Avian Point Counts on the Los Baños and Lower Cottonwood Creek Wildlife Areas, 2007 – 2008

Prepared By: Lara A. Sparks
April 2011

Los Baños Wildlife Area Publication #: 45

Status: Final Report

For additional copies, contact: Resource Assessment Program
Ca Department of Fish & Game
18110 W. Henry Miller Rd.
Los Baños, CA 93635
Phone: (209) 826-0463
Fax: (209) 826-1761

Abstract

Point count surveys have been utilized by avian biologists for many years as a cost-effective method of collecting data on species abundance, richness and diversity. The California Department of Fish and Game employed these surveys on the Los Baños and Lower Cottonwood Creek Wildlife Areas in 2007-2008 in order to monitor avian response to various management techniques. On the Los Baños Wildlife Area a wetland/riparian restoration took place in 2005, improving an existing wetland field and increasing the amount of riparian habitat available for wildlife. Our goal was to monitor how birds responded to this restoration, as well as to compare species richness and diversity between the newly created riparian with that of the old-growth habitat nearby. We were also interested in evaluating how this data might differ from results gathered at a mist-netting and banding station operated by the California Department of Fish and Game in this area from 2000-2006. Another management tool used by area managers is cattle grazing, which began in 2002 on the Lower Cottonwood Creek Wildlife Area. This regime was introduced to reduce the potential for wildfires on the area, as well as help control non-native grasses. Cattle exclusions were constructed in 2005 to provide refuge for wildlife and to protect the limited riparian and shrubland habitats found on the property. We wanted to study how grazing may be affecting bird use of this area, as well as observe any differences between the grazed and ungrazed habitat. In addition, we hoped to compare our results with data collected during baseline inventory surveys conducted in 2001, prior to cattle grazing. While our study has revealed basic information about what species are utilizing these areas, as well as general abundances and diversity, we were unable to draw many conclusions as to actual bird responses to these management actions. We recommend vegetation monitoring in conjunction with avian surveys in order to correlate differences in bird numbers with changes in habitat over time.

Keywords: avian, point count, grazing, riparian restoration, annual grassland

Introduction

The Los Baños Wildlife Area Complex is comprised of several properties that cover a variety of different habitat types, from freshwater wetlands on the valley floor to oak savannah in the coastal foothills. Wildlife area managers utilize a variety of techniques to maintain these refuges in order to provide quality habitat for wildlife. Birds are frequently used as indicator species to determine the health of the environment, as they respond quickly to changes in their surroundings (California Partners in Flight 2008). Biologists use surveys such as avian point counts to monitor the bird response to habitat modifications due to various management techniques. The California Department of Fish and Game (CDFG) uses land management practices such as the

timing of flood up or draw down of wetlands, and disking or mowing of wetland vegetation which allows for the creation of suitable habitat for wetland dependent species primarily during the winter months. Planting upland crops such as safflower (*Carthamus tinctorius*) or milo/sudan (*Sorghum bicolor*) provides forage for upland game birds as well as wintering lesser sandhill cranes (*Grus canadensis canadensis*). Grazing is another method that is used for a multitude of purposes such as controlling invasive weeds or non-native grasses, providing habitat for grassland dependent wildlife, and fire prevention. Restoration is also an important tool used to improve or expand existing habitat on an area, especially for wetland and riparian areas.

On the Los Baños Wildlife Area (LBWA), restoration projects occur on portions of the property annually. Existing semi-permanent and seasonal wetland fields are rehabilitated for reasons such as improving the water flow for irrigation, flood up and draw down, and creating more topography within the wetlands to provide different water depths, which can appeal to a variety of avian species. Also, CDFG has found that redesigning upland fields to create additional wetlands or riparian areas has been an effective tool in controlling perennial pepperweed (*Lepidium latifolium*), a highly invasive plant species. The northern-most section of LBWA, referred to as “the island”, is an area approximately 100 ha in size and is surrounded by Mud and Salt Sloughs. It contains semi-permanent and seasonal wetlands, irrigated pastures, intensively managed uplands, and riparian habitats. In the summer of 2005, a restoration project took place within this area which created a small wetland, approximately 6 ha in size, between two irrigated pastures. A deeper swale was excavated through the middle of the field providing open water habitat for waterfowl. Tree cuttings of black willow (*Salix goodingii*) and Fremont cottonwood (*Populus fremontii*) were also planted throughout the wetland with the intention of creating a small riparian section. This will add to the existing habitat on “the island”, which is composed of old growth willow and cottonwood trees that line the sloughs, and cuttings that were planted nearly 20 years ago.

Along with planting trees, additional management practices are conducted in this area of LBWA to benefit wildlife and control invasive plant species. Intensively managed upland units are planted and irrigated (similar to agricultural crops) to provide cover, foraging and breeding habitat primarily for upland game birds. Crops that have

been planted include wheat (*Triticum* sp.), vetch (*Vicia villosa*), safflower, sunflower (*Helianthus annuus*), and milo/sudan. Not only are these managed uplands valuable for game birds such as the ring-necked pheasant (*Phasianus colchicus*), but they have also been found to be beneficial to nesting grassland songbirds (Allen 2003). Another method of providing quality habitat for wildlife on LBWA is by managing the presence and expansion of invasive plants, especially perennial pepperweed. In conjunction with herbicide use, grazing has been introduced as a means of integrated invasive weed control. Goats (*Capra hircus*) were utilized from spring through fall of 2008, followed by the spraying of herbicide at the bases of the remaining plants. The goal was to reduce the growth of pepperweed and encourage more desirable plants, such as creeping wild rye (*Leymus triticoides*), which is native and more conducive to wildlife use. Cattle (*Bos taurus*) grazing in the irrigated pastures on "the island" has also been employed by CDFG since 1995, originally to provide habitat for wintering lesser sandhill cranes, which prefer areas of short grass for foraging. More recently, grazing has continued to be used to maintain the grassland habitat for a variety of spring-nesting and foraging avian species, as well as winter foraging waterbirds such as white-faced ibis (*Plegadis chihi*) and Wilson's snipe (*Gallinago delicata*).

Not only has cattle grazing been utilized as a management technique on LBWA, it has also been incorporated into the management of the Lower Cottonwood Creek Wildlife Area (LCCWA). In the winter of 2002, cattle grazing was introduced on the property to reduce the amount of annual grasses and litter which provides fuel for wildfires common to the area, as well as to help control non-native grasses. Grazing has been utilized annually, typically from October through January, and ranges from 1.90 ha/animal unit month (AUM) to 3.04 ha/AUM (average 2.42 ± 0.16 ha/AUM). Several fenced cattle exclusion areas were installed in 2005 to provide refuge for wildlife while grazing takes place, as well as to protect the limited riparian and shrubland habitats found on the property. They also contribute to habitat diversity by having areas of grazed annual grassland (763 ha), ungrazed annual grassland (93 ha), ungrazed riparian (7 ha) and ungrazed shrubland (6 ha). In fall 2007 through late winter 2008, a grazing contract was not utilized in order to provide a recovery period for the vegetation following a drought year.

With the variety of management practices occurring on both LBWA and LCCWA, CDFG was interested in observing the avian response to some of these techniques. On LBWA, we wanted to study how the avian species composition and diversity on the newly created wetland/riparian habitat compared with the well established riparian area located along and near the sloughs. From 1997-2006 a mist-netting and banding station was operated in a nearby section of old growth mixed willow riparian habitat. Rather than adding another banding station in the restored area, we decided to conduct avian point counts, which require less time and is a less intensive survey protocol. We also set up point counts on grazed and ungrazed areas at LCCWA with the purpose of determining if there are any benefits to the avian community from cattle grazing. Secondarily, we wanted to compare avian species composition and diversity with data collected prior to grazing during baseline inventory surveys conducted on this area in 2001.

