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2009 Songbird Monitoring of Pine Creek Grassland

**Report to The Nature Conservancy and
the U.S. Fish and Wildlife Service**

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INTRODUCTION

PRBO Conservation Science (PRBO) conducted avian surveys at the Pine Creek grassland restoration in 2003 and 2004 and again in 2007-2009. The purpose of these surveys was to provide measures of current bird activity to help guide ongoing management practices and to help develop future multi-species management guidelines. In this report we provide data from the 2009 field season and compare them with those from previous years and discuss the management implications.

METHODS

Study Site. The Pine Creek grassland consists of land owned and cooperatively-managed by The Nature Conservancy and U.S. Fish and Wildlife Service. The 67 hectare (165 acre) unit is located at Sacramento River mile 199 in Butte County, California. It was formerly an almond orchard and was restored to native grassland in 2004. In order to control for an accumulation of biomass and to keep non-native grasses in check, a prescribed burn was conducted on Fields 5 and 6 in October 2007 and goat grazing occurred on Fields 3 and 4 between January and March 2008 (see Appendix 1).

Point Count Surveys. Six point count stations approximately 250 meters apart were surveyed in each of the five years at the Pine Creek grassland site. The habitat within a 50 meter radius was entirely dominated by native grasses for stations five of the stations while the sixth station was comprised of approximately 50% grassland and 50% restored riparian (Appendix 1). All stations were surveyed twice each year between May 4th and June 20th with at least seven days between visits (Table 1).

Table 1. Pine Creek grassland point count survey dates.

Year	Survey 1	Survey 2
2003	10-May	31-May
2004	4-May	1-Jun
2007	22-Jun	30-Jun
2008	5-May	19-Jun
2009	28-May	16-Jun

We censused the avian community using a standardized five minute fixed radius point count survey (Ralph et al. 1993, 1995). Surveys began within 15 minutes of sunrise and were completed within four hours. We recorded all species detected by sight or sound and placed the in categories based on their initial distance from the observers. Distance intervals were 0-10m, 10-20, 20-30, 30-50, 50-100, and greater than 100. Birds flying over the study site not using the habitat were noted separately. The presence of any breeding activity was also noted for each individual. Only field biologists thoroughly trained in species identification and distance estimation conducted surveys. Surveys were not conducted in weather conditions that could significantly influence observers' ability to detect birds, such as rain or wind over 10mph.

Data Analysis. Data was analyzed using only those detections within 50 meters of observers to limit biases caused by variation in species detectability and observers' ability

to detect. Flyovers were excluded from analysis which only included individuals deemed to not be using the habitat in flight over the site. Thus, a bird flying up out of a patch of grass would not be a flyover but a Great-blue Heron in transit 200 feet above the site would be a flyover. Swallows foraging over the site were considered to be using the habitat and were included as detections within the appropriate distance category. A list of all species detected by year regardless of distance is presented in Appendix 2.

Species richness, Shannon diversity, and total bird abundance were calculated for each point count station, summed over both visits. Species richness is the mean number of species detected per station within a year. Shannon diversity is a measure of species richness weighted by the number of individuals detected. Higher Shannon diversity is achieved by increasing species richness with fewer individuals of each species. It is a measure that reflects both species richness and evenness. Total bird abundance is the mean number of individuals detected per station across both visits within year. Due to inconsistencies in how flyovers, especially swallows, were recorded in 2003, 2004, and 2007 we conducted the same analyses as described above for each point count station while excluding raptors, swallows, shorebirds, waterfowl, waders, and exotic species (e.g. European Starling) and compared each of the five years. We used these metrics to compare between years and between treatments (burned vs. unburned).

RESULTS

A total of 67 species have been detected at Pine Creek during the five years of monitoring (Appendix 2), including 32 species in 2009. Seventeen of these 32 species were detected within 50 meters of the observer in 2008 (Table 2). The most frequently detected species was Cliff Swallow comprising 68% of all detections followed by Bushtit at 7%, American Goldfinch at 5% and Lesser Goldfinch at 4% (Latin names for all species can be found in Appendix 1).

Table 2. Bird species composition within a 50m radius of point count stations at the Pine Creek grassland in 2009. Frequency represents the proportion of total individuals of a species divided by the total number of detections of all species. Only individuals with a frequency of 1% or more are listed.

