

RECLAMATION

Managing Water in the West

2007 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

May 2008

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.

2007 Monitoring Report for the Los Lunas Habitat Restoration Site

Prepared by:

Rebecca Siegle
SAIC Contractor to Reclamation

Greg Reed
Natural Resources Specialist



Prepared for:

U.S. Department of the Interior
Bureau of Reclamation
Albuquerque Area Office
Albuquerque, New Mexico

Prepared by:

U.S. Department of the Interior
Bureau of Reclamation
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Environmental Services Division
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Contents

	Page
Introduction	1
Methods	2
Avian Monitoring.....	2
Point Counts.....	2
Los Lunas Restoration Site	2
Cleared/Overbank Area	2
Burned Area.....	2
Future Desired Conditions Area	2
Site Comparison Area.....	5
Southwestern Willow Flycatcher Surveys.....	5
Vegetation Monitoring.....	5
River Transects	5
Ground Water Monitoring	7
Photo Stations	7
Results	9
Avian Monitoring.....	9
Point Counts.....	9
Los Lunas Restoration Site	9
Cleared/Overbank Area	9
Burned Area.....	22
Future Desired Conditions Area	23
Site Comparison Area.....	25
Southwestern Willow Flycatcher Surveys.....	25
Vegetation Monitoring.....	27
River Transects	Error! Bookmark not defined.
Ground Water Monitoring	35
Photo Stations	35
Conclusion and Recommendations	38
Avian Monitoring.....	38
Vegetation Monitoring.....	38
Ground Water Monitoring	39
Photo Stations	39
Literature Cited.....	39

Contents (continued)

Appendix A

Bird Species Guilds Detected During Point Counts at the Los Lunas and San Marcial Sites

Appendix B

San Marcial Comparison Site Point Count Locations

Appendix C

Southwestern Willow Flycatcher Survey Forms

Appendix D

Common and Scientific Names of Plants Detected in River Transects

Appendix E

Photo Stations 2003 - 2007

Tables

Page

Table 1. Avian point count summary for the Cleared/Overbank Area.....	10
Table 2. Statistical comparison of years by plot. Alpha = 0.05.....	13
Table 3. Data for species guilds by year for the Burned Area, Cleared/Overbank Area, Future Desired Conditions Area, and the San Marcial Site Comparison Area.....	15
Table 4. Statistical comparison of plots by year. Alpha = 0.05.....	18
Table 5. Avian point count summary for the Burned Area.....	23
Table 6. Avian point count summary for the Future Desired Conditions Area.	24
Table 7. Total and relative percent cover of individual plant species detected during monitoring of the river transects in the LLRS, middle Rio Grande, New Mexico.....	28
Table 8. Statistical comparison of paired samples between year 1 (2003) and year 5 (2007) and between consecutive years of total cover of plant, litter, bare soil, and overstory shrubs and relative cover of vegetation types; river transects, LLRS, middle Rio Grande, New Mexico. Alpha = 0.05.....	30
Table 9. Mean difference and standard deviation between paired samples comparing consecutive years and year 1 (2003) to year 5 (2007) of the study at LLRS, middle Rio Grande, New Mexico.....	31
Table 10. Total percent cover and average height of woody overstory species (>1 m) in 2007 at the LLRS, middle Rio Grande, New Mexico.	31
Table 11. Depth in inches below ground to water at the shallow monitoring wells at LLRS, middle Rio Grande, New Mexico.....	35

Figures

Figure 1. Cleared/Overbank and Burned Area point count locations at LLRS.....	3
Figure 2. Future Desired Conditions Area point count locations downstream of LLRS.....	4
Figure 3. Vegetation transect locations.....	6

Figure 4. Ground water well and photo station locations	8
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Contents (continued)

Page

Figure 5. The mean number of individual birds per point by species guilds in the in the Cleared/Overbank Area over time	12
Figure 6. The mean number of species per point by species guilds in the Cleared/Overbank Area over time	12
Figure 7. Population trends for selected edge bird species in the Cleared/Overbank Area: western kingbird, black-chinned hummingbird, indigo bunting, and northern mockingbird.....	19
Figure 8. Population trends for selected ground shrub bird species in the Cleared/Overbank Area: blue grosbeak, mourning dove, and ring-necked pheasant.....	20
Figure 9. Population trend for dense shrub bird species in the Cleared/Overbank Area: common yellowthroats	20
Figure 10. Population trends for selected mid-story bird species in the Cleared/Overbank Area: brown-headed cowbird, spotted towhee, black-headed grosbeak, and grey catbird.....	21
Figure 11. Population trends for selected water bird species in the Cleared/Overbank Area: red-winged blackbird, spotted sandpiper, black-necked stilt, and snowy egret	21
Figure 12. SWFL detections in the Belen reach in the vicinity of LLRS.....	26
Figure 13. Total vegetation cover of river transects from 2003 to 2007 at the LLRS, middle Rio Grande, New Mexico	29
Figure 14. Relative percent cover of vegetation types from 2003 to 2007 at the LLRS, middle Rio Grande, New Mexico	32
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	36

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) 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 regrowth.

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 and willow poles.

To fulfill the requirements of the BO, monitoring of habitat suitability/ sustainability is being conducted. Reclamation's Technical Service Center in Denver, Colorado, has

conducted avian, vegetation, and ground water monitoring at the restoration site 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/year during the peak breeding seasons (late-May to early-July). This report discusses two areas within the LLRS and one area south of the restoration site that were monitored during the 5-year study period from 2003 to 2007. Only one area, 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, 2004, and 2007 and in the Future Desired Conditions Area in 2006 and 2007. The three areas 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 with regrowth comprised of primarily native mixed vegetation. Eight point counts were conducted at this site from 2003 to 2006; points were relocated and increased to 12 in 2007 so that a) the points were more evenly distributed over the area, and b) all areas had the same sample size (Figure 1).

Burned Area

A previously burned cottonwood forest within the LLRS is experiencing regrowth of mixed vegetation. Seventeen point counts were conducted at this site in 2003 and 2004; points were relocated and decreased to 12 in 2007 so that a) the points were more evenly distributed over and were all within the restoration area, and b) all areas had the same sample size (Figure 1).

Future Desired Conditions Area

This area is located south of the LLRS on seasonally flooded sandbars that consist of young stands of mixed willow and cottonwood and was chosen as a reference site for comparison purposes; 12 point counts were conducted at this site in 2006 and 2007 (Figure 2).

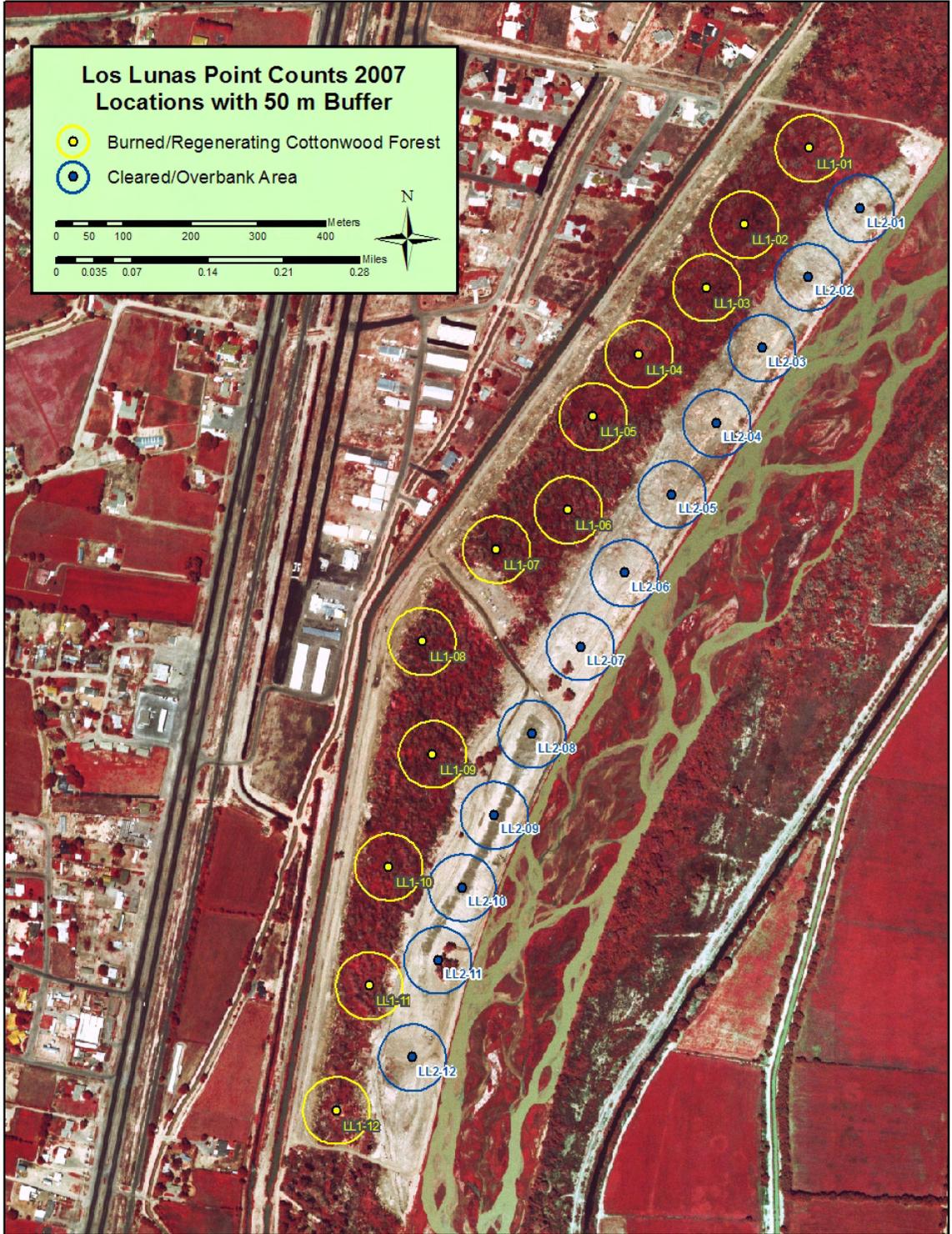


Figure 1. Cleared/Overbank and Burned Area point count locations at LLRS.