Study Area

The two study sites are located within western Merced County of California and are part of CDFG's Los Baños Wildlife Area Complex (Figure 1). The 2,266 ha LBWA is located approximately 5 km north of the city of Los Baños and is managed primarily for migrating wetland-dependant avian species and other local wildlife. Public use on the area includes hunting waterfowl and upland game birds, as well as fishing. LBWA consists of a mixture of semi-permanent, permanent and seasonal wetlands, along with areas of annual grassland, mixed willow riparian, shrubland habitats and managed uplands. The LCCWA is located approximately 24 km west of the city of Los Baños along Highway 152. This 869 ha property lies on the eastern most edge of the Coast Range with elevations ranging from 90-390 m. Public use on LCCWA is primarily hunting of deer, wild pig and dove. The habitat of this area is largely annual grassland with a small, narrow section of mixed willow riparian and shrubland. The climate of western Merced County is characterized by hot, dry summers and cool, wet winters. Precipitation averages 27 cm per year and occurs primarily between November and March (California Department of Fish and Game 2008).

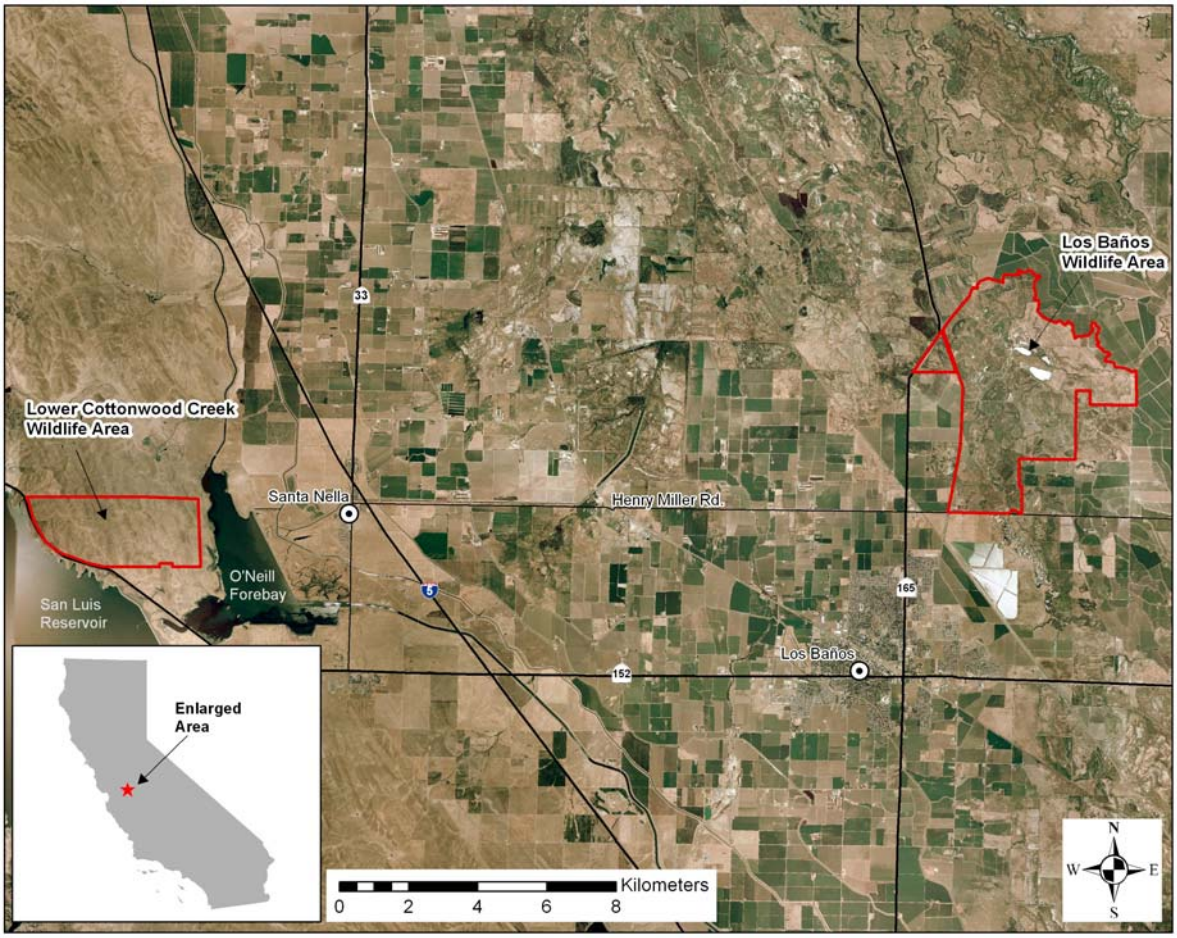

Figure 1. 2007-2008 avian point count study sites, Los Baños Wildlife Area Complex, Merced County, California.

Our survey plot on LBWA was located in the northern portion of the wildlife area and is surrounded by Salt Slough and Mud Slough (Figure 2). The plot consisted of a variety of wetland, upland and riparian habitats in different stages of succession. Riparian habitat included old growth black willow, mid- and early successional willow and Fremont cottonwood planted between 15 and 20 years ago, and areas of newly planted black willows and Fremont cottonwoods. Wetlands within the survey plot are seasonal, and were flooded each fall through early spring. Upland areas consisted of irrigated pasture and intensively managed grain plots.

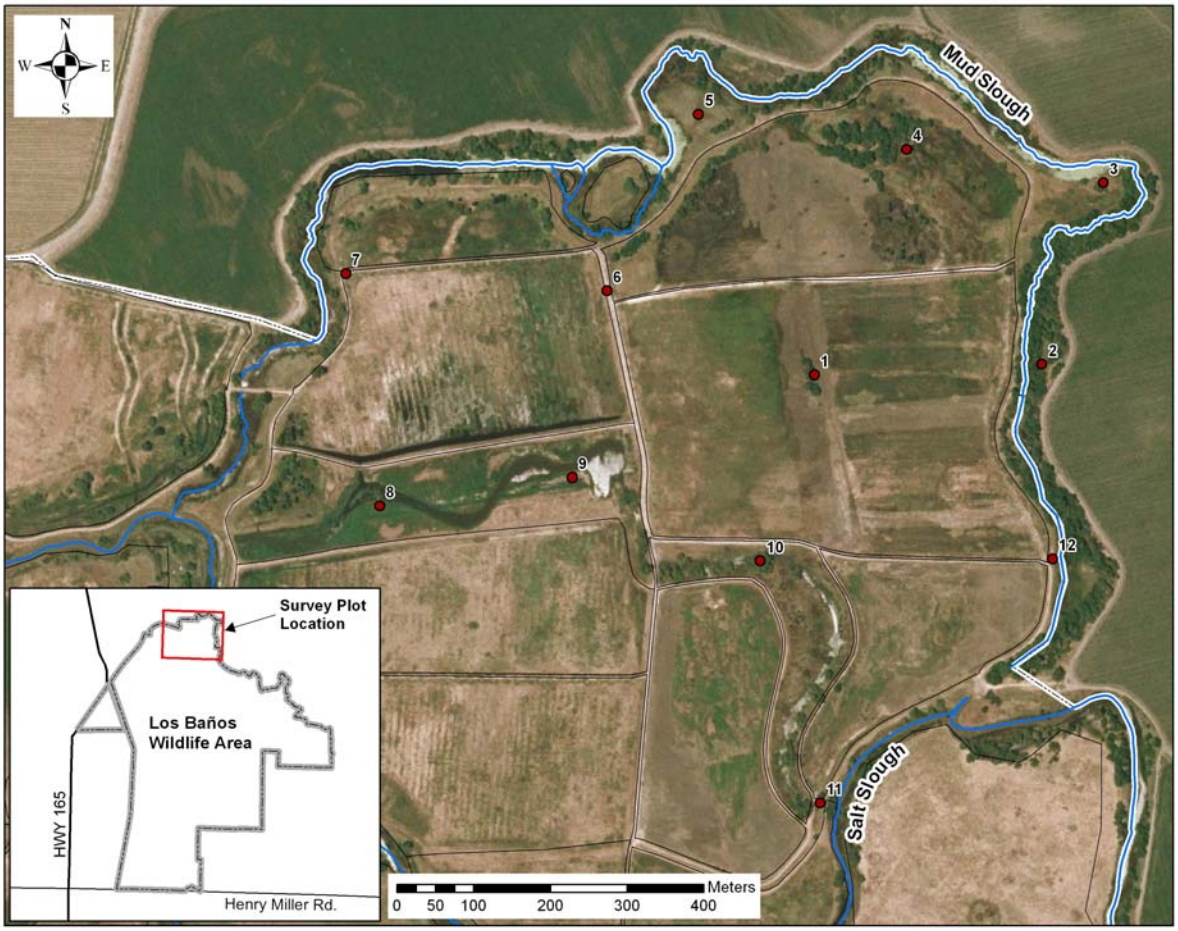

Figure 2. Los Baños Wildlife Area avian point count survey plot and point locations, Merced County, California, October 2007-June 2008.