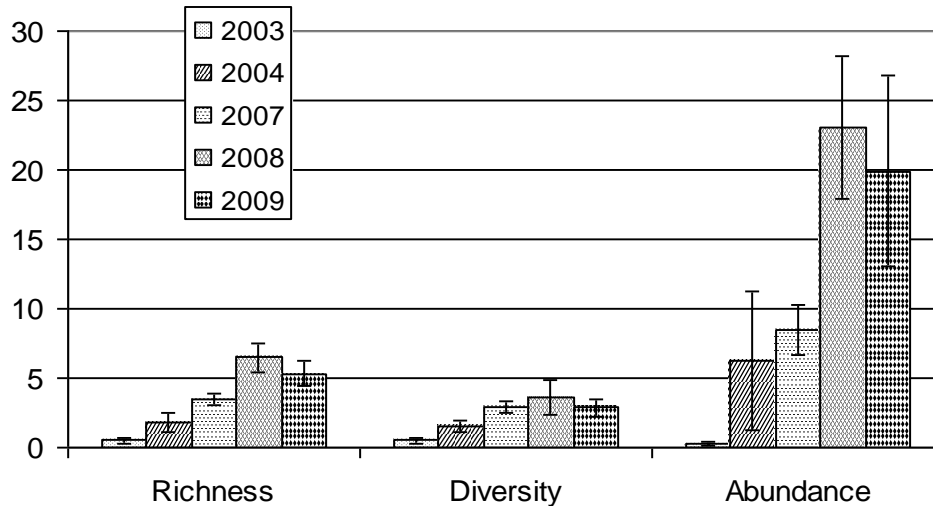
Species	Number Detected	Frequency
Cliff Swallow	162	68%
Bushtit	16	7%
American Goldfinch	13	5%
Lesser Goldfinch	9	4%
Lawrence's Goldfinch	8	3%
Red-winged Blackbird	8	3%
Western Kingbird	7	3%
Bullock's Oriole	3	1%
Northern Rough-winged Swallow	3	1%
House Finch	2	1%
Mallard	2	1%

Species richness, Shannon diversity, and total bird abundance decreased slightly from 2008 to 2009 (Table 3). Species richness was 5.33 in 2009 compared to 6.50 in 2008 and a low in 2003 of 0.50. Shannon diversity was 2.87 in 2009, slightly lower than in 2007 at 2.94 and 2008 at 3.58. Total bird abundance remained high in 2009 at 19.92 birds per station per visit, but still lower than the high of 23.08 in 2008 (Figure 1).

Table 3. Species richness, Shannon Diversity, and total bird abundance of all species detected within 50 m of observers at The Nature Conservancy’s Pine Creek Grassland restoration site in 2003, 2004, 2007, 2008, and 2009 with standard error.

	2003	2004	2007	2008	2009
Species Richness	0.50 ± 0.22	1.83 ± 0.65	3.50 ± 0.43	6.50 ± 1.02	5.33 ± 0.88
Shannon Diversity	0.50 ± 0.22	1.58 ± 0.43	2.94 ± 0.45	3.58 ± 1.23	2.87 ± 0.62
Total Bird Abundance	0.25 ± 0.11	6.25 ± 4.96	8.50 ± 1.78	23.08 ± 5.13	19.92 ± 6.87

Figure 1. Species richness, Shannon diversity and total bird abundance of all species detected within 50 m of observers at The Nature Conservancy’s Pine Creek grassland in 2003, 2004, 2007, 2008 and 2009, with standard error.

