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Managing Water in the West

2006 Monitoring Report for the Los Lunas Habitat Restoration Site

U.S. Department of the Interior
Bureau of Reclamation
Technical Service Center
Environmental Services Division
Fisheries and Wildlife Resources Group
Denver, Colorado

December 2007

Mission Statements

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian Tribes and our commitments to island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

2006 Monitoring Report for the Los Lunas Habitat Restoration Site

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Introduction

The Los Lunas Habitat Restoration Project is intended to fulfill requirements in one of eight reaches in which habitat restoration must be conducted in accordance with Element J of the Reasonable and Prudent Alternative (RPA) within the June 2001 Biological Opinion (BO) issued by the U.S. Fish and Wildlife Service (USFWS) (USFWS 2001). The U.S. Bureau of Reclamation (Reclamation) Albuquerque Area Office and the U.S. Army Corps of Engineers (Corps) Albuquerque District have acted as joint lead Federal agencies on this project, and the Middle Rio Grande Conservancy District (MRGCD) is the primary non-Federal cooperator.

In April of 2000, an area of the bosque that included the entirety of the Los Lunas Restoration Site (LLRS) suffered a severe fire that destroyed virtually all of the aboveground vegetation. This area thus presented a unique opportunity for restoration and was subsequently selected as the first BO restoration project.

The primary objectives of the restoration project were to improve habitat conditions for the Rio Grande silvery minnow (*Hybognathus amarus*)(minnow) and southwestern willow flycatcher(SWFL)[1] such that, in combination with other elements of the RPA, continued jeopardy to the two species could be avoided.

The design goals were to generate inundation of the project area at flows of greater than or equal to 2,500 cubic feet/second (cfs). For flows below 2,500 cfs, a variety of substrate elevations was integrated into the project design which allows for the inundation of certain regions at lower river stages. This includes features such as a network of variable depth side and transverse channels designed to aid in minnow egg retention and provide shallow water/low velocity rearing habitat. In addition, the increased inundation frequency would begin the process of post-fire regeneration of high-value existing and revegetated terrestrial habitats in portions within and adjacent to the restoration area to support the recovery of the SWFL.

In April 2002, the initial phase of work began by removing approximately 1,400 jetty jacks and establishing access routes and a staging area. Upon the initiation of construction, the site was largely dominated by thick stands of herbaceous and exotic re-growth. Vegetation was cleared within the overbank area, access roads, staging area, and disturbance areas next to the levee and root-wad berm, and these areas were mulched. With the removal of jetty jacks completed, crews from Reclamation's Socorro Field Office began clearing, surveying, and excavating the flood plain. Specific areas within the site were revegetated using seed, potted shrubs, or cottonwood[2] and willow poles.

[1] Scientific names of bird species in this report are listed in Appendix A.
[2] Scientific names of plant species in this report are listed in Appendix B.

To fulfill the requirements of the BO, monitoring of habitat suitability/sustainability is being conducted. Reclamation's Technical Service Center in Denver, Colorado, has carried out avian, vegetation, and ground water monitoring at the LLRS since 2003.

Methods

Avian Monitoring

Point Counts

Los Lunas Restoration Site

Avian monitoring included 5-minute, 50-meter (m) fixed-radius point counts that were conducted three times per year during the peak breeding seasons (late-May to early-July). This report discusses two sites within the LLRS, and one site south of the LLRS that were monitored during the 4-year study period from 2003 to 2006. Only one site, referred to here as the Cleared/Overbank Area, was monitored for the duration of the study. Point counts were conducted in the Burned Area in 2003 and 2004 and in the Future Desired Conditions Area in 2006 (Figures 1 and 2). The three sites are described below:

Cleared/Overbank Area This area, located within the LLRS, borders the active river channel and was cleared and excavated to allow overbank flooding; eight point counts were conducted at this site from 2003 to 2006.

Burned Area This area consists of a previously burned cottonwood forest within the LLRS that is experiencing regrowth of mixed vegetation; 17 point counts were conducted at this site for 2 seasons in 2003 and 2004.

Future Desired Conditions Area This area is located south of the LLRS on seasonally flooded sandbars that consist of young stands of mixed willow (*Salix* spp.) and cottonwood and was chosen as a reference site for comparison purposes; 12 point counts were conducted at this site for the first time in 2006.

Data from the 4 years were compared to evaluate any statistically significant changes in relative abundance of pooled species groups over time and between plots. Pooled species groups included neotropical migrants, riparian obligates, non-migratory residents, marsh/waterbirds, and invasive bird species. "Invasive" bird species are birds that are opportunistic invaders of disturbed habitat and appear to expand their population size from disturbance, agricultural development, and urbanization. Appendix A shows the groupings of individual birds species for analysis purposes.

Figure 1. Point count locations at LLRS.

Figure 2. Point count locations downstream of LLRS.

The Student's t-test of means or the Analysis of Variance (ANOVA) test was used to statistically compare normally distributed data, and the Mann-Whitney or Kruskall-Wallace nonparametric test of medians was used to compare data that were not normally distributed.

Three other sites—Unburned/Untreated Cottonwood Forest, Cottonwood Forest with Cleared Exotic Understory, and Burned Cottonwood Forest with Willow Dominated Understory—were monitored and included in analysis in 2005. Point counts were conducted at these sites as part of another study, and data were not found to be valuable for the purposes of this study. Therefore, monitoring and analysis will no longer be conducted as part of the Los Lunas Habitat Restoration Project on these three sites.

Site Comparison Area

For comparison, we have also provided data from point counts conducted concurrently in riparian areas in the San Marcial area along the Middle Rio Grande. Point count locations are in Appendix C. This site was selected as a comparison site because overbank flooding provides some of the best riparian habitat along the Rio Grande in New Mexico. The points are located adjacent to riparian habitat composed of mixed native and exotic stands.

Southwestern Willow Flycatcher Surveys

We conducted presence/absence surveys for the endangered SWFL in accordance with Sogge et al. (1997) and the USFWS revised protocol (USFWS 2000). Three SWFL presence/absence surveys were conducted each year within the LLRS from 2004 through 2006. Additional surveys were conducted within the same period on both sides of the river in adjacent sections of the Belen Reach between the Los Lunas and Belen bridges. These surveys were part of Reclamation's annual SWFL monitoring program conducted at selected sites along the Rio Grande from Velarde to Elephant Butte Reservoir (Moore and Ahlers 2006). Willow flycatcher survey forms and maps are shown in Appendix D.

Vegetation Monitoring

River Transects

Twelve 5-m permanent transects were established at the LLRS between the root-wad berm and the river to document the natural establishment of vegetation in this area. This area was not revegetated using seed or potted shrubs. All transects were evenly distributed in the disturbed area and were oriented perpendicular to the river (Figure 3).

Cover and species composition were measured every 0.5 m along the 50-m transect using the point-intercept method. The plant that was first "hit" from above the meter tape to the ground at the point of measurement was recorded. These data therefore reflect an aerial view of vegetative cover at the site and do not include other plants that fall below

Figure 3. Vegetation transect locations.

as the second or third "hit" or layer. Data were collected sometime between late-August and mid-September of 2003, 2004, 2005 and 2006.

Data from the 4 years were compared to evaluate any statistically significant changes in vegetation types over time. The Analysis of Variance (ANOVA) test was used to statistically compare normally distributed data, and the Kruskall-Wallace nonparametric test of medians was used to compare data that were not normally distributed. At present, there are no similar restoration projects in the region to use as a comparison.

Mixed Shrub Transects

Eight 50-m permanent transects were established just west of the root-wad berm to document survival rates of mixed shrubs that were planted at this site in November of 2004. Transects were randomly placed within clusters of containerized transplantings. Two 50-m permanent transects were placed just east of the root-wad berm (river side) where western black willow poles were planted. Refer to Figure 3 for the 10 transect locations.

Stem density was measured within 1 m of each side of the transect. The number of individual stems in this area was counted and species (if identifiable) and status (live or dead) were recorded. Data were collected in late-August of 2005 and mid-September of 2006. The 2006 results were compared to the 2005 data to determine the mixed shrub container plantings survival.

Cottonwood Pole Plots

Seven 25- by 10-m permanent plots were established on the east side of the drain ditch road north of the river access road to document survival rates of cottonwood pole cuttings that were planted at this site in April of 2004. Plots were evenly distributed within the planted area and were placed parallel to the road (Figure 3). They were marked by a 25-m transect in the center.

The number of live poles, dead poles, and live root sprouts within each plot was counted in late-August of 2005 and in mid-September of 2006. No other species besides cottonwoods were recorded. The 2006 results were compared to the 2005 data to evaluate the cottonwood pole plantings survival.

Ground Water Monitoring

A total of 11 ground water monitoring wells was installed along 3 transects running perpendicular to the river—4 wells on the northern end of the site, 4 in the center, and 3 on the southern end (Figure 4). All wells were installed using the methodology described in the Corps publication "Installing Monitoring Wells and Piezometers in Wetlands" (ERDC TN-WRAP-00-02). All wells averaged 5.0 feet in depth, with the ground water depth at a range of 2.0 to 4.0 feet below the surface at the time of installation. Eight wells were installed in June 2003, and the remaining westernmost three were installed July 2004.

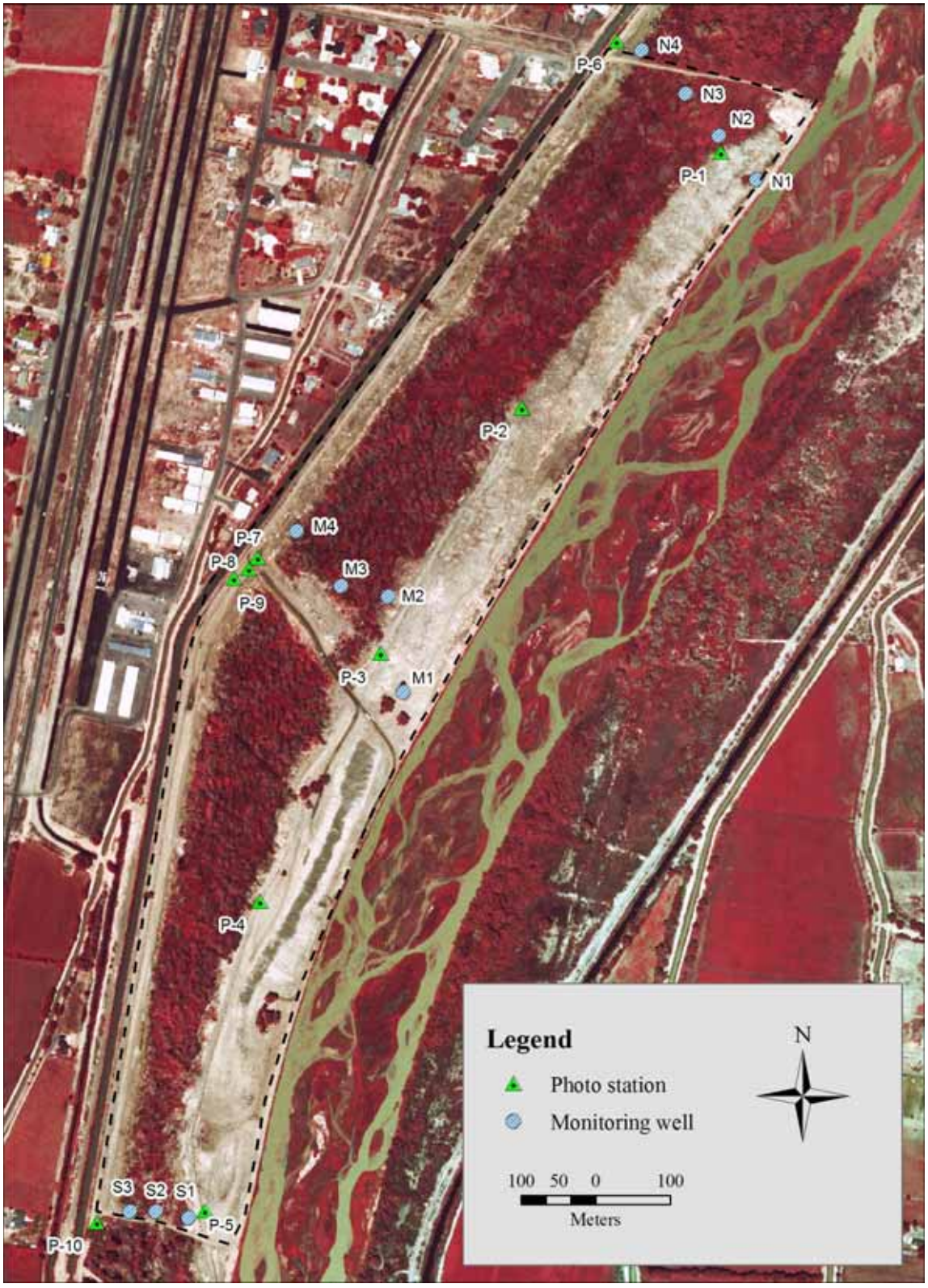


Figure 4. Ground water well and photo station locations.

Photo Stations

Ten photo stations were established throughout the study area with permanent numbered t-posts (Figure 4). Digital photographs were taken sometime between late-August and mid-September in 2003 through 2006 to visually document vegetation height, density, species composition, and overall site development. Annual photos will be compared to 2003 baseline photos to evaluate changes over time.

Results

Avian Monitoring

Point Counts

Los Lunas Restoration Site

Cleared/Overbank Area Table 1 provides data on the relative abundance of individual species for the Cleared/Overbank Area by year. The "% Plots" column shows the percentage of points in which the species was noted within each plot type. The "Mean" and "SD" columns represent the mean number and standard deviation of detections per point for the species within each plot type.

