 50 m, 50 – 100 m, and > 150 m distances (when first detected). Because most sites are only visited once annually, each point count survey was 10 minutes long with data recorded separately in three time intervals (0-3 min, 3-5 min, and 5-10 min). Surveys were conducted during the peak breeding season of most Nevada landbirds, from April 25 through June 30 (Mojave region) and May 25 – July 10 (Great Basin region), between dawn and 10:00 a.m. in fair weather conditions (no strong winds or heavy precipitation). Fly-over sightings were included in all data presented in this report. Further details about the survey protocol and sample data sheets can be obtained from the GBBO website (http://www.gbbo.org).

Several factors contributed to the decision to use this particular point count design for the NBC program. Off-road, walking transects minimize the concern that roads and their associated infrastructure (e.g., wires and fences) may cause a bias in survey results, particularly in the open habitats that predominate the Nevada landscape. Volunteers were used in order to achieve large-scale survey coverage and to facilitate community involvement in bird conservation. Trained volunteers have been used successfully in other point count survey efforts, such as USGS' national Breeding Bird Survey and more recent regional programs similar to the NBC (Welsh 1995). A great deal of discussion has occurred recently regarding the validity of the "distance-sampling" method, where distance to each bird at its place of first detection is estimated, in comparison with other bird survey methods (e.g., Rosenstock et al. 2002). A full justification for using a distance-sensitive approach, but not classic distance-sampling, goes beyond the scope of this report. However, the following three points were instrumental in the decision: (1) A key assumption (probability of bird occurrence is equal across all distance intervals) cannot be met because surveyors cause displacement of birds, particularly in open habitats; (2) Distance sampling requires that detectability curves are statistically generated for each species, separately for each major habitat type; the sample size requirements are often such that only the most abundant species and can be included, and these are often species of low conservation concern; and (3) Methods other than distance-sampling are still needed to remove certain biases from point-count data, for instance gradual change in breeding season due to global change, or gradual habitat changes that may affect detectability over time. As an alternative to classic distance-sampling, a portion of the NBC's future monitoring effort is planned to be spent on intensive inventories of a subset of point-count sites in order to document >90% of birds present,

which will provide correction factors for density estimates generated from point counts (Bart and Earnst 2002) and continually updated information about breeding status and timing.

Data Presented in This Report

The chief advantage of point counts is that, in one effort, data can be obtained for a great variety of species, resulting in an overwhelming amount of information when implemented statewide and across several habitat types. While the program has already generated data for a large portion of breeding landbirds, this report focuses only on a subset of species, those that have been identified as conservation priorities by Nevada Partners in Flight (Neel 1999).

Of the 50 priority species, 14 require survey methods other than point counts for obtaining reliable data on populations and habitats, including raptors, owls, grouse, and strictly aquatic species (rails, waterbirds, waterfowl, and most shorebirds). Other species have very restricted distributions in Nevada, which require additional intensive surveys to provide adequate monitoring. Examples include White-headed and Three-toed Woodpeckers (*Picoides albolarvatus* and *P. tridactylus*), Yellow-billed Cuckoo (*Coccyzus americanus*), and Wilson's Warbler (all scientific species names not mentioned in the text are in Appendix 1); other species may also fall into this category, for example most hummingbirds.

For all but two (Virginia's Warbler and Le Conte's Thrasher) of the remaining priority species, the NBC data set contained at least 10 observations. For these, the proportion of observations that fell into each major habitat type (weighted by survey effort) is reported for each priority species and several associated species to view general habitat association and obtain a preliminary perspective on the degree of habitat specialism.

Secondly, for the habitat types with which a species is considered to be associated, mean number of birds detected per 10-point transect was compared with the same mean from all other transects (only including observations at < 100 m). This was done to show the magnitude of the habitat effect on the priority species. Means were compared in simple pair-wise parametric tests (Analysis of Variance, ANOVA), using statistics in an exploratory fashion rather than for formal hypothesis testing.

Select species that are not of immediate conservation concern were also included in comparisons of means. These included mostly species of concern to managers because they are considered a nuisance or threat to native birds, such as the Brown-headed Cowbird, European Starling, and House Sparrow.

Limitations and Assumptions

As with all scientific endeavors, the NBC methods have limitations. The habitat-based approach for placing survey transects is complicated by the fact that edge effects play a role in spatially restricted habitat types (e.g., aspen, montane riparian, mesquite-catclaw, lowland riparian, and wetlands), but usually not in others (e.g., pinyon-juniper, sagebrush, salt desert,

Mojave scrub). It is therefore important not to overinterpret the “habitat” data presented here, because transects in certain habitat types always produce at least some data from adjacent habitat types. Until more detailed habitat information from these transects becomes available, the best way to view survey results presented for a transect is to only assume the presence of the name-giving habitat type, rather than the absence of any others.

A second limitation is that the point count data presented here are unadjusted for species-specific detectability or other biases. For the purpose of this report, point count data are only used for comparing abundances within species among different habitat types, rather than for population density estimates. It therefore only requires that detectability of a species is similar across habitat types, which appears to be a reasonable assumption.

The data presented here have been collected in only two breeding seasons, a short time period for a bird population study. Both years were characterized by drought conditions (mostly in the Mojave region) and near-drought conditions (mostly in the Great Basin). It is likely that the habitat-relationships illustrated in this report are influenced by these environmental factors and that they may change during wet years. Only long-term implementation of the monitoring program can resolve the relevance of this effect.

Finally, it is important to recognize that relationships between bird abundance and the presence of certain habitat features are not necessarily sufficient to describe optimal habitat for a species. Habitat quality is best assessed by measuring how well a species performs locally in terms of survival and reproductive success, rather than by measuring mere numbers of individuals. This is one reason why fitness measures should ideally be integrated into a monitoring program. Regardless, the persistent presence of large numbers of individuals attempting to breed generally indicates that at least their basic habitat requirements are met in a survey area.

IV. Results and Discussion

Distribution of Survey Effort

A total of 316 transects were surveyed for the NBC in 2002 and 2003 (Table 2). This figure includes revisits of transects in both years, but not multiple visits per year. The distribution of effort among habitats was a result of the distribution of NVPIF priority species (hereafter: priority species) among habitat types and of GBBO's funding partners' needs for survey coverage. Figure 2 illustrates that geographic distribution of the survey effort.

Table 2: Distribution of survey effort among bird habitat types. Listed are the number of 10-point point-count transects completed in the springs and summers of 2002 and 2003.

Habitat Type	Number of Transects Completed*	Number of Transects Repeated
Agricultural	5	0
Aspen	17	1
Coniferous Forest	13	0
Joshua Tree	11	0
Lowland Riparian	61	13
Mesquite-Catclaw	10	0
Mojave Scrub	5	0
Montane Riparian	69	11
Montane Sagebrush	12	0
Montane Shrublands	9	1
Mountain Mahogany	10	1
Pinyon-Juniper	31	0
Sagebrush	38	5
Salt Desert	11	1
Wetland	14	1
Total	**316**	

* Transects surveyed in both years counted as two transects

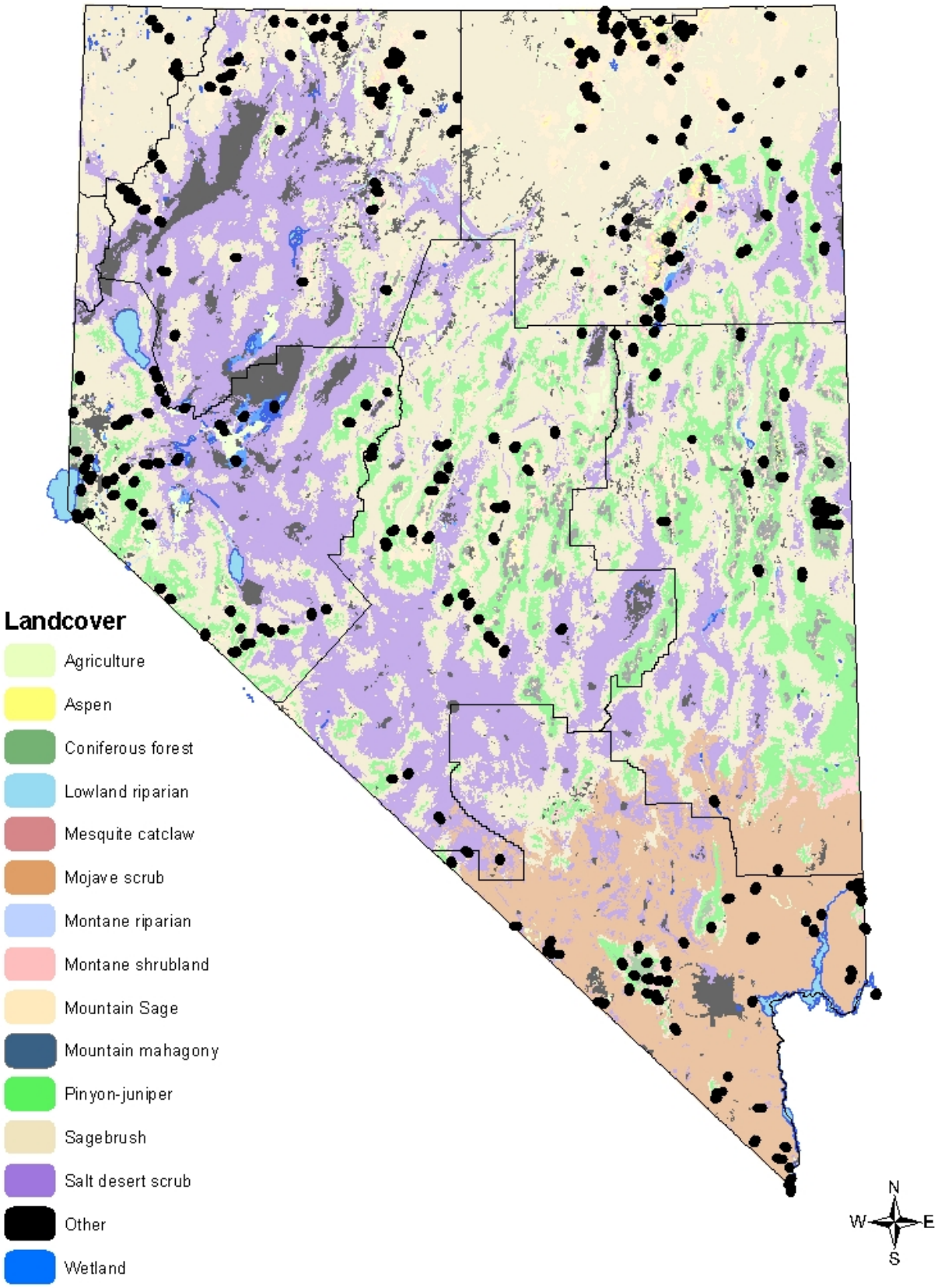
The distribution of survey effort among landownership was primarily a result of the proportion of habitat area owned by different entities. The BLM and U.S. Forest Service own the majority of land in Nevada, including most aspen, pinyon-juniper, coniferous forest, montane riparian, sagebrush, Mojave scrub, and Joshua tree areas. Therefore, the greatest proportion of the survey effort focused on these lands (Table 3).

The U.S. Fish and Wildlife Service, National Park Service, NDOW, and private landowners manage most lowland wetland, riparian, and agricultural areas. Access to these areas needs to be obtained on a case-by-case basis, and GBBO's still-increasing efforts in these habitats reflect continuing progress toward obtaining permissions.

Table 3: Distribution of transects among landownership types. Listed are the number of 10-point point-count transects completed in the springs and summers of 2002 and 2003.

Habitat	BLM	USFS	USFWS	Private	Other
Agricultural	1			3	1
Aspen		13			
Coniferous Forest	2	10		2	3
Joshua Tree	7	1	2		1
Lowland Riparian	23	1	1	18	20
Mesquite-Catclaw	6		1	2	1
Mojave Scrub	4				1
Montane Riparian	20	29	2	2	5
Montane Shrublands	3	8	1		
Mountain Mahogany	2	5	1		1
Pinyon-Juniper	19	15		1	1
Sagebrush	27	20		3	
Salt Desert	9				1
Wetland	1		4	1	7
Total	**124**	**102**	**12**	**32**	**42**

Figure 2: 2002/2003 Nevada Bird Count transect locations (black dots) in habitat types (landcovers) of Nevada.



General Results

A total of 228 species were detected during NBC surveys in 2002 and 2003, incidental observations included (Appendix 1). Table 4 illustrates, for the NVPIF priority species and several of their associated species, the total number of observations recorded and percent distribution among habitat types.

Several interesting patterns emerge, some of which will be discussed in greater detail in the following sections on each habitat type. For instance, Brewer's Sparrow was most often observed in montane sagebrush habitats, whereas the other sagebrush-obligate species Sage Sparrow and Sage Thrasher were most often observed in lower-elevation sagebrush. Vesper Sparrow was roughly equally frequently found lower-elevation sagebrush, Mountain Mahogany, and montane sagebrush (Table 4). Gray Flycatchers, which are generally considered sagebrush-obligates were most often encountered on transects that had at least some pinyon-juniper.

The majority of Chukar observations occurred in pinyon-juniper transects, and Ruffed Grouse and Greater Sage-grouse were found primarily in aspen and montane riparian transects, respectively, although the number of observations was too low to provide a statistically meaningful sample. Red-naped Sapsuckers were primarily recorded in aspen habitats, whereas Red-breasted Sapsuckers were most often found in coniferous forests. Both sapsuckers were observed in low numbers, so these preliminary patterns need to be confirmed during future surveys.

Most Mountain Bluebirds were observed in pinyon-juniper, coniferous forests, and in Mountain Mahogany. Orange-crowned and MacGillivray's warblers appear to be true aspen-associates in that the majority of sightings were made in this habitat type. Yellow Warbler, which through much of its range is primarily a lowland riparian species, was mostly observed in montane riparian areas in Nevada. Black-throated Gray Warbler was primarily found in pinyon-juniper and Mountain Mahogany transects.

Gray Vireos were primarily observed in montane shrublands, although the sample size was low. Plumbeous Vireos are evidently a pinyon-juniper associated species in Nevada, as 86% of the observations were made in this habitat type. Interestingly, Pinyon Jays were most often recorded in Joshua tree transects, with pinyon-juniper and montane shrublands being only the next-most frequently recorded habitat types. Pinyon Jays travel in vagrant flocks across large geographic areas, so these results will need to be re-examined after additional surveys. Other unexpected patterns include the number of Le Conte's Thrashers observed in mesquite-catclaw transects, a habitat type that reportedly is very rarely used by this species (Ted Floyd, pers. comm.). The total number of observations of Le Conte's Thrashers was low, however, and these findings need to be confirmed with increased sample sizes in the Mojave Desert.

Table 4: Distribution of species observations among habitats during the NBC 2002/2003 surveys. Species listed in alphabetic order.

Species (NVPIF priority species in **bold**)	No. of Observations	Agricultural	Aspen	Conif. Forest	Joshua Tree	Lowland Riparian	Mesquite-Catclaw	Mojave Scrub	Montane Riparian	Mountain Sagebrush	Montane Shrubland	Mountain Mahogany	Pinyon-Juniper	Sagebrush	Salt Desert	Wetlan
American Avocet	128					5%										**95%**
Abert's Towhee	23	**54%**				26%					20%					
American Bittern	4					41%										**59%**
American White Pelican	168					**90%**										10%
Ash-throated Flycatcher	112				19%	7%	17%	**22%**	3%	3%	9%		15%		6%	
Bank Swallow	92					**71%**										29%
Bell's Vireo	34	43%				**57%**										
Bendire's Thrasher	8				8%		37%	**55%**								
Black Phoebe	8	**80%**				20%										
Black-headed Grosbeak	78		17%	6%		7%	4%		**25%**		18%	12%	12%			
Black-throated Gray Warbler	160			2%					5%	4%	17%	24%	**48%**			
Black-throated Sparrow	785				19%	2%	12%	**34%**	1%	4%	6%		3%	10%	8%	1%
Blue Grosbeak	16		46%			**51%**			4%							
Bobolink	75	34%				**66%**										
Brewer's Sparrow	1358		7%	1%	3%		6%	5%	7%	**31%**	10%	9%	4%	17%	1%	
Broad-tailed Hummingbird	139		19%	19%		1%			**31%**	8%	15%	2%	5%			
Brown-headed Cowbird	899	1%	3%	3%		**57%**	1%		20%	1%	1%	1%	5%	2%		6%
California Quail	707					**73%**	1%		7%	1%	3%		1%	1%		14%
Calliope Hummingbird	10		41%		**42%**				17%							
Caspian Tern	10					48%										**52%**
Chukar	145					11%			22%			9%	**50%**	9%		
Clark's Grebe	13															**100%**
Cooper's Hawk	16	**30%**	9%			2%		**30%**	24%				5%			
Costa's Hummingbird	5				38%	20%	**42%**									
Crissal Thrasher	8				30%	5%	**65%**									
European Starling	712	6%				**89%**			2%							3%
Forster's Tern	80					38%										**62%**
Gambel's Quail	161	14%				6%	**31%**	27%			7%		1%		15%	
Golden Eagle	8								25%	29%		**35%**	11%			
Grace's Warbler	11			**93%**					7%							
Gray Flycatcher	286		3%				1%		7%	21%	11%	11%	**40%**	5%		1%
Gray Vireo	16				11%				7%		**54%**		28%			

Table 4: -- continued.