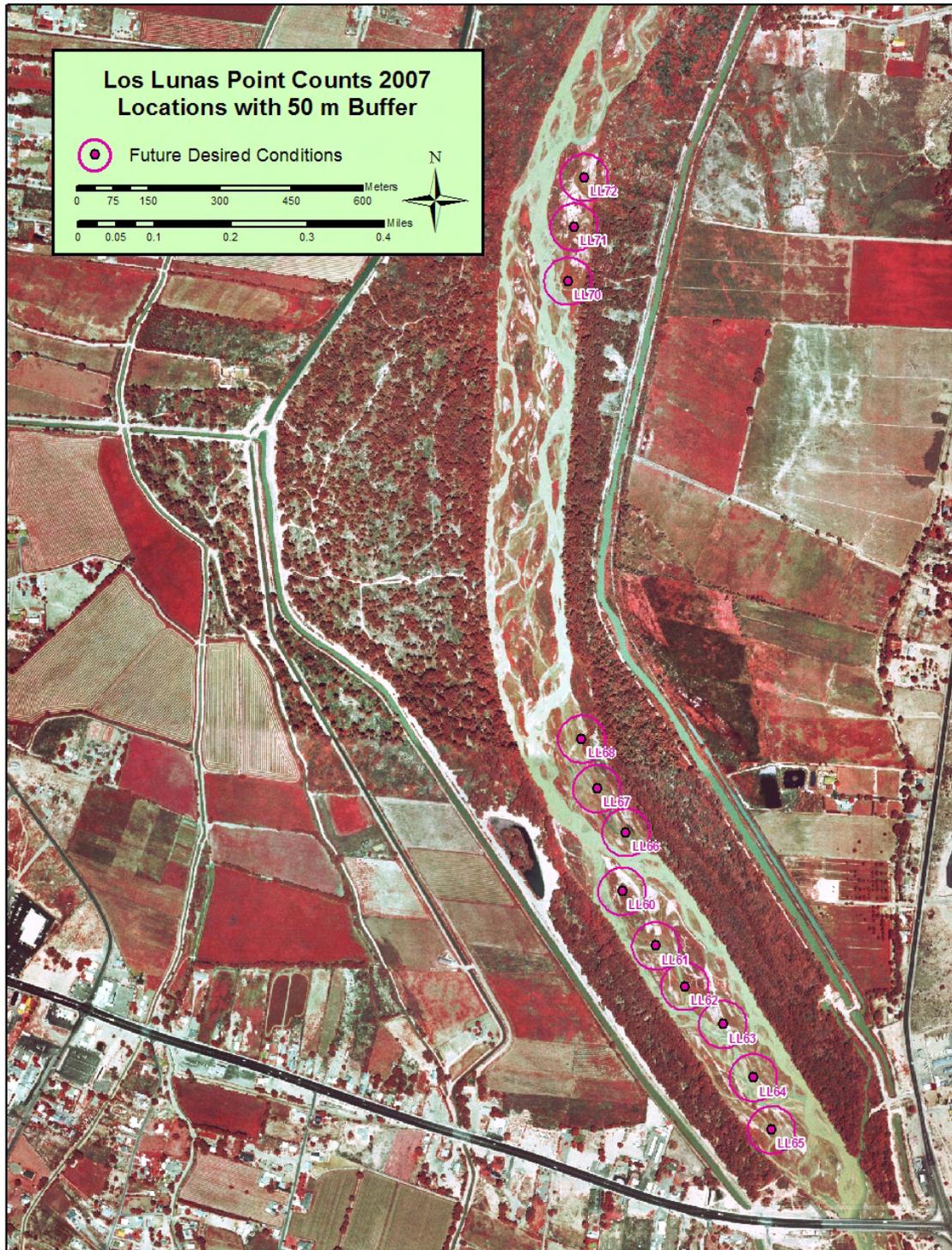


Figure 2. Future Desired Conditions Area point count locations downstream of LLRS.

Data from the 5 years were compared to evaluate any statistically significant changes in relative abundance of species guilds over time and between areas. Pooled species guilds were categorized based on nesting habitat and included canopy, cavity, dense shrub, edge, ground shrub, invasive, mid-story, openings, and water. Appendix A shows the groupings of individual bird species for analysis purposes as well as scientific names of the bird species.

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

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 B. This area was selected as a comparison site because historic overbank flooding provides some of the best riparian habitat along the Rio Grande in New Mexico. The point counts are located adjacent to wetlands within mixed native and exotic stands.

Southwestern Willow Flycatcher Surveys

Presence/absence surveys were conducted 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 2007. 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 C.

Vegetation Monitoring

River Transects

Twelve 50-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. A new methodology was used for cover measurements in 2007. For understory measurements, the point-intercept method was used, which entailed recording the first "hit" for herbaceous plant species and for woody species under 1 m tall. If a plant was not intercepted, then bare soil or litter was recorded. The line-intercept method was used for measuring overstory cover. Canopy cover was measured along the transect by noting the

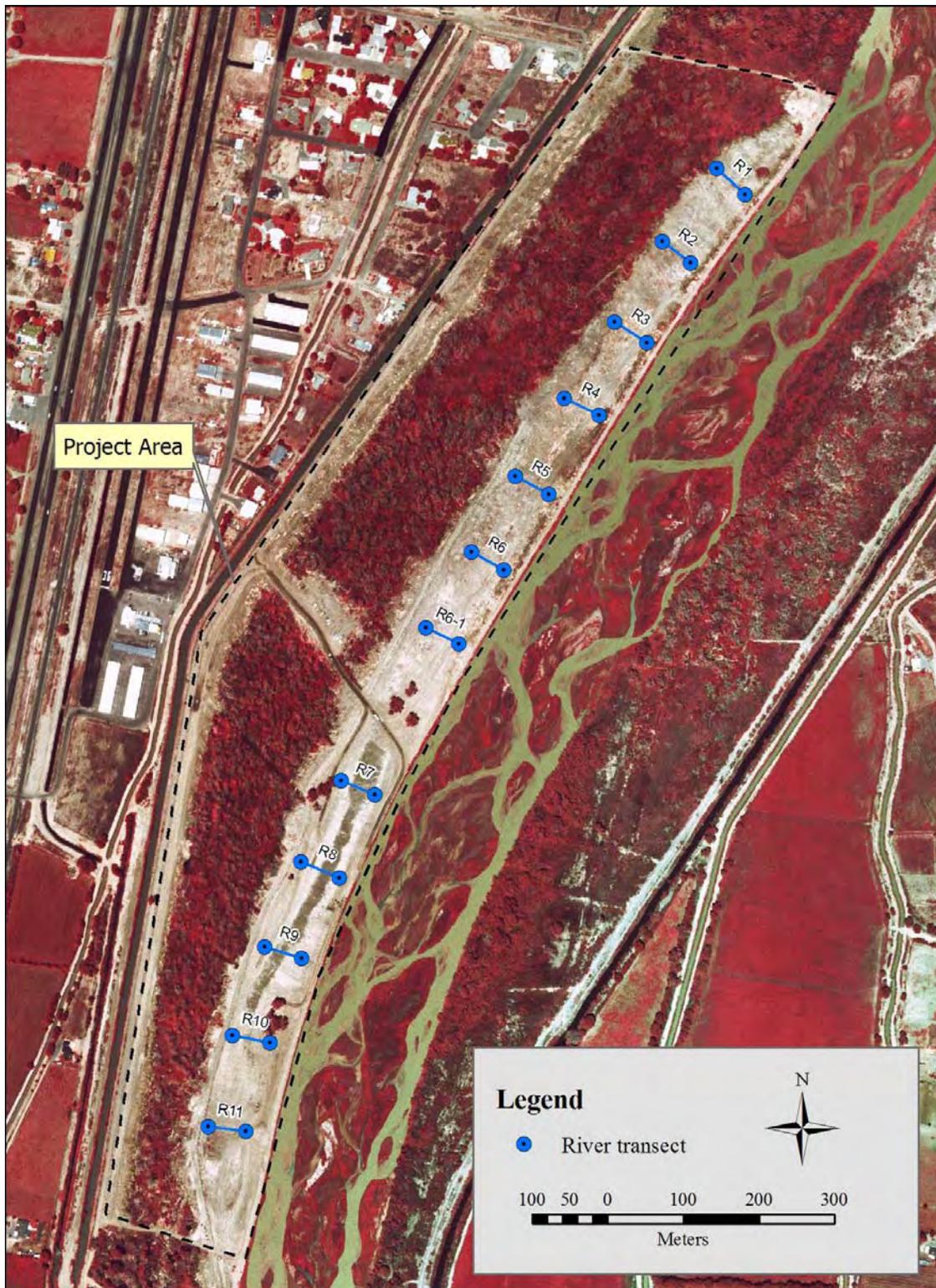


Figure 3. Vegetation transect locations.

point along the tape where the canopy began and the point at which it ended for each woody species over a meter tall. In previous years, the method used to collect understory cover was applied to all vegetation cover measurements, so that if a woody species was intercepted first, then this species was recorded. As vegetation grew, this methodology did not account for a separate overstory measurement, and understory vegetation cover was not fully captured. Because of the change in methodology in 2007, data were not directly comparable to past years. Data were collected sometime between late-August and mid-September from 2003 through 2007.