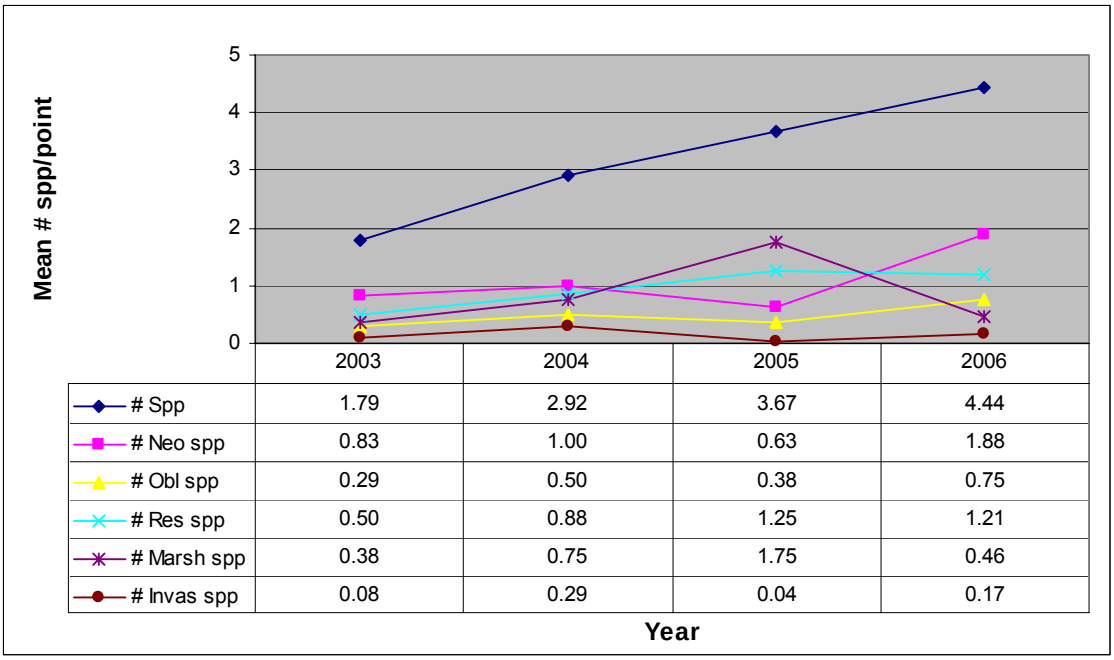
A total of 42 species was detected during the point counts conducted from 2003 to 2006. The most abundant species in 2003 were blue grosbeaks, redwing blackbirds, turkey vultures, and western kingbirds. Abundant species were similar in 2006 and included barn swallows, blue grosbeaks, mourning doves, redwing blackbirds, and western kingbirds.

There has generally been an increase in the abundance of both species and individual birds within all of the pooled groups over the monitoring period (Figures 5 and 6). These trends are consistent with the development of vegetation within the Cleared/Overbank Area, i.e., as the cover and height of vegetation have increased, so have the number and types of birds.

In statistical analysis comparing Year 1 of monitoring (2003) to Year 4 (2006), the average number of species per point increased significantly from 1.79 to 4.44 ($P<0.001$; Table 2). There was also a statistically significant increase in the number of individual birds, from 2.75 in 2003 to 8.83 in 2006 ($P<0.001$). The number of neotropical migrant species per point increased significantly from 0.83 in 2003 to 1.88 in 2006 ($P<0.001$), as did the number of neotropical migrant birds, increasing from 1.54 in 2003 to 2.92 in 2006 ($P<0.001$). The only other pooled species group to change significantly from 2003 to 2006 was the number of resident species, which increased from 0.50 to 1.21 ($P=0.011$).

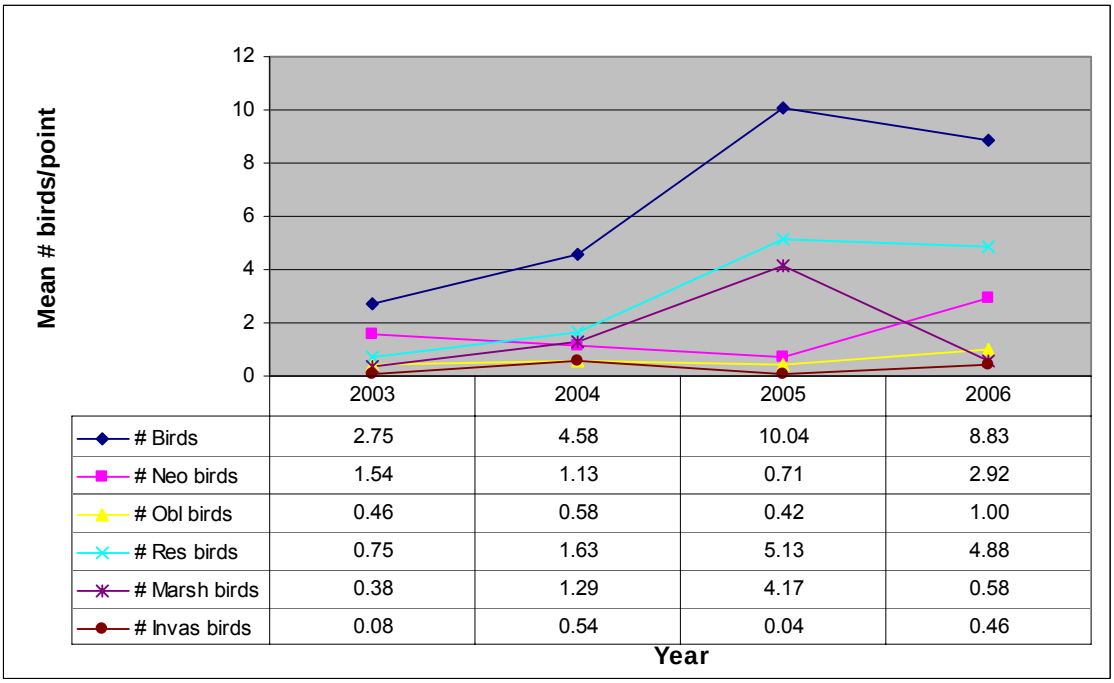
Table 1. Avian point count summary for the Cleared/Overbank Area

Cleared/Overbank Area n=24	2003			2004			2005			2006		
Species	% Plots	Mean	SD	% Plots	Mean	SD	% Plots	Mean	SD	% Plots	Mean	SD
American avocet	0.0	0.00	0.00	0.0	0.00	0.00	4.2	0.04	0.2	0.0	0.00	0.00
American crow	0.0	0.00	0.00	0.0	0.00	0.00	0.0	0.00	0.00	4.2	0.21	1.02
American kestrel	4.2	0.04	0.20	0.0	0.00	0.00	0.0	0.00	0.00	0.0	0.00	0.00
American robin	0.0	0.00	0.00	4.2	0.04	0.20	4.2	0.04	0.20	0.0	0.00	0.00
Ash-throated flycatcher	0.0	0.00	0.00	0.0	0.00	0.00	0.0	0.00	0.00	4.2	0.04	0.20
Barn swallow	4.2	0.08	0.41	16.7	0.17	0.38	8.3	0.08	0.28	2.1	0.58	1.32
Bewick's wren	0.0	0.00	0.00	8.3	0.13	0.45	0.0	0.00	0.00	0.0	0.00	0.00
Black-chinned hummingbird	4.2	0.08	0.41	8.3	0.08	0.28	12.5	0.13	0.34	29.2	0.33	0.56
Black-crowned night heron	4.2	0.04	0.20	0.0	0.00	0.00	0.0	0.00	0.00	4.2	0.04	0.20
Black-headed grosbeak	4.2	0.04	0.20	4.2	0.04	0.20	0.0	0.00	0.00	0.0	0.00	0.00
Black-necked stilt	0.0	0.00	0.00	4.2	0.17	0.82	25.0	0.42	0.83	8.3	0.13	0.45
Blue grosbeak	20.8	0.33	0.70	2.1	0.29	0.62	4.2	0.04	0.20	25.0	0.46	0.93
Blue-winged teal	0.0	0.00	0.00	0.0	0.00	0.00	12.5	0.21	0.66	0.0	0.00	0.00
Brown-headed cowbird	8.3	0.08	0.28	29.2	0.54	0.98	0.0	0.00	0.00	12.5	0.25	0.68
Cassin's finch	0.0	0.00	0.00	0.0	0.00	0.00	0.0	0.00	0.00	4.2	0.04	0.20
Cattle egret	0.0	0.00	0.00	0.0	0.00	0.00	4.2	0.25	1.22	0.0	0.00	0.00
Common yellowthroat	0.0	0.00	0.00	12.5	0.13	0.34	16.7	0.21	0.51	16.7	0.17	0.38
Downy woodpecker	0.0	0.00	0.00	0.0	0.00	0.00	4.2	0.04	0.20	0.0	0.00	0.00
Gadwall	0.0	0.00	0.00	0.0	0.00	0.00	4.2	0.13	0.61	0.0	0.00	0.00
Gray catbird	0.0	0.00	0.00	0.0	0.00	0.00	0.0	0.00	0.00	4.2	0.04	0.20
Great-blue heron	0.0	0.00	0.00	0.0	0.00	0.00	4.2	0.04	0.20	0.0	0.00	0.00
Great-tailed grackle	0.0	0.00	0.00	0.0	0.00	0.00	4.2	0.04	0.20	0.0	0.00	0.00
House finch	0.0	0.00	0.00	0.0	0.00	0.00	4.2	0.13	0.61	0.0	0.00	0.00
Indigo bunting	8.3	0.08	0.28	4.2	0.04	0.20	0.0	0.00	0.00	0.0	0.00	0.00
Killdeer	8.3	0.08	0.28	37.5	0.67	1.20	37.5	0.96	1.60	20.8	0.25	0.53
Lesser goldfinch	4.2	0.04	0.20	0.0	0.00	0.00	0.0	0.00	0.00	0.0	0.00	0.00
Loggerhead shrike	4.2	0.04	0.20	0.0	0.00	0.00	0.0	0.00	0.00	0.0	0.00	0.00
Mallard	0.0	0.00	0.00	0.0	0.00	0.00	33.3	1.46	3.16	4.2	0.04	0.20
Mourning dove	0.0	0.00	0.00	16.7	0.17	0.38	12.5	0.25	0.74	45.8	3.92	7.63
Northern flicker	0.0	0.00	0.00	4.2	0.04	0.20	4.2	0.04	0.20	0.0	0.00	0.00
Northern mockingbird	0.0	0.00	0.00	4.2	0.04	0.20	0.0	0.00	0.00	29.2	0.38	0.71
Northern rough-winged swallow	12.5	0.13	0.34	0.0	0.00	0.00	0.0	0.00	0.00	0.0	0.00	0.00
Red-winged blackbird	4.2	0.67	1.13	50.0	1.21	1.50	95.8	4.63	1.79	33.3	0.46	0.78
Ring-necked pheasant	0.0	0.00	0.00	0.0	0.00	0.00	0.0	0.00	0.00	8.3	0.08	0.28
Say's phoebe	8.3	0.13	0.45	4.2	0.04	0.20	0.0	0.00	0.00	0.0	0.00	0.00
Snowy egret	12.5	0.13	0.34	20.8	0.29	0.62	12.5	0.21	0.59	0.0	0.00	0.00
Spotted sandpiper	12.5	0.13	0.34	12.5	0.17	0.48	37.5	0.46	0.66	8.3	0.13	0.45
Turkey vulture	4.2	0.42	2.04	0.0	0.00	0.00	0.0	0.00	0.00	0.0	0.00	0.00
Unidentified swallow	0.0	0.00	0.00	0.0	0.00	0.00	0.0	0.00	0.00	25.0	0.33	0.64
Violet-green swallow	0.0	0.00	0.00	0.0	0.00	0.00	0.0	0.00	0.00	25.0	0.38	0.71
Western kingbird	12.5	0.21	0.59	25.0	0.29	0.55	16.7	0.21	0.51	37.5	0.58	0.88
Yellow-breasted chat	0.0	0.00	0.00	4.2	0.04	0.20	4.2	0.04	0.2	0.0	0.00	0.00



	2003	2004	2005	2006
# Spp	1.79	2.92	3.67	4.44
# Neo spp	0.83	1.00	0.63	1.88
# Obl spp	0.29	0.50	0.38	0.75
# Res spp	0.50	0.88	1.25	1.21
# Marsh spp	0.38	0.75	1.75	0.46
# Invas spp	0.08	0.29	0.04	0.17

Figure 5. The mean number of species per point by species groupings in the Cleared/Overbank Area over time.



	2003	2004	2005	2006
# Birds	2.75	4.58	10.04	8.83
# Neo birds	1.54	1.13	0.71	2.92
# Obl birds	0.46	0.58	0.42	1.00
# Res birds	0.75	1.63	5.13	4.88
# Marsh birds	0.38	1.29	4.17	0.58
# Invas birds	0.08	0.54	0.04	0.46

Figure 6. The mean number of individual birds per point by species groupings in the Cleared/Overbank Area over time.

Table 2. Statistical comparison of years by plot. Alpha = 0.05

	Cleared/Overbank Area 2003 vs 2006	Cleared/Overbank Area All years (2003 to 2006)	Burned Area 2003 vs 2004
# Species	03 < 06 P<0.001[1]	P<0.001[3]	03 = 04 P=0.449[1]
# Birds	03 < 06 P<0.001[2]	P<0.001[4]	03 = 04 P=0.073[1]
Neotropical spp	03 < 06 P<0.001[1]	P<0.001[4]	03 = 04 P=0.189[1]
Neotropical birds	03 < 06 P<0.001[2]	P<0.001[4]	03 = 04 P=0.067[2]
Riparian Obligate spp	03 = 06 P=0.052[2]	P=0.210[4]	03 = 04 P=0.662[1]
Riparian Obligate birds	03 = 06 P=0.109[2]	P=0.294[4]	03 = 04 P=0.252[1]
Resident spp	03 < 06 P=0.011[1]	P=0.006[4]	03 < 04 P=0.047[1]
Resident birds	03 = 06 P=0.050[2]	P<0.001[4]	03 = 04 P=0.112[2]
Marsh/waterbird spp	03 = 06 P=0.947[2]	P<0.001[4]	03 = 04 P=0.257[2]
Marsh/waterbird birds	03 = 06 P=0.989[2]	P<0.001[4]	03 = 04 P=0.257[2]
Invasive spp	03 = 06 P=0.398[2]	P=0.073[4]	03 > 04 P=0.004[2]
Invasive birds	03 = 06 P=0.323[2]	P=0.061[4]	03 > 04 P=0.004[2]

1= Students t-test; 2=Mann Whitney test; 3= ANOVA; 4=Kruskal-Wallis test; highlighted P values are statistically significant.