Species (NVPIF priority species in **bold**)	No. of Observations	Agricultural	Aspen	Conif. Forest	Joshua Tree	Lowland Riparian	Mesquite-Catclaw	Mojave Scrub	Montane Riparian	Mountain Sagebrush	Montane Shrubland	Mountain Mahogany	Pinyon-Juniper	Sagebrush	Salt Desert	Wetlan
Greater Sage Grouse	10								**61%**	39%						
House Sparrow	164	40%				**46%**										14%
Hooded Oriole	6					**100%**										
Juniper Titmouse	85					1%			7%	18%	14%	3%	**57%**			
Lazuli Bunting	419		16%			24%			**43%**	1%	5%	10%		1%		
Le Conte's Thrasher	7				13%		**87%**									
Lewis's Woodpecker	19		39%			4%			17%			**40%**				
Loggerhead Shrike	90				20%	2%	10%	**30%**	2%	1%	15%		5%	11%	2%	2%
Long-billed Curlew	42					48%			2%							**50%**
Long-eared Owl	6								**100%**							
Lucy's Warbler	76	10%				**55%**	35%									
MacGillivray's Warbler	223		**50%**	3%	7%	3%			23%	5%	1%	5%				
Mountain Bluebird	163		12%	17%					1%	13%	8%	16%	**33%**	1%		
Northern Goshawk	4			37%					14%			**49%**				
Northern Harrier	28		6%	8%		10%			14%			20%		8%		**35%**
Olive-sided Flycatcher	12		8%	**89%**		2%			2%							
Orange-crowned Warbler	63		**67%**			1%			8%			23%	1%	1%		
Phainopepla	44	19%				4%	**53%**	19%							4%	2%
Pinyon Jay	479				**40%**				1%	25%	12%		21%	1%		
Plumbeous Vireo	33					2%			4%	8%			**86%**			
Prairie Falcon	9		**46%**						28%				25%			
Red-breasted Sapsucker	7			**93%**					7%							
Red-naped Sapsucker	36		**42%**						27%	7%		24%				
Ruffed Grouse	5		**100%**													
Sage Sparrow	370				5%	1%			1%	18%			8%	**49%**	17%	1%
Sage Thrasher	217		1%		1%	1%			12%	22%	16%	8%	2%	**32%**	5%	1%
Sandhill Crane	6					31%										**69%**

Table 4: -- continued.

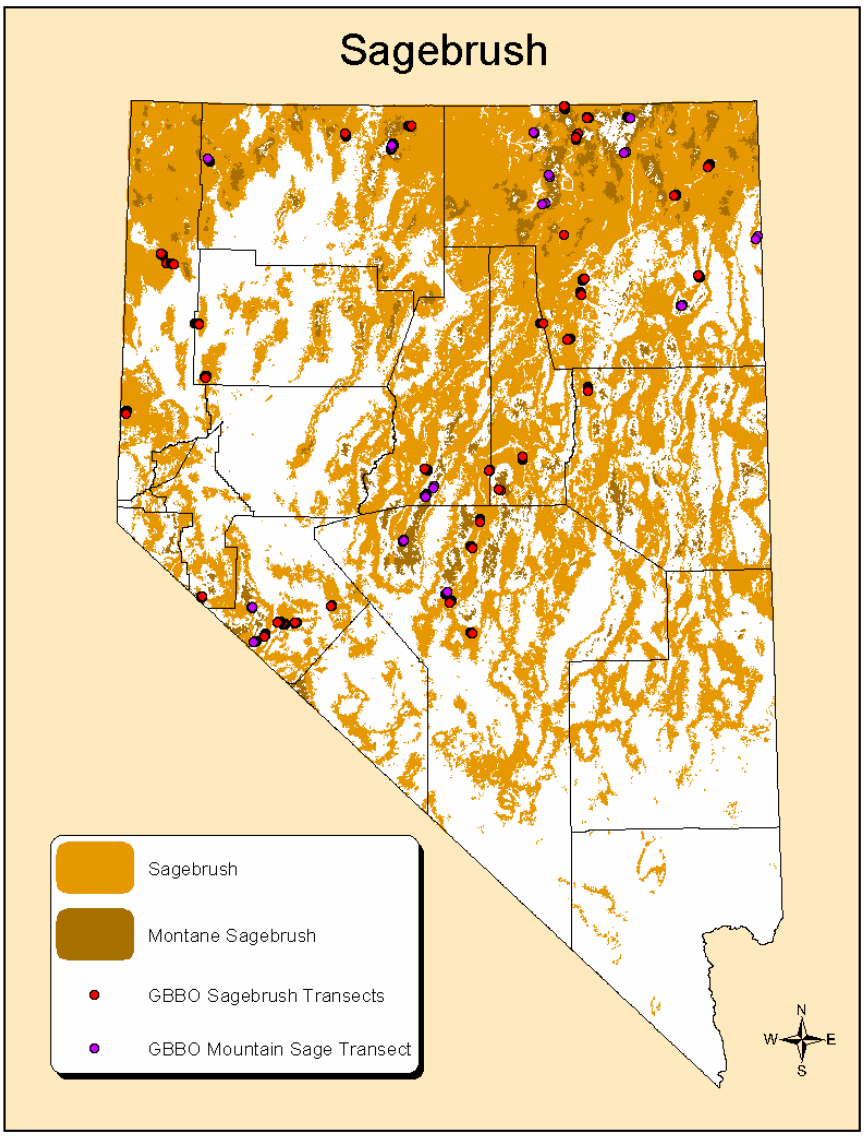
Species (NVPIF priority species in **bold**)	No. of Observations	Agricultural	Aspen	Conif. Forest	Joshua Tree	Lowland Riparian	Mesquite-Catclaw	Mojave Scrub	Montane Riparian	Mountain Sagebrush	Montane Shrubland	Mountain Mahogany	Pinyon-Juniper	Sagebrush	Salt Desert	Wetland
Scott's Oriole	39				**39%**			27%			35%					
Snowy Plover	11															**100%**
Swainson's Thrush	56		**77%**						18%		5%					
Verdin	97	19%				8%	**69%**	3%			1%					
Vesper Sparrow	237		5%	1%		1%			10%	21%	12%	23%		**25%**		1%
Virginia's Warbler	8		18%						2%		34%	**46%**				
Western Bluebird	34			17%		**44%**	33%		6%							
White-faced Ibis	166					30%										**70%**
White-throated Swift	293		10%		11%	**60%**	3%		2%	4%			10%			
Willow Flycatcher	19	**70%**				30%										
Wilson's Warbler	16		7%		11%	6%	**37%**		7%				8%		23%	
Yellow Warbler	670	15%	23%		8%	16%	2%		**28%**		4%	4%	1%			
Yellow-breasted Chat	114	22%				**58%**	15%		5%							

Habitat Effects

Lowland and Montane Sagebrush

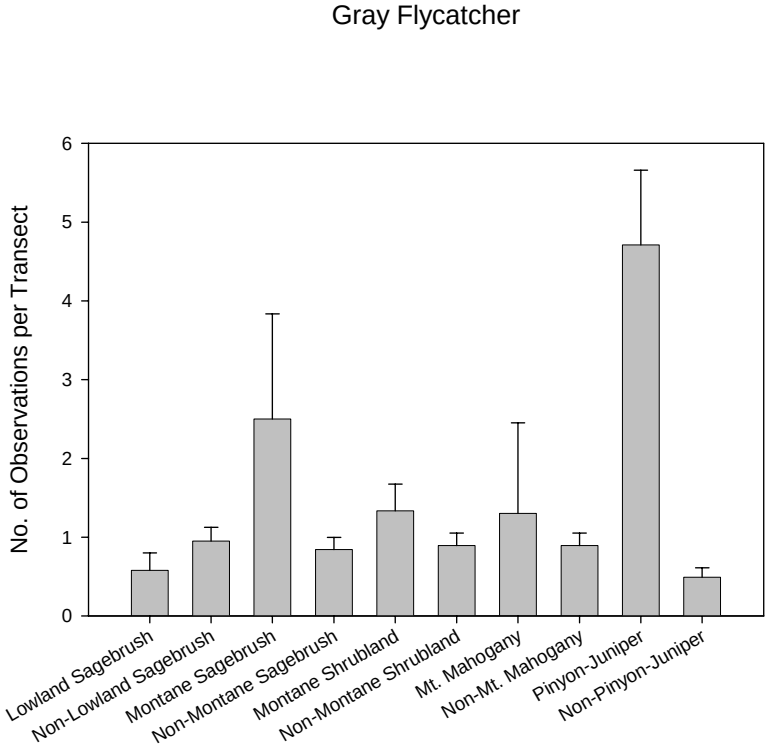
Sagebrush is among the most extensive habitat types in the Great Basin portion of Nevada (Fig. 3). For the purpose of this report, it was divided into montane and lowland sagebrush to illustrate elevational effects on bird distribution. Sagebrush is of particular concern to bird conservation in Nevada because many species for which Nevada has a high conservation responsibility are supported by this habitat type. Also, recent large brush fires caused significant changes in sagebrush habitat condition, particularly in the north-central portion of the state.

Figure 3: Distribution of lowland and montane sagebrush in Nevada. Based on GAP vegetation cover types.



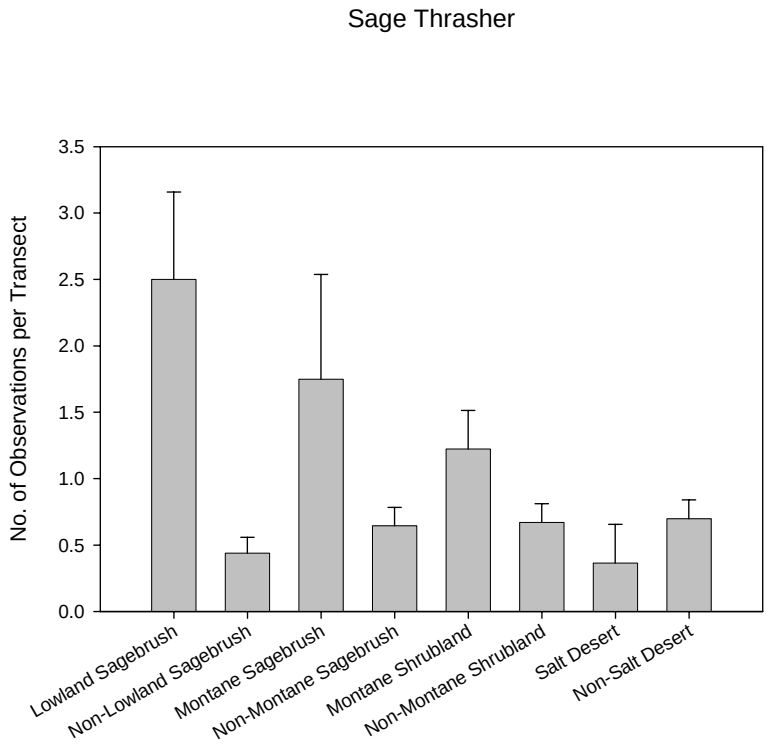
The Gray Flycatcher is associated with tall sagebrush through much of its range (Sterling 1999). In Nevada, its breeding abundances are approximately five times as high in pinyon-juniper areas than in all other habitats (Fig. 4; $p < 0.0001$). It also tended to be more abundant in montane sagebrush than in other habitats ($p = 0.042$).

Figure 4: Mean number of Gray Flycatcher observations per transect in different habitat types. Error bars indicate standard error of the mean. Data from GBBO's Nevada Bird Count program, 2002 and 2003.



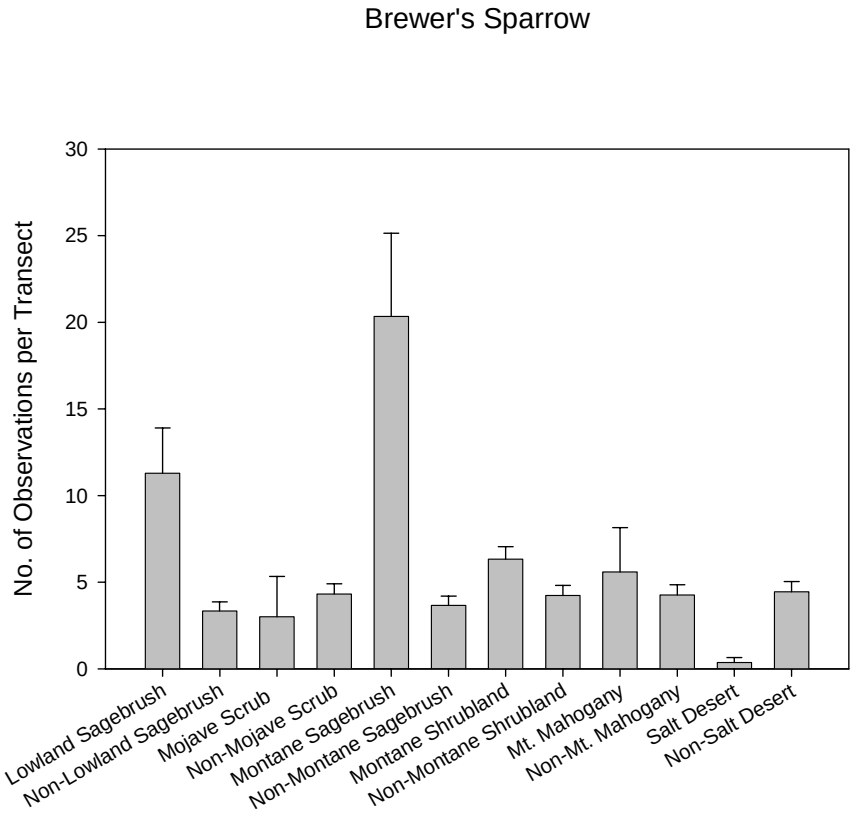
Sage Thrasher, a sagebrush-obligate species, was approximately five times more abundant in lowland sagebrush sites than in all other habitat types (Fig. 5; $p = 0.002$). It showed no difference in abundance among all other habitat comparisons ($p > 0.1$).

Figure 5: Mean number of Sage Thrasher observations per transect in different habitat types. Error bars indicate standard error of the mean. Data from GBBO's Nevada Bird Count program, 2002 and 2003.



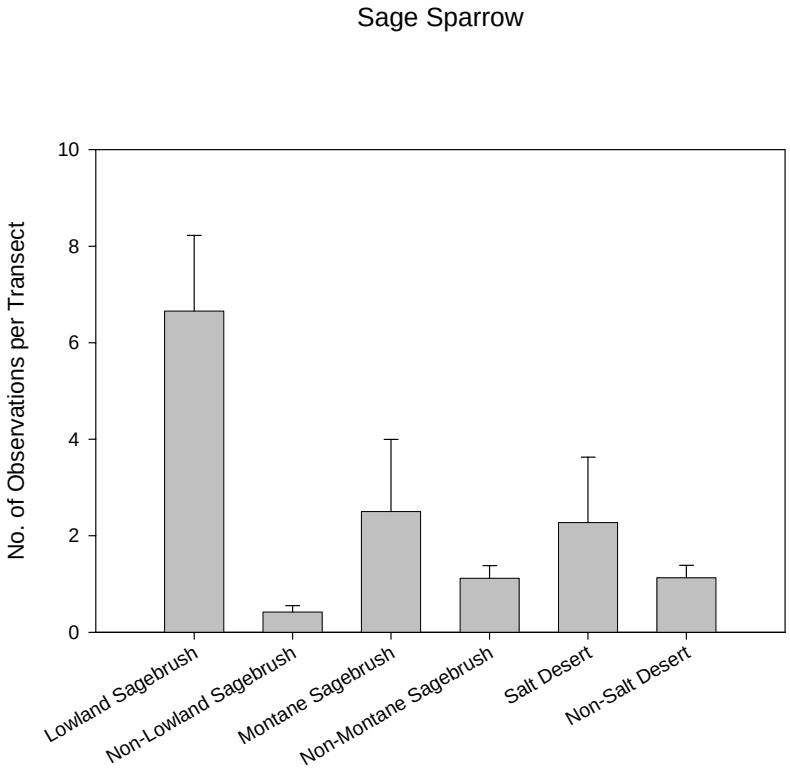
Brewer's Sparrow appeared to be primarily associated with montane sagebrush communities, where 20 birds per transect were detected, four times as many, on average, as in other habitat types (Fig. 6, $p < 0.0001$). It was approximately twice as abundant in lowland sagebrush than, on average, in other habitat types ($p = 0.003$).

Figure 6: Mean number of Brewer's Sparrow observations per transect in different habitat types. Error bars indicate standard error of the mean. Data from GBBO's Nevada Bird Count program, 2002 and 2003.