We had two survey plots on LCCWA, one of which was located within the grazed area of the property, while the other was located within two grazing exclusions (Figure 3). The plot within the grazed section consisted of annual grassland habitat. The ungrazed plot was located within two grazing exclusion areas, one containing annual grassland, and the other containing a narrow mixed willow riparian strip and grassland.

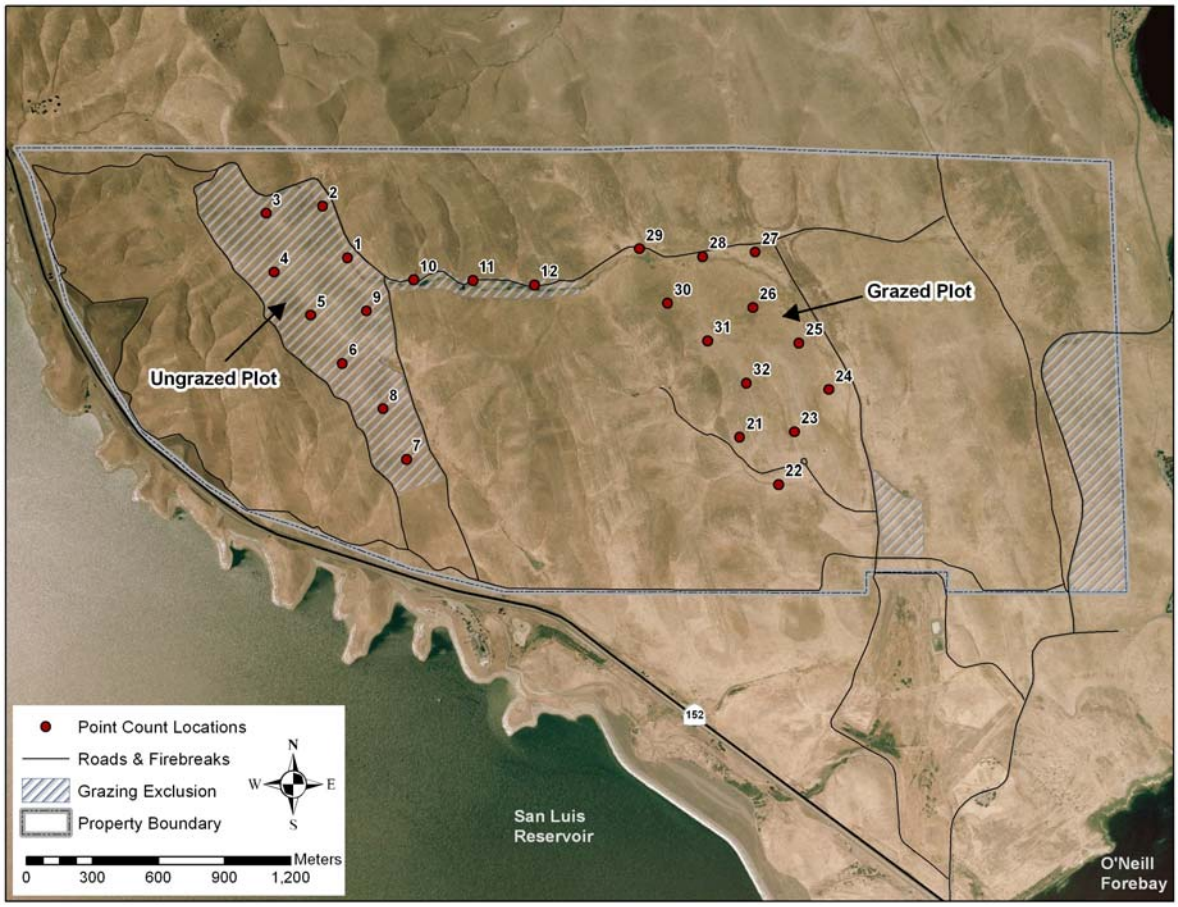

Figure 3. Lower Cottonwood Creek Wildlife Area avian point count survey plots and point locations, Merced County, California, October 2007-May 2008.

Methods

Data Collection

We conducted surveys on LBWA and LCCWA once per month from October 2007 – June 2008, and followed the guidelines for avian point counts as presented in the Handbook of Field Methods for Monitoring Landbirds (Ralph et al. 1993). Using aerials within ArcMap, we created point count routes within each survey plot prior to the start of the season, and placed points a minimum of 250 m apart among suitable habitat. We ground-truthed the points to be sure that one could walk between them in 10-15 minutes, and that each route could be completed within three hours. On LBWA, we created one route consisting of 12 points within riparian habitat, ranging from newly restored wetland/riparian to old-growth black willow riparian (Figure 2). On LCCWA, we created two routes of 12 points each; one route within the grazed area, and one route

within an ungrazed area of the property (Figure 3).

We began each survey at sunrise and used a global positioning system (GPS) unit to navigate to each point. Weather conditions and temperature were collected prior to us arriving at the first location. We approached each point with as little disturbance as possible, and once at the point, we stood still and counted all bird species seen or heard during a five minute interval. For all of our bird detections, we tallied them into one of three categories: those seen or heard within 50 m of the point, those greater than 50 m from the point, or those that flew over. For each individual, we also recorded the microhabitat type where we observed it, such as grassland, riparian or wetland. During the spring and summer seasons, we recorded any observations which confirmed that a species bred on the area. These included observing a mated pair, copulation, territorial display, distraction display, carrying nesting material, finding a nest, carrying food for nestlings, carrying away fecal sacs, or the presence of fledglings. Birds that we saw or heard while walking between points were recorded as incidental species. After surveys were completed for the day, we entered all data into an Access database.

Data Analysis

For analysis, we considered fall as October and November, winter as December through February, spring as March and April, and summer as May and June. We analyzed data from each property separately, and compiled overall species lists using data from four categories (≤ 50 m, > 50 m, flyovers and incidentals). For analyses of point counts however, we only used avian detections that were within 50 m of the survey point. Vegetation surveys were not conducted as part of this protocol, thus we did not analyze data by habitat type. On LCCWA, we grouped and analyzed data from both plots as a whole, as well as by grazed and ungrazed plots. To determine whether there was a seasonal difference in species richness (total number of species), species diversity (heterogeneity of species) and in bird abundance at LBWA and LCCWA, we conducted 2-sample *t*-tests. If an outlier was found within the data, we removed it prior to running the *t*-test. We calculated species diversity using the Shannon index based on proportional abundances, transformed by $e^{H'}$, which expresses diversity in terms of species (Nur et al. 1999). Thus, comparing species richness with diversity provides a

measure of how evenly distributed the bird species are at a location. We used NCSS 2001 (Hintze 2001) for all statistical tests and used an alpha level of 0.05 with two-tailed hypothesis testing. In each case, we examined the data to determine if they met the assumptions of normality and equal variance. If the data did not meet these assumptions, we transformed the data by a natural log transformation. We present all summary statistics as means $\pm$ 1 standard error.