Comparisons between all years of monitoring (2003, 2004, 2005, and 2006) found significant differences not only within those groups noted above—total number species and birds, neotropical migrant species and birds, and resident species—but also within the resident birds (K=33.66, P<0.001), marsh/waterbird species (K=23.38, P<0.001), and marsh/waterbird birds (K=26.84, P<0.001) groups. The mean number of marsh/ waterbird species and individual bird detections per point were significantly higher in 2005 when the extent and duration of overbank flooding was greater.

Means and totals for the pooled species groups for all sites, including the San Marcial Comparison Area, are shown in Table 3. Totals for the numbers of species within each group accounted for all species detected during all three point count periods per year. Totals for the number of birds within each group were calculated by averaging the number of birds detected at each point over the three point count periods and then

Table 3. Data for pooled species groups by year for the Burned Area, Cleared/Overbank Area, Future Desired Conditions Area, and the San Marcial Comparison Area

2003	Los Lunas Burned Area 17 points			Los Lunas Cleared/Overbank Area 8 points			San Marcial Comparison Area 25 points		
	Total	Mean	SD	Total	Mean	SD	Total	Mean	SD
# Species	30	5.71	1.68	18	1.79	1.25	43	6.59	1.97
# Birds	146	8.44	3.27	22	2.75	3.08	346	13.83	7.42
# Neotropical migrant species	13	3.32	1.19	10	0.83	0.92	23	3.32	1.23
# Neotropical migrant birds	85	4.90	2.52	12	1.54	2.59	114	4.56	1.95
# Riparian obligate species	6	2.71	0.98	3	0.29	0.46	12	2.64	1.04
# Riparian obligate birds	66	3.71	1.63	4	0.46	0.78	91	3.64	1.70
# Resident species	12	1.64	1.19	3	0.50	0.59	13	2.77	1.28
# Resident birds	35	2.12	1.74	6	0.75	1.15	210	8.39	7.12
# Marsh and waterbird species	3	0.10	0.37	4	0.38	0.65	3	0.05	0.28
# Marsh and waterbird birds	1	0.10	0.37	3	0.38	0.65	1	0.05	0.28
# Invasive species	2	0.68	0.47	1	0.08	0.28	4	0.44	0.53
# Invasive birds	24	1.37	1.43	1	0.08	0.28	21	0.83	1.29

2004	Los Lunas Burned Area 17 points			Los Lunas Cleared/Overbank Area 8 points			San Marcial Comparison Area 25 points		
	Total	Mean	SD	Total	Mean	SD	Total	Mean	SD
# Species	27	5.43	1.39	20	2.92	1.61	45	6.62	2.43
# Birds	118	7.33	2.57	37	4.58	2.92	392	15.77	9.96
# Neotropical migrant species	11	2.96	1.15	9	1.00	0.88	19	3.03	1.39
# Neotropical migrant birds	63	3.93	1.99	9	1.13	1.03	131	5.22	4.17
# Riparian obligate species	13	2.59	1.07	5	0.50	0.66	11	2.41	1.19
# Riparian obligate birds	53	3.26	1.77	5	0.58	0.78	94	3.77	2.04
# Resident species	34	2.11	0.98	6	0.88	0.90	43	2.68	1.22
# Resident birds	43	2.70	1.55	13	1.63	1.61	14	8.34	7.19
# Marsh and waterbird species	1	0.02	0.15	4	0.75	0.74	9	0.34	0.80
# Marsh and waterbird birds	0	0.02	0.15	10	1.29	1.94	12	0.49	1.37
# Invasive species	2	0.37	0.49	1	0.29	0.46	3	0.58	0.57
# Invasive birds	11	0.67	1.14	4	0.54	0.98	43	1.73	2.51

Table 3, cont.

2005	Los Lunas Cleared/Overbank Area 8 points			San Marcial Comparison Area 25 points		
	Total	Mean	SD	Total	Mean	SD
# Species	23	3.67	1.40	44	5.61	1.74
# Birds	80	10.04	4.61	361	14.45	9.83
# Neotropical migrant species	6	0.63	0.58	22	2.57	1.02
# Neotropical migrant birds	6	0.71	0.69	83	3.34	1.39
# Riparian obligate species	4	0.38	0.58	12	2.18	0.91
# Riparian obligate birds	3	0.42	0.65	71	2.85	1.30
# Resident species	6	1.25	0.61	12	2.28	1.18
# Resident birds	41	5.13	2.03	249	9.95	8.68
# Marsh and waterbird species	10	1.75	1.29	8	0.23	0.59
# Marsh and waterbird birds	33	4.17	4.30	6	0.46	1.93
# Invasive species	1	0.04	0.20	2	0.53	0.53
# Invasive birds	0	0.04	0.20	18	0.70	0.79

2006	Los Lunas Cleared/Overbank Area 8 points			Los Lunas Desired Conditions Area 12 points			San Marcial Comparison Area 25 points		
	Total	Mean	SD	Total	Mean	SD	Total	Mean	SD
# Species	21	4.44	4.39	18	2.97	1.50	41	4.79	2.23
# Birds	71	8.83	9.17	61	5.11	2.97	340	13.60	10.86
# Neotropical migrant species	9	1.88	0.95	12	2.14	1.20	20	2.23	1.36
# Neotropical migrant birds	23	2.92	1.74	47	3.89	2.56	81	3.23	3.31
# Riparian obligate species	4	0.75	0.90	7	1.08	1.02	10	1.88	1.22
# Riparian obligate birds	8	1.00	1.35	17	1.42	1.52	60	2.41	1.76
# Resident species	5	1.21	1.18	5	0.58	0.73	14	1.87	1.09
# Resident birds	39	4.88	8.09	9	0.78	1.22	229	9.15	9.79
# Marsh and waterbird species	5	0.46	0.88	0	0.00	0.00	5	0.12	0.40
# Marsh and waterbird birds	5	0.58	1.18	0	0.00	0.00	5	0.20	0.74
# Invasive species	2	0.17	0.38	1	0.25	0.44	2	0.57	0.55
# Invasive birds	4	0.46	1.18	5	0.44	0.84	26	1.03	1.44

summing all point averages. Note that sample sizes in each of the plot types were different, so totals are not equally comparable between sites. “Mean” and “SD” are the mean number and standard deviation of detections per point within each pooled species group.

Pooled species groups in the Cleared/Overbank Area were compared to groups within the Future Desired Conditions Area for 2006 (Table 4). The only statistical differences identified were within the Resident Bird group; the average number of resident species (P=0.046) and individual birds (P=0.033) detected per point were significantly higher in the Cleared/Overbank Area than in the Future Desired Conditions Area.

Population trends as represented by the mean number of detections per point for selected bird species within each of the pooled groups are graphed in Figures 7 to 11. The abundance of neotropical migrant western kingbirds has been steadily increasing over the monitoring period, with a considerable increase in 2006. Blue grosbeaks have consistently been the most abundant riparian obligate species, except in 2005, which could be attributable to flooding and competition from the abundant, possibly aggressive red-wing blackbirds. Common yellowthroats, alternatively, responded favorably to flooding in 2005. Not surprisingly, abundance of the resident red-wing blackbird was highest during flooding but numbers decreased considerably in 2006, while the mourning dove population had a substantial increase this year. As would be expected, all of the selected marsh/waterbirds were most abundant while water levels were high. Finally, abundance of the invasive brown-headed cowbird crashed in 2005 after peaking in 2004, but the population resumed in 2006. The American crow was detected for the first time on the site in 2006.

Burned Area No data were collected within the Burned Area in 2006 and therefore no analysis was conducted for this year. Tables 2, 3, and 4 show results of analysis at this site from 2003 and 2004. Table 5 shows relative abundance of individual species for the Burned Area by year. These data are provided for reference purposes only. Point counts will be restarted within the Burned Area in 2007, when analysis and discussion will resume.

Future Desired Conditions Area Table 6 provides data on the relative abundance of individual species for the Future Desired Conditions Area in 2006. A total of 18 species were detected during point counts conducted this first year. The most common species were comprised of a variety of swallows, including bank, barn, and violet-green, as well as the black-chinned hummingbird. Statistically, this site is similar to the Cleared/Overbank Area in regards to the abundance of the pooled species groups with the exception of fewer resident species and birds, as described above. This site was chosen as a reference site for point counts due to habitat conditions that are potentially similar to LLRS (i.e., adjacent to the river, overbank flooding, developing vegetation).

Table 4. Statistical comparison of plots by year. Alpha = 0.05

	2006 Cleared vs Desired	2004 Burned vs Cleared	2003 Burned vs Cleared
# Species	Cleared = Desired P=0.116[1]	Burned > Cleared P<0.001[1]	Burned > Cleared P=0.000[1]
# Birds	Cleared = Desired P=0.224[2]	Burned > Cleared P<0.001[1]	Burned > Cleared P<0.001[2]
Neotropical spp	Cleared = Desired P=0.369[1]	Burned > Cleared P<0.001[1]	Burned > Cleared P<0.001[1]
Neotropical birds	Cleared = Desired P=0.110[1]	Burned > Cleared P<0.001[1]	Burned > Cleared P<0.001[2]
Riparian Obligate spp	Cleared = Desired P=0.180[2]	Burned > Cleared P=0.000[1]	Burned > Cleared P=0.000[1]
Riparian Obligate birds	Cleared = Desired P=0.196[2]	Burned > Cleared P<0.001[2]	Burned > Cleared P<0.001[2]
Resident spp	Cleared > Desired P=0.046[2]	Burned > Cleared P<0.001[1]	Burned > Cleared P<0.001[2]
Resident birds	Cleared > Desired P=0.033[2]	Burned > Cleared P=0.008[2]	Burned > Cleared P<0.001[2]
Marsh/waterbird spp	No marsh birds in Desired Conditions area	Burned < Cleared P<0.001[2]	Burned < Cleared P=0.019[2]
Marsh/waterbird birds	No marsh birds in Desired Conditions area	Burned < Cleared P<0.001[2]	Burned < Cleared P=0.019[2]
Invasive spp	Cleared = Desired P=0.453[2]	Burned = Cleared P=0.454[2]	Burned > Cleared P<0.001[2]
Invasive birds	Cleared = Desired P=0.557[2]	Burned = Cleared P=0.538[2]	Burned > Cleared P<0.001[2]

1= Students t-test; 2=Mann Whitney test, highlighted P values are statistically significant.

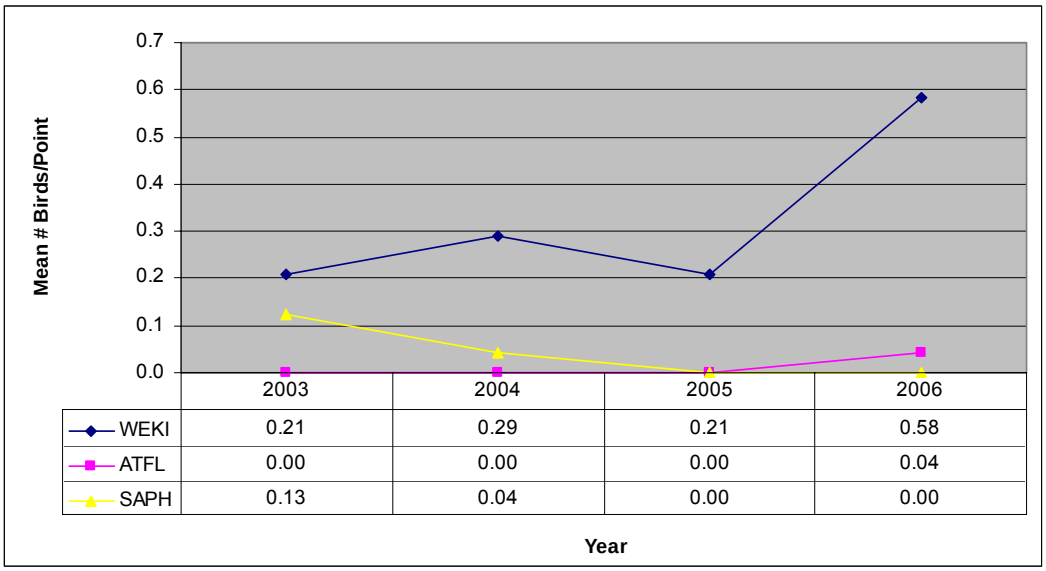
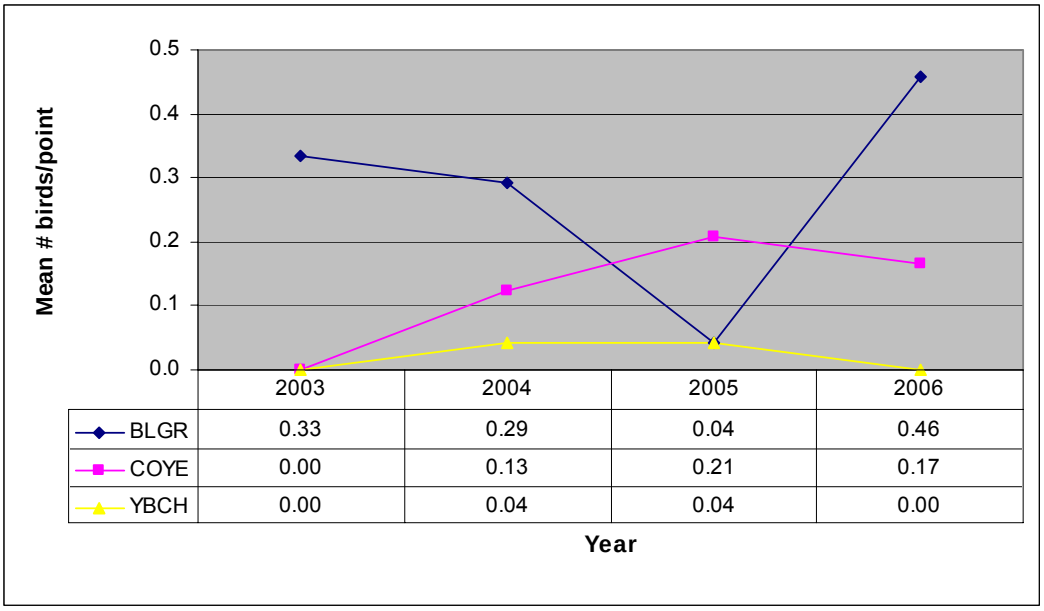
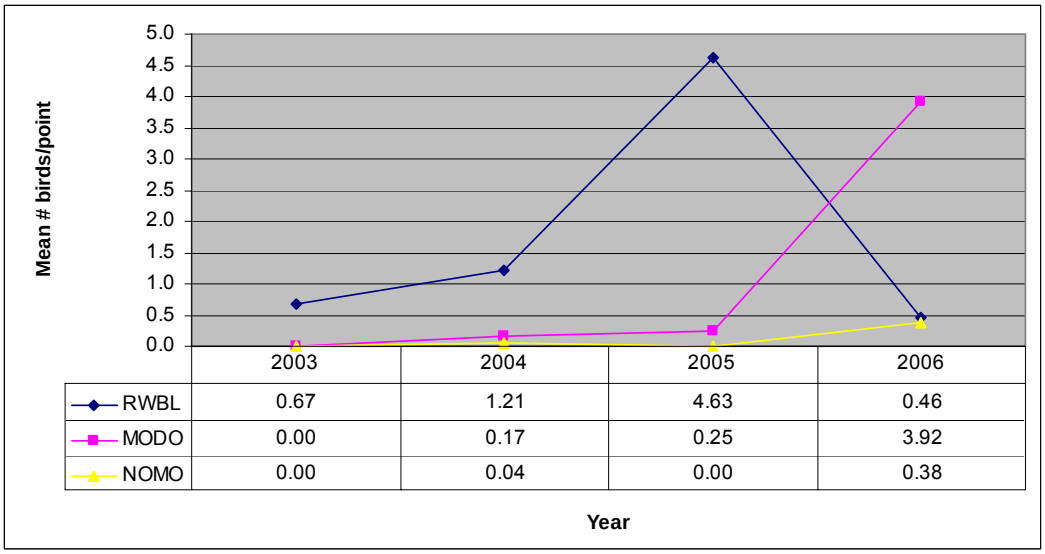