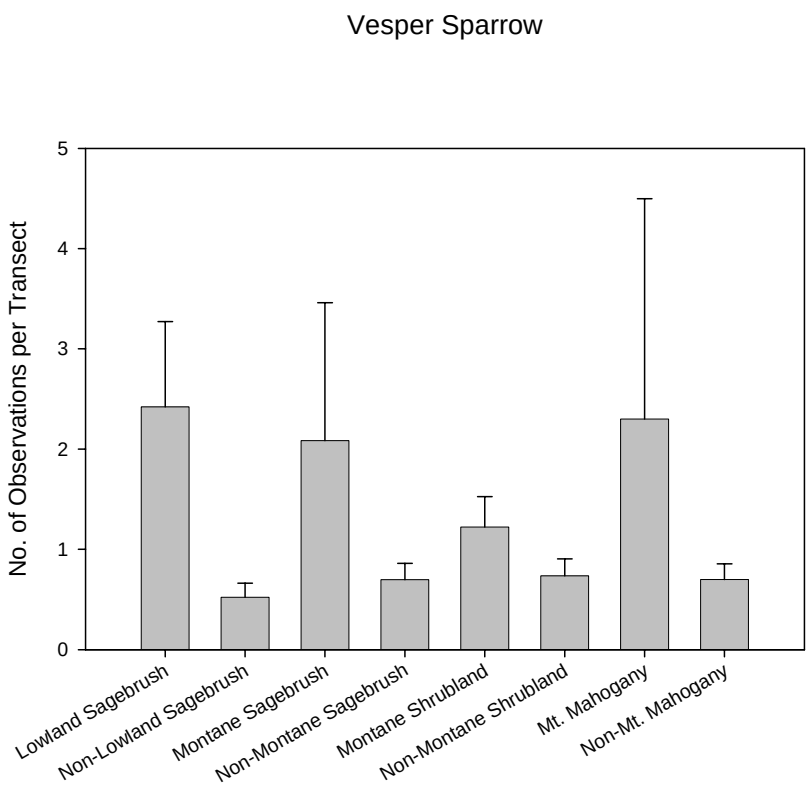
In contrast to Brewer's Sparrow, Sage Sparrow was primarily associated with lowland sagebrush, where abundances were on average seven times higher than in other habitats (Fig. 7, $p < 0.0001$). All other abundance comparisons among habitat types showed no difference ($p > 0.1$).

Figure 7: Mean number of Sage Sparrow observations per transect in different habitat types. Error bars indicate standard error of the mean. Data from GBBO's Nevada Bird Count program, 2002 and 2003.



Vesper Sparrow tended to be more abundant in lowland sagebrush than in other habitat types (Fig. 8, $p = 0.028$), but the pattern was relatively weak and needs to be confirmed in future surveys. Abundances among other habitat types were statistically indistinguishable.

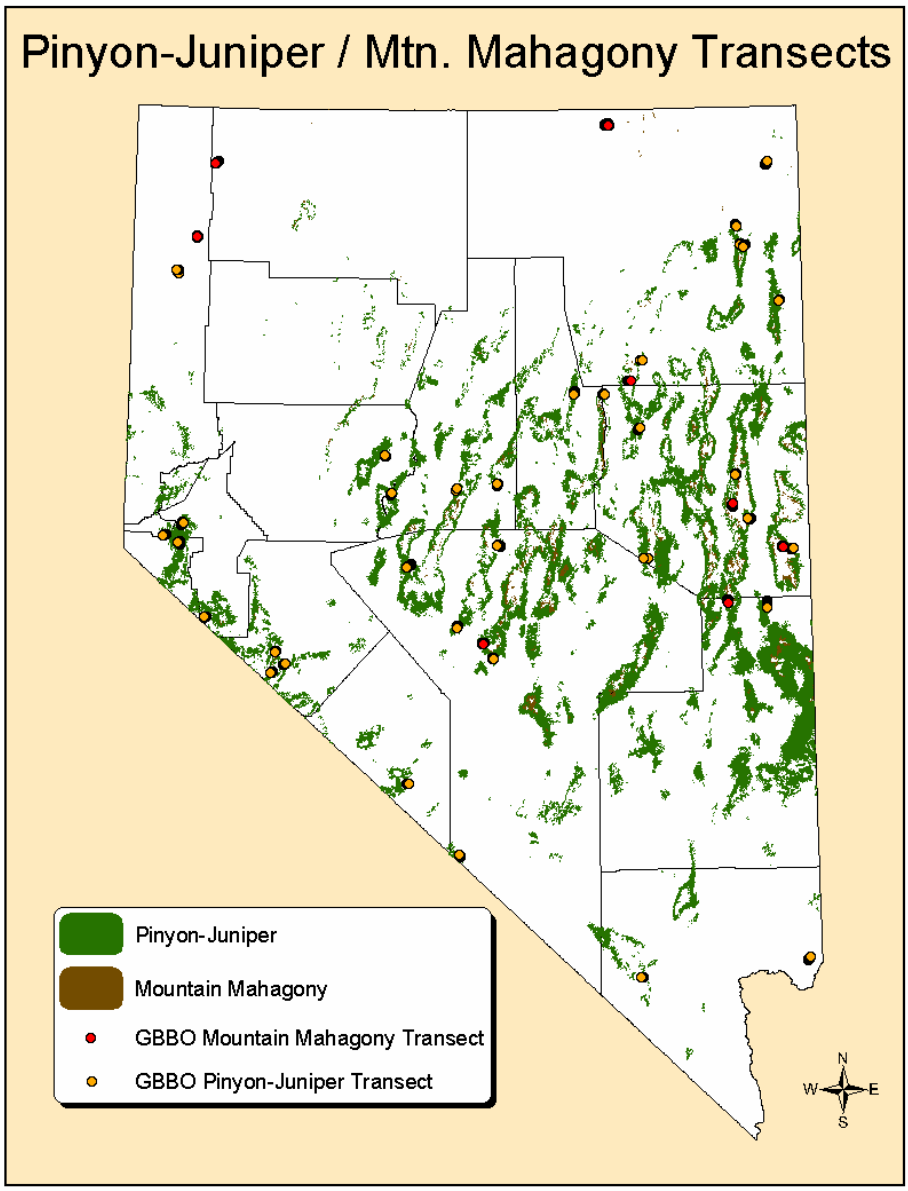
Figure 8: Mean number of Vesper Sparrow observations per transect in different habitat types. Error bars indicate standard error of the mean. Data from GBBO's Nevada Bird Count program, 2002 and 2003.



Pinyon-Juniper and Mountain Mahogany

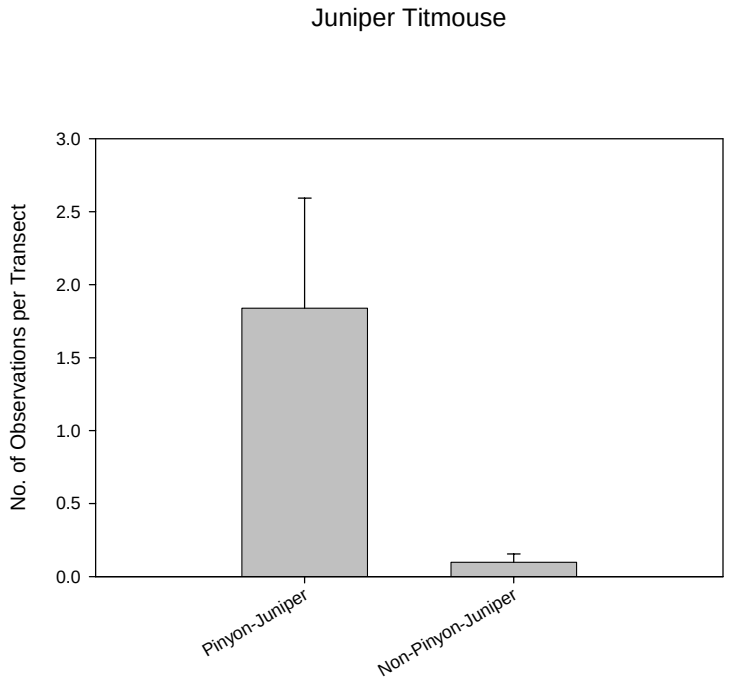
Pinyon-juniper is widely distributed throughout the Great Basin portion of Nevada and, less so, through the Mojave region (Fig. 9). It is most abundant in the east-central portion of the state and ranks high in conservation priority, because its distribution may be undergoing changes that affect habitat quality for pinyon-juniper and sagebrush associated birds. Even though Mountain Mahogany is usually in the same basic vegetation zone as pinyon-juniper, it was analyzed separately to study effects it alone may have on bird abundances.

Figure 9: Distribution of pinyon-juniper and Mountain Mahogany in Nevada. Based on GAP vegetation cover types.



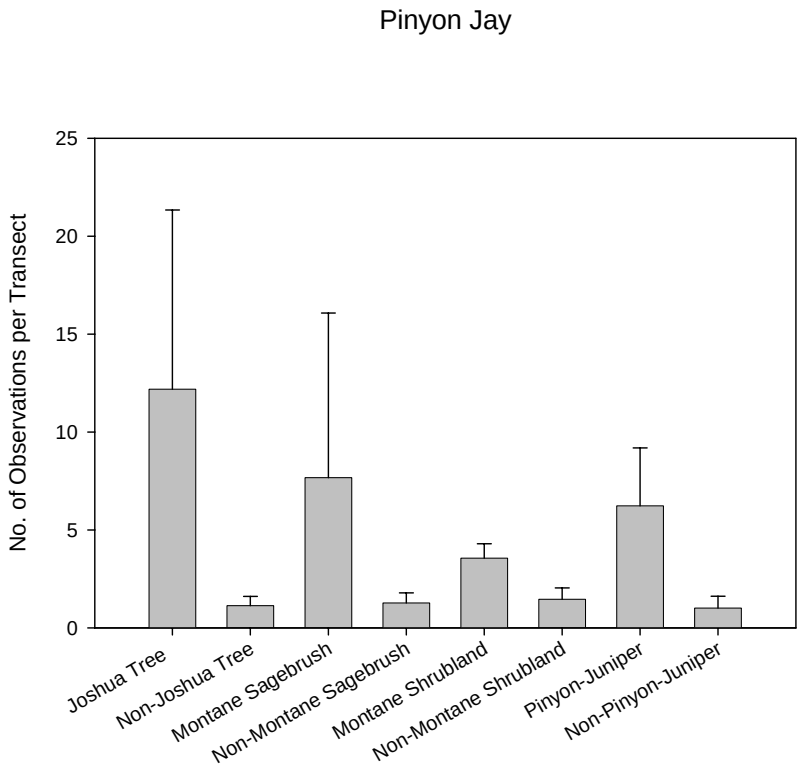
Priority species of pinyon-juniper and Mountain Mahogany that were sufficiently sampled by NBC in 2002/2003 include Juniper Titmouse, Black-throated Gray Warbler, Pinyon Jay, Gray Flycatcher, Western Bluebird and Scott's Oriole. Gray Flycatcher is discussed in the section on sagebrush (above), Western Bluebird in the section on lowland riparian (below), and Scott's Oriole under Mojave Scrub (below). Juniper Titmouse tended to be more abundant in pinyon-juniper than in other habitat types, but the association needs to be confirmed with future surveys (Fig. 10; $p = 0.021$). No other differences in abundance among habitat types were detected for this species ($p > 0.1$).

Figure 10: Mean number of Juniper Titmouse observations per transect in different habitat types. Error bars indicate standard error of the mean. Data from GBBO's Nevada Bird Count program, 2002 and 2003.



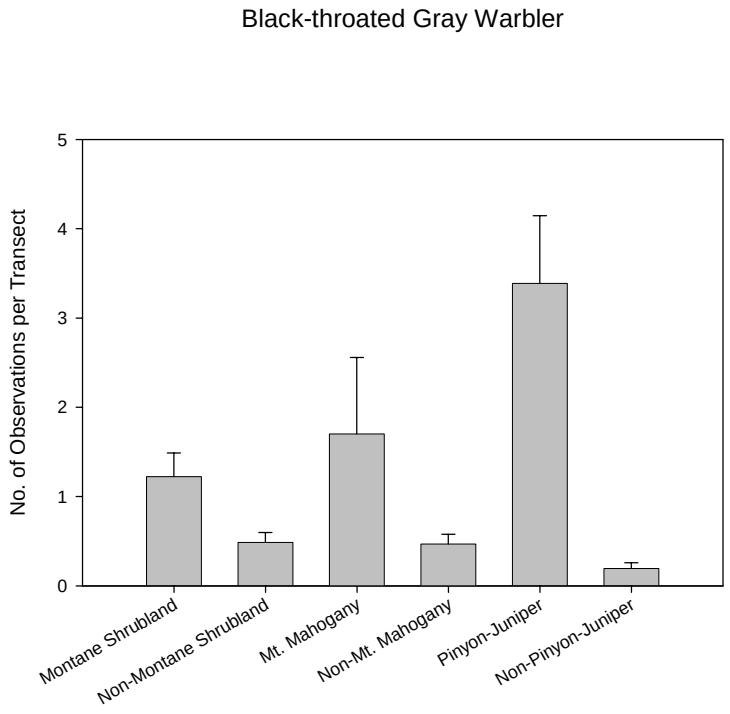
Pinyon Jays are often considered the classic pinyon-juniper associated bird. Interestingly, the NBC data collected thus far show a greater flexibility in habitat use than its name suggests. Average abundances in Nevada were similarly high in Joshua tree and montane sagebrush as in pinyon-juniper transects (Fig. 11). A comparison between pinyon-juniper and all other habitat types showed no difference in Pinyon Jay abundance ($p > 0.1$), and only in Joshua tree transects, abundances were higher than in all others ($p < 0.0001$). In southern regions, similar flexibility in habitat association has been reported elsewhere (Balda 2002). Whether these habitat associations are temporary, and whether they are related to pine crop cycles as often speculated, remains to be studied during longer-term implementation of the NBC.

Figure 11: Mean number of Pinyon Jay observations per transect in different habitat types. Error bars indicate standard error of the mean. Data from GBBO's Nevada Bird Count program, 2002 and 2003.



Black-throated Gray Warblers were approximately six to seven times more abundant in pinyon-juniper transects than in all others (Fig. 12, $p < 0.0001$). They also tended to be associated with Mountain Mahogany ($p = 0.048$), but less significantly so.

Figure 12: Mean number of Black-throated Gray Warbler observations per transect in different habitat types. Error bars indicate standard error of the mean. Data from GBBO's Nevada Bird Count program, 2002 and 2003.



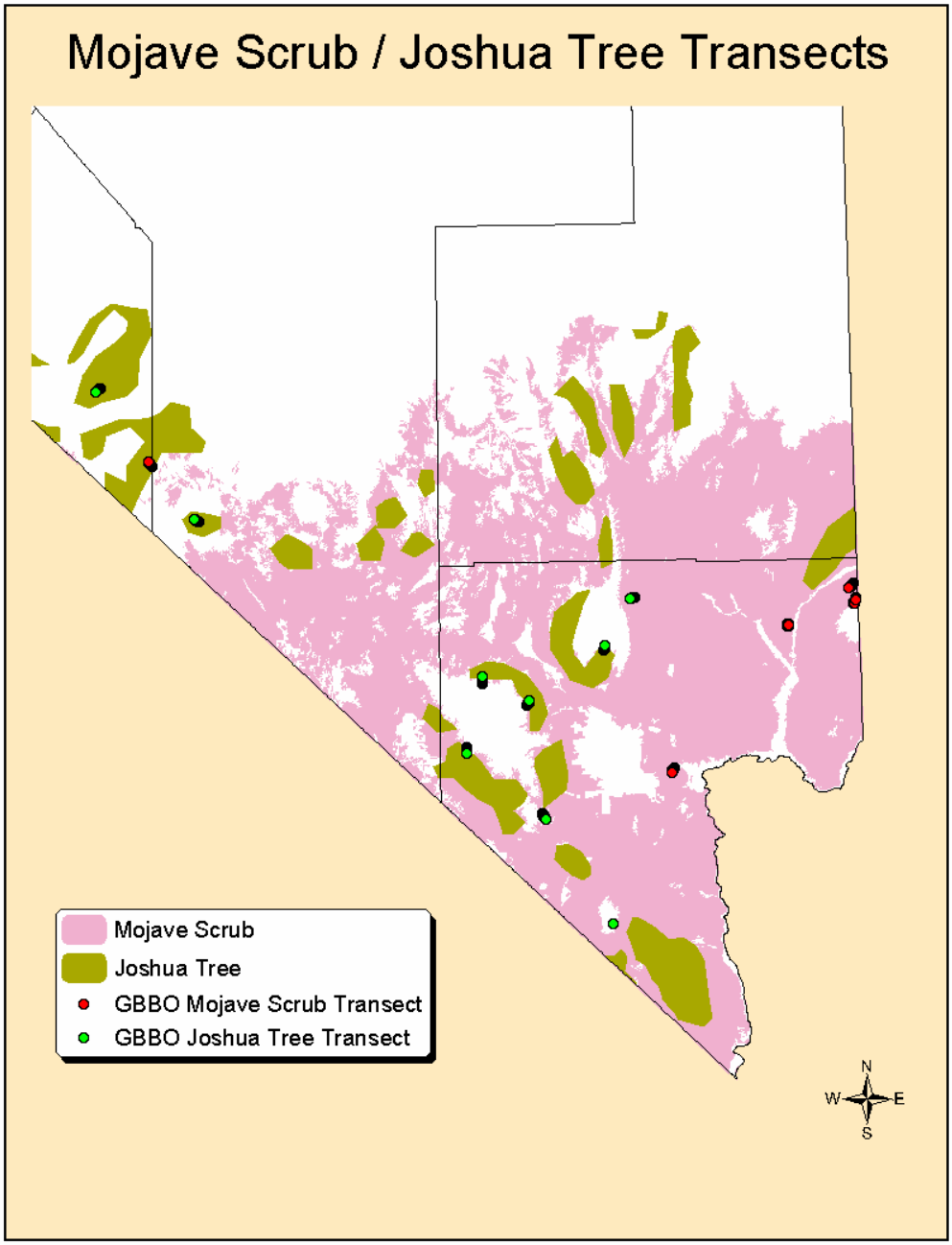
Salt Desert

None of the NVPIF priority species were associated with salt desert. Only Horned Lark appeared more abundant in this habitat type (mean = 10 birds per transect) than in all other habitat types (mean = 2 birds per transect). Black-throated Sparrow was also slightly more often recorded in salt desert transects (mean = 4.8 birds per transect) than in other habitat types (mean = 2.4 birds per transect). Overall, salt desert is the most species-poor habitat type surveyed in the NBC program, with generally less than 10 species observed per transect.