Data from the 4 years were compared to evaluate any statistically significant changes within vegetation types over time. The paired t-test was used to statistically compare normally distributed data, and the signed rank nonparametric test 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.

Ground Water Monitoring

Eleven ground water monitoring wells were 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.

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 2007 to visually document vegetation height, density, species composition, and overall site development.

Annual photos were compared to 2003 baseline photos to evaluate visual changes over time.

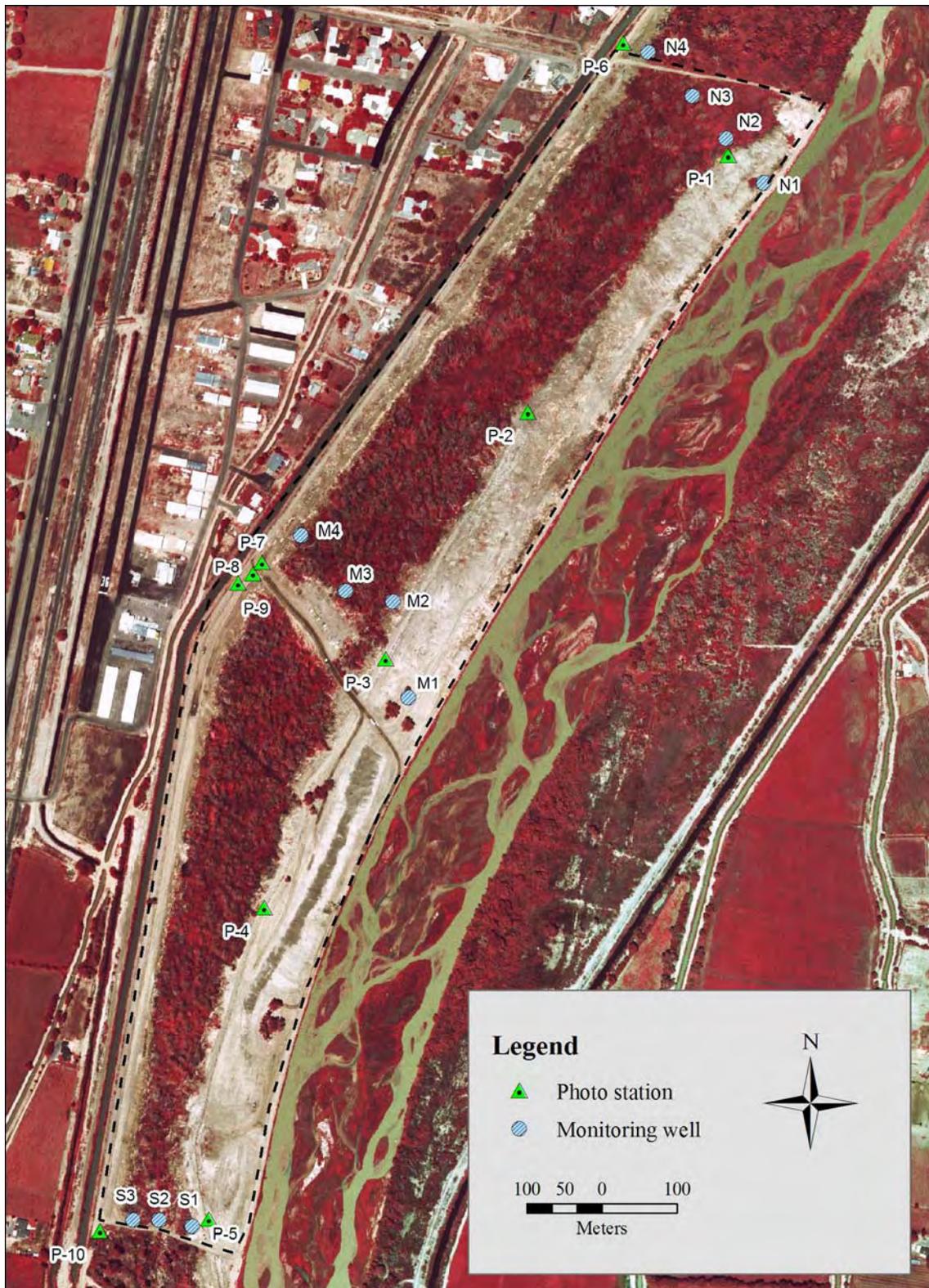


Figure 4. Ground water well and photo station locations.

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 this area. The “Mean” and “SD” columns represent the mean number and standard deviation of detections per point for the species.

Forty-six species were detected during the point counts conducted from 2003 to 2007. The most abundant species (based on the mean number of detections per point) in 2003 were blue grosbeaks, redwing blackbirds, turkey vultures, and western kingbirds. Abundant species in 2007 included Brewer’s blackbirds, blue grosbeaks, mourning doves, redwing blackbirds, and common yellowthroats.

There was generally an increase in the abundance of both species and individual birds within most of the species guilds over the monitoring period (Figures 5 and 6). The exception was within the canopy species guild, where the abundance of birds went down over time. Abundance within the cavity, invasive, and open bird guilds stayed the same or increased only slightly. The increasing trend for most guilds is 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. The decrease in the abundance of canopy species is unexpected since the amount of canopy habitat within the vegetation has presumably increased over time.

In statistical analysis comparing year 1 of monitoring (2003) to year 5 (2007), the average number of species per point increased significantly from 1.79 to 3.81 (refer to Table 2 for all P-values). There was also a statistically significant increase in the number of individual birds from 2.75 in 2003 to 7.83 in 2007. The number of ground shrub species per point increased significantly from 0.29 in 2003 to 1.06 in 2007, as did the number of ground shrub birds increasing from 0.42 in 2003 to 1.94 in 2007. There was also a significant increase in the number of mid-story species from 0.17 to 0.61, and in the number of mid-story birds from 0.17 to 1.00, from 2003 to 2007. The mid-story guild is important as an indicator in that the SWFL is classified within this group. Therefore, efforts to develop SWFL habitat at the LLRS can be gauged using this habitat type. The increase in mid-story species and birds in this area, as well as the increase in diversity and number of birds in general, are favorable developments.

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

<i>Cleared/Overbank Area</i>	2003 n=24			2004 n=24			2005 n=24			2006 n=24			2007 n=36		
Species	% 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	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	0.0	0.00	0.00
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	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	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	0.0	0.00	0.00
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	2.8	0.11	0.67
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	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	38.9	0.58	0.84
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	0.0	0.00	0.00
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	5.6	0.06	0.23
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	0.0	0.00	0.00
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	44.4	0.69	0.89
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	0.0	0.00	0.00
Brewer's blackbird	0.0	0.00	0.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.8	1.25	7.50
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	25.0	0.50	1.00
Bushtit	0	0.00	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.00	0.00	0.00	2.8	0.11	0.67
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	0.0	0.00	0.00
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	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	61.1	0.81	0.86
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	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	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	2.8	0.03	0.17
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	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	2.8	0.03	0.17
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	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	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	22.2	0.42	0.94
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	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	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	5.6	0.11	0.52
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	25.0	0.69	2.08
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	5.6	0.06	0.23

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<i>Cleared/Overbank Area</i>	2003 n=24			2004 n=24			2005 n=24			2006 n=24			2007 n=36		
Species, cont.	% Plots	Mean	SD												
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	0.0	0.00	0.00
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	8.3	0.17	0.61
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	47.2	1.11	1.69
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	14.9	0.14	0.35
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	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	8.3	0.11	0.40
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	8.3	0.08	0.28
Spotted towhee	0.0	0.00	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.00	0.00	0.00	16.7	0.19	0.47
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	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	2.8	0.08	0.50
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	2.8	0.03	0.17
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	16.7	0.36	0.90
White-winged dove	0.0	0.00	0.0	0.0	0.00	0.00	0.0	0.00	0.00	0.00	0.00	0.00	2.8	0.06	0.33
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	5.6	0.06	0.23