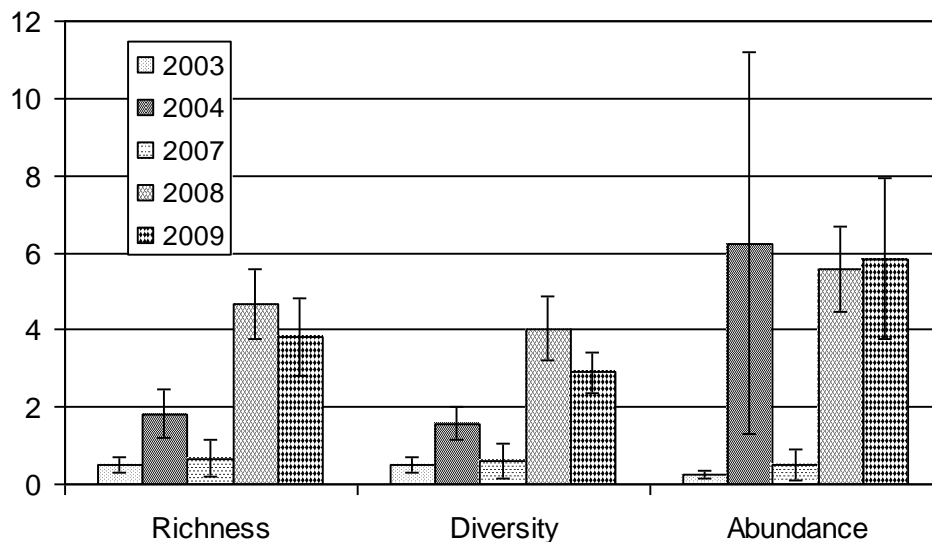


Using the more limited set of species, the pattern of slightly lower species richness and Shannon diversity in 2009 compared to those in 2008 was consistent with the more inclusive data (Table 4, Figure 2). Contrary to the more inclusive data pattern, total bird abundance in 2009 appears higher than in 2008 (5.83 vs. 5.58). The noticeable spike in total bird abundance in 2004 can be attributed to a large group of foraging American Goldfinch detected during one visit at one point. If this one flock of goldfinch was excluded from analysis, the pattern of total bird abundance is more similar to that of the more inclusive data. It is safe to say that using this more conservative group of species in the analysis produces similar patterns of species indices to those of the more inclusive data.

Table 4. Species richness, Shannon diversity, and total bird abundance of all species detected within 50 m of observers, excluding exotic species and those not adequately censused using the point count method (e.g. swallows, raptors, shorebirds) at The Nature Conservancy’s Pine Creek grassland in 2003, 2004, 2007, 2008 and 2009, with standard error.

	2003	2004	2007	2008	2009
Species Richness	0.50 ± 0.22	1.83 ± 0.65	0.67 ± 0.49	4.67 ± 0.93	3.83 ± 1.01
Shannon Diversity	0.50 ± 0.22	1.58 ± 0.43	0.60 ± 0.43	4.04 ± 0.84	2.89 ± 0.51
Total Bird Abundance	0.25 ± 0.11	6.25 ± 4.96	0.50 ± 0.41	5.58 ± 1.10	5.83 ± 2.08

Figure 2. Species richness, Shannon diversity, and total bird abundance of all species detected within 50 m of observers, excluding exotic species and those not adequately censused using the point count method (e.g. swallows, raptors, shorebirds) at The Nature Conservancy’s Pine Creek grassland in 2003, 2004, 2007, 2008 and 2009, with standard error.



Total bird abundance and species richness at both burned and grazed stations in 2009 decreased from 2008, but remained above 2007 levels (Figure 2 and Figure 3). Total bird abundance in 2009 at burned stations was 9.75 compared to 15.25 in 2008 and 7.25 in 2007. At grazed stations, total bird abundance was 28.5 in 2009 compared to 32.5 in 2008 and 11 in 2007. Species richness at burned stations in 2009 was 4.5 compared to 5.5 in 2008 and 4 in 2007. Species richness at grazed stations was 5 in 2009 compared to 5.67 in 2008 and 2.67 in 2007.

Figure 3. Total bird abundance before (2007), 2-7 months after (2008), and 1.2 – 1.6 years after (2009) management activities at two burned point count stations and three adjacent goat-grazed stations in the The Nature Conservancy’s Pine Creek grassland.