Mojave Scrub and Joshua Tree

The southern region of Nevada is predominantly covered by Mojave scrub, which in some areas transitions into Joshua tree stands (Fig. 13). The added component of Joshua trees is important to arboreal species, such as Scott's Oriole or Pinyon Jay. A total of 11 transects were surveyed in Joshua tree stands, while five were surveyed in Mojave scrub.

Figure 13: Distribution of Joshua tree and Mojave scrub in southern Nevada. Only the southern third of the state illustrated. Based on GAP vegetation cover types.



Loggerhead Shrike abundances were higher in Mojave scrub ($p = 0.003$) and Joshua tree ($p = 0.009$) areas than in other habitat types (Fig. 14). While this species was also recorded in a variety of other habitat types, it did not show any specific affinity to them based on these data. Scott's Oriole was also associated with both of these habitats (Mojave scrub: $p = 0.006$; Joshua tree: $p < 0.0001$), as well as with montane shrublands ($p < 0.0001$), when compared with all other habitat types (Fig. 15). Pinyon Jay, which is generally considered a pinyon-juniper obligate was also most noticeably associated with Joshua tree ($p < 0.0001$) and somewhat associated with montane sagebrush ($p = 0.033$). More specific Pinyon Jay results are reported in the Pinyon-Juniper section (above).

Figure 14: Mean number of Loggerhead Shrike observations per transect in different habitat types. Error bars indicate standard error of the mean. Data from GBBO's Nevada Bird Count program, 2002 and 2003.

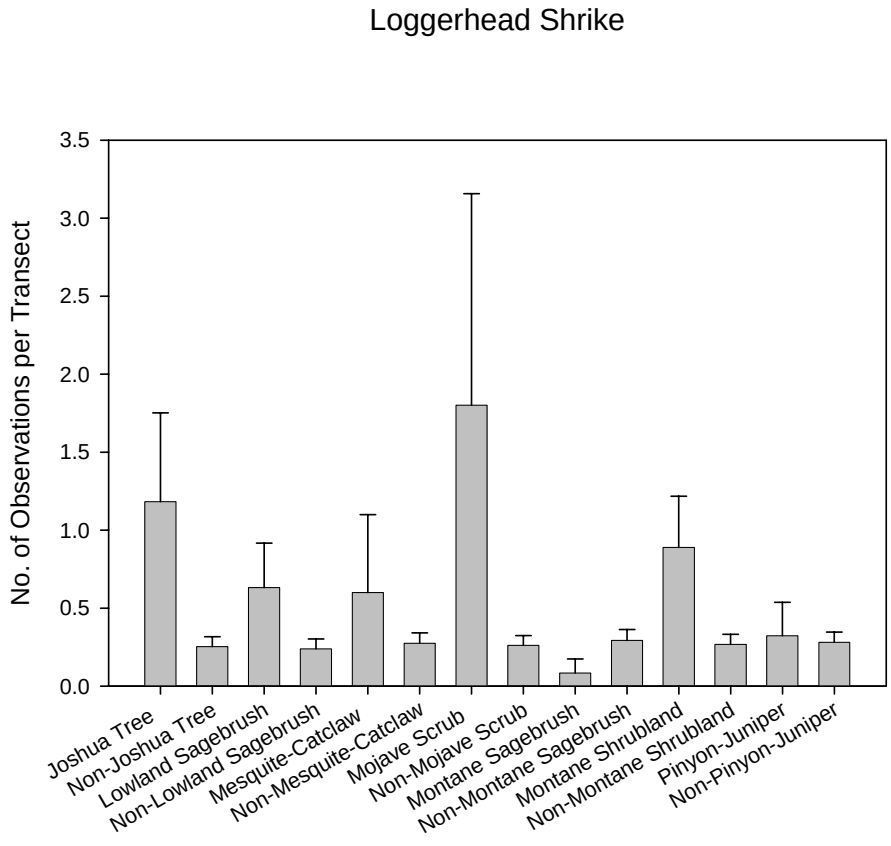
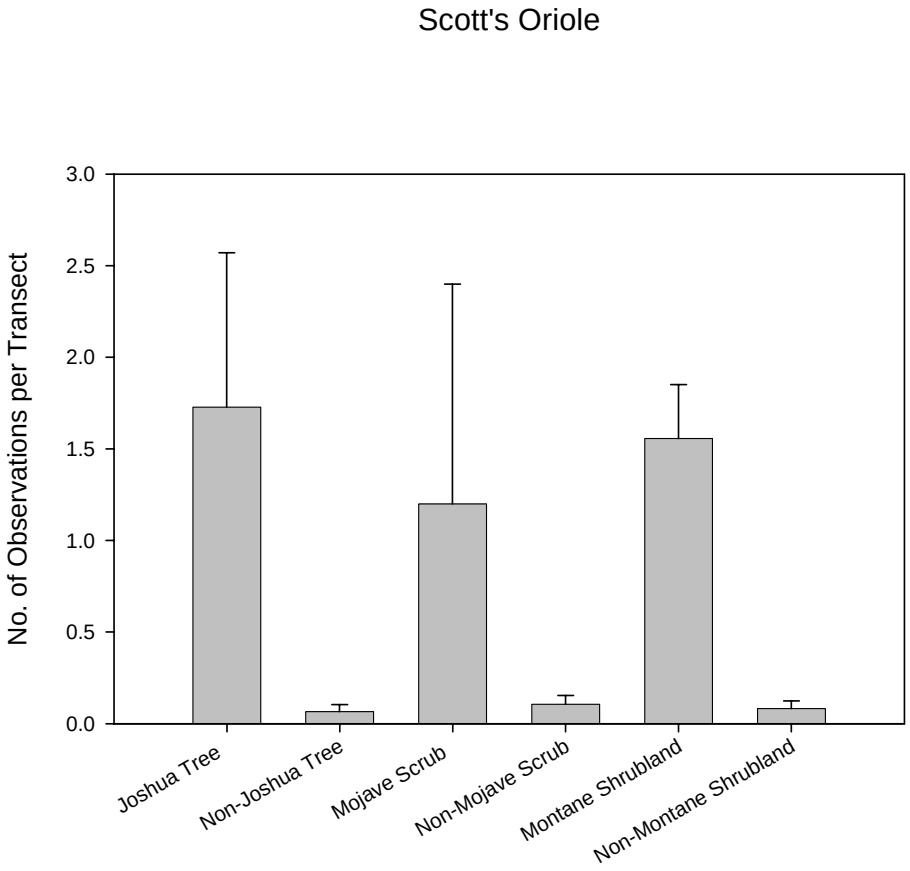


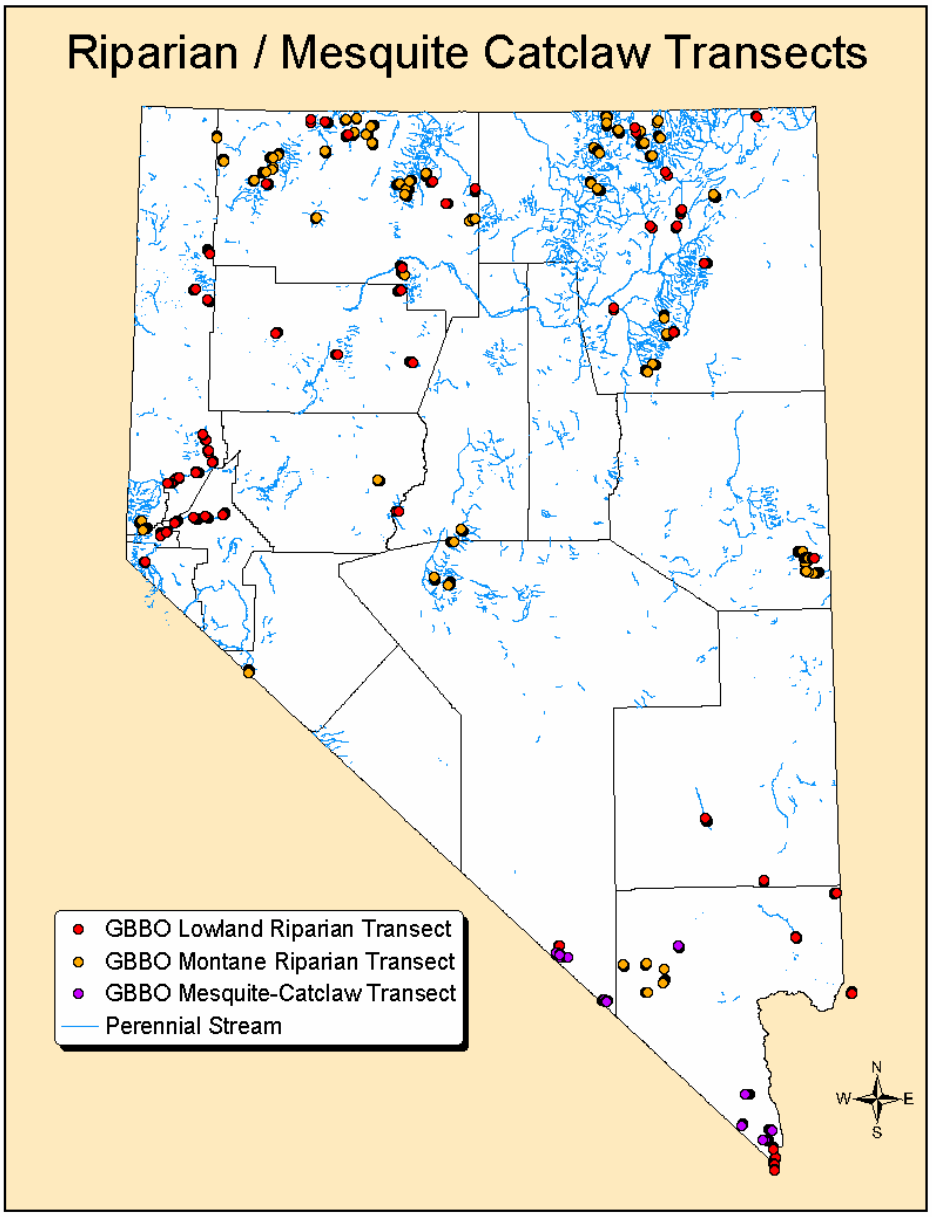
Figure 15: Mean number of Scott's Oriole observations per transect in different habitat types. Error bars indicate standard error of the mean. Data from GBBO's Nevada Bird Count program, 2002 and 2003.



Lowland Riparian

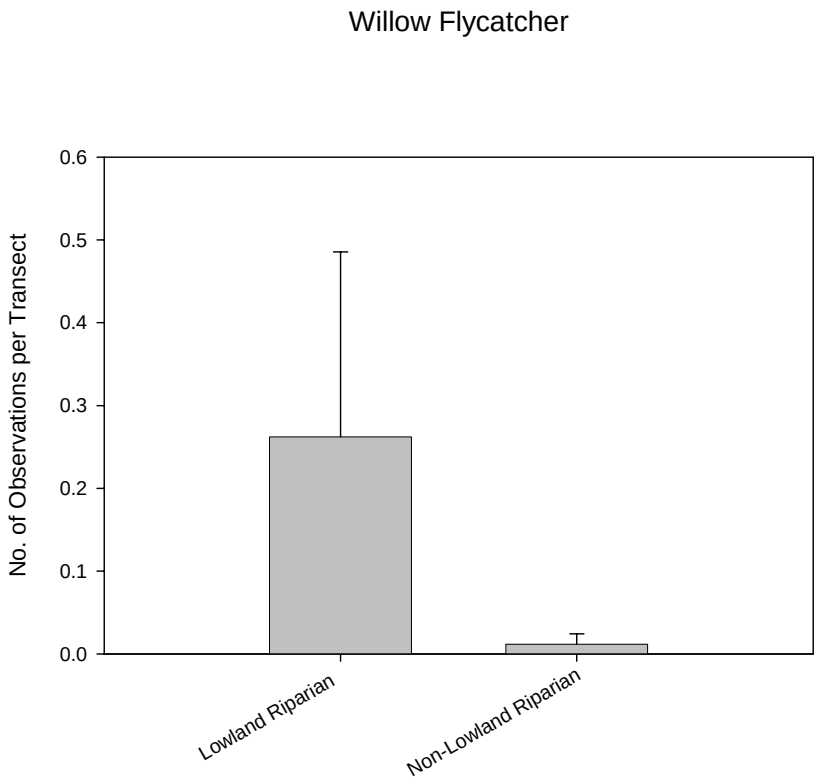
With 61 transects surveyed, riparian was one of the best-sampled habitat types of the NBC's first two years (Fig. 16). This habitat type supports the greatest number of NVPIF's conservation priority species and other species of potential concern.

Figure 16: Distribution of riparian areas and mesquite-catclaw in Nevada. Based on GAP vegetation cover types and perennial streams of Nevada.



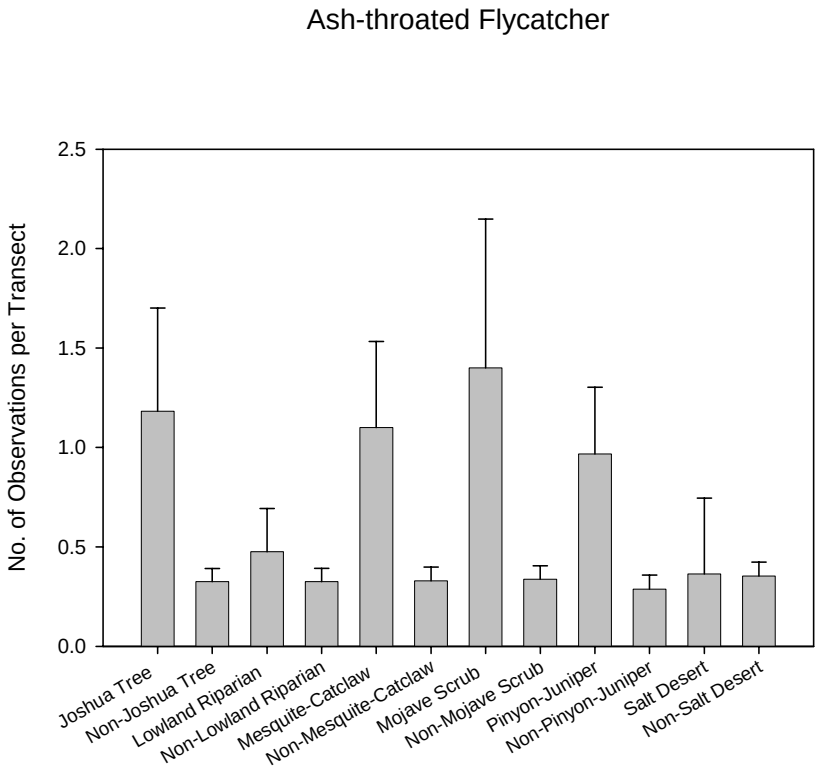
Willow Flycatchers in Nevada include the endangered Southwestern subspecies, primarily found in the Mojave region, and two other subspecies in the Great Basin. Interestingly, most reports of Willow Flycatcher from NBC point counts were from the Mojave region, reflecting how uncommon this species is in the central Great Basin. As its name suggests, it is typically found in willow thickets along streams, wetlands, and reservoirs, but no statistically clear association with lowland riparian areas was found in the NBC data ($p > 0.1$; Fig. 17). This was likely a result of the overall low sample size (19 observations).

Figure 17: Mean number of Willow Flycatcher observations per transect in different habitat types. Error bars indicate standard error of the mean. Data from GBBO's Nevada Bird Count program, 2002 and 2003.