Results

Los Baños Wildlife Area

We detected a total of 109 avian species from October 2007 through June 2008 on LBWA (Appendix A). Of these species, 78 were detected within 50 m of a point, while we found 22 species over 50 m from a point; six species were found solely because they flew over the survey area and we observed three incidentally. The greatest number of species per season was in spring, while we observed the fewest number of species in fall (Table 1). Winter, spring and summer all had a significantly higher number of bird species than in fall (winter: $t_{16.2} = -2.72$, $P = 0.02$; spring: $t_{22} = -3.13$, $P = 0.01$; summer: $t_{22} = -3.14$, $P = 0.01$). Fall also had the lowest species diversity of all the seasons, while we found summer to be the most diverse (Table 2). As with species richness, our surveys revealed fall diversity to be significantly lower than the remaining seasons (winter: $t_{22} = -2.21$, $P = 0.04$; spring: $t_{22} = -3.21$, $P = 0.004$; summer: $t_{22} = 4.26$, $P = 0.0003$). We also determined summer to be slightly more diverse than winter ($t_{22} = 2.23$, $P = 0.04$).

Table 1. Avian species richness by season during point count surveys on the Los Baños Wildlife Area, Merced County, California, October 2007 – June 2008.

Point #	Fall (n=2)	Winter (n=3)	Spring (n=2)	Summer (n=2)
1	6	7	8	8
2	3	10	12	12
3	10	11	13	8
4	4	13	14	11
5	9	7	10	15
6	6	11	6	14
7	7	12	15	16
8	8	12	11	8
9	8	12	13	14
10	9	12	17	11
11	9	12	13	15
12	17	13	15	12
Average	8	11	12	12
Cumulative	27	41	47	43

Table 2. Avian species diversity by season during point count surveys on the Los Baños Wildlife Area, Merced County, California, October 2007 – June 2008.

Point #	Fall (n=2)	Winter (n=3)	Spring (n=2)	Summer (n=2)
1	3.63	3.26	5.44	4.63
2	2.61	8.40	8.45	9.06
3	7.51	7.40	8.26	5.03
4	1.80	7.31	10.69	9.05
5	7.58	5.37	7.92	11.64
6	2.19	5.62	4.19	8.10
7	3.93	8.07	11.34	10.05
8	6.74	3.77	1.69	4.97
9	5.88	4.00	5.96	9.16
10	3.73	9.26	11.88	8.18
11	5.64	6.06	10.51	11.03
12	3.92	8.67	11.78	10.75
Average	4.60	6.43	8.18	8.47
Cumulative	9.11	15.68	11.03	17.33

During our surveys at LBWA, we saw ten species commonly in all seasons, including the American coot, Nuttall's woodpecker, black phoebe, bushtit, house wren, common yellowthroat, spotted towhee, song sparrow, red-winged blackbird and American goldfinch (scientific names are listed in Appendix A). We confirmed breeding for five bird species, which were the great horned owl, marsh wren, northern harrier, red-winged blackbird and Swainson's hawk. Of the ten most commonly observed birds we recorded, we found their abundances varied seasonally (Table 3). The song sparrow, red-winged blackbird and marsh wren were the only species that we consistently found as one of the most common birds in all seasons. We detected five species, the American goldfinch, common yellowthroat, red-winged blackbird, song sparrow and white-crowned sparrow, at all 12 points throughout the year. In comparison, we found a total of 26 species that were observed at only one point. Of the eight species of waterfowl we detected within 50 m of a point, half were observed at a single point.

Table 3. Top ten avian species by season during point count surveys on the Los Baños Wildlife Area, Merced County, California, October 2007 – June 2008.

	Percent of Total Detections			
Species	**Fall**	**Winter**	**Spring**	**Summer**
American Coot	3%	19%	42%	2%
White-crowned Sparrow	46%	16%	1%	
Red-winged Blackbird	3%	14%	8%	19%
Song Sparrow	7%	9%	8%	14%
Marsh Wren	3%	3%	5%	8%
American Goldfinch	4%	2%	5%	7%
Bushtit	6%	3%	3%	2%
Brown-headed Cowbird			6%	6%
Common Yellowthroat	1%	<1%	4%	8%
Savannah Sparrow	6%	4%	<1%	

Between October and June on LBWA, we detected a total of 2,429 individual birds on all surveys combined, with an average number of birds detected per point and season ranging from 18.81 in winter to 29.88 in spring (Table 4). We counted a large number of American coots during a spring survey which was found to be an outlier within the data. After removing this outlier, the only significant difference found was for

seasonal abundances between winter and summer ($t_{46.2} = 2.67$, $P = 0.01$).

Table 4. Average number of bird individuals (± standard error) detected per point and by season during avian point count surveys on the Los Baños Wildlife Area, Merced County, California, October 2007 – June 2008.

Point #	**Fall** (n=2)	**Winter** (n=3)	**Spring** (n=2)	**Summer** (n=2)
1	13.50 ± 2.50	7.33 ± 5.36	13.50 ± 0.50	20.00 ± 5.00
2	6.00 ± 0	9.33 ± 3.18	16.00 ± 1.00	17.00 ± 4.00
3	19.00 ± 2.00	13.67 ± 5.46	24.50 ± 5.50	29.00 ± --
4	29.50 ± 27.50	19.33 ± 11.70	19.50 ± 4.50	14.50 ± 2.50
5	12.50 ± 3.50	5.33 ± 3.84	15.00 ± 1.00	17.50 ± 0.50
6	20.50 ± 12.50	18.33 ± 2.96	12.50 ± 7.50	23.00 ± 4.00
7	18.50 ± 12.50	11.33 ± 5.84	21.50 ± 2.50	30.50 ± 7.50
8	22.50 ± 6.50	42.67 ± 16.23	140.00 ± 128.00	21.00 ± 1.00
9	21.50 ± 4.50	36.00 ± 12.90	35.00 ± 16.00	34.00 ± 11.00
10	34.50 ± 23.50	17.33 ± 1.76	24.50 ± 5.50	19.50 ± 2.50
11	14.50 ± 0.50	30.00 ± 17.06	15.00 ± 5.50	21.50 ± 10.50
12	58.00 ± 29.00	15.00 ± 4.36	21.00 ± 4.00	14.50 ± 2.50
Average	22.54 ± 4.06	18.81 ± 2.89	29.88 ± 10.51	21.48 ± 1.74

Lower Cottonwood Creek Wildlife Area

During our survey period, grazing did not take place on LCCWA. We detected a total of 54 avian species from October 2007 through May 2008, which includes five species seen incidentally (Appendix B). We observed 30 species within 50 m of a point and 14 species at greater than 50 m from a point; five bird species were detected flying over survey points. Spring had the greatest number of species per season overall, while we found summer to have the fewest number of species observed (fall: 17, winter: 10, spring: 20, summer: 8). When we grouped the data by management regime, the ungrazed plot had the highest number of species during all seasons, both on average and cumulatively (Table 5). However, when removing the riparian data and comparing just the grassland ungrazed and grazed points, we found that the ungrazed area had fewer avian species on average (fall: 1.3, winter: 1.1, spring: 1.3, summer: 0.0) and cumulatively (fall: 3, winter: 4, spring: 5, summer: 0) during all seasons except spring. In contrast, we identified the majority of bird species found along the ungrazed route located within the riparian habitat (fall: 16, winter: 9, spring: 18, summer: 6).

Table 5. Avian species richness by season and management regime during point count surveys on the Lower Cottonwood Creek Wildlife Area, Merced County, California, October 2007 – May 2008.

Ungrazed					Grazed				
Point #	**Fall** (n=2)	**Winter** (n=3)	**Spring** (n=2)	**Summer** (n=1)	**Point #**	**Fall** (n=2)	**Winter** (n=3)	**Spring** (n=2)	**Summer** (n=1)
1	3	3	2	0	**21**	0	1	1	0
2	2	2	3	0	**22**	1	1	3	1
3	2	1	2	0	**23**	0	1	0	0
4	0	0	0	0	**24**	1	1	1	0
5	2	1	0	0	**25**	2	1	1	0
6	0	1	1	0	**26**	2	1	1	1
7	1	0	1	0	**27**	2	0	1	0
8	1	2	1	0	**28**	2	3	1	1
9	1	0	2	0	**29**	7	3	2	1
10	8	5	6	0	**30**	2	1	1	0
11	3	5	8	4	**31**	0	1	0	1
12	14	2	12	2	**32**	1	2	1	0
Average	3.1	1.8	3.2	0.5		1.7	1.3	1.1	0.4
Cumulative	16	9	19	6		8	4	4	3

We calculated species diversity on LCCWA for both plots cumulatively, as well as by management regime (Table 6). For both grazed and ungrazed points combined, we found fall to have the greatest diversity of birds and winter to have the least diversity during our survey period (fall: 7.57, winter: 4.97, spring: 7.12, summer: 6.09). However, when we evaluate the data by management type, we found spring to be the most diverse among the ungrazed points. The ungrazed plot also appears to be more diverse overall than the grazed points in all seasons. When we remove the riparian point data from within the ungrazed plot and compare just the grassland points (fall: 1.82, winter: 2.14, spring: 2.67, summer: no birds observed) to the grazed route, we find that the grazed area had more avian diversity in all seasons except spring. Significance among diversity was not analyzed because we had many points where birds were not observed.