2007 Monitoring Report for the Los Lunas Habitat Restoration Site

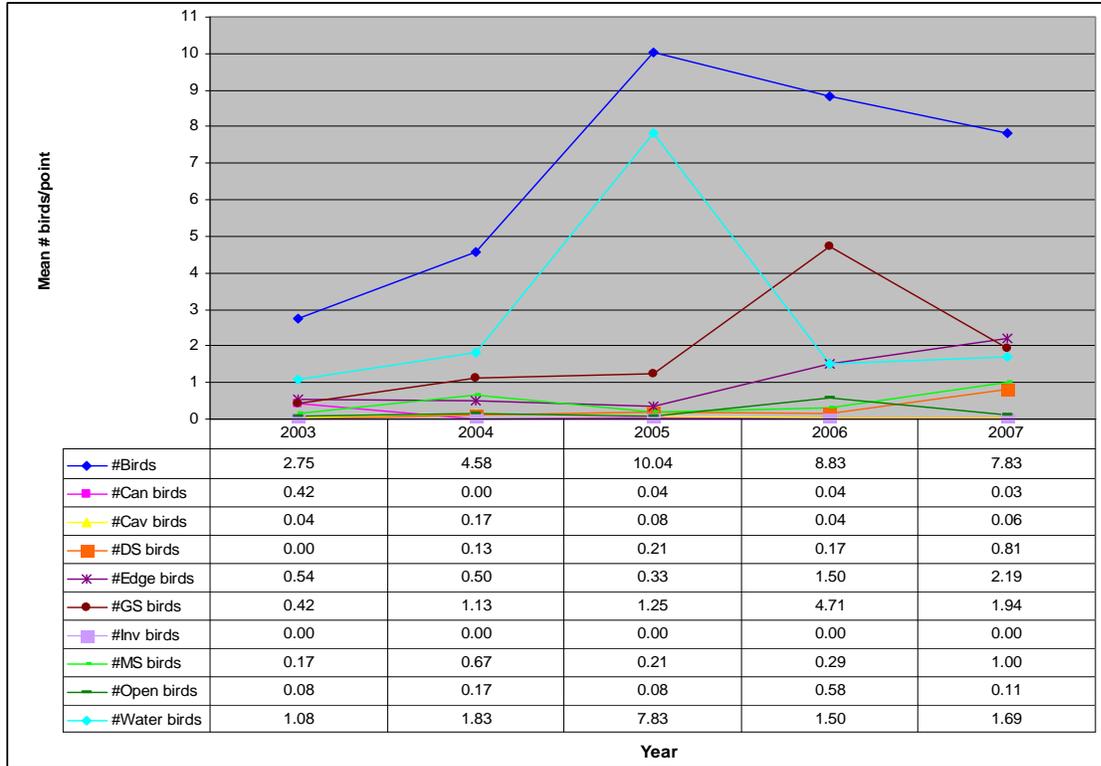


Figure 5. The mean number of individual birds per point by species guilds in the Cleared/Overbank Area over time.

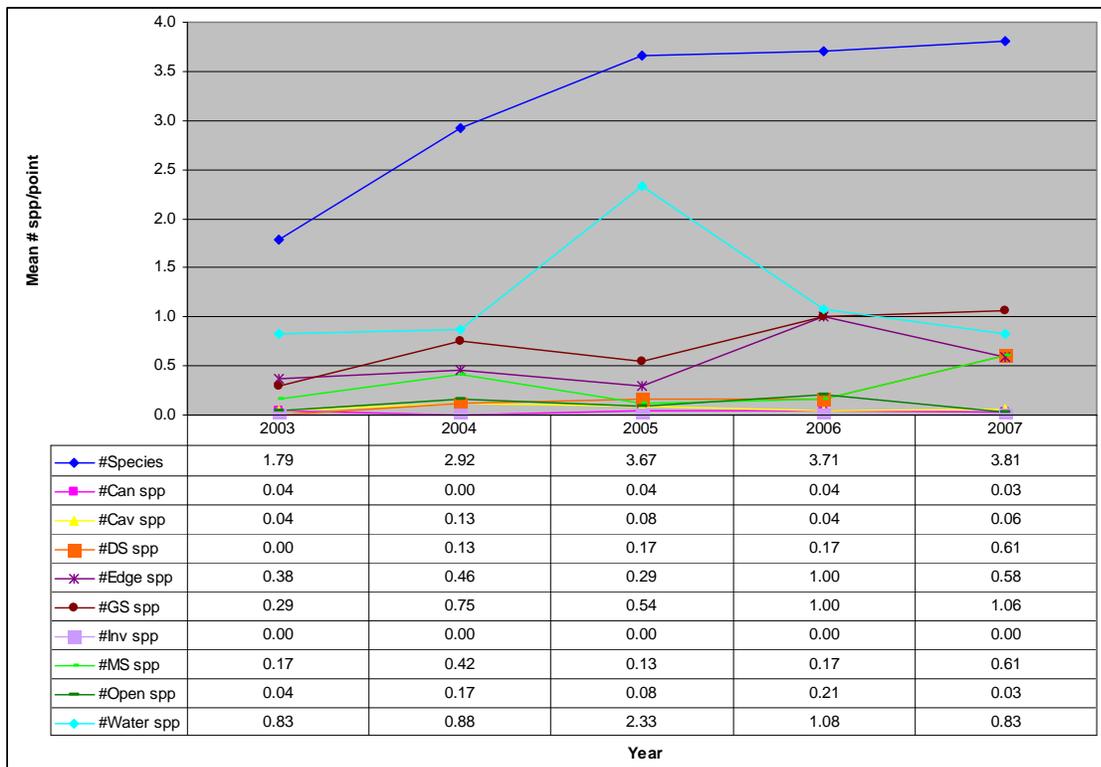


Figure 6. The mean number of species per point by species guilds in the Cleared/Overbank Area over time.

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

	Cleared/overbank Area		Burned Area		Future Desired Cond. Area
	2003 vs 2007	All years (2003 to 2007)	2003 vs 2007	All years (2003,2004,2007)	2006 vs 2007
# Species	03 < 07 P<0.001 ²	P<0.001 ⁴	03 = 07 P=0.879 ²	P=0.754 ⁴	06 < 07 P=0.010 ¹
# Birds	03 < 07 P<0.001 ²	P<0.001 ⁴	03 = 07 P=0.583 ¹	P=0.124 ⁴	06 = 07 P=0.749 ²
# Canopy species	03 = 07 P=0.789 ²	P=0.900 ⁴	03 = 07 P=0.259 ²	P=0.208 ⁴	No canopy spp in 2006
# Canopy birds	03 = 07 P=0.771 ²	P=0.898 ⁴	03 = 07 P=0.191 ²	P=0.203 ⁴	No canopy spp in 2006
# Cavity species	03 = 07 P=0.826 ²	P=0.940 ⁴	03 = 07 P=0.207 ¹	P=0.147 ⁴	No cavity spp in 2006 or 2007
# Cavity birds	03 = 07 P=0.826 ²	P=0.935 ⁴	03 = 07 P=0.299 ²	P=0.090 ⁴	No cavity spp in 2006 or 2007
# Dense shrub species	No dense shrub spp in 2003	P<0.001 ⁴	03 = 07 P=0.792 ²	P=0.524 ⁴	06 = 07 P=0.077 ²
# Dense shrub birds	No dense shrub spp in 2003	P<0.001 ⁴	03 = 07 P=0.792 ²	P=0.524 ⁴	06 = 07 P=0.076 ²
# Edge species	03 = 07 P=0.157 ²	P=0.051 ⁴	03 < 07 P=0.001 ¹	P=0.001 ³	06 = 07 P=0.069 ²
# Edge birds	03 = 07 P=0.113 ²	P=0.043 ⁴	03 < 07 P=0.001 ²	P<0.001 ⁴	06 = 07 P=0.186 ²
# Ground shrub species	03 < 07 P<0.001 ¹	P=0.002 ⁴	03 = 07 P=0.772 ¹	P=0.925 ³	06 = 07 P=0.067 ²
# Ground shrub birds	03 < 07 P<0.001 ²	P=0.002 ⁴	03 = 07 P=0.140 ²	P=0.925 ³	06 = 07 P=0.071 ²
# Invasive species	No invasive spp in cleared area	No invasive spp in cleared area	03 = 07 P=0.927 ²	P=0.982 ⁴	No invasive spp in desired cond. area
# Invasive birds	No invasive spp in cleared area	No invasive spp in cleared area	03 = 07 P=0.912 ²	P=0.978 ⁴	No invasive spp in desired cond. area
# Mid-story species	03 < 07 P=0.011 ²	P=0.003 ⁴	03 = 07 P=0.147 ¹	P=0.070 ³	06 < 07 P<0.001 ¹
# Mid-story birds	03 < 07 P=0.008 ²	P=0.003 ⁴	03 > 07 P=0.033 ¹	P=0.100 ⁴	06 < 07 P=0.002 ²
# Opening species	03 = 07 P=0.789 ²	P=0.115 ⁴	No opening spp in 2007	P=0.662 ⁴	No opening spp in 2007
# Opening birds	03 = 07 P=0.808 ²	P=0.113 ⁴	No opening spp in 2007	P=0.662 ⁴	No opening spp in 2007
# Water species	03 = 07 P=0.840 ²	P<0.001 ⁴	03 = 07 P=0.994 ²	P=0.651 ⁴	06 > 07 P=0.002 ²
# Water birds	03 = 07 P=0.612 ²	P<0.001 ⁴	03 = 07 P=0.895 ²	P=0.597 ⁴	06 > 07 P=0.002 ¹

1= Students t-test; 2=Mann Whitney test; 3= ANOVA; 4=Kruskal-Wallis test
 Highlighted boxes = significant difference at the 95-percent confidence level

Comparisons between all years of monitoring (2003, 2004, 2005, 2006, and 2007) found significant differences not only within those groups noted above—total number species and birds, ground shrub species and birds, and mid-story species and birds—but also within the dense shrub species and dense shrub birds, edge birds, water species, and water birds guilds.