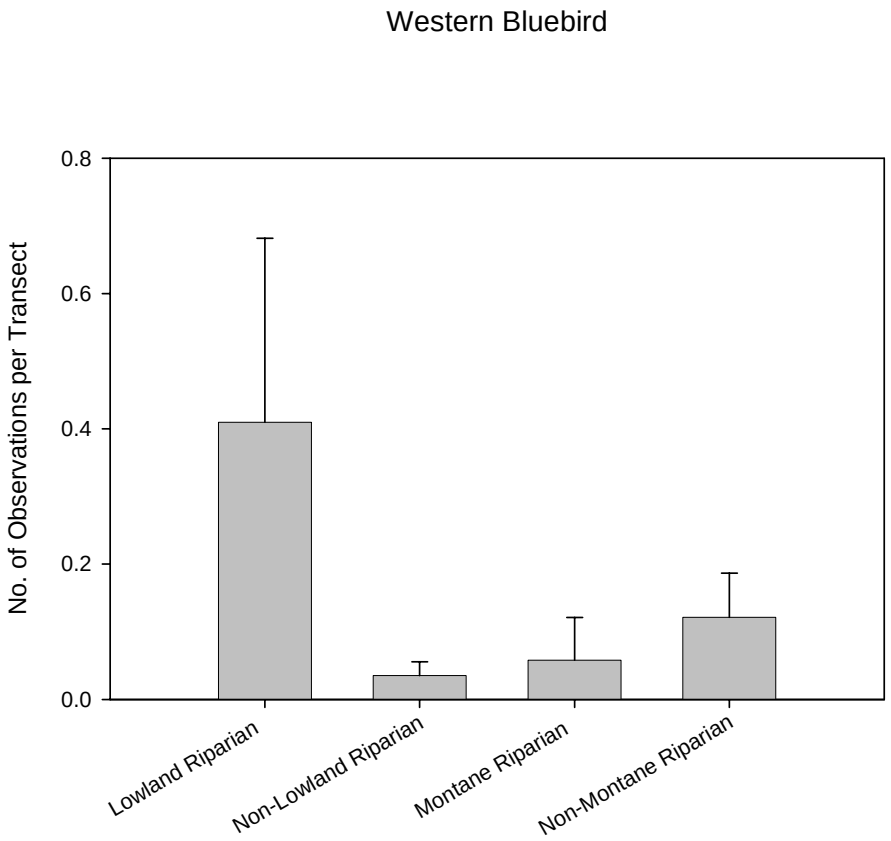
Ash-throated Flycatcher is often described as a riparian-associated species in the Great Basin and Mojave regions. However, the NBC data suggest otherwise, with no greater Ash-throated Flycatcher abundances in lowland riparian areas than all other habitats ($p > 0.1$), but instead, about 3-times greater abundances in Joshua tree ($p = 0.0019$) and in Pinyon-Juniper ($p = 0.005$; Fig. 18).

Figure 18: Mean number of Ash-throated Flycatcher observations per transect in different habitat types. Error bars indicate standard error of the mean. Data from GBBO's Nevada Bird Count program, 2002 and 2003.



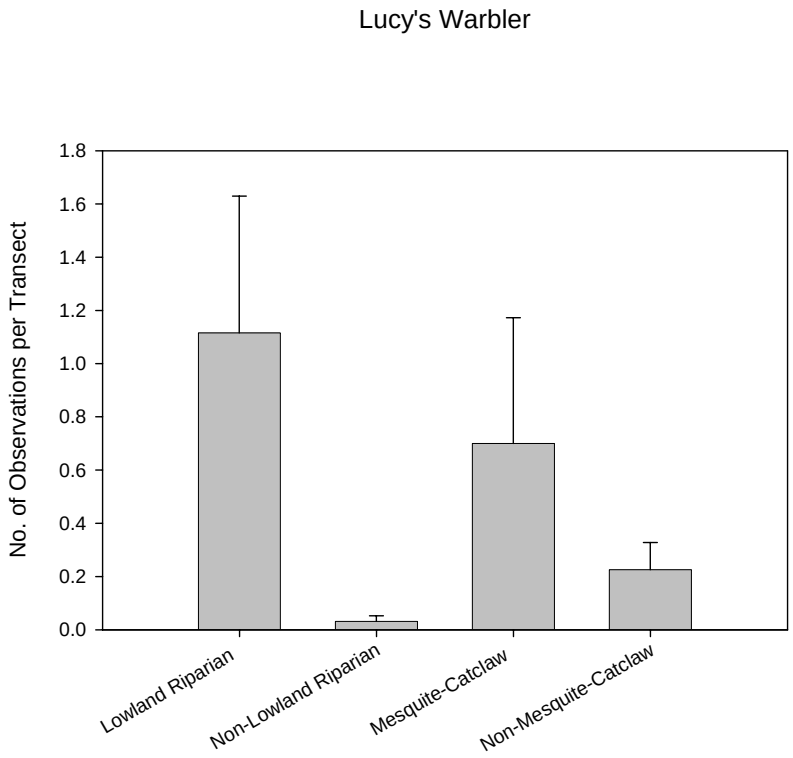
Although Western Bluebirds were most often reported for lowland riparian transects (Table 4), their abundances were not statistically distinguishable among habitat types (Fig. 19; $p > 0.1$). However, they were only observed in lowland riparian, mesquite-catclaw, coniferous forest, and montane riparian transects, suggesting a close association with arboreal habitats and watercourses.

Figure 19: Mean number of Western Bluebird observations per transect in different habitat types. Error bars indicate standard error of the mean. Data from GBBO's Nevada Bird Count program, 2002 and 2003.



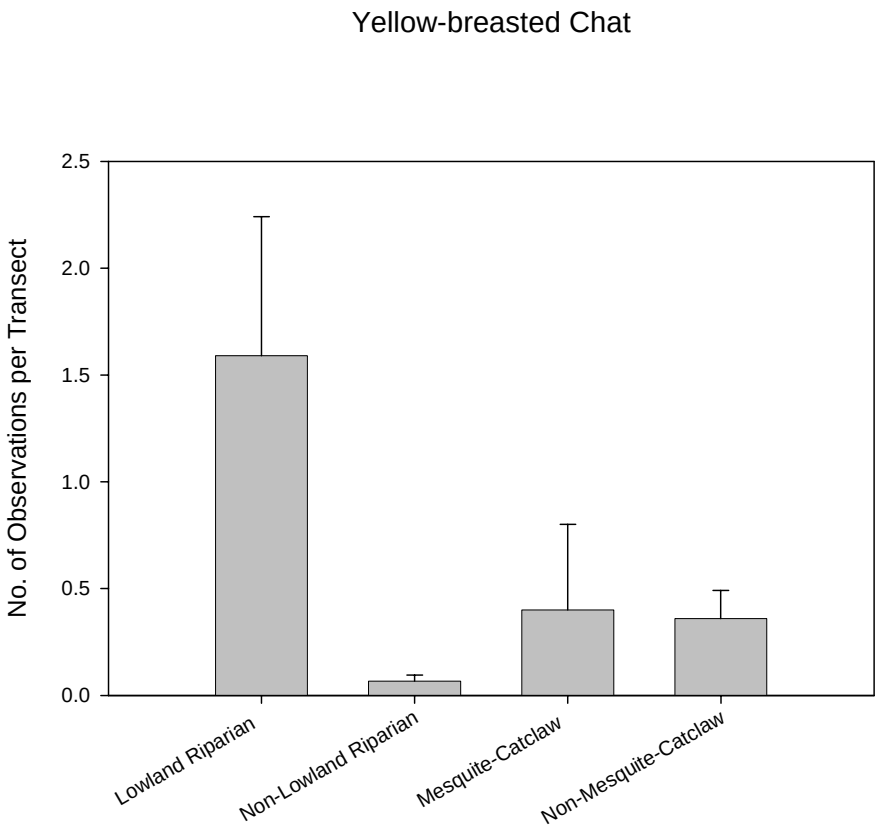
Lucy's Warbler tended to be more abundant in lowland riparian areas than all other habitat types (Fig. 20, $p = 0.036$) and were also reported for mesquite-catclaw areas. Lucy's Warbler is one of the very few North American warblers that nest in cavities and they are considered a specialist of mesquite-riparian habitat types (Johnson et al. 1997). Additional data are needed for the Mojave region to clarify their habitat associations in Nevada.

Figure 20: Mean number of Lucy's Warbler observations per transect in different habitat types. Error bars indicate standard error of the mean. Data from GBBO's Nevada Bird Count program, 2002 and 2003.



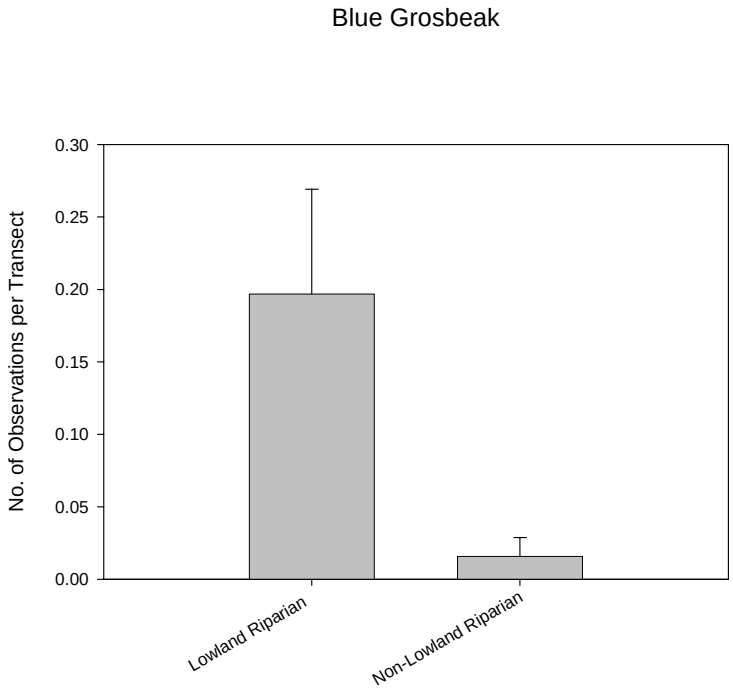
Yellow-breasted Chats were eight times more abundant in lowland riparian areas than in other habitats (Fig. 21, $p = 0.02$). They are generally considered a species sensitive to riparian habitat degradation, and their numbers in the Great Basin and Mojave region are low. For instance, among nine transects on the lower Truckee River, the Yellow-breasted Chat could only be confirmed in two single locations during the breeding season. Additional surveys are needed to confirm their habitat associations and determine habitat suitability.

Figure 21: Mean number of Yellow-breasted Chat observations per transect in different habitat types. Error bars indicate standard error of the mean. Data from GBBO's Nevada Bird Count program, 2002 and 2003.



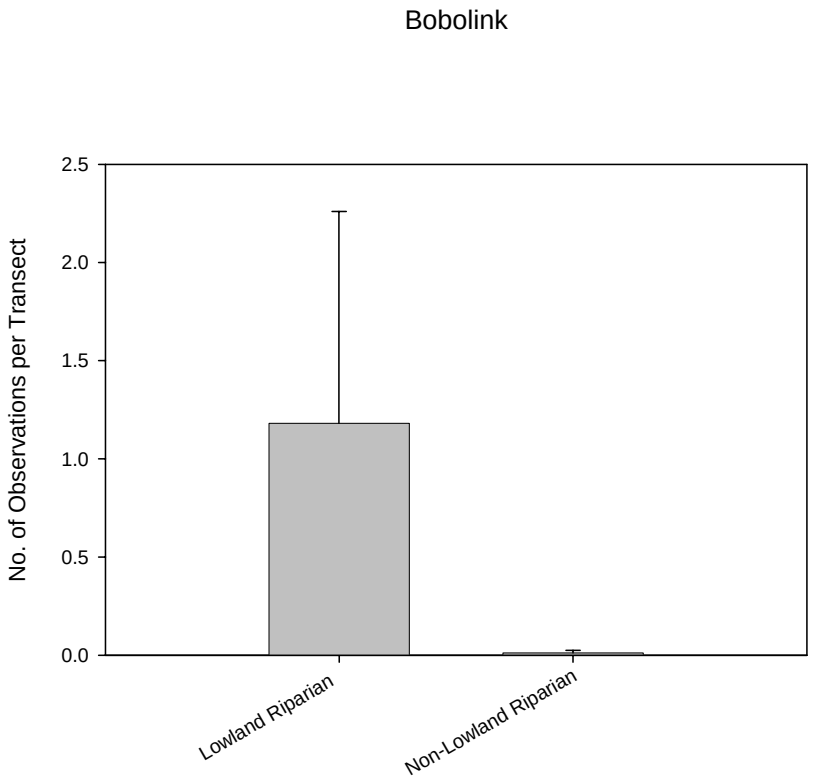
Blue Grosbeak was detected rarely during the 2002/2003 NBC surveys. Most observations were reported from lowland riparian transects from the Mojave region, but a greater sample size is needed to confirm the nature of its association with lowland riparian areas (Fig. 22, p = 0.013). Previous studies in the Mojave region suggested that this species is comparatively tolerant of many types of riparian habitat degradation (E. Ammon unpubl. data), but whether this is true in the southern Nevada region needs to be determined during future NBC surveys.

Figure 22: Mean number of Blue Grosbeak observations per transect in different habitat types. Error bars indicate standard error of the mean. Data from GBBO's Nevada Bird Count program, 2002 and 2003.



Bobolinks breed in moist and wet meadows that are naturally associated with lowland riparian areas and wetlands of the Great Basin. They also use irrigated agriculture that simulates these natural habitats. Bobolinks are uncommon in Nevada and were only observed along transects classified as lowland riparian or agricultural (Table 4). They nest in spatial proximity with each other in so-called breeding fields (Martin and Gavin 1995), which makes a statistical comparison of abundances among transects difficult. Therefore, even though they were most often found in riparian and agricultural areas, mean abundances were statistically indistinguishable among habitat types (Fig. 23, $p > 0.1$).

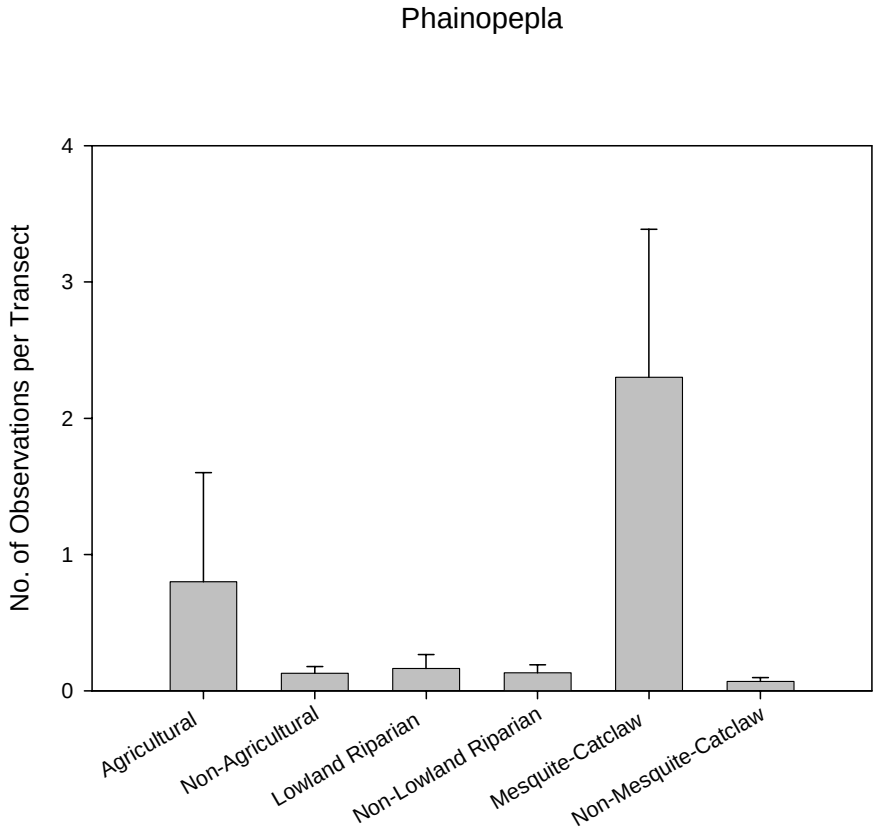
Figure 23: Mean number of Bobolink observations per transect in different habitat types. Error bars indicate standard error of the mean. Data from GBBO's Nevada Bird Count program, 2002 and 2003.



Mesquite-Catclaw

Phainopepla is a classic mesquite-catclaw associated species, with abundances about ten times greater in these habitats than in others (Fig. 24, $p < 0.0001$). Ash-throated Flycatcher and Bendire's Thrasher may also have some association with this habitat type, but additional data are needed for clarification. Mesquite-catclaw habitat can form a riparian woodland, in which case it supports other lowland riparian birds, for example Lucy's Warbler, Yellow-breasted Chat, and Common Yellowthroat. Other stands that are not necessarily associated with open water support Verdins, Crissal Thrashers, and Gambel's Quail (Table 4). Birds that are associated with more arid landscapes such as Mojave scrub (e.g., Le Conte's Thrasher) may also use mesquite-catclaw habitats, possibly as a result of resource shortages in their primary habitat types. However, this hypothesis needs further study.

Figure 24: Mean number of Phainopepla observations per transect in different habitat types. Error bars indicate standard error of the mean. Data from GBBO's Nevada Bird Count program, 2002 and 2003.



Wilson's Warbler was most often observed in mesquite-catclaw habitats of the Mojave region (Table 4). This species breeds in montane and subalpine riparian areas (Ammon and Gilbert 1999), and for Nevada breeding has only been confirmed for the western-most section (Sierra Nevada region; Ted Floyd pers. comm.). Scattered breeding populations may also occur in the north-western and north-eastern corners of the state. Therefore, the reports of Wilson's Warblers in mesquite-catclaw were most likely observations of migrant individuals.