Figure 7. Population trends for selected neotropical migrant species: western kingbird, ash-throated flycatcher, and Say's phoebe.



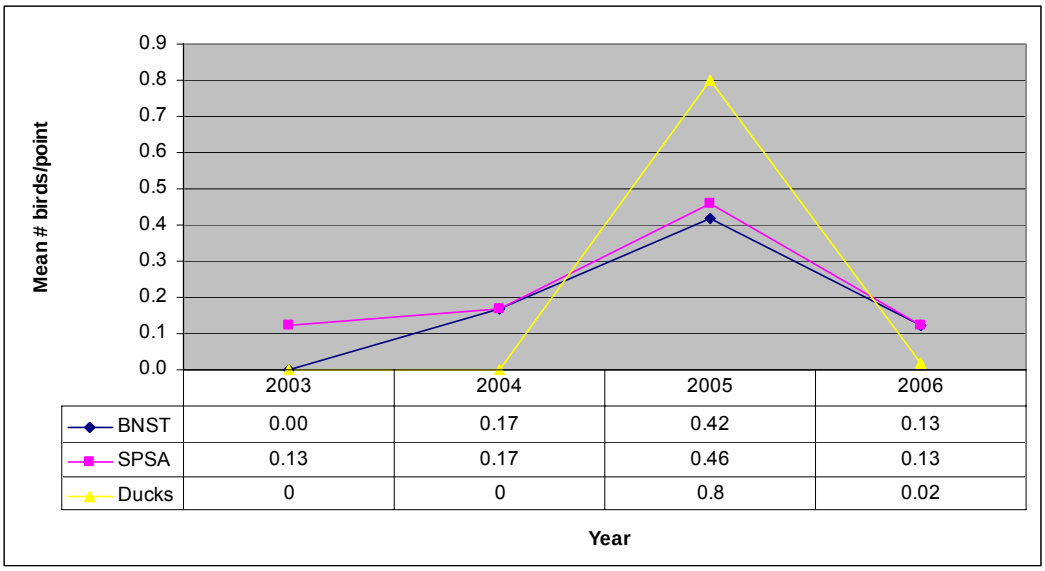
	2003	2004	2005	2006
BLGR	0.33	0.29	0.04	0.46
COYE	0.00	0.13	0.21	0.17
YBCH	0.00	0.04	0.04	0.00

Figure 8. Population trends for selected riparian obligate species: blue grosbeak, common yellowthroat, and yellow-breasted chat.



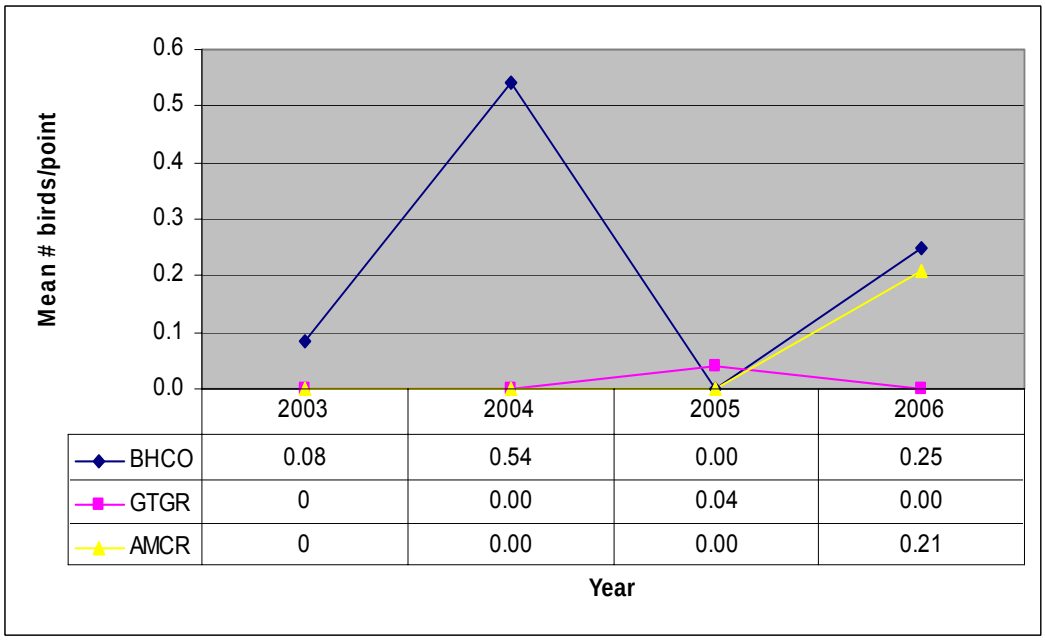
	2003	2004	2005	2006
RWBL	0.67	1.21	4.63	0.46
MODO	0.00	0.17	0.25	3.92
NOMO	0.00	0.04	0.00	0.38

Figure 9. Population trends for selected resident species: red-winged blackbird, mourning dove, and northern mockingbird.



	2003	2004	2005	2006
BNST	0.00	0.17	0.42	0.13
SPSA	0.13	0.17	0.46	0.13
Ducks	0	0	0.8	0.02

Figure 10. Population trends for selected marsh/waterbird species: black-necked stilt, spotted sandpiper, and combined ducks (mallard, gadwall).



	2003	2004	2005	2006
BHCO	0.08	0.54	0.00	0.25
GTGR	0	0.00	0.04	0.00
AMCR	0	0.00	0.00	0.21

Figure 11. Population trends for selected invasive species: brown-headed cowbird, great-tailed grackle, and American crow.

Table 5. Avian point count summary for the Burned Area

Burned Area	2003 n=42			2004 n=47		
Species	**% Plots**	**Mean**	**SD**	**% Plots**	**Mean**	**SD**
American kestrel	7.1	0.10	0.37	2.1	0.02	0.15
American robin	4.8	0.05	0.22	14.9	0.21	0.59
Ash-throated flycatcher	19.0	0.19	0.40	6.4	0.06	0.25
Barn swallow	2.4	0.02	0.15	2.1	0.02	0.15
Bewick's wren	4.8	0.05	0.22	0.0	0.00	0.00
Black-chinned hummingbird	45.2	0.57	0.74	46.8	0.51	0.59
Black-headed grosbeak	69.0	1.00	0.88	61.7	0.74	0.67
Black-necked stilt	2.4	0.02	0.15	0.0	0.00	0.00
Blue grosbeak	33.3	0.40	0.63	21.3	0.26	0.53
Black phoebe	0.0	0.00	0.00	2.1	0.02	0.15
Brown-headed cowbird	66.7	1.36	1.43	36.2	0.66	1.13
Common bushtit	0.0	0.00	0.00	2.1	0.11	0.73
Common yellowthroat	19.0	0.19	0.40	10.6	0.11	0.31
Downy woodpecker	0.0	0.00	0.00	2.1	0.02	0.15
European starling	2.4	0.02	0.15	2.1	0.02	0.15
Gambel's quail	0.0	0.00	0.00	2.1	0.02	0.15
Gray catbird	26.2	0.26	0.45	48.9	0.53	0.58
Hairy woodpecker	0.0	0.00	0.00	4.3	0.04	0.20
House finch	2.4	0.02	0.15	0.0	0.00	0.00
Killdeer	2.4	0.02	0.15	0.0	0.00	0.00
Lesser goldfinch	2.4	0.05	0.31	0.0	0.00	0.00
Mourning dove	4.8	0.67	0.90	61.7	0.96	0.88
Northern flicker	19.0	0.21	0.47	10.6	0.11	0.31
Northern mockingbird	2.4	0.05	0.31	0.0	0.00	0.00
Red-tailed hawk	4.8	0.05	0.22	0.0	0.00	0.00
Red-winged blackbird	9.5	0.12	0.40	6.4	0.06	0.25
Ring-necked pheasant	4.8	0.05	0.22	4.2	0.04	0.20
Say's phoebe	2.4	0.02	0.15	0.0	0.00	0.00
Snowy egret	0.0	0.00	0.00	2.1	0.02	0.15
Spotted sandpiper	4.8	0.05	0.22	0.0	0.00	0.00
Spotted towhee	50.0	0.69	0.84	80.8	0.91	0.54
Turkey vulture	19.0	0.67	1.72	8.5	0.36	1.28
Western kingbird	11.9	0.19	0.59	17.0	0.19	0.45
Western wood pewee	0.0	0.00	0.00	2.1	0.02	0.15
Western tanager	2.4	0.02	0.15	0.0	0.00	0.00
White-breasted nuthatch	7.1	0.07	0.26	17.0	0.17	0.38
Yellow-breasted chat	76.2	1.26	0.91	70.2	1.13	1.03

Table 6. Avian point count summary for the Future Desired Conditions Area

Desired Conditions Area n=36	2006		
Species	**% Plots**	**Mean**	**SD**
Bank swallow	19.4	0.50	1.13
Barn swallow	30.6	0.69	1.14
Black-chinned hummingbird	38.9	0.56	0.77
Black-headed grosbeak	5.6	0.11	0.52
Blue grosbeak	27.8	0.36	0.64
Brown-headed cowbird	25.0	0.44	0.84
Bushtit	5.6	0.22	0.96
Common yellowthroat	13.9	0.17	0.45
Gray catbird	5.6	0.06	0.23
Indigo bunting	11.1	0.17	0.51
Mourning dove	2.8	0.03	0.17
Ring-necked pheasant	11.1	0.11	0.32
Sandhill crane	2.8	0.03	0.17
Spotted towhee	36.1	0.39	0.55
Summer tanager	2.8	0.03	0.17
Unidentified swallow	22.2	0.47	1.00
Violet-green swallow	22.2	0.64	1.27
Yellow-breasted chat	13.9	0.14	0.35

Site Comparison Area

Abundance data for the pooled species groups at the San Marcial Comparison Area are displayed in Table 3 for comparison purposes. In 2003, the number of species and individual birds at the San Marcial Comparison Area were much greater than at the Cleared/Overbank Area, excluding marsh/waterbirds which have always been lower in numbers at San Marcial. Throughout the monitoring period, the mean number of detections per point has gradually increased at the LLRS and is approaching values at San Marcial.

One of the success criteria for achieving quality riparian habitat in terms of avian habitat values at the LLRS was defined as a mean number of neotropical migrant and riparian obligate detections per point that reached at least 75 percent of the values of the comparison site (Siegle 2006). These criteria have been met with respect to the mean number of neotropical migrant species, which was 84 percent of that at the San Marcial Area, and the mean number of neotropical migrant birds, which was 90 percent of the same value at San Marcial.