Abundance within both the dense shrub and mid-story guilds was higher in 2007 than in all other years. Points were relocated, and the sample size increased in this area in 2007 which may have been a factor in the change; or the difference could be attributed to increased habitat for these species types. Mean detections of birds within the edge guild were significantly higher in 2006 and 2007. The mean number of water 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 areas including the San Marcial Site 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 individual birds within each group were calculated by averaging the number of birds detected at each point over the three point count periods and then summing all point averages. Note that sample sizes were sometimes different, so totals are not always equally comparable between areas or years. “Mean” and “SD” are the mean number and standard deviation of detections per point within each pooled species group.

Species guilds in the Cleared/Overbank Area were compared to guilds within the Burned Area for 2003, 2004, and 2007 and to guilds in the Future Desired Conditions Area for 2006 and 2007 (see Table 4 for all P-values). During all the years surveyed, the Cleared/Overbank Area had significantly fewer mean detections per point than the Burned Area within the total number of species, total number of birds, cavity species and birds, and mid-story species and birds guilds. Cottonwood snags in the Burned Area likely provided more habitat for cavity nesters. The Burned Area began regenerating soon after the fire and before clearing of the Cleared/Overbank Area; therefore habitat for mid-story species had more time to develop. The Cleared/Overbank Area had a significantly higher abundance of water species and birds in all years, which would be expected since this area is adjacent to the river. In 2007, the Cleared/Overbank Area had a significantly higher mean number of detections of dense shrub species and birds—a guild that includes only the common yellowthroat within the study area—than the Burned Area. This could indicate that desirable dense shrub habitat has been created in the Cleared/Overbank Area over time since there were no common yellowthroats detected there in 2003. Abundance in the edge bird guild was also statistically higher in the Cleared/Overbank Area in 2007; however, the mean number of edge species per point was actually significantly lower than the Burned Area this same year. This was due to the huge number of Brewer’s blackbirds detected at one point within the Cleared/Overbank Area in 2007. Barn swallows, the only opening bird species detected in the study area, were more numerous in the Cleared/ Overbank Area in 2004. Finally, the Cleared/Overbank Area had significantly fewer detections per point for canopy species, ground shrub species, and ground shrub bird guilds in 2003. These results can be explained by an increase in the number of ground shrub species and birds over time in the Cleared/Overbank Area, while numbers remained relatively unchanged in the Burned Area, which appears to indicate that ground shrub habitat is improving over time within the Cleared/Overbank Area. Canopy species, on the other hand, decreased at the Burned

2007 Monitoring Report for the Los Lunas Habitat Restoration Site

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

2003	Los Lunas Burned Area 17 points			Los Lunas Cleared/Overbank Area 8 points			San Marcial 25 points		
	Total	Mean	SD	Total	Mean	SD	Total	Mean	SD
# Species	30	5.71	1.66	18	1.79	1.25	43	6.59	1.97
# Birds	146	8.45	3.23	22	2.75	3.08	346	13.83	7.42
# Canopy species	3	0.26	0.50	1	0.04	0.20	4	0.25	0.44
# Canopy birds	11	0.74	1.80	3	0.42	2.04	7	0.28	0.53
# Cavity species	5	0.57	0.67	1	0.04	0.20	5	0.68	0.84
# Cavity birds	12	0.62	0.76	1	0.04	0.20	22	0.88	1.17
# Dense shrub species	1	0.19	0.40	0	0.00	0.00	4	0.96	0.56
# Dense shrub birds	3	0.19	0.40	0	0.00	0.00	34	1.37	1.10
# Edge species	4	0.62	0.58	5	0.38	0.65	8	0.43	0.64
# Edge birds	15	0.83	0.93	5	0.54	1.02	13	0.51	0.81
# Ground shrub species	4	0.88	0.80	2	0.29	0.46	5	1.04	0.58
# Ground shrub birds	18	1.14	1.26	3	0.42	0.72	59	2.36	1.57
# Invasive species	1	0.02	0.15	0	0.00	0.00	0	0.00	0.00
# Invasive birds	1	0.02	0.15	0	0.00	0.00	0	0.00	0.00
# Mid-story species	8	2.98	1.18	3	0.17	0.38	9	2.49	1.23
# Mid-story birds	83	4.69	2.28	1	0.17	0.38	102	4.07	2.40
# Opening species	1	0.02	0.15	1	0.04	0.20	4	0.09	0.29
# Opening birds	1	0.02	0.15	2	0.08	0.41	4	0.16	0.66
# Water species	3	0.17	0.38	5	0.83	0.82	4	0.64	0.54
# Water birds	4	0.19	0.45	9	1.08	1.21	105	4.20	6.72

2004	Los Lunas Burned area 17 points			Los Lunas Cleared/Overbank Area 8 points			San Marcial 25 points		
	Total	Mean	SD	Total	Mean	SD	Total	Mean	SD
# Species	27	5.47	1.40	20	2.92	1.61	45	6.62	2.43
# Birds	118	7.34	2.55	37	4.58	2.92	394	15.77	9.96
# Canopy species	2	0.11	0.31	0	0.00	0.00	4	0.15	0.36
# Canopy birds	6	0.38	1.28	0	0.00	0.00	5	0.16	0.41
# Cavity species	6	0.43	0.68	2	0.13	0.45	5	0.70	0.82
# Cavity birds	7	0.43	0.68	2	0.17	0.56	25	0.99	1.34
# Dense shrub species	1	0.11	0.31	1	0.13	0.34	5	0.93	0.63
# Dense shrub birds	2	0.11	0.31	1	0.13	0.34	39	1.57	1.22
# Edge species	2	0.64	0.61	5	0.46	0.59	6	0.15	0.39
# Edge birds	12	0.70	0.69	5	0.50	0.66	5	0.22	0.65
# Ground shrub species	4	0.89	0.70	3	0.75	0.79	5	1.01	0.80
# Ground shrub birds	20	1.28	1.04	27	1.13	1.54	51	2.05	2.52
# Invasive species	1	0.02	0.15	0	0.00	0.00	0	0.00	0.00
# Invasive birds	1	0.02	0.15	0	0.00	0.00	0	0.00	0.00
# Mid-story species	7	3.15	0.98	4	0.42	0.78	7	2.65	1.25
# Mid-story birds	69	4.30	1.94	16	0.67	1.20	125	4.99	3.13
# Opening species	1	0.02	0.15	1	0.17	0.38	3	0.16	0.47
# Opening birds	1	0.02	0.15	1	0.17	0.38	19	0.74	3.32
# Water species	3	0.11	0.31	4	0.88	0.90	10	0.86	0.93
# Water birds	3	0.11	0.31	15	1.83	2.48	126	5.05	7.18

Table 3, cont.

2005	Los Lunas Cleared/Overbank Area 8 points			San Marcial 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
# Canopy species	1	0.04	0.20	6	0.23	0.51
# Canopy birds	1	0.04	0.20	7	0.28	0.67
# Cavity species	2	0.08	0.28	5	0.61	0.66
# Cavity birds	2	0.08	0.28	18	0.72	0.84
# Dense shrub species	1	0.17	0.38	5	1.15	0.68
# Dense shrub birds	2	0.21	0.51	41	1.62	1.06
# Edge species	2	0.29	0.46	2	0.12	0.33
# Edge birds	3	0.33	0.56	5	0.20	0.62
# Ground shrub species	3	0.54	0.59	5	0.45	0.55
# Ground shrub birds	10	1.25	1.62	20	0.82	1.22
# Invasive species	0	0.00	0.00	0	0.00	0.00
# Invasive birds	0	0.00	0.00	0	0.00	0.00
# Mid-story species	3	0.13	0.45	9	2.11	1.11
# Mid-story birds	3	0.21	0.83	68	2.72	1.72
# Opening species	1	0.08	0.28	2	0.03	0.16
# Opening birds	1	0.08	0.28	2	0.03	0.16
# Water species	10	2.33	1.05	10	0.92	0.86
# Water birds	63	7.83	3.83	201	8.05	9.50

2006	Los Lunas Cleared/Overbank Area 8 points			Los Lunas Desired Conditions 12 points			San Marcial 25 points		
	Total	Mean	SD	Total	Mean	SD	Total	Mean	SD
# Species	21	3.71	2.07	17	2.94	1.43	41	4.79	2.23
# Birds	71	8.83	9.17	61	5.08	2.93	340	13.60	10.86
# Canopy species	1	0.04	0.20	0	0.00	0.00	6	0.35	0.58
# Canopy birds	1	0.04	0.20	0	0.00	0.00	10	0.41	0.72
# Cavity species	1	0.04	0.20	0	0.00	0.00	5	0.52	0.66
# Cavity birds	1	0.04	0.20	0	0.00	0.00	16	0.63	0.90
# Dense shrub species	1	0.17	0.38	1	0.14	0.35	3	0.84	0.62
# Dense shrub birds	1	0.17	0.38	2	0.17	0.45	29	1.17	1.10
# Edge species	4	1.00	1.06	2	0.50	0.65	3	0.19	0.48
# Edge birds	12	1.50	1.84	9	0.72	0.97	7	0.28	0.83
# Ground shrub species	4	1.00	0.83	3	0.42	0.65	4	0.32	0.55
# Ground shrub birds	38	4.71	7.80	6	0.50	0.77	13	0.52	1.12
# Invasive species	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
# Invasive birds	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
# Mid-story species	2	0.17	0.48	6	0.92	1.11	10	1.77	1.19
# Mid-story birds	2	0.29	0.81	16	1.36	1.76	70	2.79	2.57
# Opening species	1	0.21	0.41	1	0.31	0.47	2	0.05	0.23
# Opening birds	5	0.58	1.32	8	0.69	1.14	12	0.49	2.71
# Water species	7	1.08	0.83	4	0.67	0.63	8	0.75	0.74
# Water birds	12	1.50	1.25	20	1.64	1.74	183	7.31	10.04

Table 3, cont.