Aspen

Seventeen NBC transects surveyed in 2002/2003 were located in aspen. Lewis's Woodpecker and Red-naped Sapsucker were more abundant ($p = 0.005$ for both) in aspen transects than transect in other habitats (Fig. 25 and 26). Red-naped Sapsucker also tended to be more abundant in Mountain Mahogany transects than all other habitats ($p = 0.021$). Other habitat effects described in Figures 25 and 26 are not statistically meaningful ($p > 0.05$).

Figure 25: Mean number of Lewis's Woodpecker observations per transect in different habitat types. Error bars indicate standard error of the mean. Data from GBBO's Nevada Bird Count program, 2002 and 2003.

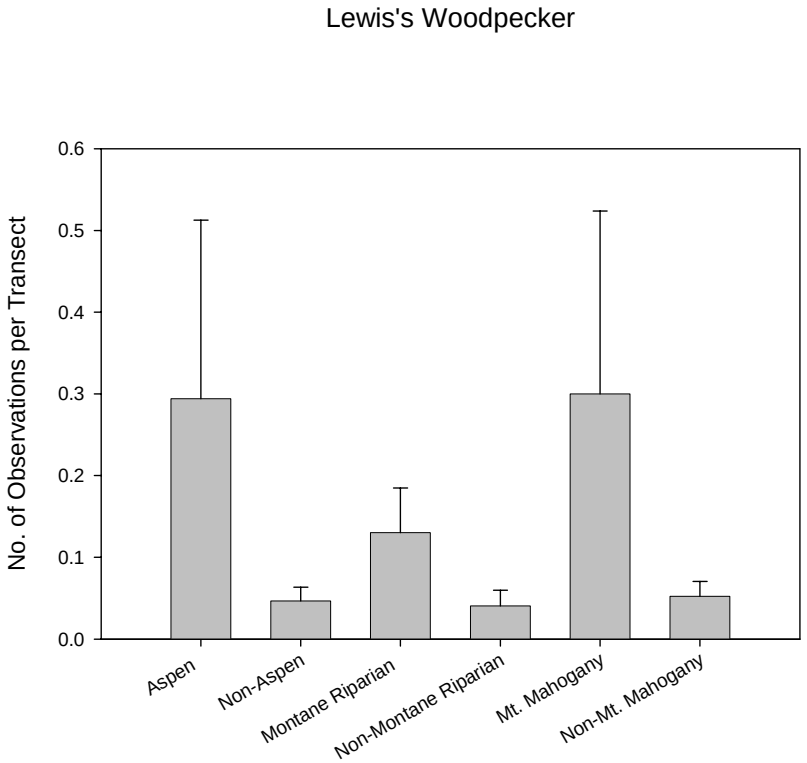
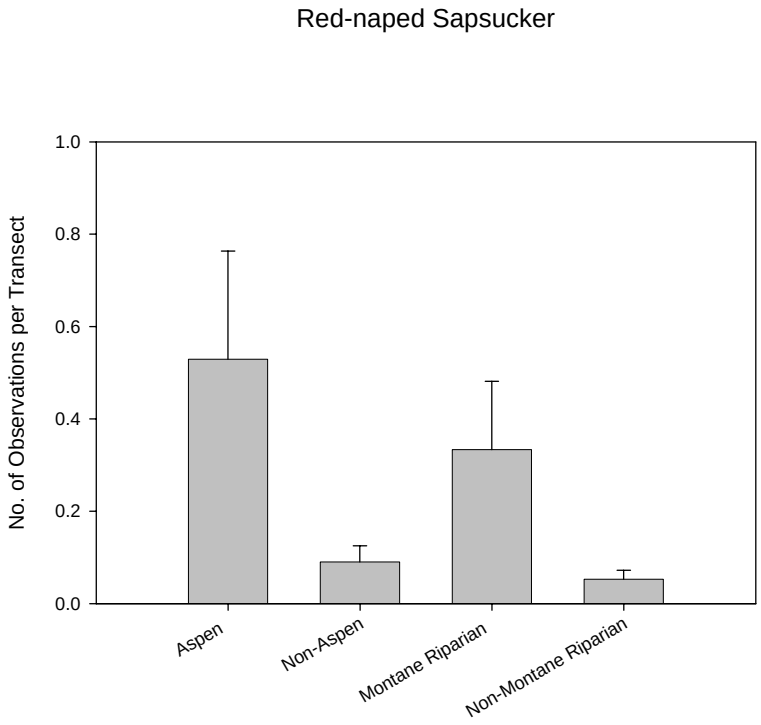


Figure 26: Mean number of Red-naped Sapsucker observations per transect in different habitat types. Error bars indicate standard error of the mean. Data from GBBO's Nevada Bird Count program, 2002 and 2003.



Both Orange-crowned and MacGillivray's warblers were associated with aspen transects (both at $p < 0.0001$; Fig. 27 and 28). Unlike Orange-crowned, MacGillivray's Warbler also tended to be more common in montane riparian habitats than all other habitats combined ($p = 0.002$; Fig. 28).

Figure 27: Mean number of Orange-crowned Warbler observations per transect in different habitat types. Error bars indicate standard error of the mean. Data from GBBO's Nevada Bird Count program, 2002 and 2003.

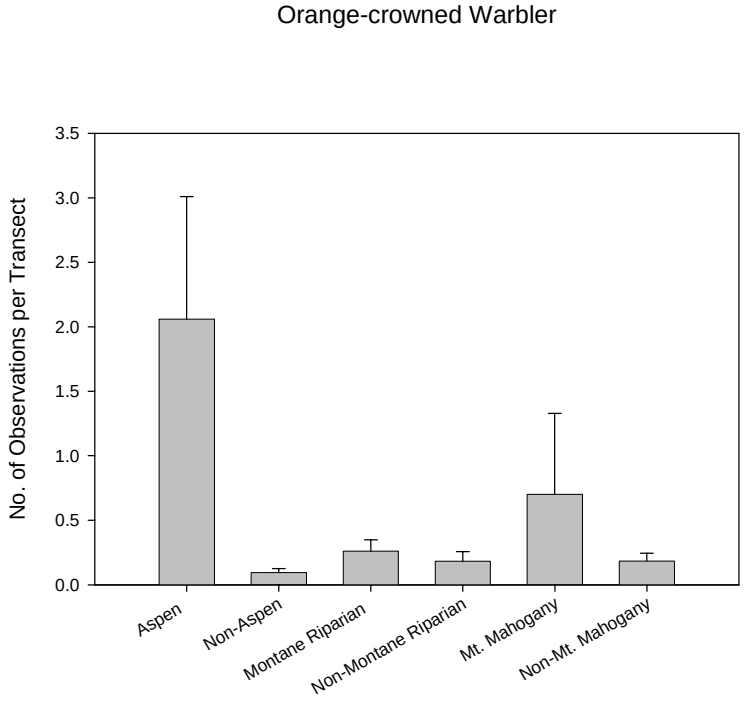
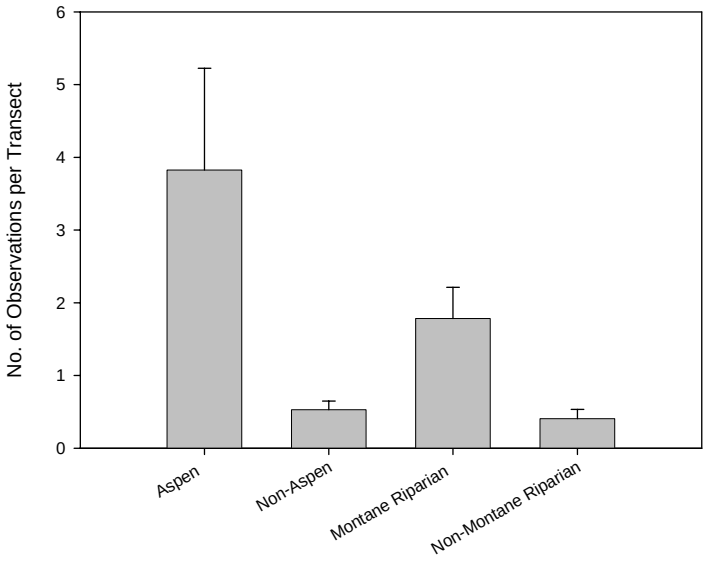


Figure 28: Mean number of MacGillivray's Warbler observations per transect in different habitat types. Error bars indicate standard error of the mean. Data from GBBO's Nevada Bird Count program, 2002 and 2003



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Coniferous Forest

Coniferous forests are fairly sparse in Nevada (Fig. 29), but they provide habitats for a variety of bird species of conservation priority, such as Olive-sided Flycatcher, Western Bluebird, Grace's Warbler, Lewis's Woodpecker, and Red-naped Sapsucker (Neel 1999). Thirteen point count transects were surveyed in coniferous forest habitats during 2002 and 2003. Olive-sided Flycatchers and Grace's Warbler were more abundant in coniferous forests than other habitat types (both $p < 0.0001$; Fig. 30 and 31), although total number of sightings were overall low and the findings need to be confirmed in future surveys. Several mountain ranges have not yet been included in the initial survey effort by NBC and should be targeted in future efforts (Fig. 29).

Figure 29: Distribution of coniferous forests in Nevada. Based on GAP vegetation cover types.

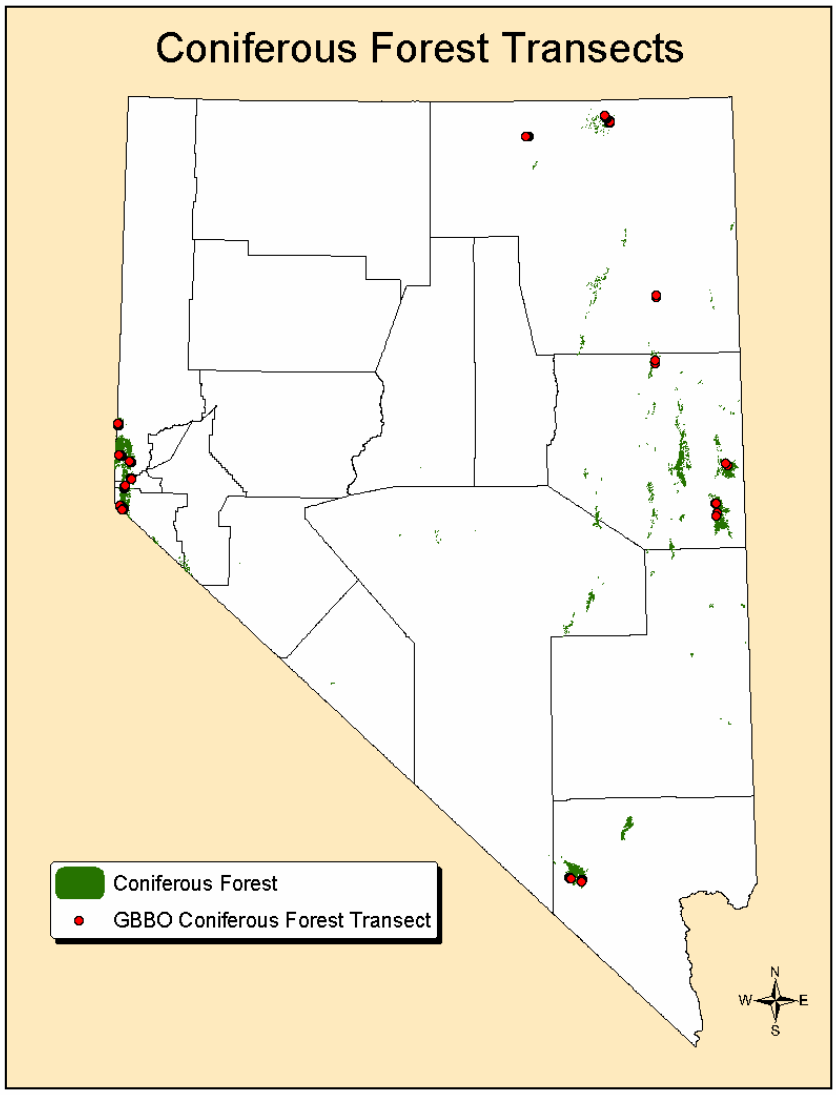


Figure 30: Mean number of Olive-sided Flycatcher observations per transect in different habitat types. Error bars indicate standard error of the mean. Data from GBBO's Nevada Bird Count program, 2002 and 2003.

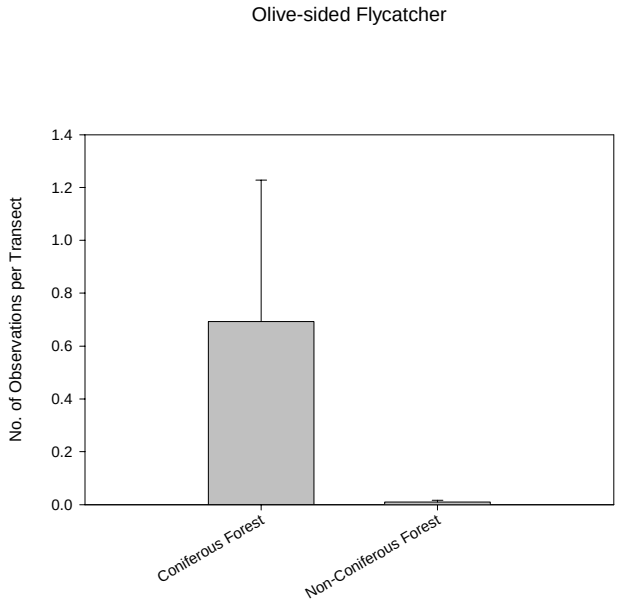
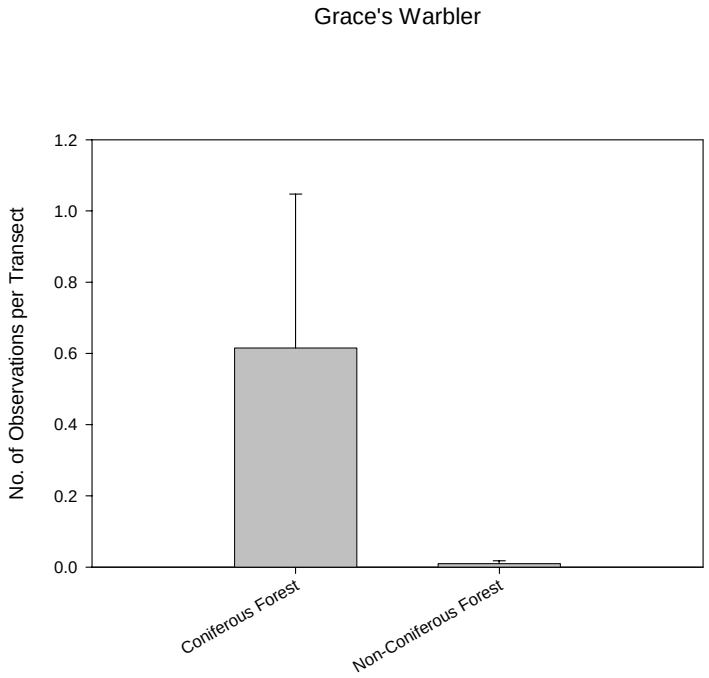


Figure 31: Mean number of Grace's Warbler observations per transect in different habitat types. Error bars indicate standard error of the mean. Data from GBBO's Nevada Bird Count program, 2002 and 2003.



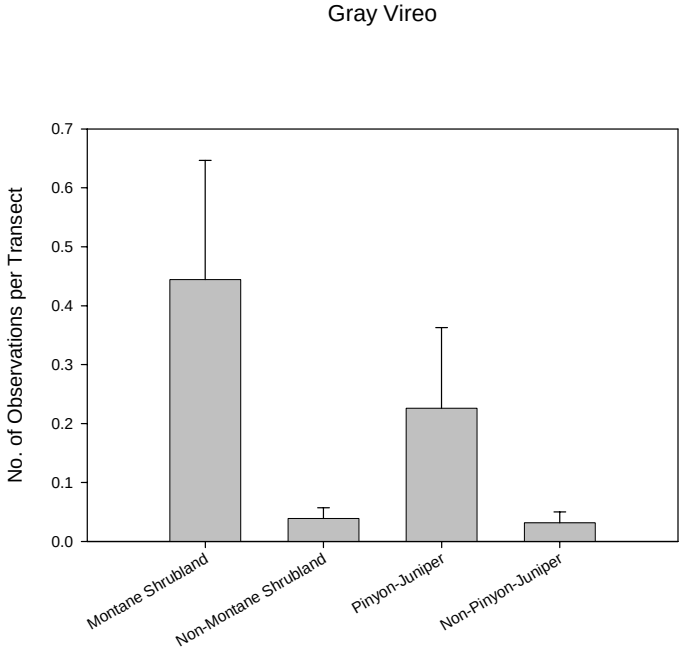
Montane Riparian

Montane riparian areas in Nevada consist of mostly shrub-willow and aspen dominated areas along streams. They are linear habitats and rarely exceed 20 – 30 m in corridor width. Nonetheless, several priority and associated species use montane riparian areas, including Greater Sage-grouse, Cooper's Hawk, Northern Goshawk, and Lewis's Woodpecker. Despite a good sample size (n = 69), few species could be confirmed to be positively associated with montane riparian areas. MacGillivray's Warbler is approximately three times more abundant in montane riparian areas than other habitats (p = 0.002; see results in Aspen section, above). Other species, such as Calliope Hummingbird and Lewis's Woodpecker showed only weak, statistically insignificant associations with this habitat type.