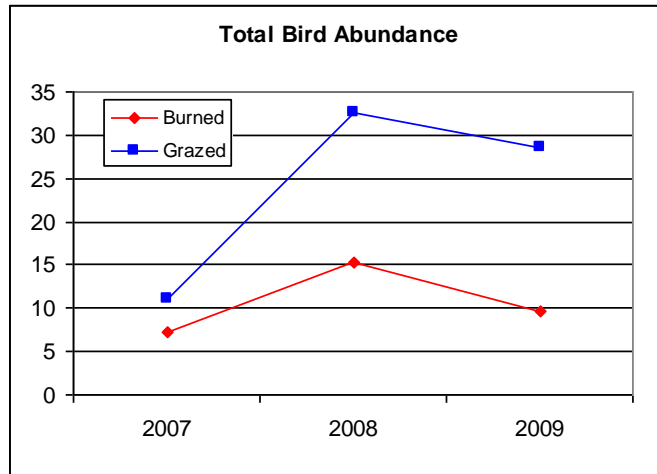
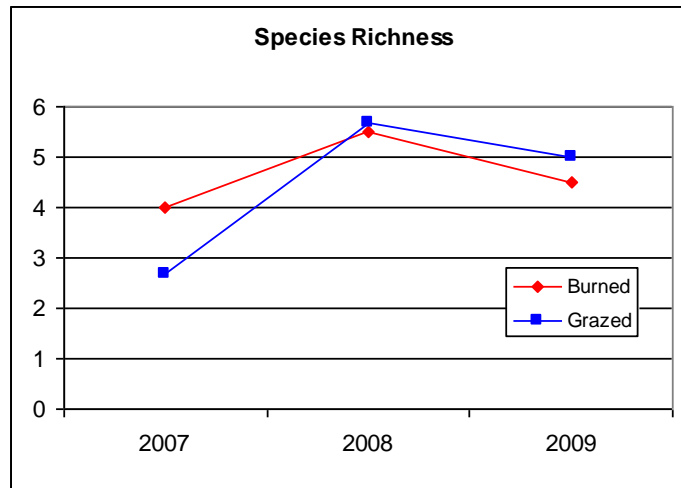


Figure 4. Species richness before (2007), 2-7 months after (2008), and 1.2 – 1.6 years after (2009) management activities at two burned point count stations and three adjacent goat-grazed stations in The Nature Conservancy’s Pine Creek grassland.



DISCUSSION

Species richness, species diversity, and avian abundance have all increased at the Pine Creek site since it was converted from a fallow field to grassland in 2004. Notably, cumulative species richness has increased from just two species detected in 2003 to a high of seventeen species detected in 2009 (Appendix 3). However, survey results indicate that the site is being primarily used by a handful of generalist species: Cliff Swallow, Red-winged Blackbird, American Goldfinch and Lesser Goldfinch. In addition to these four generalists, Bushtit and Lawrence’s Goldfinch rounded off the top six most abundant species in 2009. However, survey observations indicate that these most frequently detected species are not using the site for breeding but they are exploiting different food resources within and above the grassland.

Each year of PRBO monitoring of the Pine Creek grassland a nesting Cliff Swallow colony was observed at the overpass just to the west of the grassland and large groups of the swallows have been recorded during surveys foraging on flying insects above the grassland. In 2009, a colony of Red-winged Blackbirds nested in a sunflower field just to the north of the grassland, and on occasion crossed into the grassland where they appeared to forage on insects within the field or the native grass seed. American Goldfinch, Lesser Goldfinch, and Lawrence's Goldfinch were observed in large, but infrequent, groups targeting the patches of fiddleneck (*Amsinckia* spp.) interspersed in the grassland. Lawrence's Goldfinch is an uncommon species on the valley floor and a newly recorded species for the grassland. However, it is unlikely any of these goldfinches bred within the grassland due to a lack of suitable nesting substrate, namely lichen-adorned mature trees. It is uncommon to observe all three of these goldfinches foraging together during the breeding season, and their presence suggests the grassland provides an attractive food resource for them. We presume that all three species were breeding in the restored riparian habitat adjacent to the grassland. Bushtits, while they were the second most abundant species within the grassland, were only observed gleaning the foliage within the planted patches of Valley Oak groves interspersed in the grassland. They too most likely bred within the restored riparian area to the south of the grassland.

Grassland associated songbird breeders, such as Savannah Sparrow, Western Meadowlark, and Grasshopper Sparrow have yet to populate the Pine Creek grassland. The absence of Savannah Sparrow and Western Meadowlark is especially concerning as these species are considered grassland generalists which inhabit a wide range of grassland habitats and are a common sight along roadside grasslands. The relatively small size of the site and isolation from other grasslands may be limiting its utility to grassland birds, many of which are area sensitive (CPIF 2000). In addition, the height of the grass and density may reduce foraging efficiency of some grassland species that prefer patches of bare ground (mosaics on a grassland scale). If this site is not capable of supporting California Partner's in Flight grassland focal species it may be appropriate to consider adding components that would increase its use by other species. Incorporating additional clumps of trees and shrubs may increase the suitable nesting structure for a greater diversity of avian species. However, doing so may further limit its suitability to species associated with large tracts of open grassland habitat uninterrupted by trees or shrubs. For Northern Harrier, planting larger trees (e.g. cottonwoods) may reduce the suitability of the grassland as it may provide hunting perches for Red-tailed Hawk. Whereas shorter shrubs (e.g. elderberry, coyote bush) in small clumps scattered around the grassland would be less likely to encourage this larger raptor which may compete with or even prey upon young harriers.