2007	Los Lunas Burned Area 12 points			Los Lunas Cleared/Overbank Area 12 points			Los Lunas Desired Conditions 12 points			San Marcial 25 points		
	Total	Mean	SD	Total	Mean	SD	Total	Mean	SD	Total	Mean	SD
# Species	24	5.81	2.23	25	3.81	1.72	16	4.00	1.62	32	5.56	1.88
# Birds	107	8.89	3.77	94	7.83	11.21	43	5.38	2.93	386	15.43	9.03
# Canopy species	2	0.14	0.35	1	0.03	0.17	1	0.13	0.34	4	0.27	0.47
# Canopy birds	2	0.14	0.35	1	0.03	0.17	1	0.13	0.34	7	0.28	0.51
# Cavity species	5	0.81	0.95	1	0.06	0.23	0	0.00	0.00	4	0.60	0.66
# Cavity birds	12	1.03	1.25	1	0.06	0.23	0	0.00	0.00	20	0.79	0.96
# Dense shrub species	1	0.17	0.38	1	0.61	0.49	1	0.33	0.48	3	1.12	0.64
# Dense shrub birds	2	0.17	0.38	10	0.81	0.86	3	0.42	0.65	36	1.43	0.99
# Edge species	3	1.08	0.65	3	0.58	0.65	2	0.75	0.53	4	0.19	0.43
# Edge birds	20	1.69	1.21	26	2.19	8.09	7	0.92	0.72	6	0.23	0.53
# Ground shrub species	3	0.83	0.61	4	1.06	0.89	1	0.63	0.49	2	0.73	0.62
# Ground shrub birds	21	1.75	1.73	23	1.94	2.40	6	0.79	0.72	33	1.31	1.46
# Invasive species	1	0.03	0.17	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
# Invasive birds	1	0.06	0.33	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
# Mid-story species	8	2.58	1.18	7	0.61	0.73	7	1.96	1.12	7	1.81	1.05
# Mid-story birds	44	3.64	1.96	12	1.00	1.37	22	2.75	2.07	62	2.47	1.76
# Opening species	0	0.00	0.00	1	0.03	0.17	0	0.00	0.00	2	0.04	0.20
# Opening birds	0	0.00	0.00	2	0.11	0.67	0	0.00	0.00	2	0.09	0.60
# Water species	1	0.17	0.38	7	0.83	0.94	4	0.21	0.51	6	0.80	0.59
# Water birds	5	0.42	1.16	20	1.69	2.25	4	0.38	1.01	221	8.84	8.51

2007 Monitoring Report for the Los Lunas Habitat Restoration Site

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

	2007			2006	2004	2003
	Cleared vs Burned	Cleared vs Desired	Burned vs Desired	Cleared vs Desired	Cleared vs Burned	Cleared vs Burned
# Species	Cleared<Burned P<0.001 ²	Cleared=Desired P=0.572 ²	Burned>Desired P=0.001 ²	Cleared =Desired P=0.097 ¹	Cleared<Burned P<0.001 ¹	Cleared<Burned P=0.000 ¹
# Birds	Cleared<Burned P=0.003 ²	Cleared=Desired P=0.319 ²	Burned>Desired P<0.001 ¹	Cleared =Desired P=0.221 ²	Cleared<Burned P<0.001 ¹	Cleared<Burned P<0.001 ²
# Canopy species	Cleared=Burned P=0.093 ²	Cleared=Desired P=0.147 ²	Burned=Desired P=0.888 ²	No canopy spp in Desired Cond. area	No canopy spp in Cleared Area	Cleared<Burned P=0.041 ²
# Canopy birds	Cleared=Burned P=0.093 ²	Cleared=Desired P=0.147 ²	Burned=Desired P=0.888 ²	No canopy spp in Desired Cond. Area	No canopy spp in Cleared Area	Cleared=Burned P=0.055 ²
# Cavity species	Cleared<Burned P<0.001 ²	No cavity spp in Desired Cond. Area	No cavity spp in Desired Cond. Area	No cavity spp in Desired Cond. Area	Cleared<Burned P=0.025 ²	Cleared<Burned P<0.001 ²
# Cavity birds	Cleared<Burned P<0.001 ²	No cavity spp in Desired Cond. Area	No cavity spp in Desired Cond. Area	No cavity spp in Desired Cond. Area	Cleared<Burned P=0.034 ²	Cleared<Burned P<0.001 ²
# Dense shrub species	Cleared>Burned P<0.001 ²	Cleared>Desired P=0.037 ²	Burned=Desired P=0.141 ²	Cleared =Desired P=0.772 ²	Cleared =Burned P=0.824 ²	No dense shrub spp in Cleared Area
# Dense shrub birds	Cleared>Burned P<0.001 ²	Cleared>Desired P=0.048 ²	Burned=Desired P=0.112 ²	Cleared =Desired P=0.817 ²	Cleared =Burned P=0.824 ²	No dense shrub spp in Cleared Area
# Edge species	Cleared<Burned P=0.002 ¹	Cleared=Desired P=0.300 ¹	Burned>Desired P=0.041 ¹	Cleared =Desired P=0.075 ²	Cleared =Burned P=0.236 ¹	Cleared=Burned P=0.063 ²
# Edge birds	Cleared>Burned P=0.007 ²	Cleared=Desired P=0.620 ²	Burned>Desired P=0.006 ¹	Cleared =Desired P=0.130 ²	Cleared =Burned P=0.240 ¹	Cleared=Burned P=0.079 ²
# Ground shrub species	Cleared=Burned P=0.221 ¹	Cleared>Desired P=0.036 ¹	Burned=Desired P=0.168 ¹	Cleared>Desired P=0.003 ²	Cleared =Burned P=0.316 ²	Cleared<Burned P=0.002 ¹
# Ground shrub birds	Cleared=Burned P=0.977 ²	Cleared=Desired P=0.060 ²	Burned>Desired P=0.042 ²	Cleared>Desired P<0.001 ²	Cleared =Burned P=0.171 ²	Cleared<Burned P=0.007 ²
# Invasive species	No invasive spp in Cleared or Desired Cond. areas	No invasive spp in Cleared or Desired Cond. areas	No invasive spp in Cleared or Desired Cond. areas	No invasive spp in Cleared or Desired Cond. areas	No invasive spp in Cleared or Desired Cond. areas	No invasive spp in Cleared or Desired Cond. areas
# Invasive birds	No invasive spp in Cleared or Desired cond. areas	No invasive spp in Cleared or Desired Cond. areas	No invasive spp in Cleared or Desired Cond. areas	No invasive spp in Cleared or Desired Cond. areas	No invasive spp in Cleared or Desired Cond. areas	No invasive spp in Cleared or Desired Cond. areas
# Mid-story species	Cleared<Burned P<0.001 ¹	Cleared<Desired P<0.001 ¹	Burned>Desired P=0.045 ¹	Cleared<Desired P=0.003 ²	Cleared<Burned P<0.001 ²	Cleared<Burned P<0.001 ²
# Mid-story birds	Cleared<Burned P<0.001 ²	Cleared<Desired P<0.001 ²	Burned=Desired P=0.098 ¹	Cleared<Desired P=0.004 ²	Cleared<Burned P<0.001 ²	Cleared<Burned P<0.001 ²
# Opening species	No opening spp in Burned Area	No opening spp in Desired Cond. Area	No opening spp in Burned or Desired Cond. areas	Cleared =Desired P=0.414 ²	Cleared>Burned P=0.025 ²	Cleared=Burned P=0.703 ²
# Opening birds	No opening spp in Burned Area	No opening spp in Desired Cond. Area	No opening spp in Burned or Desired Cond. areas	Cleared =Desired P=0.484 ²	Cleared>Burned P=0.025 ²	Cleared=Burned P=0.686 ²
# Water species	Cleared>Burned P<0.001 ²	Cleared>Desired P=0.003 ²	Burned=Desired P=0.953 ²	Cleared>Desired P=0.031 ¹	Cleared>Burned P<0.001 ²	Cleared>Burned P<0.001 ²
# Water birds	Cleared>Burned P=0.001 ²	Cleared>Desired P=0.003 ²	Burned=Desired P=0.991 ²	Cleared =Desired P=0.994 ²	Cleared>Burned P<0.001 ²	Cleared>Burned P<0.001 ²

1= Students t-test; 2=Mann Whitney test

Area over time (probably due to cottonwood snags falling), with no change in the Cleared/Overbank Area.