Montane Shrublands

Only four NVPIF priority species are thought to be associated with montane shrublands of Nevada, Black Rosy Finch, Calliope Hummingbird, Loggerhead Shrike, and Swainson's Hawk (Neel 1999). None of these associations could be confirmed with data from the first two years of the NBC program, partly because only seven transects were completed. However, the Gray Vireo appeared to be positively associated with this habitat type with approximately eight times greater abundances in montane shrublands compared with other habitat types (Fig. 32, p = 0.001). Similar results were reported for Scott's Oriole abundances in montane shrublands (see Mojave Scrub and Joshua Tree section, above).

Figure 32: Mean number of Gray Vireo observations per transect in different habitat types. Error bars indicate standard error of the mean. Data from GBBO's Nevada Bird Count program, 2002 and 2003.



Agricultural

Only five transects were surveyed in agricultural areas during 2002 and 2003, reflecting that overall, irrigated agriculture is a relatively minor component of the Nevada landscape, as well as the fact that landowner permission needs to be obtained prior to surveys. As the NBC program becomes established, an increasing number of agricultural sites will likely be included.

A number of species commonly thought to be associated with agricultural areas, such as Bobolinks, Long-billed Curlews, Sandhill Crane, and White-faced Ibis, were primarily found in wetland transects (see section below, Wetlands). This may be partly due to the currently low sample size for agricultural areas, but could also indicate that these species primarily depend on wetland areas in Nevada, where agriculture is sparse. Interestingly, European Starlings were not more abundant in agricultural sites than in all other habitats ($p > 0.1$), whereas House Sparrows were most abundant in agricultural areas ($p < 0.0001$; see results below: Disturbance-associated Species).

Wetlands

Wetlands are critically important for a variety of species, particularly waterfowl, other waterbirds, waders, rails, gulls and terns, and shorebirds. The priority species listed in NVPIF's Bird Conservation Plan for Nevada include White-faced Ibis, Snowy Plover, American Avocet, Black Tern, American White Pelican, Clark's Grebe, Long-billed Curlew, Short-eared Owl and Sandhill Crane. Because of their strict dependency on resources provided by wetlands, most of the species, for which sufficient sample sizes were reached in the NBC point count effort, were strongly positively associated with wetlands (e.g. White-faced Ibis, American Avocet, and Long-billed Curlew: Fig. 33 - 35, $p < 0.0001$ for all). American White Pelican, however, tended to be associated with lowland riparian areas during the point count season (Fig. 36, $p = 0.04$), suggesting that their foraging habits focus around rivers rather than wetlands at that time of the year.

Figure 33: Mean number of White-faced Ibis observations per transect in different habitat types. Error bars indicate standard error of the mean. Data from GBBO's Nevada Bird Count program, 2002 and 2003.

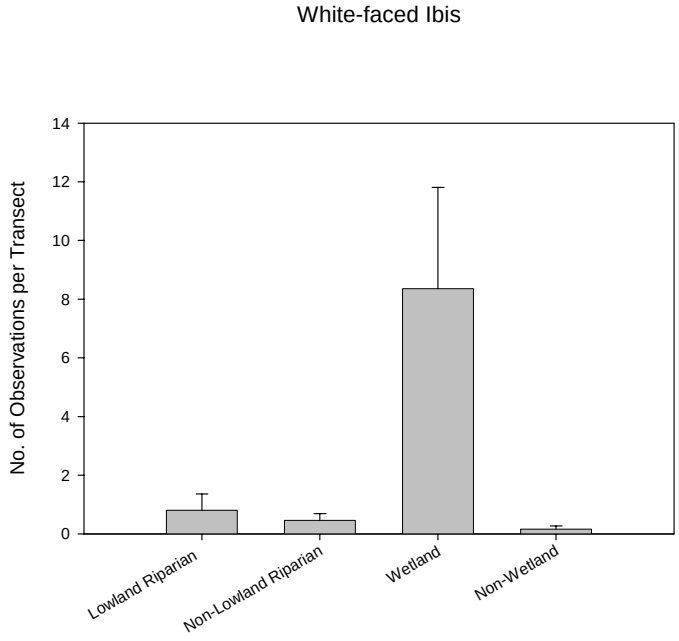


Figure 34: Mean number of American Avocet observations per transect in different habitat types. Error bars indicate standard error of the mean. Data from GBBO's Nevada Bird Count program, 2002 and 2003.

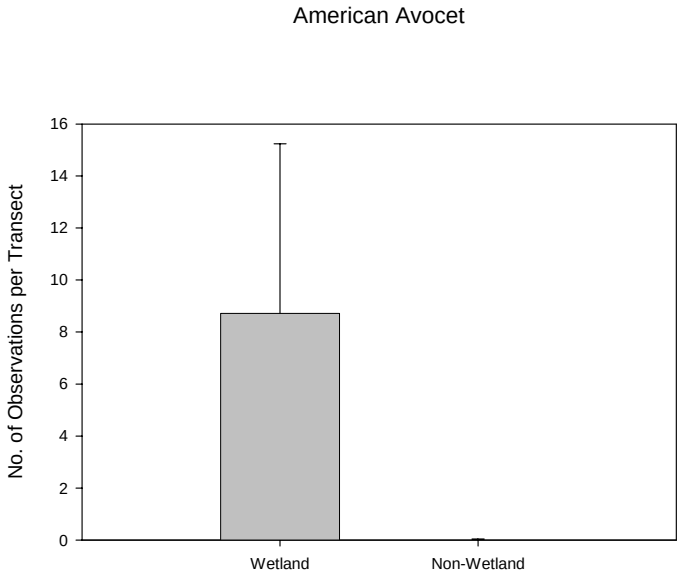


Figure 35: Mean number of Long-billed Curlew observations per transect in different habitat types. Error bars indicate standard error of the mean. Data from GBBO's Nevada Bird Count program, 2002 and 2003.

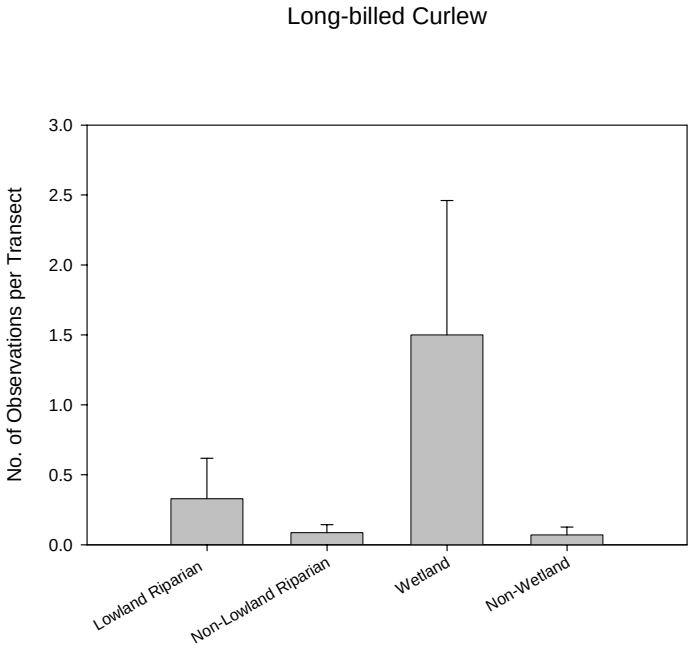
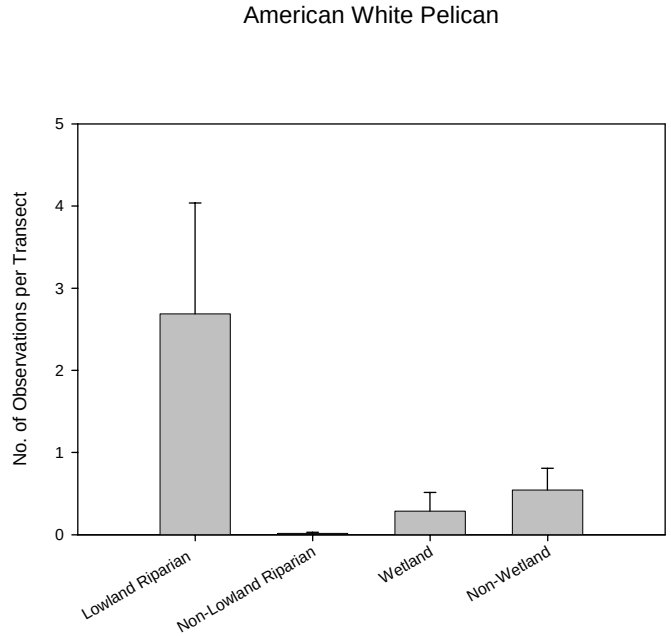


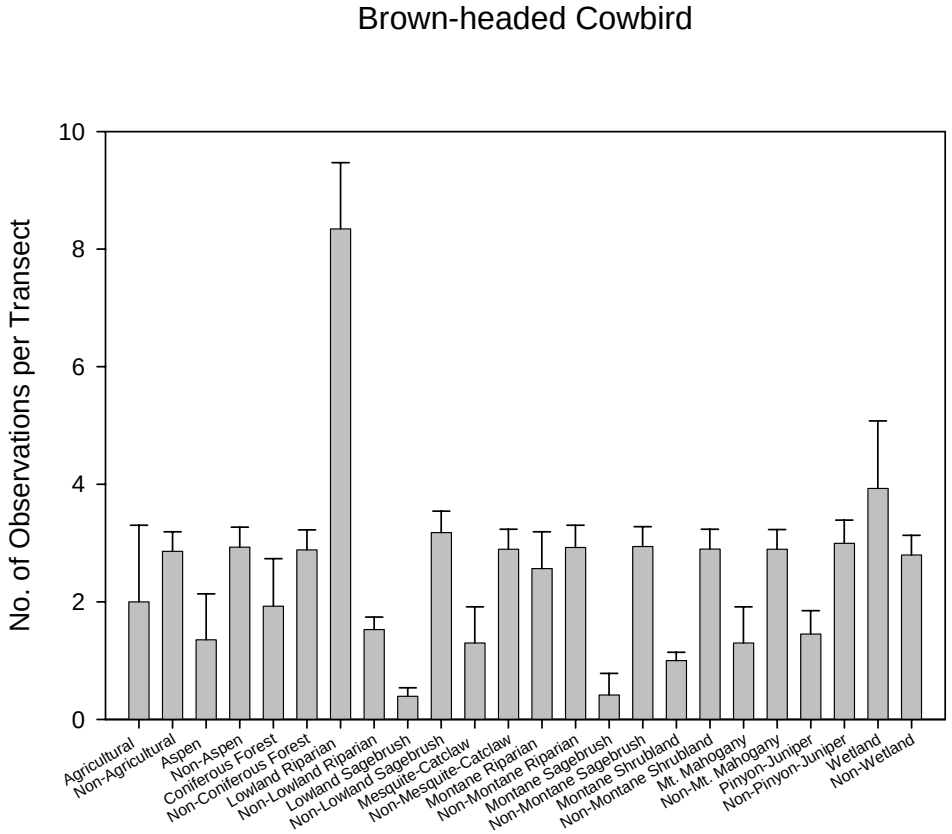
Figure 36: Mean number of American White Pelican observations per transect in different habitat types. Error bars indicate standard error of the mean. Data from GBBO's Nevada Bird Count program, 2002 and 2003.



Disturbance-Associated Bird Species

Some species are of concern to resource managers because they indicate a disturbance and are often suspected to have a negative impact on species of conservation concern. For instance, the Brown-headed Cowbird is a brood parasite that deposits its eggs into nests of native songbirds and relies on these hosts to raise its young, often at the expense of the host's own offspring. As their name suggests, cowbirds are often associated with livestock and more generally with disturbed areas. The NBC data can be used to characterize cowbird habitat use in Nevada, a preliminary indication of which bird communities may be most affected by cowbirds. Fig. 37 shows that cowbirds are almost three times as abundant in lowland riparian areas than all other habitats ($p < 0.0001$). Cowbirds may be avoiding other habitats, such as lowland and montane sagebrush where their abundances appeared lower than on average. Whether these abundance patterns match relative parasitism rates in these habitats will need to be determined with nest data.

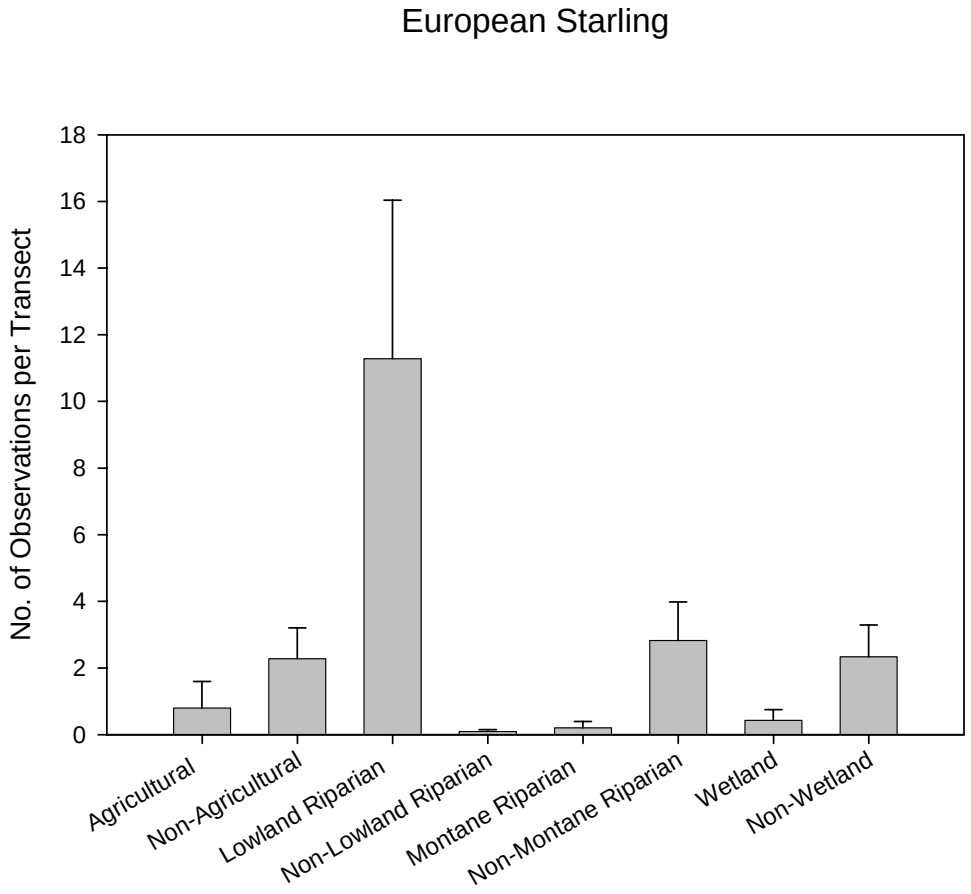
Figure 37: Mean number of Brown-headed Cowbird observations per transect in different habitat types. Error bars indicate standard error of the mean. Data from GBBO's Nevada Bird Count program, 2002 and 2003.



European Starlings were found in fewer habitat types than Brown-headed Cowbirds, but they too tended to be most abundant in lowland riparian areas (Fig. 38, $p = 0.019$). Interestingly, agricultural areas had low abundances of starlings, likely because they

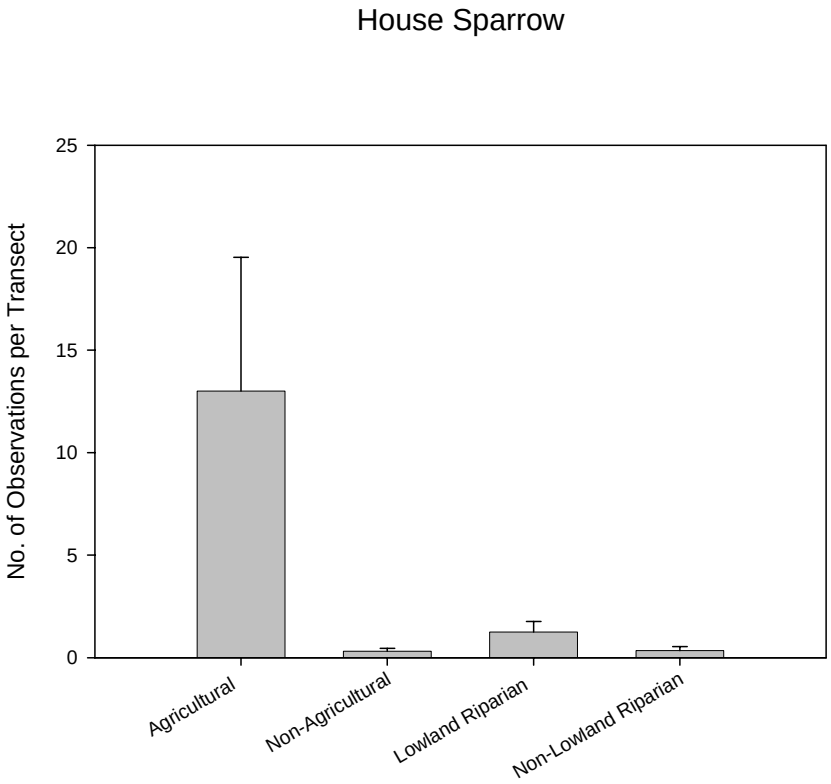
often lack trees in Nevada. Starlings are tree cavity nesters, so they are most often found in woodland-dominated habitats during the breeding season.