Southwestern Willow Flycatcher Surveys

In 2006, no SWFLs were detected within the boundaries of the LLRS, although two detections were documented just north of the site. A total of 11 SWFLs was detected at areas within the Belen Reach between the Los Lunas and Belen bridges. All these detections occurred in late-May and early-June at locations shown on Figure 12. Because we made no detections at these sites during the subsequent surveys, and the detections

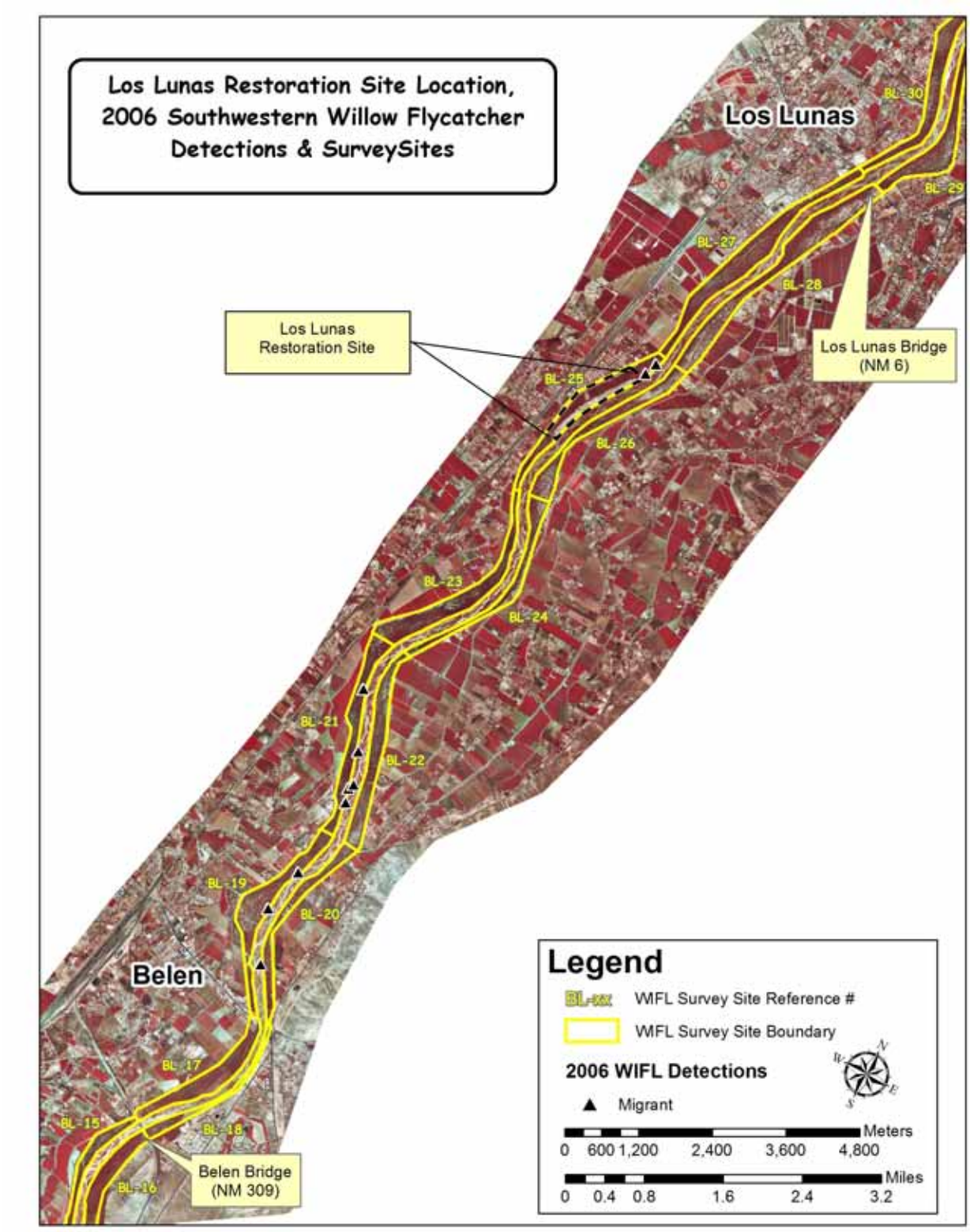


Figure 12. SWFL detections in the Belen Reach in the vicinity of LLRS.

were made during the late migration period, the SWFLs were determined to be migrants, and no territories were documented.

The survey protocol requires a qualitative habitat assessment. The Cleared/Overbank Area had not developed riparian vegetation of suitable height, density, and structure to provide breeding habitat by the breeding season of 2006. The overbank flooding and high ground water levels during the runoff period of 2005 established stands of germinating riparian plants. If these seedlings are maintained by sufficient flows and ground water levels during the next several years, we estimate that suitable SWFL breeding habitat would develop in 5 to 10 years. It appears that small areas of highly suitable habitat currently exist within adjacent sites in the Belen Reach. These sites are apparently unoccupied by breeding SWFLs. The closest breeding populations that could serve as sources for SWFL dispersal into the Los Lunas sites are 15 miles upstream at Isleta Pueblo or 35 miles downstream at the La Joya SWA. However, much of the riparian habitat in the Belen Reach including the LLRS is currently suitable as stopover habitat for migrating SWFLs as confirmed by our presence/absence surveys.

Vegetation Monitoring

River Transects

Vegetation sampling in the area adjacent to the river included 42 annual and perennial species (Table 7). Total vegetative cover of shrubs, grasses, and forbs for the sampled area increased over time from 32.1 percent in 2003, 67.5 percent in 2004, 60.9 percent in 2005, to 76.9 percent in 2006. Total cover of plant litter was 4.4 percent, 5.2 percent, 7.3 percent, and 5.5 percent in 2003, 2004, 2005, and 2006, respectively. Total cover of bare ground was on a decreasing trend from 63.5 percent in 2003 to 27.3 percent in 2004, 31.5 percent in 2005, and 17.6 percent in 2006 (Figure 13). The increase in total plant cover over the years was statistically significant ($F_{3,44}$ =28.84, P<0.001), as was the decrease in bare soil cover ($F_{3,44}$ = 28.52, P<0.001; Table 8). Total cover of litter did not change significantly (K = 2.92, P=0.404) over time.

Coyote willow and saltcedar were the only two shrub species detected every year since vegetation monitoring began in 2003. Goodding's willow (native) and Russian olive (introduced) were detected within the river transects for the first time in 2006. Cottonwood was the dominant shrub species based on coverage for the first time in 2006. The total percent cover of native shrub species showed an increasing trend from 0.6 percent in 2003 to 3.2 percent in 2005, with a considerable increase to 13.6 percent in 2006. Total cover of introduced shrubs increased from 0.4 percent to 5.2 percent over the sampling period. Relative plant cover by vegetation type from 2003 to 2006 is shown in Figure 14. Relative cover of native shrubs increased from 1.8 percent to 2.5 percent to 6.7 percent to 17.7 percent from 2003 to 2006, which was statistically significant between years (K=25.31, P<0.001). Relative cover of introduced shrubs increased over time from 1.3 percent in 2003, 1.2 percent in 2004, 4.7 percent in 2005, to 6.8 percent in 2006, which was also a significant change (K=10.51, P=0.015).

Table 7. Vegetation sampling	**2003**		**2004**		**2005**		**2006**	
	Percent cover	**Relative plant cover**	**Percent cover**	**Relative plant cover**	**Percent cover**	**Relative plant cover**	**Percent cover**	**Relative plant cover**
Coyote willow	0.6	1.8	1.0	1.5	1.9	3.1	4.7	6.2
Cottonwood	0.0	0.0	0.4	0.5	1.3	2.2	7.1	9.2
Spearleaf rabbitbrush	0.0	0.0	0.3	0.5	0.8	1.4	1.7	2.2
Gooddings willow	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
Native shrubs	0.6	1.8	1.7	2.5	4.0	6.7	13.6	17.7
Saltcedar	0.4	1.3	0.8	1.2	2.8	4.7	5.0	6.5
Russian olive	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3
Introduced shrubs	0.4	1.3	0.8	1.2	2.8	4.7	5.2	6.8
Fragrant flatsedge	1.7	5.4	3.5	5.2	8.4	13.8	0.5	0.7
Baltic rush	1.3	3.9	0.0	0.0	0.0	0.0	0.0	0.0
Muhly	1.3	3.9	2.7	3.9	0.0	0.0	0.0	0.0
Witchgrass	1.1	3.4	5.2	7.7	4.4	7.1	0.8	1.0
Thin paspalum	0.4	1.3	0.4	0.6	1.6	2.6	4.7	6.1
Dropseed	2.2	7.0	6.7	9.9	0.0	0.0	0.0	0.0
Common spikerush	0.0	0.0	0.2	0.4	0.0	0.0	0.0	0.0
Saltgrass	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0
Bluegrass	0.0	0.0	0.2	0.3	0.6	1.0	0.3	0.4
Sedge	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0
Mexican sprangletop	0.0	0.0	0.0	0.0	1.1	1.8	2.5	3.2
Teal lovegrass	0.0	0.0	0.0	0.0	2.6	4.2	0.0	0.0
Barley foxtail	0.0	0.0	0.0	0.0	0.0	0.0	2.8	3.7
Native grasses	8.0	24.9	19.1	28.2	18.7	30.5	11.6	15.1
Barnyard grass	1.3	4.2	4.3	6.4	6.0	9.8	2.8	3.6
Rabbitfoot grass	1.6	4.9	4.5	6.7	2.8	4.6	0.1	0.1
Introduced grasses	2.9	9.1	8.8	13.1	8.8	14.4	2.9	3.7
Horseweed	0.2	0.5	0.0	0.0	0.0	0.0	4.3	5.6
Common sunflower	7.9	24.7	13.9	20.6	0.3	0.4	3.9	5.1
Pale smartweed	0.8	2.3	1.2	1.8	0.2	0.3	5.9	7.7
Common cocklebur	0.3	0.8	3.3	4.9	17.9	29.4	8.1	10.5
Beggarstick	0.0	0.0	0.9	1.4	3.4	5.5	0.5	0.7
Clasping-leaf dogbane	0.0	0.0	0.0	0.0	0.3	0.4	0.2	0.2
Milkvetch	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3
Pussytoes	0.0	0.0	0.0	0.0	0.0	0.0	1.2	1.5
Ragged marshelder	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3
Hooker's evening primrose	0.0	0.0	0.0	0.0	0.0	0.0	1.2	1.5
Dodder	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
Native forbs	9.2	28.3	19.3	28.7	22.1	36.0	25.8	33.5
Lambsquarters	6.2	19.5	5.2	7.8	0.3	0.4	0.1	0.1
Kochia	0.5	1.6	3.6	5.3	3.8	6.3	4.2	5.5
Prickly lettuce	0.1	0.3	0.8	1.0	0.0	0.0	6.0	7.8
White sweetclover	4.2	13.2	7.1	10.5	0.4	0.6	6.8	8.9
Russian thistle	0.0	0.0	0.7	1.0	0.0	0.0	0.0	0.0
Perrenial pepperweed	0.0	0.0	0.2	0.4	0.0	0.0	0.0	0.0
Wormwood	0.0	0.0	0.2	0.3	0.0	0.0	0.0	0.0
Curly dock	0.0	0.0	0.0	0.0	0.1	0.1	0.5	0.7
Prostrate amaranth	0.0	0.0	0.0	0.0	0.2	0.3	0.0	0.0
Goats head	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2
Introduced forbs	11.0	34.6	17.8	26.3	4.8	7.7	17.8	23.2
Litter	4.4		5.2		7.3		5.5	
Bare soil	63.5		27.3		31.5		17.6	
Total cover	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

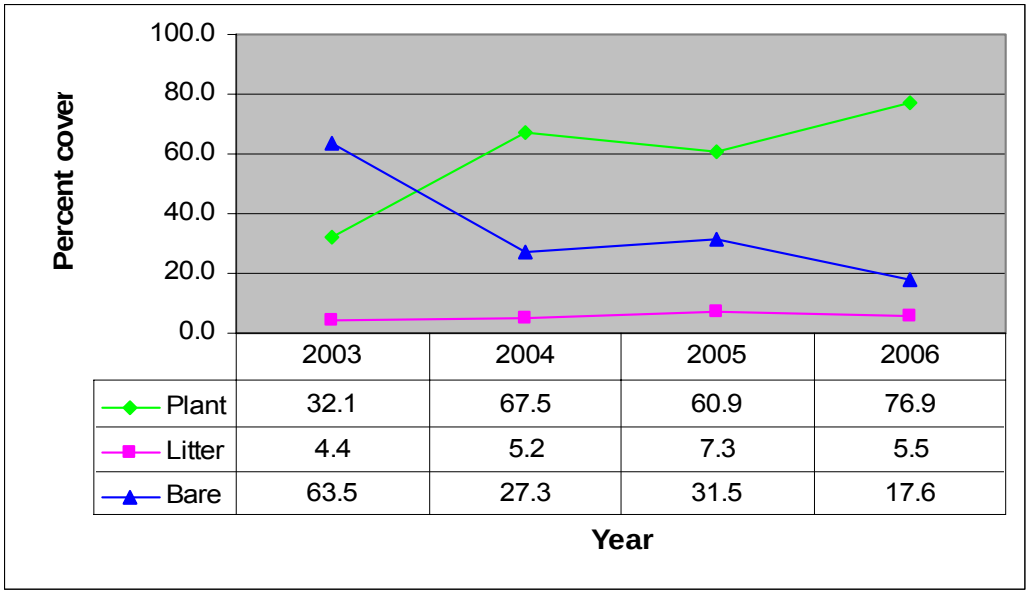
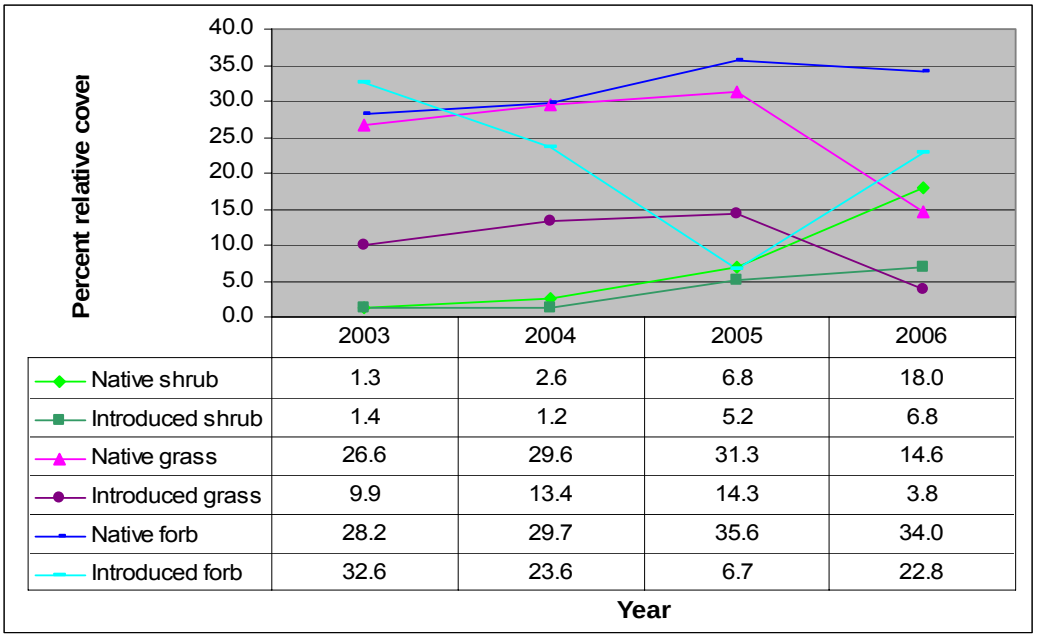


Figure 13. Total vegetation cover of river transects from 2003 to 2006 at the LLRS, Middle Rio Grande, New Mexico.