Table 6. Avian species diversity by season and management regime during point count surveys on the Lower Cottonwood Creek Wildlife Area, Merced County, California, October 2007 – May 2008.

Ungrazed					Grazed				
Point #	**Fall** (n=2)	**Winter** (n=3)	**Spring** (n=2)	**Summer** (n=1)	**Point #**	**Fall** (n=2)	**Winter** (n=3)	**Spring** (n=2)	**Summer** (n=1)
1	1.63	2.36	1.65		**21**		1.00	1.00	
2	2.00	1.96	2.89		**22**	1.00	1.00	2.60	1.00
3	1.82	1.00	1.75		**23**		1.00		
4					**24**	1.00	1.00	1.00	
5	1.42	1.00			**25**	1.89	1.00	1.00	
6		1.00	1.00		**26**	1.89	1.00	1.00	1.00
7	1.00		1.00		**27**	1.89		1.00	
8	1.00	2.00	1.00		**28**	1.98	1.70	1.00	1.00
9	1.00		1.96		**29**	2.77	2.52	1.36	1.00
10	6.30	2.50	4.52		**30**	1.75	1.00	1.00	
11	1.93	3.16	5.00	3.46	**31**		1.00		1.00
12	7.48	1.75	6.09	2.00	**32**	1.00	1.46	1.00	
Average	2.56	1.86	2.69	2.73		1.69	1.24	1.20	1.00
Cumulative	6.66	6.33	7.03	5.45		4.10	2.28	2.41	2.59

On LCCWA we commonly saw five species of birds in all seasons, including the mourning dove, common raven, red-winged blackbird, western meadowlark and lesser goldfinch. The savannah sparrow was the most common species we detected from fall through spring (Table 7). The only abundant species that we consistently observed in all four seasons was the western meadowlark. We also confirmed breeding for only one species, the common raven. Of all the avian species we detected, there were none that were observed at all 24 points, and we found nine species that had been detected at only a single point. When we compare species observed on grazed versus ungrazed plots, the savannah sparrow was the most common bird recorded in both management regimes. Although not the most numerous bird, we also found the western meadowlark to inhabit the grazed and ungrazed areas equally. In contrast, the majority of white-crowned sparrows we recorded were on the ungrazed plot, primarily at the points located within the riparian and shrubland habitats.

Table 7. Top ten avian species by season during point count surveys on the Lower Cottonwood Creek Wildlife Area, Merced County, California, October 2007 – May 2008.

	Percent of Total Detections			
Species	**Fall**	**Winter**	**Spring**	**Summer**
Savannah Sparrow	25%	48%	36%	
White-crowned Sparrow	12%	10%	29%	
Lesser Goldfinch	24%	18%	1%	7%
Mourning Dove	15%	5%	6%	
Western Meadowlark	11%	10%	4%	20%
Ruby-crowned Kinglet	2%	5%	3%	
Red-winged Blackbird			6%	
Say's Phoebe	3%	2%	<1%	
Cliff Swallow			4%	7%
Western Kingbird			1%	33%

We identified a total of 724 individual birds on all surveys combined at LCCWA, with an average number of birds detected per point and season ranging from 0.63 in summer to 7.0 in fall. Within the ungrazed area, we found spring to have the highest average number of birds, whereas in the grazed area abundance was the highest during fall (Tables 8a and 8b). The ungrazed plot had the highest average number of birds for all seasons except fall. When comparing only the ungrazed and grazed grassland points (i.e. omitting the riparian points), we observed more birds on average on the grazed area except in spring (fall: 4.17 ± 1.96, winter: 1.15 ± 0.32, spring: 3.89 ± 1.83, summer: 0).

Table 8a. Average number of bird individuals (± standard error) detected per point and by season during avian point count surveys within the ungrazed plot on the Lower Cottonwood Creek Wildlife Area, Merced County, California, October 2007 – May 2008.

	Ungrazed			
Point #	**Fall** (n=2)	**Winter** (n=3)	**Spring** (n=2)	**Summer** (n=1)
1	20.00 ± 15.00	3.67 ± 0.88	2.50 ± 1.50	0.00
2	6.00 ± 4.00	1.67 ± 1.20	4.50 ± 2.50	0.00
3	3.50 ± 0.50	2.33 ± 1.45	2.00 ± 1.00	0.00
4	0.00	0.00	0.00	0.00
5	4.50 ± 4.50	1.33 ± 0.88	0.00	0.00
6	0.00	0.67 ± 0.67	2.00 ± 1.00	0.00
7	0.50 ± 0.50	0.00	3.50 ± 3.50	0.00
8	0.50 ± 0.50	0.67 ± 0.67	4.00 ± 4.00	0.00
9	2.50 ± 2.50	0.00	16.5 ± 16.5	0.00
10	9.50 ± 3.50	8.33 ± 4.67	8.00 ± 4.00	0.00
11	7.00 ± 6.00	9.00 ± 5.69	21.50 ± 8.50	6.00
12	21.00 ± 11.00	1.33 ± 0.33	23.50 ± 9.50	4.00
Average	6.50 ± 2.02	2.42 ± 0.74	7.33 ± 2.13	0.83 ± 0.58

Table 8b. Average number of bird individuals (± standard error) detected per point and by season during avian point count surveys within the grazed plot on the Lower Cottonwood Creek Wildlife Area, Merced County, California, October 2007 – May 2008.

	Grazed			
Point #	**Fall** (n=2)	**Winter** (n=3)	**Spring** (n=2)	**Summer** (n=1)
21	0.00	0.33 ± 0.33	0.50 ± 0.50	0.00
22	0.50 ± 0.50	0.67 ± 0.67	3.50 ± 2.50	1.00
23	0.00	2.67 ± 1.33	0.00	0.00
24	1.00 ± 1.00	1.00 ± 0.58	1.00 ± 1.00	0.00
25	3.00 ± 2.00	1.00 ± 0.58	3.50 ± 3.50	0.00
26	1.50 ± 1.50	0.33 ± 0.33	2.00 ± 0.00	1.00
27	1.50 ± 1.50	0.00	2.00 ± 0.00	0.00
28	8.00 ± 4.00	8.33 ± 6.01	2.50 ± 0.50	1.00
29	66.00 ± 28.00	4.33 ± 2.60	5.50 ± 3.50	1.00
30	4.00 ± 4.00	0.33 ± 0.33	0.50 ± 0.50	0.00
31	0.00	0.33 ± 0.33	0.00	1.00
32	1.00 ± 1.00	2.67 ± 1.45	4.5 ± 4.50	0.00
Average	7.52 ± 4.28	1.83 ± 0.62	2.13 ± 0.57	0.42 ± 0.15

Discussion

Point count surveys are one of the most recommended and cost-effective methods for assessing avian species abundance, richness, and diversity (Ralph et al. 1993). Nur et al. (1999) stated that acquiring an inventory could be accomplished in one year, whereas determining species richness, relative abundance and breeding status could take anywhere from one to three years of data collection. Our study was only conducted for a total of nine months due to staff limitations and thus very little can be concluded from the data collected. The species lists that we developed for both LBWA and LCCWA are comparable to the existing lists that were compiled using data from previous studies and incidental observations. The majority of the most common species that we expected to find were detected during our surveys. On LBWA, despite suitable habitat being available, there were a few common species that we did not observe such as the American kestrel, American avocet and Wilson's warbler. Conversely, we did record one new species, the lesser goldfinch, which had not been observed on LBWA prior to our study. We also observed most of the expected common species on LCCWA, except for the white-tailed kite and barn owl, which have been seen regularly during other surveys in previous years. White-tailed kites are a nomadic species and may not use the property every year. Barn owls most likely were missed because our surveys were conducted during daylight hours, whereas these owls are strictly nocturnal. Although we were able to produce a comprehensive list of the most common birds on each property within nine months, we feel we were not able to determine a breeding status for all of the locally nesting species. Due to our study ending during the height of the breeding season (May-June) we were only able to confirm breeding for five species on LBWA and one species on LCCWA.