Figure 38: Mean number of European Starling observations per transect in different habitat types. Error bars indicate standard error of the mean. Data from GBBO's Nevada Bird Count program, 2002 and 2003.



Finally, the introduced House Sparrow was most abundant in agricultural areas, compared with all other habitat types (Fig. 39, $p < 0.0001$). This species appears to be the most closely associated with human-created habitat types.

Figure 39: Mean number of House Sparrow observations per transect in different habitat types. Error bars indicate standard error of the mean. Data from GBBO's Nevada Bird Count program, 2002 and 2003.



V. Conclusions

The results presented in this report are the first step in GBBO's quantitative assessment of habitat associations and habitat suitability for birds in the Nevada region. While habitat information is often available from other parts of a bird's distribution, local information is needed to plan effective conservation strategies for Nevada. For instance, species such as Lazuli Bunting or Yellow-breasted Chat may use a variety of shrublands in other parts of their range, but only riparian areas in the arid landscapes of Nevada. Abundance data collected during breeding are useful in making an initial determination about which habitat types are most critical to the preservation of populations. The next steps in implementing the NBC will focus on the following objectives:

- Clarify basic habitat associations of uncommon species
- Continue monitoring to determine short-term habitat effects, for instance responses to drought conditions

- Refine understanding of habitat suitability for priority species by building habitat models from habitat measurements
- Integrate an intensive subsampling effort into the point count program to remove biases of the point count method and derive reliable population density estimates

Future monitoring will clarify bird-habitat associations because additional sampling will increase statistical power. In 2004 and 2005, GBBO will intensify its efforts particularly in the Mojave region of Nevada, where many priority species occur for which additional information is needed. This step will also allow GBBO to examine status and habitat use of birds other than the priority species currently recognized by NVPIF, and NBC can thus serve as an "early-warning" system for birds that may be jeopardized due to specialized habitat needs or may require additional attention due to habitat threats.

Building multi-species and single-species habitat suitability models will be possible with rapid habitat assessments conducted at the point count transects. For these, emphasis will first be placed on habitat types of greatest concern with regard to landbird conservation in Nevada: aspen, lowland riparian and mesquite-catclaw areas, sagebrush, and pinyon-juniper.

Measures that remove biases from rapid bird survey methods need to be included as part of the long-term monitoring program. Intensive subsampling of point count sites allows for correction of species- and gender-specific biases in detectability, seasonal effects, habitat effects, and other factors influencing point count data. If implemented at enough sites, it may also provide useful nesting data, such as cowbird parasitism rates, onset of nesting season, and nest success rates.

The next NBC program phase will also include formulating a more specific sampling plan for long-term monitoring of breeding landbirds and of aquatic species. The NBC is only a part of a larger effort toward Coordinated Bird Monitoring in Nevada (Ammon et al. 2003). Coordinated Bird Monitoring goes beyond covering breeding landbirds and entails all birds that would warrant management action if trends of concern were detected in their populations (Bart 2003, Ammon et al. 2003). Full implementation of Nevada's Coordinated Bird Monitoring plan requires a cooperative effort between multiple agencies and other partners, because the plan depends on leadership from each of the entities with the greatest experience in different monitoring efforts. GBBO's goal is therefore to fully integrate the NBC under the Coordinated Bird Monitoring plan in order to generate information useful to implementing all-bird conservation.

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Appendix 1: List of species observed during Nevada Bird Count point-count surveys in the springs/summers of 2002 and 2003, including incidental sightings, sorted by AOU number.

Tally	Species	Scientific Name
1	Western Grebe	*Aechmophorus occidentalis*
2	Clark's Grebe	*Aechmophorus clarkii*
3	Eared Grebe	*Podiceps nigricollis*
4	Pied-billed Grebe	*Podilymbus podiceps*
5	California Gull	*Larus californicus*
6	Ring-billed Gull	*Larus delawarensis*
7	Caspian Tern	*Sterna caspia*
8	Forster's Tern	*Sterna forsteri*
9	Common Tern	*Sterna hirundo*
10	Black Tern	*Chlidonias niger*
11	Double-crested Cormorant	*Phalacrocorax auritus*
12	American White Pelican	*Pelecanus erythrorhynchos*
13	Common Merganser	*Mergus merganser*
14	Mallard	*Anas platyrhynchos*
15	Gadwall	*Anas strepera*
16	Green-winged Teal	*Anas crecca*
17	Blue-winged Teal	*Anas discors*
18	Cinnamon Teal	*Anas cyanoptera*
19	Northern Shoveler	*Anas clypeata*
20	Northern Pintail	*Anas acuta*
21	Wood Duck	*Aix sponsa*
22	Redhead	*Aythya americana*
23	Canvasback	*Aythya valisineria*
24	Lesser Scaup	*Aythya affinis*
25	Bufflehead	*Bucephala albeola*
26	Ruddy Duck	*Oxyura jamaicensis*
27	Canada Goose	*Branta canadensis*
28	Trumpeter Swan	*Cygnus buccinator*
29	White-faced Ibis	*Plegadis chihi*
30	American Bittern	*Botaurus lentiginosus*
31	Great Blue Heron	*Ardea herodias*
32	Great Egret	*Ardea alba*
33	Snowy Egret	*Egretta thula*
34	Black-crowned Night-Heron	*Nycticorax nycticorax*
35	Sandhill Crane	*Grus canadensis*
36	Virginia Rail	*Rallus limicola*
37	Sora	*Porzana carolina*
38	American Coot	*Fulica americana*
39	Red-necked Phalarope	*Phalaropus lobatus*
40	Wilson's Phalarope	*Phalaropus tricolor*
41	American Avocet	*Recurvirostra americana*
42	Black-necked Stilt	*Himantopus mexicanus*
43	Wilson’s Snipe	*Gallinago gallinago*
44	Long-billed Dowitcher	*Limnodromus scolopaceus*

Tally	Species	Scientific Name
45	Greater Yellowlegs	*Tringa melanoleuca*
46	Willet	*Catoptrophorus semipalmatus*
47	Spotted Sandpiper	*Actitis macularia*
48	Long-billed Curlew	*Numenius americanus*
49	Killdeer	*Charadrius vociferus*
50	Snowy Plover	*Charadrius alexandrinus*
51	Chukar	*Alectoris chukar*
52	Mountain Quail	*Oreortyx pictus*
53	California Quail	*Callipepla californica*
54	Gambel's Quail	*Callipepla gambelii*
55	Blue Grouse	*Dendragapus obscurus*
56	Ruffed Grouse	*Bonasa umbellus*
57	Greater Sage-grouse	*Centrocercus urophasianus*
58	Ring-necked Pheasant	*Phasianus colchicus*
59	Wild Turkey	*Meleagris gallopavo*
60	Band-tailed Pigeon	*Columba fasciata*
61	Rock Pigeon	*Columba livia*
62	Mourning Dove	*Zenaida macroura*
63	White-winged Dove	*Zenaida asiatica*
64	Turkey Vulture	*Cathartes aura*
65	Northern Harrier	*Circus cyaneus*
66	Sharp-shinned Hawk	*Accipiter striatus*
67	Cooper's Hawk	*Accipiter cooperii*
68	Northern Goshawk	*Accipiter gentilis*
69	Red-tailed Hawk	*Buteo jamaicensis*
70	Swainson's Hawk	*Buteo swainsoni*
71	Ferruginous Hawk	*Buteo regalis*
72	Golden Eagle	*Aquila chrysaetos*
73	Prairie Falcon	*Falco mexicanus*
74	American Kestrel	*Falco sparverius*
75	Osprey	*Pandion haliaetus*
76	Barn Owl	*Tyto alba*
77	Long-eared Owl	*Asio otus*
78	Short-eared Owl	*Asio flammeus*
79	Great Horned Owl	*Bubo virginianus*
80	Burrowing Owl	*Athene cunicularia*
81	Northern Pygmy-Owl	*Glaucidium gnoma*
82	Greater Roadrunner	*Geococcyx californianus*
83	Belted Kingfisher	*Ceryle alcyon*
84	Hairy Woodpecker	*Picoides villosus*
85	Downy Woodpecker	*Picoides pubescens*
86	Ladder-backed Woodpecker	*Picoides scalaris*
87	Black-backed Woodpecker	*Picoides arcticus*
88	Red-naped Sapsucker	*Sphyrapicus nuchalis*
89	Red-breasted Sapsucker	*Sphyrapicus ruber*
90	Williamson's Sapsucker	*Sphyrapicus thyroideus*
91	Pileated Woodpecker	*Dryocopus pileatus*

Tally	Species	Scientific Name
92	Lewis's Woodpecker	*Melanerpes lewis*
93	Northern Flicker	*Colaptes auratus*
	Red-shafted Flicker	*Colaptes auratus*
94	Common Poorwill	*Phalaenoptilus nuttallii*
95	Common Nighthawk	*Chordeiles minor*
96	Lesser Nighthawk	*Chordeiles acutipennis*
97	Vaux's Swift	*Chaetura vauxi*
98	White-throated Swift	*Aeronautes saxatalis*
99	Black-chinned Hummingbird	*Archilochus alexandri*
100	Costa's Hummingbird	*Calypte costae*
101	Anna's Hummingbird	*Calypte anna*
102	Broad-tailed Hummingbird	*Selasphorus platycercus*
103	Rufous Hummingbird	*Selasphorus rufus*
104	Calliope Hummingbird	*Stellula calliope*
105	Eastern Kingbird	*Tyrannus tyrannus*
106	Western Kingbird	*Tyrannus verticalis*
107	Brown-crested Flycatcher	*Myiarchus tyrannulus*
108	Ash-throated Flycatcher	*Myiarchus cinerascens*
109	Say's Phoebe	*Sayornis saya*
110	Black Phoebe	*Sayornis nigricans*
111	Olive-sided Flycatcher	*Contopus cooperi*
112	Western Wood-Pewee	*Contopus sordidulus*
113	Cordilleran Flycatcher	*Empidonax occidentalis*
	Western-type Flycatcher	
114	Willow Flycatcher	*Empidonax traillii*
115	Hammond's Flycatcher	*Empidonax hammondii*
116	Dusky Flycatcher	*Empidonax oberholseri*
117	Gray Flycatcher	*Empidonax wrightii*
118	Vermilion Flycatcher	*Pyrocephalus rubinus*
119	Horned Lark	*Eremophila alpestris*
120	American Magpie	*Pica hudsonia*
121	Steller's Jay	*Cyanocitta stelleri*
122	Western Scrub-jay	*Aphelocoma californica*
123	Common Raven	*Corvus corax*
124	American Crow	*Corvus brachyrhynchos*
125	Clark's Nutcracker	*Nucifraga columbiana*
126	Pinyon Jay	*Gymnorhinus cyanocephalus*
127	European Starling	*Sturnus vulgaris*
128	Bobolink	*Dolichonyx oryzivorus*
129	Brown-headed Cowbird	*Molothrus ater*
130	Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*
131	Red-winged Blackbird	*Agelaius phoeniceus*
132	Western Meadowlark	*Sturnella neglecta*
133	Scott's Oriole	*Icterus parisorum*
134	Hooded Oriole	*Icterus cucullatus*
135	Bullock's Oriole	*Icterus bullockii*
136	Brewer's Blackbird	*Euphagus cyanocephalus*

Tally	Species	Scientific Name
137	Great-tailed Grackle	*Quiscalus mexicanus*
138	Cassin's Finch	*Carpodacus cassinii*
139	House Finch	*Carpodacus mexicanus*
140	Red Crossbill	*Loxia curvirostra*
141	American Goldfinch	*Carduelis tristis*
142	Lesser Goldfinch	*Carduelis psaltria*
143	Pine Siskin	*Carduelis pinus*
144	Vesper Sparrow	*Pooecetes gramineus*
145	Savannah Sparrow	*Passerculus sandwichensis*
146	Grasshopper Sparrow	*Ammodramus savannarum*
147	Lark Sparrow	*Chondestes grammacus*
148	White-crowned Sparrow	*Zonotrichia leucophrys*
149	Chipping Sparrow	*Spizella passerina*
150	Brewer's Sparrow	*Spizella breweri*
151	Black-chinned Sparrow	*Spizella atrogularis*
	Slate-colored Junco	*Junco hyemalis*
	Oregon Junco	*Junco hyemalis*
152	Dark-eyed Junco	*Junco hyemalis*
153	Black-throated Sparrow	*Amphispiza bilineata*
154	Sage Sparrow	*Amphispiza belli*
155	Song Sparrow	*Melospiza melodia*
156	Fox Sparrow	*Passerella iliaca*
157	Spotted Towhee	*Pipilo maculatus*
158	Green-tailed Towhee	*Pipilo chlorurus*
159	Abert's Towhee	*Pipilo aberti*
160	Black-headed Grosbeak	*Pheucticus melanocephalus*
161	Blue Grosbeak	*Passerina caerulea*
162	Indigo Bunting	*Passerina cyanea*
163	Lazuli Bunting	*Passerina amoena*
164	Western Tanager	*Piranga ludoviciana*
165	Summer Tanager	*Piranga rubra*
166	Cliff Swallow	*Petrochelidon pyrrhonota*
167	Barn Swallow	*Hirundo rustica*
168	Tree Swallow	*Tachycineta bicolor*
169	Violet-green Swallow	*Tachycineta thalassina*
170	Bank Swallow	*Riparia riparia*
171	Northern Rough-winged Swallow	*Stelgidopteryx serripennis*
172	Cedar Waxwing	*Bombycilla cedrorum*
173	Phainopepla	*Phainopepla nitens*
174	Northern Shrike	*Lanius excubitor*
175	Loggerhead Shrike	*Lanius ludovicianus*
176	Warbling Vireo	*Vireo gilvus*
177	Plumbeous Vireo	*Vireo plumbeus*
178	Cassin's Vireo	*Vireo cassinii*
	Solitary Vireo	
179	Bell's Vireo	*Vireo bellii*
180	Gray Vireo	*Vireo vicinior*

Tally	Species	Scientific Name
181	Lucy's Warbler	*Vermivora luciae*
182	Virginia's Warbler	*Vermivora virginiae*
183	Nashville Warbler	*Vermivora ruficapilla*
184	Orange-crowned Warbler	*Vermivora celata*
185	Yellow Warbler	*Dendroica petechia*
	Audubon's Warbler	*Dendroica coronata*
186	Yellow-rumped Warbler	*Dendroica coronata*
187	Grace's Warbler	*Dendroica graciae*
188	Black-throated Gray Warbler	*Dendroica nigrescens*
189	Townsend's Warbler	*Dendroica townsendi*
190	Hermit Warbler	*Dendroica occidentalis*
191	MacGillivray's Warbler	*Oporornis tolmiei*
192	Common Yellowthroat	*Geothlypis trichas*
193	Yellow-breasted Chat	*Icteria virens*
194	Wilson's Warbler	*Wilsonia pusilla*
195	House Sparrow	*Passer domesticus*
196	American Pipit	*Anthus rubescens*
197	American Dipper	*Cinclus mexicanus*
198	Sage Thrasher	*Oreoscoptes montanus*
199	Northern Mockingbird	*Mimus polyglottos*
200	Gray Catbird	*Dumetella carolinensis*
201	Bendire's Thrasher	*Toxostoma bendirei*
202	Le Conte's Thrasher	*Toxostoma lecontei*
203	Crissal Thrasher	*Toxostoma crissale*
204	Cactus Wren	*Campylorhynchus brunneicapillus*
205	Rock Wren	*Salpinctes obsoletus*
206	Canyon Wren	*Catherpes mexicanus*
207	Bewick's Wren	*Thryomanes bewickii*
208	House Wren	*Troglodytes aedon*
209	Marsh Wren	*Cistothorus palustris*
210	Brown Creeper	*Certhia americana*
211	White-breasted Nuthatch	*Sitta carolinensis*
212	Red-breasted Nuthatch	*Sitta canadensis*
213	Pygmy Nuthatch	*Sitta pygmaea*
214	Juniper Titmouse	*Baeolophus griseus*
215	Black-capped Chickadee	*Poecile atricapilla*
216	Mountain Chickadee	*Poecile gambeli*
217	Bushtit	*Psaltriparus minimus*
218	Verdin	*Auriparus flaviceps*
219	Golden-crowned Kinglet	*Regulus satrapa*
220	Ruby-crowned Kinglet	*Regulus calendula*
221	Blue-gray Gnatcatcher	*Polioptila caerulea*
222	Black-tailed Gnatcatcher	*Polioptila melanura*
223	Townsend's Solitaire	*Myadestes townsendi*
224	Swainson's Thrush	*Catharus ustulatus*
225	Hermit Thrush	*Catharus guttatus*
226	American Robin	*Turdus migratorius*

Tally	Species	Scientific Name
227	Western Bluebird	*Sialia mexicana*
228	Mountain Bluebird	*Sialia currucoides*