For the past three years of monitoring, we observed the greatest species richness and diversity at point 19-07, which is within 50m of the restored riparian forest to the south of the grassland (see Appendix 1). The increased structural and plant diversity within the forest compared to the grassland allows a greater number of bird species to utilize this habitat during the breeding season. Several unique species were observed foraging within the planted sloughs and patches of valley oak habitat that were not observed within the

grassland itself. An open valley oak-riparian grassland savannah that transitions from the denser riparian plantings would be worth considering as a long-term vision for this site.

An extensive area search of Fields 3, 4, 5, 6 in 2009 resulted in the confirmation of just two species nesting at the Pine Creek grassland: Black Phoebe and Northern Harrier. The phoebe nest was not within the grassland itself, but rather tucked underneath the awning of the Sacramento National Wildlife Refuge kiosk. The Northern Harrier nest was located in the northeastern corner of Field 5 (Appendix 1). On the first census date, May 28th, the nest contained 5 eggs and 2 nestlings approximately 4 and 2 days old (Photo 1). This original nest failed between survey dates and when checked on June 16th contained a new clutch of 4 eggs (Photo 2). A pair of Northern Harriers bred in a similar location at the Pine Creek grassland in 2007, but none were detected in 2008. Herkert et al. (1999) found that Northern Harriers in Illinois showed strong selection for unmanaged grasslands for nesting. This is most likely due to their preference for nesting areas with vegetation >55 cm tall and where dead vegetation makes up at least 12% of total cover (Duebbert and Lokemoen 1977, Kantrud and Higgins 1992). The prescribed burn on Fields 5 and 6 in November 2007 and the goat-grazing on Fields 3 and 4 in January through March 2008 may have stunted vegetation height and reduced standing dead vegetation density such that the habitat was not suitable for Northern Harriers during the 2008 breeding season. It appears that by 2009 the height of vegetation and dead biomass had returned to pre-management levels thus making Pine Creek more suitable nesting habitat for the harriers. However, a sample size of one makes drawing conclusions difficult, and the absence of the nesting harriers in 2008 could be attributed to factors other than habitat conditions at Pine Creek. No other nesting birds were observed within the grassland in 2009.

Prior to management activities to control biomass accumulation, total bird abundance at the burned and grazed stations was similar (7.25 and 11, respectively), but the year following management activities total bird abundance increased by over 20 birds per point at the grazed stations while increasing by just 8 birds per point at the burned stations. This gap in total bird abundance between the grazed and burned stations was observed in 2009 as well. Anecdotally, this suggests the effects of the grazing may have temporarily benefited the Pine Creek grassland and more so than burning. However, due to our limited sample size (two stations in burned fields and three in grazed fields), caution is advised in drawing conclusions from these results. The burned stations and grazed stations are in such close proximity that understanding the use of each field by birds that are not holding territories (e.g. just foraging) make it difficult to draw any clear patterns. However, it is interesting to note that in 2009, the grazed fields included two granivorous birds not detected on the burned fields, Lesser Goldfinch and Lawrence's Goldfinch. While the patches of fiddleneck these birds were observed feeding on were only present within the grazed fields, it is unclear if the grazing or some other management or natural activity attributed to the presence of the fiddleneck. To more accurately evaluate the effects of management actions within the relatively small fields at Pine Creek, we suggest more intensive area searches and nest searching would be a more appropriate survey technique in future years. These techniques would allow us to determine if any of the observed species (e.g. goldfinch, blackbirds) or more secretive

grassland species (e.g. sparrows) are nesting within the grassland and what habitat attributes they are associated with.

Prescribed burning and grazing are useful tools for managing the accumulation of dead biomass, however, the literature on the response of grassland birds to these management activities is either limited or conflicting with both positive and negative effects observed for the same species. The timing and intensity of burning or grazing along with the type of grassland habitat are all likely to play a role in how a species responds. Thus, we recommend prescribed burning or grazing at discrete portions of the grassland each year to create a mosaic of vegetation patches in various stages of recovery from disturbance. The size of the treatment patches and duration between treatments should be experimented with over time in order to identify the acreage, recovery period, and combination of treatments most beneficial to the avian community at Pine Creek. This approach should create nesting habitat for a variety of grassland species attracted to different seral stages assuming other factors influencing the occupancy do not trump micro-site conditions - as may currently be the case.