Despite our short study period, we found spring to have the highest species richness on LBWA and LCCWA. This corresponds to spring migration where there are of a combination of wintering birds that are preparing to move north to breed, as well as those that live in the area and reproduce locally. It also includes birds that wintered in Mexico or South America and are passing through on their way north to their breeding grounds. In addition, because spring is breeding season, birds are very vocal in order to attract mates, thus making their detections much higher. In contrast, the lowest

number of species on LBWA was observed in the fall, most likely due to the fact that our surveys began in October, after the fall migration would have occurred. The peak of fall migration is in August, and by October birds such as neotropical migrants would have already passed through on their way south, leaving primarily resident species and those that winter in this area from more northern ranges. On LCCWA we found the lowest species richness to occur in the summer, possibly because there is little variety in habitat types on this property, which would limit the number of nesting bird species attracted to the area to breed.

When we compared the data from points within the newly created wetland/riparian habitat on LBWA with that of points within old-growth riparian, we found similarities and differences. The species richness and diversity between these two areas were somewhat similar. We recorded 49 avian species in both areas combined, 39% of which were common to both habitat types. However, some differences we found in bird species composition were related to habitat. For example, ten of the 17 species that we observed solely at the wetland/riparian points were waterbirds, corresponding to the presence of more open wetland habitat. At the points within the old-growth riparian habitat, we observed bird species that are associated with larger, more mature trees such as ash-throated flycatchers and great horned owls. Over time, as the trees within the wetland/riparian habitat continue to grow, avian species composition will most likely have more overlap with the old-growth riparian.

Prior to this study we operated a passerine mist-netting and banding station within the mature riparian area. This station was run annually from 2000 through 2006, primarily in the summer and fall months, but also during winter and spring in select years (Sparks 2008). When we compared our avian species list with that of the banding station's, we found our inventory to contain only about 24% of the birds recorded during the previous banding years. However, more than half of the species documented during those years were low in abundance, which would have made them more difficult for us to detect in just one year. We encountered the majority of locally common birds in both studies, with the exception of a few individuals. White-crowned sparrows were one of the more frequently seen species we observed during our point counts, but these birds were rarely detected in the seven years of banding. Our observations of these

sparrows may have been by chance, as they can be secretive and often difficult to notice. Conversely, Nuttall's woodpeckers are often highly vocal making them easier to detect. During banding, these birds were regularly observed in and around the banding station, especially in the summer and fall months. However, this species was not recorded in this same area during our point counts. An inadequate number of surveys in the summer could explain our lack of detection, but not for the fall period. Using mist-nets to document avian presence often produces a completely different species list than incidental observations or point counts. Some of the most commonly captured birds may be the least detected during other protocols, especially those that are very inconspicuous or rarely vocalize. For example, two species that were often captured in mist-nets, the Swainson's thrush and Lincoln's sparrow, were not seen at our point count locations. These birds spend a majority of their time within the vegetation, rarely venturing into the open, and also have a soft call note that can often be missed. In order to detect these types of birds, as well as other rare species using the point count method, we would need to perform these surveys over several years and use only well-trained personnel throughout the duration of the study. However, we do feel that point counts, even over a short period of time, can provide valuable information about bird species composition and habitat use.

Another protocol that is often used to develop a basic avian species list are walking transects, which were conducted on LCCWA from November 2000 through October 2001 (prior to cattle grazing). During that baseline survey, two transects were walked along firebreaks through grassland, riparian and shrubland habitats; one on the eastern side of the property and the other on the western side. For that protocol, birds were identified and tallied only within 50 m of each transect route. When we compared the species observed along those transects with birds seen during our study, nearly twice as many species were found during the walking transects. While conducting our surveys, we recorded all of the common species that were seen along the transect routes, with the savannah sparrow being the most common bird found in both studies. Birds that were observed in the initial study and that we did not encounter on our surveys were species that are rare. However, we also found some less common species, two of which had not been previously documented on LCCWA, including the

blue-gray gnatcatcher and Nuttall's woodpecker. More bird species were found along the western transect of the baseline survey than on the eastern transect. This is similar to what we found on our ungrazed versus grazed plots. A section of the western transect and some points in the ungrazed plot were located within the narrow riparian strip, which most likely increased the number of species on both surveys. When we compared relative abundance of birds from walking transects in 2000-2001 to point counts during 2007-2008, most of the top ten species were more numerous per hectare during the transect inventory surveys. Two species that were fairly prevalent during the initial inventory, the house finch and American goldfinch, were not as numerous on our point count plots. However, we found the lesser goldfinch to be much more abundant than in the previous study. Based on the foraging characteristics of these birds, the differences could be due to habitat structure changes caused by precipitation and/or cattle grazing. During 2000-2001 there was average rainfall, possibly allowing for greater production of herbaceous plants. In 2007-2008 the rainfall was almost 11 cm below the average (California Department of Fish and Game 2008), and following a drought year, this type of vegetation may not have been as successful. In addition to low rainfall years, it has been found that grazing with cattle is typically used to advance the succession of vegetation, which would increase the production of perennial grasses and decrease the forb abundance (Vavra 2005). House finches and goldfinches often feed on seeds of low growing plants such as thistles, and with the lack of these types of forbs it may have caused a decrease in the numbers of house finches and goldfinches we detected. However, lesser goldfinches also have been found to tolerate wider rainfall and temperature ranges than other goldfinches (Grinnell and Miller 1944), which may explain why we observed these birds in higher numbers. Therefore changes in abundances of these finches on LCCWA could have been caused by a reduction in forbs due to the effects of cattle grazing and differences in precipitation, although without corresponding vegetation measurements, we cannot make this determination with certainty.

Several studies found cattle grazing to have both positive and negative effects on passerines in grassland habitat depending upon grazing intensity, grassland type, and the birds' foraging and nesting preferences. The grasshopper sparrow, a California bird

Species of Special Concern, is described as preferring “short to middle-height, moderately open grasslands with scattered shrubs” (Unitt 2008). Although not conducted in California, research has shown that these birds respond positively to moderate grazing in tallgrass prairies (Risser et al. 1981, Skinner 1975). However, they have also been found to respond negatively to moderate grazing in semidesert (Bock et al. 1984) or to heavy grazing in shortgrass habitat (Ryder 1980, Wiens 1973). Unfortunately there has not been a standardized definition of grazing intensity and thus we cannot compare the grazing regime on LCCWA with that of other studies. However, based on local practices, the grazing intensity on LCCWA is considered short-term and heavy (W. Cook, Jr. pers. comm. March 15, 2011) with an introduction of cattle in late fall when the germination of less desirable, non-native grasses begins. Cattle are then removed in late winter to promote the growth of more desirable grasses, such as oats (*Avena* sp.), and natives such as purple needlegrass (*Nassella pulchra*). Despite this grazing practice, actual numbers of individual grasshopper sparrows found on this property have remained the same between 2000-2001 and 2007-2008 (six per study period), although abundance per hectare has increased. During our point count surveys, the majority of individuals were actually recorded within the grazed area, and we found only one individual in ungrazed grassland habitat. Grazing on LCCWA may have improved conditions for this species by providing less dense, shorter stature grassland, but without conducting simultaneous vegetation sampling we cannot verify this conclusion.