Table 8. Statistical comparison between years 2003, 2004, 2005, and 2006 of total cover of plant, litter, and bare soil and relative cover of vegetation types of river transects at the LLRS, Middle Rio Grande, New Mexico. Alpha = 0.05

Total cover	
Plant	P < 0.001*
Litter	P = 0.404**
Bare	P < 0.001*
Relative cover	
Native shrub	P < 0.001**
Introduced shrub	P = 0.015**
Native grass	P = 0.059*
Introduced grass	P = 0.010**
Native forb	P = 0.617*
Introduced forb	P < 0.001**
All native species	P = 0.091*

* ANOVA test; ** Kruskal Wallis test; highlighted P values are statistically significant.



	2003	2004	2005	2006
Native shrub	1.3	2.6	6.8	18.0
Introduced shrub	1.4	1.2	5.2	6.8
Native grass	26.6	29.6	31.3	14.6
Introduced grass	9.9	13.4	14.3	3.8
Native forb	28.2	29.7	35.6	34.0
Introduced forb	32.6	23.6	6.7	22.8

Figure 14. Relative percent cover of vegetation types from 2003 to 2006 at the LLRS, Middle Rio Grande, New Mexico.

Both native and introduced shrubs have followed a similar pattern over time, steadily increasing in cover with a considerable rise in 2006. Cover of native shrubs has increased at greater rates than introduced shrubs, especially within the last year of monitoring.

Bearded flatsedge, witchgrass, barnyard grass, and rabbitfoot polypogon were consistently among the highest cover of grass and grass-like species found during the sampling period from 2003 to 2005. In 2006, the most common grass species shifted to thin paspalum, barley foxtail, barnyard grass, and Mexican sprangletop.

Total cover of native grasses increased from 8.0 percent to 19.2 percent from 2003 to 2004 and then decreased to 18.6 percent in 2005 and to 11.6 percent in 2006. Total cover of introduced grasses increased from 2.9 percent in 2003 to 8.8 percent in both 2004 and 2005 and then decreased to 3.7 percent in 2006. Relative cover of native grasses increased from 24.9 percent in 2003 to 30.5 percent in 2005 and decreased to15.1 percent in 2006. The changes between years were not statistically significant ($F_{3,44}$ =2.67, P=0.059). Relative cover of introduced grasses increased from 9.1 percent to 14.4 percent from 2003 to 2005, and decreased to 3.7 in 2006, which was a significant change between years (K=11.25, P=0.010).

Native and introduced grasses also followed similar patterns over time, with cover increasing gradually until 2005, then dropping considerably in 2006. Native species consistently had higher coverage than introduced species over the years. The reason for a decline in the cover of all grass and grass-like species is unknown, although as other

lifeforms grow taller and wider (especially shrubs), it is less likely that grass species at ground level will be captured under this method of data collection.
The most common forb species shifted from sunflowers, lambsquarters, and white sweetclover in 2003 to common cocklebur, white sweet clover, prickly lettuce, and pale smartweed in 2006. Total cover of native forbs increased from 9.2 percent to 25.8 percent from 2003 to 2006. Introduced forbs increased from 11.0 percent total cover to 17.8 percent over the sampling period. Percent cover of native forbs relative to other species gradually increased from 2003 to 2005—from 28.2 percent to 35.6 percent, then dropped slightly to 34.0 percent in 2006. These changes were statistically insignificant ($F_{3,44} = 0.60$, P=0.617). Relative cover of introduced forbs decreased substantially from 32.6 percent in 2003 to 23.6 percent in 2004 to 6.7 percent in 2005, then increased back up to previous levels at 22.8 percent in 2006. This was a significant difference between years (K = 17.02, P<0.001) due to the significant decrease in relative cover in 2005.

Native and introduced forbs showed opposite trends from each other. Relative cover of native forbs slowly increased until 2005, then decreased slightly in 2006. Introduced forbs decreased in cover from 2003 to 2005, then increased in 2006. Flooding in the spring of 2005 appeared to effect composition and cover of forbs at the site. The considerable decline in 2005 of the introduced species, the same year that cover of native forbs peaked, could be attributed to the inability of introduced species to adapt to flooded conditions. Native riparian species thrived, presumably because they are more tolerant of anaerobic conditions and because of less competition from exotic species. The following year, in the absence of flooding, the cover of introduced forb species increased to almost prior levels while native forb species had a small decrease.

Since the onset of vegetation monitoring, the majority of plant species have been composed of native species rather than introduced. Relative cover of native species was 56.1 percent in 2003, 61.8 percent in 2004, 73.8 percent in 2005, and 66.6 percent in 2006. There was not a significant difference in the native species composition between years ($F_{3,44} = 2.30$, P=0.091). Although much of the native vegetative cover is composed of predominately weedy species, like common cocklebur and horseweed, this is more desirable than a plant population dominated by invasive exotic species. The total percent cover for salt cedar after 4 years of monitoring was 5.2 percent, which is low compared to other areas adjacent to the site. The large increase in plant cover and concurrent drop in bare soil over time was also a favorable trend for the site, helping to stabilize soil and reduce erosion.

Perennial pepperweed was documented at the site in 2003 and 2004, but inundation appeared to eradicate the species in 2005. The noxious weed was again detected in 2006.

Mixed Shrub Transects

Results of stem counts among the mixed shrub transects detected a total of 87 live and 35 dead shrubs in 2006 (Table 9). Total counts of both live and dead shrubs were lower than the previous year. The remains of dead shrubs have disintegrated over time, which accounts for differences in the grand total of shrubs counted. Also, as other vegetation

encroaches and grows denser, it is increasingly difficult to detect every transplanted shrub.

Table 9. Results of 2005 and 2006 survival counts of the mixed shrub planting plots at the LLRS, Middle Rio Grande, New Mexico

Species	2005		2006	
	Live	Dead	Live	Dead
New Mexico olive (*Forestiera neomexicana*)	50	4	30	7
Cottonwood (*Populus deltoides*)	0	10	3	7
Wolfberry (*Lycium torreyii*)	3	6	4	0
Goodding's willow (*Salix gooddingii*)	51	21	50	21
Other (Unidentifiable)	0	15	0	0
Total	104	56	87	35

Fifty-four percent of the 160 shrubs originally counted in 2005 at this site had survived. New Mexico olive and Goodding's willow were the most successful species among the transplanted shrubs.

Cottonwood Pole Plots

A total of 47 live or dead trees and live root sprouts was counted within the cottonwood pole planting plots (Table 10). One tree and one root sprout had died since the previous year's data collection, for a total of 13 live cottonwood poles or sprouts and 34 dead.

The majority of cottonwood poles counted within these plots was dead prior to the first year of monitoring. Pole planting may not be the best method for establishing cottonwoods at this sight. The most success with this type of planting appears to be from root sprouting. These observations are supported by data from the mixed shrub transects as well, where there was 100 percent mortality in 2005, and apparent root sprouting in 2006. Cottonwood seedlings are regenerating on their own adjacent to the river, which may prove to be the most efficient method for cottonwood establishment at this site.

Table 10. Results of 2005 and 2006 survival counts of the cottonwood pole plots at the LLRS, Middle Rio Grande, New Mexico

Cottonwood type	Count 2005	Count 2006
Live tree/pole	2	1
Root sprout	13	12
Dead	32	34
Total	47	47

Ground Water Monitoring

Regular monthly well monitoring began in September 2004. The depth (in inches) below the ground surface to water at each well for each reading from June 2004 to October 2006 is summarized in Table 11. Data from the northern, middle, and southern wells were

Table 11. Depth in inches below ground to water at the shallow monitoring wells at LLRS, Middle Rio Grande, New Mexico

	Well number (depth of well)										
Date	**N1 (62)**	**N2 (62)**	**N3 (60.5)**	**N4 (64)**	**M1 (59)**	**M2 (61)**	**M3 (59)**	**M4 (61)**	**S1 (56)**	**S2 (61.5)**	**S3 (69)**
06/04/03	44.0	41.0	29.0	No well	30.0	29.0	28.0	No well	34.0	49.0	No well
09/04/03	dry	dry	dry	No well	dry	dry	dry	No well	dry	dry	No well
10/30/03	45.0	41.0	31.0	No well	32.0	32.5	36.5	No well	40.0	dry	No well
11/27/03	36.0	41.0	37.0	No well	20.0	19.0	22.5	No well	28.5	51.0	No well
12/21/03	37.0	33.0	25.0	No well	20.0	20.0	21.5	No well	30.5	53.0	No well
01/24/04	38.0	33.0	23.0	No well	20.5	19.5	20.5	No well	31.0	53.0	No well
03/11/04	38.5	33.5	23.5	No well	21.5	20.5	20.5	No well	32.0	54.0	No well
04/01/04	32.0	27.5	18.5	No well	15.5	15.5	18.0	No well	27.5	50.5	No well
04/30/04	42.0	37.0	26.0	No well	26.5	25.5	25.5	No well	37.5	60.0	No well
05/30/04	35.5	33.0	24.0	No well	19.5	20.5	21.5	No well	31.5	55.5	No well
06/29/04	53.5	47.5	35.0	No well	39.5	37.0	36.5	No well	48.5	dry	No well
08/05/04	57.0	53.0	46.0	42.0	31.0	41.0	41.5	dry	39.5	dry	65.0
09/02/04	dry	dry	dry	58.0	dry	dry	dry	dry	56.0	dry	66.0
10/05/04	54.0	49.0	37.0	39.5	41.5	42.0	46.5	dry	50.5	dry	64.0
11/05/04	42.0	37.0	26.0	31.0	28.0	No well	29.5	41.0	35.5	58.0	49.0
12/04/04	36.5	30.0	19.0	23.5	20.0	No well	17.5	28.0	27.5	48.5	41.0
01/07/05	36.5	32.0	23.5	30.0	19.0	20.0	21.0	36.5	29.5	51.0	45.0
02/04/05	36.5	32.0	23.0	29.5	19.0	16.0	20.0	34.5	29.5	51.0	44.0
03/03/05	30.0	27.0	19.0	27.5	13.0	11.0	16.0	33.0	23.0	45.5	39.5
04/02/05	26.5	24.0	16.0	26.0	10.0	8.5	13.0	32.0	19.0	42.0	37.0
05/06/05	0.0	14.5	8.5	19.0	0.0	0.0	5.5	25.5	11.0	36.0	32.5
06/06/05	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
07/31/05	dry	57.5	43.0	40.5	47.0	39.5	42.0	49.5	52.0	dry	61.5
08/30/05	dry	59.0	40.0	34.0	48.0	40.0	37.5	52.0	52.5	dry	63.0
09/30/05	56.0	47.0	34.0	35.5	26.0	26.0	34.5	47.0	39.5	dry	56.0
10/31/05	52.0	43.5	31.0	34.0	28.0	24.5	29.0	43.5	34.5	56.5	48.5
11/29/05	45.5	38.0	27.0	32.0	22.5	20.0	25.0	40.0	30.0	52.0	45.5
12/30/05	42.5	35.0	23.5	28.0	21.0	17.0	21.5	33.0	29.0	50.0	43.5
01/31/06	46.5	39.0	27.5	32.5	24.0	21.0	25.0	38.0	34.0	54.5	46.5
02/28/06	48.0	40.0	28.5	32.5	26.5	22.5	25.0	38.5	36.5	56.5	49.0
03/31/06	59.5	49.5	35.0	36.0	39.5	32.5	34.5	44.5	46.0	dry	55.5
04/28/06	57.5	48.5	36.0	37.0	38.0	32.0	35.5	47.0	43.0	dry	54.5
05/29/06	53.5	46.5	36.0	38.0	32.0	29.0	34.5	47.5	39.0	dry	53.0
06/30/06	54.0	45.0	32.0	33.5	37.0	31.0	33.0	42.5	40.5	60.0	50.0
07/26/06	dry	55.0	39.5	36.0	52.0	43.5	43.5	49.0	55.5	dry	60.5
08/28/06	55.5	46.5	33.0	33.5	39.0	32.5	33.5	43.0	42.0	dry	52.5
09/21/06	dry	53.5	38.5	38.0	48.0	40.0	41.5	50.0	52.0	dry	60.5
10/31/06	42.0	35.0	36.0	29.5	19.0	17.0	22.5	36.5	26.5	49.5	43.0

combined across transects to get an average depth per transect per month. These data were used to create a hydrograph that also included river discharge at the Rio Grande floodway in San Acacia, New Mexico (Figure 15).