Because of Pine Creek grassland's limited use by grassland dependent species, we suggest management actions that can improve nesting habitat for a greater diversity of avian species. Incorporating additional patches of shrubs such as blue elderberry (*Sambucus mexicana*) and coyote bush (*Baccharis pilularis*) and considering clumps of valley oaks, may attract species such as Blue Grosbeak, Spotted Towhee, Lazuli Bunting, and Lark Sparrow. We recommend expanding the area search and nest monitoring components of avian monitoring following the implementation of prescribed fire or other management actions at the Pine Creek grassland in order to better assess the effects of management actions on the avian community. We also recommend that any management action that could result in the take of nesting birds be conducted before April or after August, including application of herbicide, discing, mowing, prescribed fire, grazing, and seed harvesting.

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Appendix 1. PRBO point count stations and nest location of breeding Northern Harriers in 2007 and 2009 at the The Nature Conservancy's Pine Creek grassland restoration.



Appendix 2. Common and scientific names of all species detected at The Nature Conservancy's Pine Creek Grassland, Butte County, CA, 2003, 2004, 2007, 2008, and 2009.

Common Name	Scientific Name	2003	2004	2007	2008	2009
Acorn Woodpecker	<i>Melanerpes formicivorus</i>				X	
American Crow	<i>Corvus brachyrhynchos</i>	X				
American Goldfinch	<i>Carduelis tristis</i>	X	X	X	X	X
American Kestrel	<i>Falco sparverius</i>	X				
American Robin	<i>Turdus migratorius</i>		X			
Ash-throated Flycatcher	<i>Myiarchus cinerascens</i>		X	X	X	X
Bank Swallow	<i>Riparia riparia</i>			X		
Bewick's Wren	<i>Thryomanes bewickii</i>	X	X		X	X
Black Phoebe	<i>Sayornis nigricans</i>	X	X	X	X	X
Black-headed Grosbeak	<i>Pheucticus melanocephalus</i>	X	X	X	X	X
Blue Grosbeak	<i>Passerina caerulea</i>					
Brewer's Blackbird	<i>Euphagus cyanocephalus</i>	X		X	X	
Brown-headed Cowbird	<i>Molothrus ater</i>	X	X		X	X
Bullock's Oriole	<i>Icterus bullockii</i>	X			X	X
Bushtit	<i>Psaltriparus minimus</i>				X	X
California Quail	<i>Callipepla californica</i>					
California Towhee	<i>Pipilo crissalis</i>				X	X
Cedar Waxwing	<i>Bombycilla cedrorum</i>				X	
Cinnamon Teal	<i>Anas cyanoptera</i>					X
Cliff Swallow	<i>Petrochelidon pyrrhonota</i>	X	X	X	X	X
Common Yellowthroat	<i>Geothlypis trichas</i>				X	
Double-crested Cormorant	<i>Phalacrocorax auritus</i>	X				
Downy Woodpecker	<i>Picoides pubescens</i>					X
European Starling	<i>Sturnus vulgaris</i>	X			X	
Grasshopper Sparrow	<i>Ammodramus savannarum</i>			X		
Great Blue Heron	<i>Ardea herodias</i>	X				
Great-horned Owl	<i>Bubo virginianus</i>			X		
House Finch	<i>Carpodacus mexicanus</i>	X	X	X	X	X
House Wren	<i>Troglodytes aedon</i>	X			X	
Killdeer	<i>Charadrius vociferus</i>		X	X	X	
Lark Sparrow	<i>Chondestes grammacus</i>	X	X			X
Lawrence's Goldfinch	<i>Carduelis lawrencei</i>		X			X
Lazuli Bunting	<i>Passerina amoena</i>		X	X		X
Lesser Goldfinch	<i>Carduelis psaltria</i>	X	X		X	X
Loggerhead Shrike	<i>Lanius ludovicianus</i>	X				
Mallard	<i>Anas platyrhynchos</i>				X	X
Mourning Dove	<i>Zenaida macroura</i>		X	X	X	X
Northern Rough-winged Swallow	<i>Stelgidopteryx serripennis</i>		X	X	X	X
Northern Flicker	<i>Colaptes auratus</i>				X	
Northern Harrier	<i>Circus cyaneus</i>			X		X
Northern Mockingbird	<i>Mimus polyglottos</i>					
Nuttall's Woodpeckers	<i>Picoides nuttallii</i>		X		X	X
Oak Titmouse	<i>Baeolophus inornatus</i>	X				
Orange-crowned Warbler	<i>Vermivora celata</i>					X
Osprey	<i>Pandion haliaetus</i>					X
Red-tailed Hawk	<i>Buteo jamaicensis</i>	X	X			
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	X	X	X	X	X