Vegetation monitoring alongside avian surveys is critical for determining how birds may be responding to the various management techniques used on the wildlife areas. Our study has provided a basic inventory, as well as richness and diversity of the more abundant species, although a full year’s worth of data would provide a more complete account. If the main interest for area managers is to observe a general change in these over time, this type of monitoring would suffice. Returning to the study sites to conduct surveys once every two to three years would most likely document changes. However, relating such differences to factors such as habitat alterations would continue to be difficult. Thus, we recommend adding vegetation sampling to these surveys if they continue, such as recording plant type, density and height. Also, if

riparian restoration occurs or grazing regimes are utilized, we recommend conducting surveys for a minimum of three years to monitor changes in vegetation and birds over time as habitats continue through succession.

Acknowledgements

Funding for this study was provided by the California Department of Fish and Game Resource Assessment Program. We would like to thank William Cook, Jr., manager of the Los Baños Wildlife Area Complex, for his interest and support of our monitoring efforts. Data collection by Melanie Bernal and Matt Schaap (technicians), and Lara Sparks (avian biologist).

Literature Cited

Allen, R. W. 2003. The effect of gamebird management on nongame bird species richness, density, and nesting success in the San Joaquin Valley, California. M. S. Thesis, Humboldt State University, Arcata. 34pp.

Bock, C. E., and B. Webb. 1984. Birds as grazing indicator species in southeastern Arizona. Journal of Wildlife Management 48(3):1045-1049.

California Department of Fish and Game. 2008. Rainfall data 1970-2008. Los Baños Wildlife Area unpublished data, Los Baños.

California Partners in Flight. 2008. Bringing the Birds Back: A Guide to Habitat Enhancement for Birds in the Sacramento Valley (R. DiGaudio, K. Kreitinger and T. Gardali, lead authors). California Partners in Flight Regional Conservation Plan No. 2. 24pp.

Grinnell, J., and A. H. Miller. 1944. The Distribution of the Birds of California. Pacific Coast Avifauna, No. 27. 617pp.

Hintze, J. 2001. NCSS and PASS. Number cruncher statistical systems. Kaysville, Utah.

Nur, N., S. L. Jones, and G. R. Geupel. 1999. A statistical guide to data analysis of avian monitoring programs. U. S. Department of the Interior, Fish and Wildlife Service, BTP-R6001-1999, Washington, D. C.

Ralph, C. J., G. R. Geupel, P. M. Pyle, T. E. Martin, and D. F. DeSante. 1993. Handbook of field methods for monitoring landbirds. Gen. Tech. Rep. PSW-GTR-144-www. Albany, CA: Pacific Southwest Research Station, Forest Service, U. S. Department of Agriculture. 41pp.

Risser, P. G., E. C. Birney, H. D. Blocker, S. W. May, W. J. Parton, and J. A. Wiens. 1981. The true prairie ecosystem. Hutchinson Ross Publishing Company, Stroudsburg, PA. 557pp.

Ryder, R. A. 1980. Effects of grazing on bird habitats. Pages 51-66 *in* R. M. Degraff and N. G. Tilghman, comps. Management of western forests and grasslands for nongame birds. USDA Forest Service Gen. Tech. Rep. INT-86. Intermountain Forest and Range Experiment Station, Ogden, UT. 535pp.

Skinner, R. M. 1975. Grassland use patterns and prairie bird populations of Missouri. Pages 171-180 *in* M. K. Wali, ed. Prairie: a multiple view. University of North Dakota Press, Grand Forks, ND. 433pp.

Sparks, L. A. 2008. Los Baños Wildlife Complex Mist-netting and Passerine Banding Report – 2005 & 2006. California Department of Fish and Game, Los Baños. Final Report, Los Baños Wildlife Area Publication #41. 31pp.

Unitt, P. 2008. Grasshopper sparrow (*Ammodramus savannarum*). Pages 393-399 *in* W. D. Shuford and T. Gardali, eds. California Bird Species of Special Concern: A ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California. Studies of Western Birds 1. Western Field Ornithologists, Camarillo, and California Department of Fish and Game, Sacramento. 450pp.

Vavra, M. 2005. Livestock Grazing and Wildlife: Developing Compatibilities. Rangeland Ecology & Management 58(2):128-134.

Wiens, J. A. 1973. Pattern and process in grassland bird communities. Ecological Monographs 43(2):237-270.

Personal Communications

William Cook, Jr. 2011. Wildlife Habitat Supervisor II. California Department of Fish and Game, Los Baños.

Appendix A. Avian species detected during point count surveys on the Los Baños Wildlife Area by season, October 2007 – June 2008. (A: ≤ 50 meters, B: > 50 meters, C: Flyover, X: Incidental)

Common Name	Scientific Name	Fall	Winter	Spring	Summer
Greater White-fronted Goose	*Anser albifrons*			C	
Snow Goose	*Chen caerulescens*		B	B	
Canada Goose	*Branta canadensis*		B		
Tundra Swan	*Cygnus columbianus*		B		
Wood Duck	*Aix sponsa*		A	X	A
Gadwall	*Anas strepera*	X	A	X	X
American Wigeon	*Anas americana*		B	X	
Mallard	*Anas platyrhynchos*	A	A	A	
Cinnamon Teal	*Anas cyanoptera*	A		A	A
Northern Shoveler	*Anas clypeata*		A		
Northern Pintail	*Anas acuta*		B	B	
Green-winged Teal	*Anas crecca*			A	
Canvasback	*Aythya valisineria*			A	
Ring-necked Duck	*Aythya collaris*			B	
Lesser Scaup	*Aythya affinis*		C	C	
Ruddy Duck	*Oxyura jamaicensis*		A		
California Quail	*Callipepla californica*	A		A	A
Ring-necked Pheasant	*Phasianus colchicus*			A	A
Pied-billed Grebe	*Podilymbus podiceps*			A	A
American White Pelican	*Pelecanus erythrorhynchos*			C	C
Double-crested Cormorant	*Phalacrocorax auritus*	C	C	C	C
American Bittern	*Botaurus lentiginosus*		A	A	
Great Blue Heron	*Ardea herodias*		X	A	A
Great Egret	*Ardea alba*	A		A	
Snowy Egret	*Egretta thula*				A
Black-crowned Night-Heron	*Nycticorax nycticorax*				A
White-faced Ibis	*Plegadis chihi*		A		
White-tailed Kite	*Elanus leucurus*		B		
Northern Harrier	*Circus cyaneus*	X			A
Sharp-shinned Hawk	*Accipiter striatus*	A	X		
Cooper's Hawk	*Accipiter cooperii*	X	X	X	
Red-shouldered Hawk	*Buteo lineatus*	X	A		
Swainson's Hawk	*Buteo swainsoni*			A	A

Appendix A *continued*. Avian species detected during point count surveys on the Los Baños Wildlife Area by season, October 2007 – June 2008. (A: ≤ 50 meters, B: > 50 meters, C: Flyover, X: Incidental)

Common Name	Scientific Name	Fall	Winter	Spring	Summer
Red-tailed Hawk	*Buteo jamaicensis*		A	A	X
Merlin	*Falco columbarius*		B		
Peregrine Falcon	*Falco peregrinus*		B		
Virginia Rail	*Rallus limicola*			A	A
Sora	*Porzana carolina*		A	A	
Common Moorhen	*Gallinula chloropus*		X		A
American Coot	*Fulica americana*	A	A	A	A
Sandhill Crane	*Grus canadensis*		A		
Killdeer	*Charadrius vociferus*		A	A	A
Black-necked Stilt	*Himantopus mexicanus*		A	A	
Greater Yellowlegs	*Tringa melanoleuca*		A	A	
Long-billed Curlew	*Numenius americanus*	C	C		X
Western Sandpiper	*Calidris mauri*		B		
Least Sandpiper	*Calidris minutilla*		A		
Dunlin	*Calidris alpina*		B		
Long-billed Dowitcher	*Limnodromus scolopaceus*	X	B	B	
Wilson's Snipe	*Gallinago delicata*	X	A	X	
Ring-billed Gull	*Larus delawarensis*		B		
Rock Pigeon	*Columba livia*				B
Mourning Dove	*Zenaida macroura*	X	A	A	A
Barn Owl	*Tyto alba*		X		
Great Horned Owl	*Bubo virginianus*	A	X	A	A
Anna's Hummingbird	*Calypte anna*	B			
Belted Kingfisher	*Megaceryle alcyon*	B			
Nuttall's Woodpecker	*Picoides nuttallii*	A	A	A	A
Downy Woodpecker	*Picoides pubescens*			A	A
Red-shafted Flicker	*Colaptes auratus cafer*		A	X	X
Black Phoebe	*Sayornis nigricans*	A	A	A	A
Say's Phoebe	*Sayornis saya*	B	B		
Ash-throated Flycatcher	*Myiarchus cinerascens*				A
Western Kingbird	*Tyrannus verticalis*			A	A
Loggerhead Shrike	*Lanius ludovicianus*		X		
Warbling Vireo	*Vireo gilvus*				A