In comparisons with the Future Desired Conditions Area, the Cleared/Overbank Area had significantly fewer mid-story species and birds in both 2006 and 2007, the years in which both areas were surveyed. Within these same years, the Cleared/Overbank Area had a significantly greater abundance of ground shrub species and water species. In 2007, the Cleared/Overbank Area had significantly higher mean detections per point of dense shrub species and birds and of water birds. Lastly, the Cleared/Overbank Area had a greater abundance of ground shrub birds than the Future Desired Conditions Area in 2006. In summary, based on statistical analysis, the Future Desired Conditions Area had better mid-story habitat and the Cleared/Overbank Area had better ground shrub, water, and dense shrub habitat.

Population trends, as represented by the mean number of detections per point for selected bird species within the most common guilds in the Cleared/Overbank Area, are graphed in Figures 7-11. The abundance of black-chinned hummingbirds, an edge species, has been steadily increasing over the monitoring period. Among the ground shrub species, abundance of blue grosbeaks has been gradually increasing, with a dip in numbers in 2005, which could be attributable to flooding and competition from the abundant, possibly aggressive red-wing blackbirds. Detections of common yellowthroats, the only dense shrub bird species, have been rising over time with a considerable increase this year. Abundance of the brown-headed cowbird crashed in 2005 after peaking in

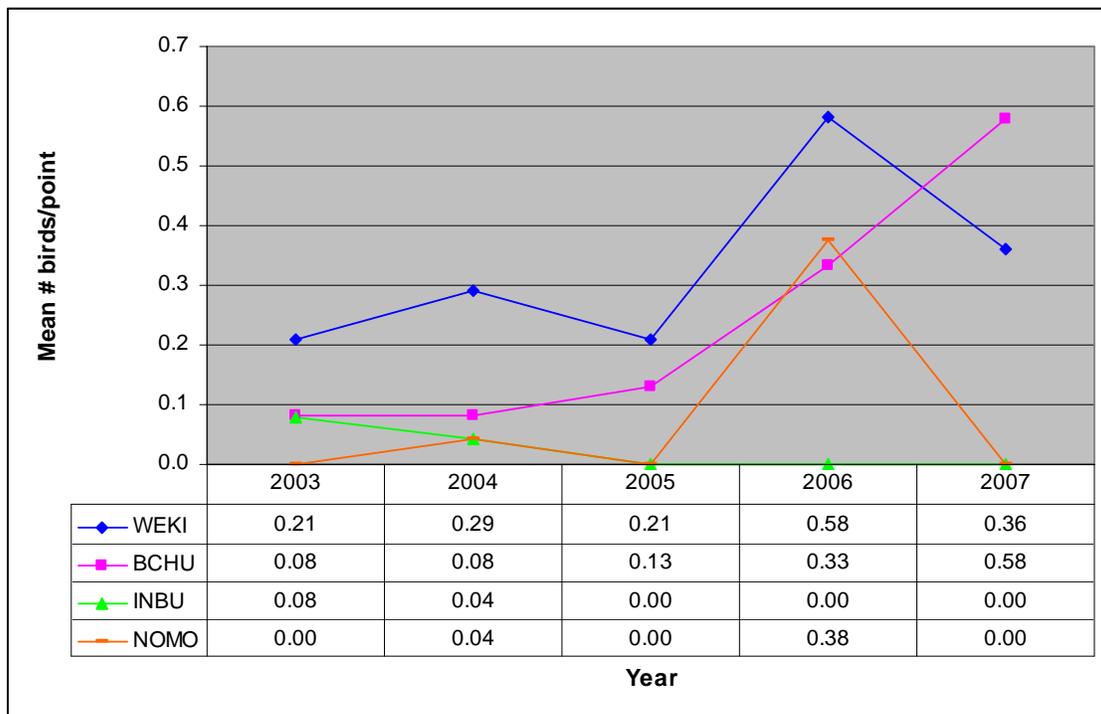


Figure 7. Population trends for selected edge bird species in the Cleared/Overbank Area: western kingbird, black-chinned hummingbird, indigo bunting, and northern mockingbird.

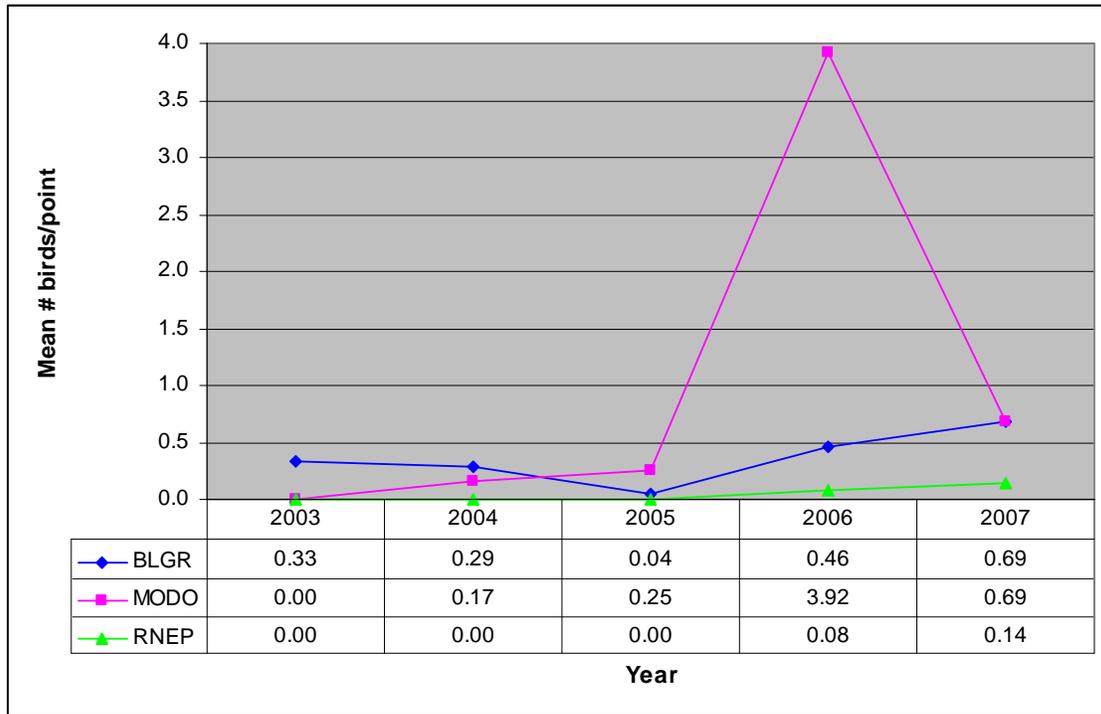


Figure 8. Population trends for selected ground shrub bird species in the Cleared/Overbank Area: blue grosbeak, mourning dove, and ring-necked pheasant.

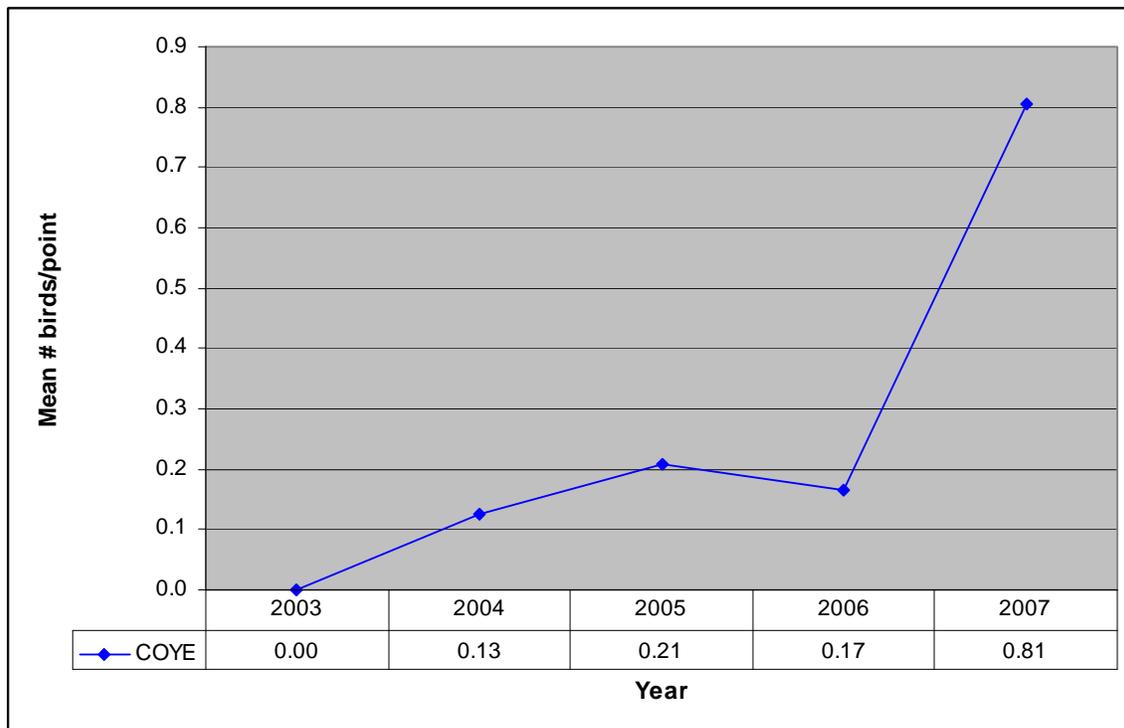


Figure 9. Population trend for dense shrub bird species in the Cleared/Overbank Area: common yellowthroats.