Common Name	Scientific Name	2003	2004	2007	2008	2009
Ring-necked Pheasant	<i>Phasianus colchicus</i>					X
Savannah Sparrow	<i>Passerculus sandwichensis</i>		X			
Spotted Towhee	<i>Pipilo maculatus</i>	X	X	X	X	X
Townsend's Warbler	<i>Dendroica townsendi</i>					
Tree Swallow	<i>Tachycineta bicolor</i>	X		X	X	X
Turkey Vulture	<i>Cathartes aura</i>					
Warbling Vireo	<i>Vireo gilvus</i>					
Western Bluebird	<i>Sialia mexicana</i>					
Western Kingbird	<i>Tyrannus verticalis</i>	X	X	X	X	X
Western Meadowlark	<i>Sturnella neglecta</i>	X		X		
Western Scrub-Jay	<i>Aphelocoma californica</i>				X	
Western Tanager	<i>Piranga ludoviciana</i>				X	
Western Wood-Pewee	<i>Contopus sordidulus</i>			X	X	X
White-breasted Nuthatch	<i>Sitta carolinensis</i>					
White-tailed Kite	<i>Elanus leucurus</i>	X		X		X
Wilson's Warbler	<i>Wilsonia pusilla</i>					
Wood Duck	<i>Aix sponsa</i>					
Yellow Warbler	<i>Dendroica petechia</i>				X	X
Yellow-billed Magpie	<i>Pica nuttalli</i>					
Yellow-breasted Chat	<i>Icteria virens</i>				X	
Total Species Detected		26	22	22	33	32

Appendix 3. Bird species composition at Pine Creek grassland site in 2003, 2004, 2007, 2008, and 2009. N represents the number of individuals detected within 50 meters of point count stations across two visits in each year.

2003		2004		2007		2008		2009	
Species	N	Species	N	Species	N	Species	N	Species	N
Lark Sparrow	2	American Goldfinch	35	Cliff Swallow	58	Cliff Swallow	204	Cliff Swallow	162
Brewer's Blackbird	1	Savannah Sparrow	16	Bank Swallow	17	Red-winged Blackbird	23	Bushtit	16
		Lesser Goldfinch	9	Tree Swallow	16	American Goldfinch	10	American Goldfinch	13
		Mourning Dove	8	Northern Rough-winged Swallow	3	Lesser Goldfinch	9	Lesser Goldfinch	9
		Lawrence's Goldfinch	4	Spotted Towhee	3	House Finch	7	Lawrence's Goldfinch	8
		Red-winged Blackbird	2	Western Kingbird	3	Black-headed Grosbeak	4	Red-winged Blackbird	8
		Lark Sparrow	1	Great-horned Owl	1	Brewer's Blackbird	4	Western Kingbird	7
				Lazuli Bunting	1	Tree Swallow	4	Bullock's Oriole	3
						Bullocks Oriole	3	Northern Rough-winged Swallow	3
						Common Yellowthroat	2	House Finch	2
						Mourning Dove	2	Mallard	2
						Bewick's Wren	1	Ash-throated Flycatcher	1
						Brown-headed Cowbird	1	Lark Sparrow	1
						Northern Rough-wing Swallow	1	Nuttall's Woodpecker	1
						Nuttall's Woodpecker	1	Ring-necked Pheasant	1
						Western Tanager	1	Spotted Towhee	1
								Tree Swallow	1

Photo 1. Northern Harrier nest with 5 eggs and 2 nestlings at The Nature's Conservancy's Pine Creek grassland 28 May 2009.



Photo 2. Northern Harrier nest with 4 eggs at The Nature's Conservancy's Pine Creek grassland 16 June 2009.