Appendix A *continued*. Avian species detected during point count surveys on the Los Baños Wildlife Area by season, October 2007 – June 2008. (A: ≤ 50 meters, B: > 50 meters, C: Flyover, X: Incidental)

Common Name	Scientific Name	Fall	Winter	Spring	Summer
Western Scrub-Jay	*Aphelocoma californica*	A		A	A
American Crow	*Corvus brachyrhynchos*	B	B	B	B
Common Raven	*Corvus corax*	B		B	
Tree Swallow	*Tachycineta bicolor*				A
Cliff Swallow	*Petrochelidon pyrrhonota*				A
Barn Swallow	*Hirundo rustica*				A
Bushtit	*Psaltriparus minimus*	A	A	A	A
Bewick's Wren	*Thryomanes bewickii*		A		
House Wren	*Troglodytes aedon*	A	A	A	A
Marsh Wren	*Cistothorus palustris*	A	A	A	A
Ruby-crowned Kinglet	*Regulus calendula*	A	A	A	
Swainson's Thrush	*Catharus ustulatus*				A
Hermit Thrush	*Catharus guttatus*		A		
American Robin	*Turdus migratorius*			A	A
Northern Mockingbird	*Mimus polyglottos*		A		
European Starling	*Sturnus vulgaris*		B		
American Pipit	*Anthus rubescens*		A		
Cedar Waxwing	*Bombycilla cedrorum*	X	X	A	
Orange-crowned Warbler	*Oreothlypsis celata*	A		X	
Yellow Warbler	*Dendroica petechia*				A
Audubon's Warbler	*Dendroica coronata audubonii*	A	A	A	
Common Yellowthroat	*Geothlypis trichas*	A	A	A	A
Spotted Towhee	*Pipilo maculatus*	A	A	A	A
California Towhee	*Melozone crissalis*			A	
Savannah Sparrow	*Passerculus sandwichensis*	A	A	A	
Fox Sparrow	*Passerella iliaca*	A	A		
Song Sparrow	*Melospiza melodia*	A	A	A	A
Lincoln's Sparrow	*Melospiza lincolnii*	A	A	A	
White-crowned Sparrow	*Zonotrichia leucophrys*	A	A	A	
Golden-crowned Sparrow	*Zonotrichia atricapilla*	A	A	A	
Dark-eyed Junco	*Junco hyemalis*	B	X		
Black-headed Grosbeak	*Pheucticus melanocephalus*				A
Blue Grosbeak	*Passerina caerulea*				A

Appendix A *continued*. Avian species detected during point count surveys on the Los Baños Wildlife Area by season, October 2007 – June 2008. (A: ≤ 50 meters, B: > 50 meters, C: Flyover, X: Incidental)

Common Name	Scientific Name	Fall	Winter	Spring	Summer
Red-winged Blackbird	*Agelaius phoeniceus*	A	A	A	A
Tricolored Blackbird	*Agelaius tricolor*				A
Western Meadowlark	*Sturnella neglecta*	A		A	
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*			C	
Brewer's Blackbird	*Euphagus cyanocephalus*	X	B		X
Brown-headed Cowbird	*Molothrus ater*			A	A
Bullock's Oriole	*Icterus bullockii*			A	A
House Finch	*Carpodacus mexicanus*		X	A	A
Lesser Goldfinch	*Spinus psaltria*		A	A	
American Goldfinch	*Spinus tristis*	A	A	A	A

Appendix B. Avian species detected during point count surveys on the Lower Cottonwood Creek Wildlife Area by season, October 2007 – May 2008. (A: ≤ 50 meters, B: > 50 meters, C: Flyover, X: Incidental)

Common Name	Scientific Name	Fall	Winter	Spring	Summer
Mallard	*Anas platyrhynchos*			X	
California Quail	*Callipepla californica*	A		X	B
Double-crested Cormorant	*Phalacrocorax auritus*		C		
Great Egret	*Ardea alba*				C
Turkey Vulture	*Cathartes aura*		X	X	
Northern Harrier	*Circus cyaneus*		B	B	B
Sharp-shinned Hawk	*Accipiter striatus*	B			
Red-tailed Hawk	*Buteo jamaicensis*	B	B	B	
Golden Eagle	*Aquila chrysaetos*		B	B	
American Kestrel	*Falco sparverius*	B	B		
Merlin	*Falco columbarius*			C	
Prairie Falcon	*Falco mexicanus*	B			
Killdeer	*Charadrius vociferus*		B		C
Long-billed Curlew	*Numenius americanus*		X		
Ring-billed Gull	*Larus delawarensis*		B	B	
Herring Gull	*Larus argentatus*	C			
Mourning Dove	*Zenaida macroura*	A	A	A	B
Great Horned Owl	*Bubo virginianus*	B	X		
Burrowing Owl	*Athene cunicularia*		B		
Anna's Hummingbird	*Calypte anna*	A			
Nuttall's Woodpecker	*Picoides nuttallii*	A	B		
Red-shafted Flicker	*Colaptes auratus cafer*	B	B		
Black Phoebe	*Sayornis nigricans*	A			
Say's Phoebe	*Sayornis saya*	A	A	A	
Ash-throated Flycatcher	*Myiarchus cinerascens*				A
Western Kingbird	*Tyrannus verticalis*			A	A
Loggerhead Shrike	*Lanius ludovicianus*	A	B	A	
American Crow	*Corvus brachyrhynchos*	A	B		B
Common Raven	*Corvus corax*	B	B	A	A
Tree Swallow	*Tachycineta bicolor*			B	B
Cliff Swallow	*Petrochelidon pyrrhonota*			A	A
Bewick's Wren	*Thryomanes bewickii*	X	A		
Ruby-crowned Kinglet	*Regulus calendula*	A	A	A	

Appendix B *continued*. Avian species detected during point count surveys on the Lower Cottonwood Creek Wildlife Area by season, October 2007 – May 2008. (A: ≤ 50 meters, B: > 50 meters, C: Flyover, X: Incidental)

Common Name	Scientific Name	Fall	Winter	Spring	Summer
Blue-gray Gnatcatcher	*Polioptila caerulea*	A			
Western Bluebird	*Sialia mexicana*	B	B		
American Pipit	*Anthus rubescens*		A		
Audubon's Warbler	*Dendroica coronata auduboni*	A	X	A	
Townsend's Warbler	*Dendroica townsendi*	X			
California Towhee	*Melozone crissalis*	X	B	A	X
Savannah Sparrow	*Passerculus sandwichensis*	A	A	A	
Grasshopper Sparrow	*Ammodramus savannarum*			A	
Lincoln's Sparrow	*Melospiza lincolnii*		X	A	
White-crowned Sparrow	*Zonotrichia leucophrys*	A	A	A	
Golden-crowned Sparrow	*Zonotrichia atricapilla*	A	B	A	
Dark-eyed Junco	*Junco hyemalis*	X			
Blue Grosbeak	*Passerina caerulea*				A
Red-winged Blackbird	*Agelaius phoeniceus*	B	B	A	B
Western Meadowlark	*Sturnella neglecta*	A	A	A	A
Brewer's Blackbird	*Euphagus cyanocephalus*		C		
Brown-headed Cowbird	*Molothrus ater*			A	A
Bullock's Oriole	*Icterus bullockii*			B	
House Finch	*Carpodacus mexicanus*	A	A	A	X
Lesser Goldfinch	*Spinus psaltria*	A	A	A	A
American Goldfinch	*Spinus tristis*	B	B	A	