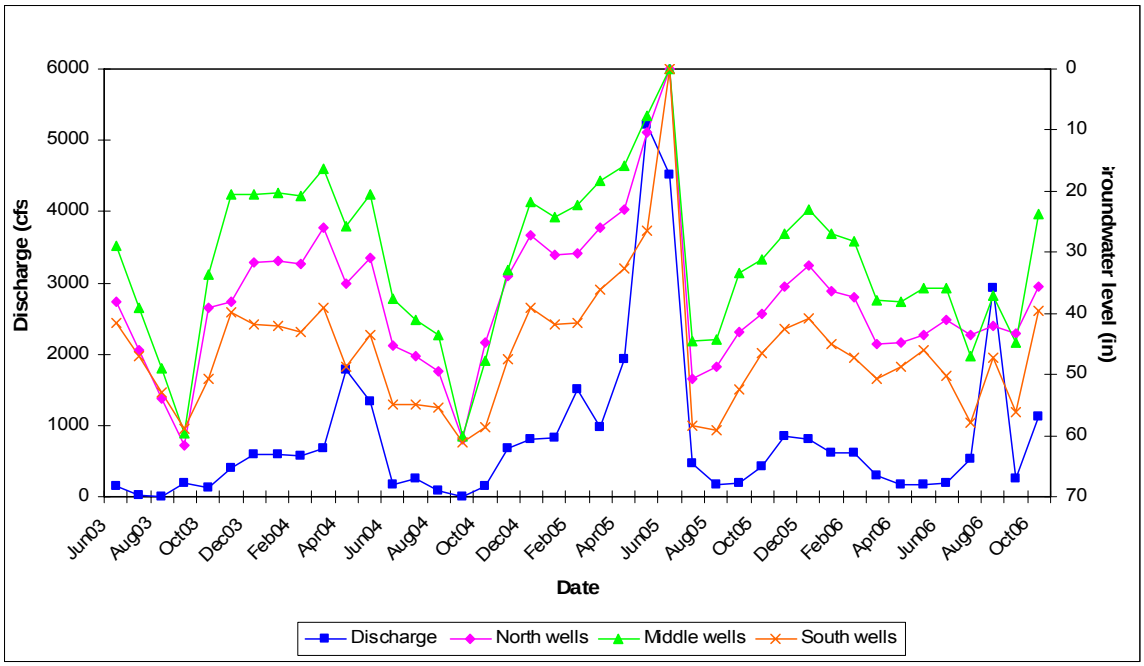


Figure 15. Discharge in cubic feet/second of the Rio Grande at San Acacia, New Mexico, and average ground water levels in inches at the LLRS, New Mexico.

The level of ground water at the LLRS correlates closely with the flows in the river. Records from the monitoring wells helped explain the shift in vegetation composition following the period of inundation in 2005.

Photo Stations

Photos taken in 2003, 2004, 2005, and 2006 are shown for comparison purposes in Appendix E.

Photos taken at Stations 1 through 5, which are located along the berm and face east toward the river, show considerable growth in the regenerating shrubs from 2005 to 2006, particularly in willow and cottonwood. In photos taken at Stations 6 through 10, which are located along the road and face east, the density of standing dead cottonwoods in the burned forest has noticeably decreased over the years as the growth of regenerating understory has increased.

Conclusion and Recommendations

Avian Monitoring

During the 4-year monitoring period, baseline conditions have been established for avian abundance and species richness at the LLRS in riparian habitat along the Middle Rio Grande. Monitoring has continued to track the development of the avian population and habitat suitability in the Cleared/Overbank Area where established stands of riparian vegetation bordering high flow channels is the desired future condition.

The abundance and diversity of breeding neotropical migrants and riparian obligates in this plot increased noticeably in 2006 compared to earlier years of monitoring, especially among neotropical migrant species. The number of riparian obligates (including the SWFL) will, however, likely remain relatively low for at least a few more seasons until woody riparian plants develop height and density suitable for nesting substrate and cover. Nevertheless, suitability for stopover habitat for migrating landbirds is probably developing much faster.

It is expected that within a 5- to 10-year timeframe the Cleared/Overbank Area would develop linear patches of understory 1- to 3-m-high riparian shrubs, preferably dominated by willow, interspersed with high flow channels. Stands of overstory trees and understory shrubs will probably develop only on the interior edge of this stand as a result of pole plantings and natural regeneration.

In order to accurately represent a reference area for the desired future condition of the avian population of the Cleared/Overbank Area, the monitoring plan was modified this year to include a plot with stands of understory riparian vegetation near the active river channel that is interspersed with high flow channels. Point counts in the Desired Future Conditions Area should continue to be compared with the Cleared/Overbank Area.

We recommend resuming point counts in the Burned Area plots that were previously monitored in 2003 and 2004, with the exception of former point numbers 15 to17 which are located north of the actual LLRS boundaries. There are no high flow channels located within the Burned Area, but because it is adjacent to the Cleared/Overbank Area, birds and habitat are somewhat similar and therefore it could function as a sufficient comparison plot. We also recommend relocating and renumbering the points within the Cleared/Overbank Area and the Burned Area so that the points are more evenly distributed over the area and have the same sample size (Figure 16).

Table 12 presents suggested success measures and target values for avian abundance, diversity, and habitat suitability. Target values were met in 2006 for the mean number of individual birds and species per point within the neotropical migrant pooled species

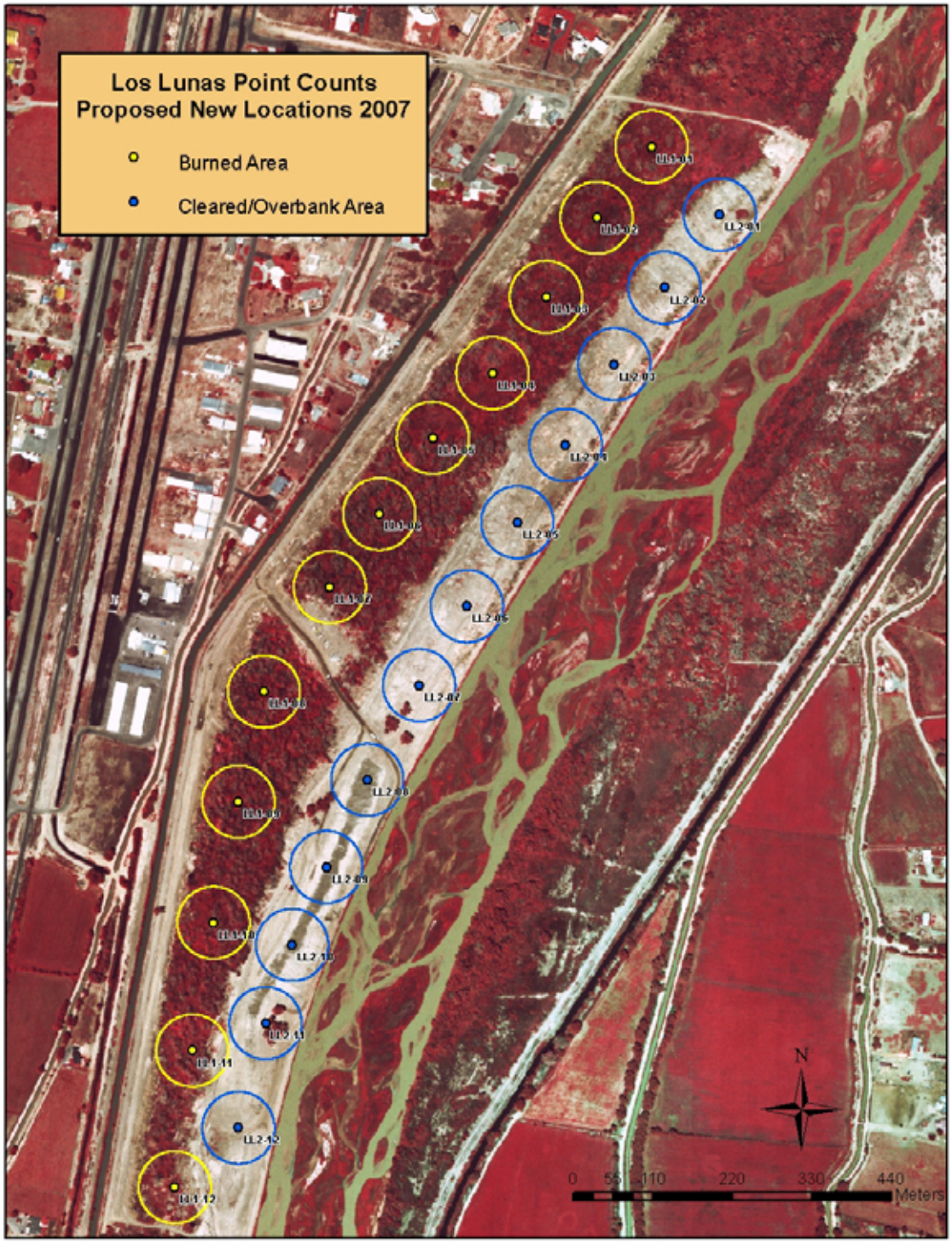


Figure 16. Proposed sites for continuing point counts at the Cleared/Overbank and Burned areas at the LLRS.

Table 12. Recommendations for success measures and target values for developing riparian avian habitat at the Cleared/Overbank Area in the LLRS

Resource category	Success measure	Target values (2004, 2005, 2006 values)
Neotropical migrant landbirds	Abundance	Mean number birds/point ≥2.50 for 3 consecutive yrs. (1.13, 0.71, 2.92)
Neotropical migrant landbirds	Diversity	Mean number species/point ≥1.85 for 3 consecutive yrs. (1.00, 0.63, 1.88)
Riparian obligate bird	Abundance	Mean number birds/point ≥1.86 for 3 consecutive yrs. (0.58, 0.42, 1.00)
Riparian obligates bird	Diversity	Mean point count value ≥1.46 for 3 consecutive yrs. (0.50, 0.38, 0.75)
Riparian obligate bird	Common yellowthroat	Mean number birds/point ≥ 0.25 for 3 consecutive yrs. (0.13, 0.21, 0.17)
Riparian obligate bird	Yellow-breasted chat	Mean number birds/point ≥ 0.36 for 3 consecutive yrs. (0.04, 0.04, 0.00)
Riparian obligate bird	Blue grosbeak	Mean number birds/point ≥ 0.47 for 3 consecutive yrs. (0.29, 0.04, 0.46)
Nesting habitat suitability for understory nesters	Shrub species composition and height	Shrub species dominated by natives. Mean vegetation height > 3m (Natives composed 72% of shrubs in 2006; mean height <1m)
Nesting habitat suitability for SWFLs	Shrub species composition and height; Hydrology	Same as above plus habitat flooded or has moist soil and <50m of surface water in breeding season (2003-2005 hydrology met these conditions)

group. Nesting habitat suitability was also met in 2006 with respect to native shrub species composition.

Finally, current bird count data used in research are increasingly using bird guilds based on nesting habitat. For example, Finch and Hawksworth (no date) separated birds into four general nesting guilds—Ground Shrub, Mid-Story, Canopy, and Cavity—for evaluation. We recommend revising the pooled species groups (i.e., neotropical migrants, riparian obligates, residents, marsh/waterbirds, and invasives) based on nesting habitat guilds to be consistent with point count data that Reclamation is collecting on the Middle Rio Grande.

Vegetation Monitoring

Baseline and monitoring data are being used to document: 1) the effectiveness of the native planting effort, 2) the natural establishment of riparian vegetation of the disturbed areas, 3) the establishment of wetland vegetation in depression areas, and 4) the possible establishment of noxious weeds and recolonization of exotics. Success of the riparian restoration at this site can also be used for comparison at other restoration sites along the Middle Rio Grande.

River Transects

Monitoring should be continued at the established vegetation transects. Changes in vegetative structure will be documented, and this information will be used to determine if the resulting habitat is suitable for supporting SWFLs. Further monitoring will also examine if native species will continue to dominate vegetative cover and how future climate will affect the trend in species over time. In 2004, it was noted that perennial pepperweed was rapidly invading the river site. Flooding appeared to have controlled the spread of this species in 2005, however it was detected again in 2006. Pepperweed and other invasive species should continue to be closely monitored to allow for early control if treatment is needed.

The development of overstory vegetation has created different conditions than when monitoring began and vegetation was just emerging. We therefore recommend using a different methodology in order to capture both understory and overstory measurements. The current method should be used to measure cover of understory species with the requirement that a plant greater than 1 m tall must not be recorded. Therefore, if the first "hit" lands on a plant within the overstory layer, it should be disregarded and the process continued until an understory plant, litter, or bare ground are intercepted. We recommend using the line-intercept method for measuring overstory cover. Canopy cover is measured along the transect by noting the point along the tape where the canopy begins and the point at which it ends for each species (Elzinga et al. 1998). Gaps in the canopy should be noted and not included in the measurement. When the length of these intercepts is added then divided by the length of the tape, a percent cover for that species results. Revising the protocol will mean that data will not be directly comparable to past years. Relative assessments can still be made but the change in methodology should be noted.

Mixed Shrub Transects

We recommend that monitoring for the success of mixed shrub containerized plantings be discontinued. Two years of data have been gathered, which should be sufficient time to allow for mortality due to transplanting and to determine survivorship of individuals.

Cottonwood Pole Plots

We recommend that monitoring of the success of cottonwood pole plantings be discontinued. Two years of data have been gathered, which should be sufficient time to allow for mortality due to transplanting and to determine survivorship of individuals.

Ground Water Monitoring

Data from the monitoring wells are being used to correlate the development and extent of wetland/riparian type vegetation on the site. As was demonstrated during the flood event in 2005, these data have been instrumental in interpreting the development of plant communities at the site. Well monitoring should be continued for the duration of vegetation monitoring.

Photo Stations

Changes in the vegetation at the LLRS are evident in photos taken over the 4 years of monitoring. Trends in the vegetation should continue to be captured through photos to visually document changes and overall development of the site over time.

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APPENDIX A

Groupings of Bird Species Detected During Point Count

Groupings of bird species detected during point count						
SPECIES	Scientific name	Neotropical migrant	Riparian obligate	Marsh/ waterbird	Resident	Invasive bird
American avocet	*Recurvirostra americana*			X		
American crow	*Corvus brachyrhynchos*					X
American kestrel	*Falco sparverius sparverius*				X	
American robin	*Turdus migratorius*				X	
Ash-throated flycatcher	*Myiarchus cinerascens*	X				
Barn swallow	*Hirundo rustica*	X				
Bank swallow	*Riparia riparia*	X				
Bewick's wren	*Thryomanes bewickii*				X	
Black phoebe	*Sayornis nigricans*				X	
Black-chinned hummingbird	*Archilochus alexandri*	X	X			
Black-crowned night heron	*Nycticorax nycticorax*			X		
Black-headed grosbeak	*Pheucticus melanocephalus*	X	X			
Black-necked stilt	*Himantopus mexicanus*			X		
Blue grosbeak	*P. caerulea*	X	X			
Blue-winged teal	*Anas discors*			X		
Brown-headed cowbird	*Molothrus ater*					X
Cassin's finch	*Carpodacus cassinii*				X	
Cattle egret	*Bubulcus ibis*			X		
Common bushtit	*Psaltriparus minimus*				X	
Common yellowthroat	*Geothlypis trichas*	X	X			
Downy woodpecker	*Picoides pubescens*				X	
European starling	*Sturnus vulgaris*					X
Gadwall	*Anas strepera*			X		
Gambel's quail	*Callipepla gambelii*				X	
Gray catbird	*Dumetella carolinensis*	X	X			
Great-blue heron	*Ardea herodias*			X		
Great-tailed grackel	*Quiscalus mexicanus*					X
Hairy woodpecker	*Picoides villosus*				X	
House finch	*Carpodacus mexicanus*				X	
Indigo bunting	*Passerina cyanea*	X				
Killdeer	*Charadrius vociferus*			X		
Lesser goldfinch	*Carduelis psaltria*	X				
Loggerhead shrike	*Lanius ludovicianus*				X	
Mallard	*Anas platyrhynchos*			X		
Northern flicker	*Colaptes auratus*				X	
Northern mockingbird	*Mimus polyglottos*				X	
Northern rough-winged swallow	*Stelgidopteryx serripennis*	X				
Red-tailed hawk	Buteo jamaicensis				X	
Red-winged blackbird	*Agelaius phoeniceus*				X	
Ring-necked pheasant	*Phasianus colchicus*				X	
Sandhill crane	*Grus canadensis*				X	
Say's phoebe	*Sayornis saya*	X				
Snowy egret	*Egretta thula*			X		
Spotted sandpiper	*Actitis macularia*			X		

Groupings of bird species detected during point count						
SPECIES	Scientific name	Neotropical migrant	Riparian obligate	Marsh/ waterbird	Resident	Invasive bird
Spotted towhee	*Pipilo maculatus*				X	
SPECIES		Neotropical migrant	Riparian obligate	Marsh/waterbird	Resident	Invasive bird
Summer tanager	*Piranga rubra*	X	X			
Turkey vulture	*Cathartes aura*	X				
Unidentified swallow		X				
Violet-green swallow	*Tachycineta thalassina*	X				
Western kingbird	*Tyrannus verticalis*	X				
Western tanager	*Piranga ludoviciana*	X				
Western wood pewee	*Contopus sordidulus*	X				
Yellow-breasted chat	*Icteria virens*	X	X			

APPENDIX B

Common and Scientific Names of Plants Detected in River Transects

Common and scientific names of plants detected in river transects

Common name	Scientific name	Lifeform*
Coyote willow	*Salix exigua*	NS
Cottonwood	*Populus deltoides*	NS
Spearleaf rabbitbrush	*Chrysothamnus linifolius*	NS
Gooddings willow	*Salix gooddingii*	NS
Saltcedar	*Tamarix* spp.	IS
Russian olive	*Eleagnus angustifolia*	IS
Fragrant flatsedge	*Cyperus odoratus*	NG
Baltic rush	*Juncus balticus*	NG
Muhly	*Muhlenbergia racemosa*	NG
Witchgrass	*Panicum capillare*	NG
Thin paspalum	*Paspalum setaceum*	NG
Dropseed	*Sporobolus* sp.	NG
Common spikerush	*Eleocharis palustris*	NG
Saltgrass	*Distichlis spicata*	NG
Bluegrass	*Poa* sp.	NG
Sedge	*Carex* sp.	NG
Mexican sprangletop	*Leptochloa fusca*	NG
Teal lovegrass	*Eragrostis hypnoides*	NG
Barley foxtail	*Hordeum jubatum*	NG
Barnyard grass	*Echinochloa crus-galli*	IG
Rabbitfoot grass	*Polypogon monspeliensis*	IG
Horseweed	*Conyza canadensis*	NF
Common sunflower	*Helianthus annuus*	NF
Pale smartweed	*Polygonum lapathifolium*	NF
Common cocklebur	*Xanthium strumarium*	NF
Beggarstick	*Bidens frondosa*	NF
Clasping-leaf dogbane	*Apocynum cannabinum*	NF
Milkvetch	*Astragalus* sp.	NF
Pussytoes	*Antennaria* sp.	NF
Ragged marshelder	*Hedosyne ambrosifolia*	NF
Hooker's evening primrose	*Oenothera elata*	NF
Dodder	*Cuscuta* sp.	NF
Lambsquarters	*Chenopodium album*	IF
Kochia	*Kochia scoparia*	IF
Prickly lettuce	*Lactuca serriola*	IF
White sweetclover	*Melilotus albus*	IF
Russian thistle	*Salsola iberica*	IF
Perrenial pepperweed	*Lepidium latifolium*	IF
Wormwood	*Artemisia absinthium*	IF
Curly dock	*Rumex crispis*	IF
Prostrate amaranth	*Amaranthus blitoides*	IF
Goats head	*Tribulus terrestris*	IF

*NS=Native shrub; IS=Introduced shrub; NG=Native grass; IG=Introduced grass; NF-Native forb; IF=Introduced forb

APPENDIX C

San Marcial Comparison Site Point Count Location

San Marcial comparison site point count locations.

APPENDIX D

Southwestern Willow Flycatcher
Survey Forms and Maps

Willow Flycatcher Survey and Detection Form (revised April, 2004)

Site Name **Los Lunas Restoration Site** State **NM** County **Valencia**
USGS Quad Name **Tome, Los Lunas** Elevation **1469** feet / **meters**

Is copy of USGS map marked with survey area and SWFL sightings attached (as required) ■ ***Yes*** ☐ ***No***

Site Coordinates: Start:N 3847943 E 340938 UTM Datum NAD83 (NAD27 preferred)
Stop:N 3846343 E 340432 UTM Zone 13

***** Fill in additional site information on back of this page *****

Survey # / Observer(s) (Full Name)	Date (m/d/y) Survey time	Number of Adult WIFLs	Estimated Number of Pairs	Estimated Number of Territories	Nest(s) Found? Y or N	Cowbirds Detected? Y or N	Presence of Livestock, Recent sign, If Yes, Describe Y or N	Comments about this survey (e.g., bird behavior, evidence of pairs or breeding, number of nests, nest contents or number of fledges seen; potential threats)
1.F.Leonard	Date 5/23/06 Start 6:35am Stop 9:35am Total hrs 3.0	0	0	0	N	Y	N	
2.A.Maruster	Date 6/6/06 Start 6:30am Stop 9:15am Total hrs 3.0	0	0	0	N	Y	N	
3.T.Duncan	Date 6/28/06 Start 6:45am Stop 9:15am Total hrs 2.5	0	0	0	N	Y	N	
4	Date Start Stop Total hrs _____							
5	Date Start Stop Total hrs _____							

Overall Site Summary (Total **resident** SWFLs only)	Adults	Pairs	Territories	Nests	Were any SWFLs color-banded? Yes **No**
Total survey hrs 8.5	0	0	0	0	If yes, report color combination(s) in the comments section on back of form

Reporting Individual Darrell Ahlers Date Report Completed 8/10/06
US Fish and Wildlife Service Permit # TE819475-0 AZ Game and Fish Department (or other state) Permit # N/A

Reporting Individual **Darrell Ahlers** Phone # **(303) 445-2233**
Affiliation **BOR** E-mail **dahlers@do.usbr.gov**
Site Name **Los Lunas Restoration Site** Date Report Completed **8/10/06**

Did you verify that this site name is consistent with that used in previous years? **Yes** / No (circle one)
If name is different, what name(s) was used in the past? _____
If site was surveyed last year, did you survey the same general area this year? **Yes** / No If no, summarize in comments below.
Did you survey the same general area during each visit to this site this year? **Yes** / No If no, summarize in comments below.

Management Authority for Survey Area (circle one): Federal Municipal/County **State** Tribal Private
Name of Management Entity or Owner (e.g., Tonto National Forest) **MRGCD**
Length of area surveyed: **1mi** (specify units, e.g., miles = mi, kilometers = km, meters = m)

Vegetation Characteristics: Overall, are the species in tree/shrub layer at this site comprised predominantly of (check one):

☐ Native broadleaf plants (entirely or almost entirely, includes high-elevation willow)

■ **Mixed native and exotic plants (mostly native)**

☐ Mixed native and exotic plants (mostly exotic)

☐ Exotic/introduced plants (entirely or almost entirely)

Identify the 2-3 predominant tree/shrub species: **Cottonwood, Coyote Willow, Russian olive**

Average height of canopy (Do not put a range): **10 ft.**

Was surface water or saturated soil present at or adjacent to site? **Yes** / No (circle one)
Distance from the site to surface water or saturated soil: **0m** (specify units)

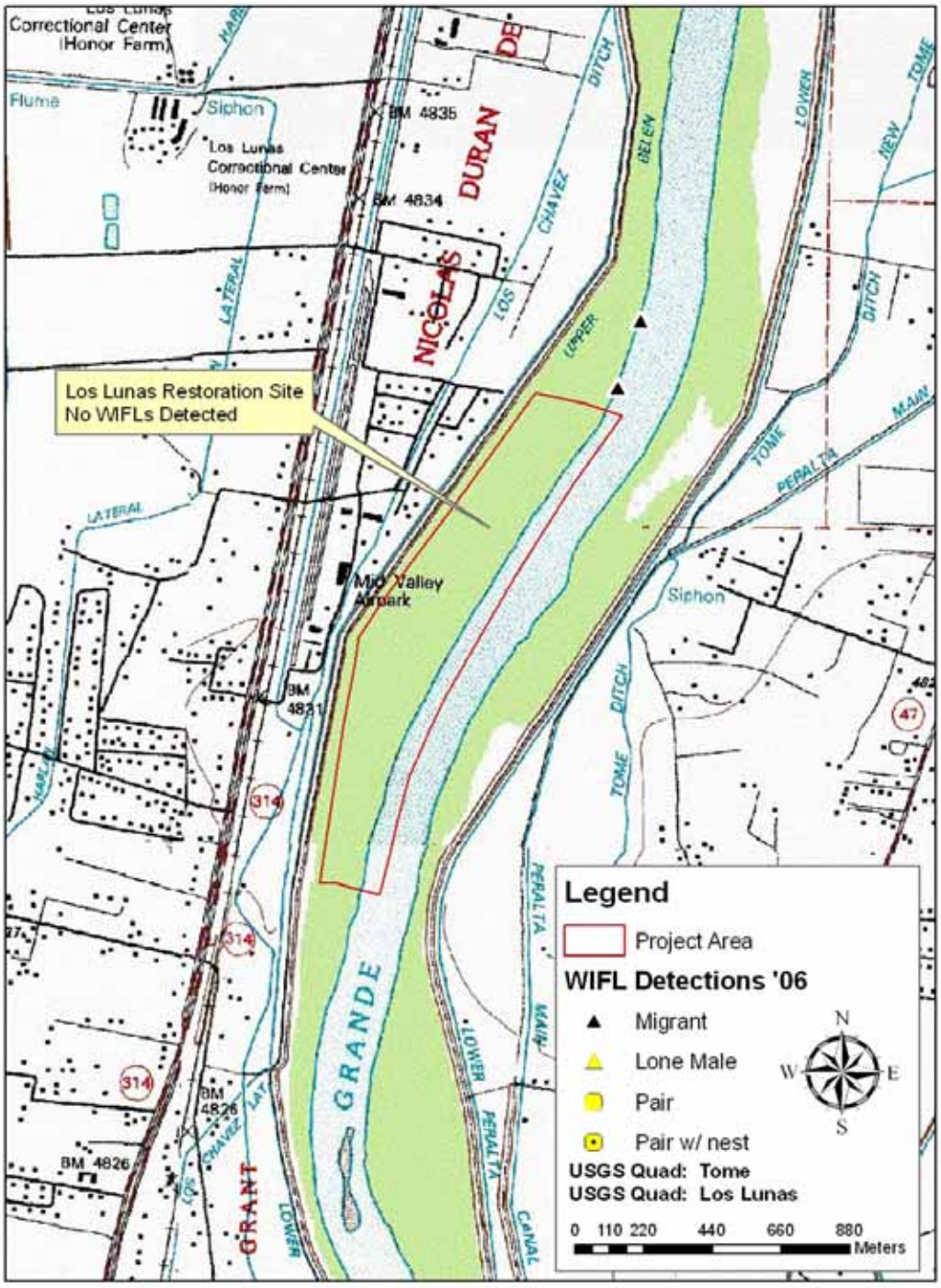
Did hydrological conditions change significantly among visits (did the site flood or dry out)? Yes / **No** (circle one)
If yes, describe in comments section below.

Remember to attach a copy of a USGS quad/topographical map (REQUIRED) of the survey area, outlining the survey site and location of SWFL detections. Also include a sketch or aerial photograph showing details of site location, patch shape, survey route in relation to patch, and location of any willow flycatchers or willow flycatcher nests detected. Such sketches or photographs are welcomed, but DO NOT substitute for the required USGS quad map. Please include photos of the interior of the patch, exterior of the patch, and overall site and describe any unique habitat features.

Comments (attach additional sheets if necessary)

SWFL Detection Locations:

Date Detected	N UTM	E UTM	Date Detected	N UTM	E UTM



SWFL detections 2006.

APPENDIX E

Photo Stations
2003 - 2006

Photo Station 1 - Facing North

2003

2004

2005

2006

Photo Station 1 – Facing River

2003

2005

2006

Photo Station 1 – Facing South

2003

2004

2005

2006

Photo Station 2 – Facing North

2003

2004

2005

2006

Photo Station 2 – Facing River

2003

2005

2006

Photo Station 2 – Facing South

2003

2004

2005

2006

Photo Station 3 – Facing North

2003

2004

2005

2006

Photo Station 3 - Facing South

2003

2004

2005

2006

Photo Station 4 – Facing North

2003

2004

2005

2006

Photo Station 4 – Facing South

2003

2004

2005

2006

Photo Station 5 – Facing North

2003

2004

2005

2006

Photo Station 5 – Facing South

2003

2004

2005

2006

Photo Station 6 – Facing North

2004

2005

2006

Photo Station 6 – Facing South

2003

2004

2005

2006

Photo Station 7 – Facing North

2003

2004

2005

2006

Photo Station 8 - Pond

2003

2004

2005

2006

Photo Station 9 – Facing South

2003

2004

2005

2006

Photo Station 10 – Facing North

2003

2004

2005

2006