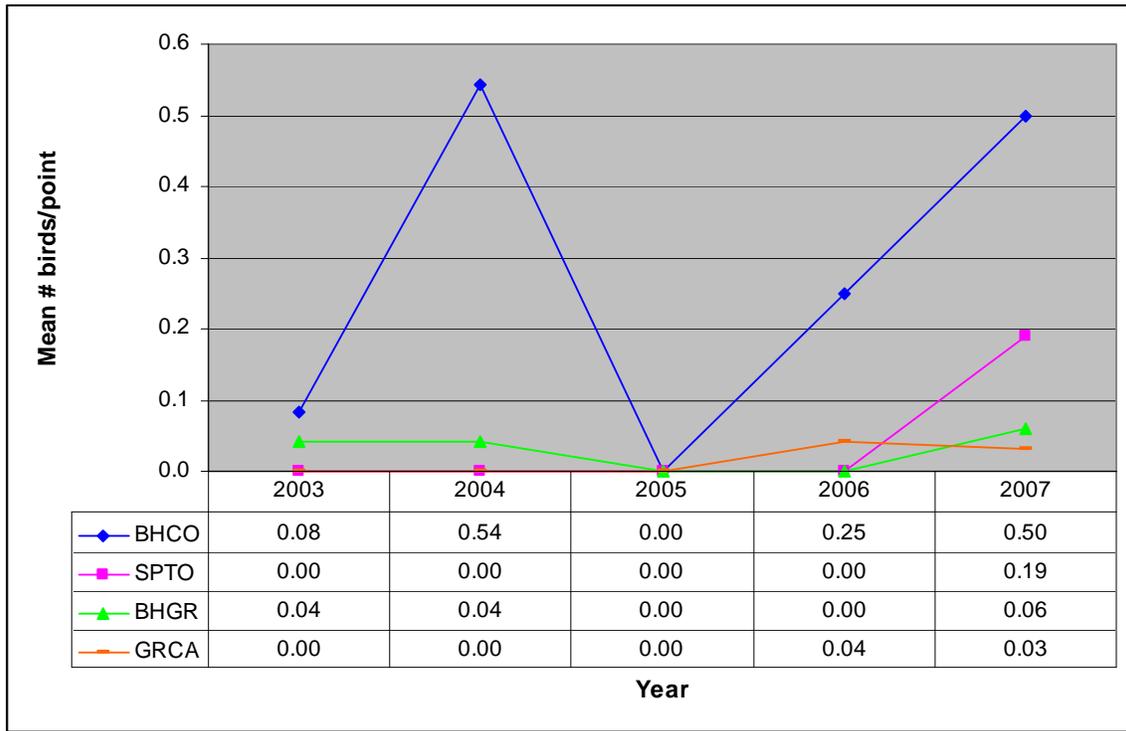


Figure 10. Population trends for selected mid-story bird species in the Cleared/Overbank Area: brown-headed cowbird, spotted towhee, black-headed grosbeak, and grey catbird.

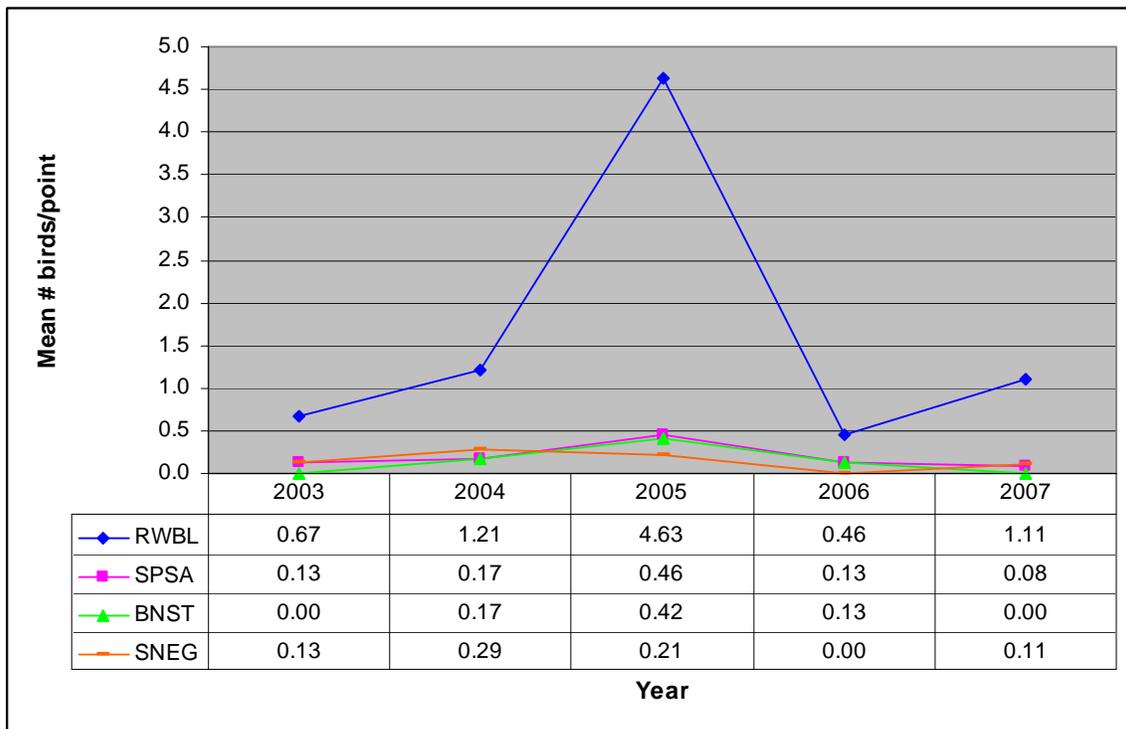


Figure 11. Population trends for selected water bird species in the Cleared/Overbank Area: red-winged blackbird, spotted sandpiper, black-necked stilt, and snowy egret.

2004, but the population resumed and all of the selected mid-story species were at or near their peak abundance in 2007. Not surprisingly, all of the selected water bird species were most abundant while water levels were high in 2005, particularly red-winged blackbirds.

Burned Area

Table 5 shows relative abundance of individual species for the Burned Area by year. Forty-one species were detected in this area in 2003, 2004, and 2007. The most abundant species in 2003 were the brown-headed cowbird, yellow-breasted chat, and spotted towhee. In 2007, the most common species included the mourning dove, black-chinned hummingbird, and spotted towhee.

There were few significant changes identified when comparing abundance data from 2003 to 2007 within the Burned Area. The mean number of detections for species within the edge guild increased significantly from 0.62 in 2003 to 1.08 in 2007, as did the number of edge bird detections, which increased from 0.83 in 2003 to 1.69 in 2007 (see Tables 2 and 3). Abundance of mid-story birds was significantly higher in 2003 (4.69) than in 2007 (3.64).

When comparing all years (2003, 2004, and 2007), the only statistical differences were within the edge guild, where mean numbers of species and individual bird detections were higher in 2007 than in other years.

Statistical comparisons with the Cleared/Overbank Area are discussed above. In review, the number of detections of total species and birds, cavity species and birds, and mid-story species and birds were greater in the Burned Area, and the abundance of water species and birds were greater in the Cleared/Overbank Area for all years surveyed. In 2003 only, the Burned Area had significantly more canopy species and ground shrub species and birds. In 2007, the Cleared/Overbank Area had a significantly greater abundance of dense shrub species and birds (i.e., common yellowthroats) than the Burned Area.

The only year that point counts were conducted within both the Burned Area and the Future Desired Conditions Area was 2007. This year the Burned Area had a significantly greater abundance of total species and birds, edge species and birds, ground shrub birds, and mid-story species than the Future Desired Conditions Area (see Table 4).

Point counts at the Burned Area were resumed in 2007 after a 2-year hiatus. This area was considered to be valuable as a comparison site for the Cleared/Overbank Area because the two areas are adjacent; therefore birds and habitat are somewhat similar. The Burned Area has more developed vegetation and thus far has supported higher numbers of species and birds than the Cleared/Overbank Area, which provides useful reference criteria for the Cleared/Overbank Area over time.

Table 5. Avian point count summary for the Burned Area

<i>Burned area</i>	2003 n=42			2004 n=47			2007 n=36		
	% Plots	Mean	SD	% Plots	Mean	SD	% Plots	Mean	SD
American kestrel	7.1	0.10	0.37	2.1	0.02	0.15	13.9	0.17	0.45
American robin	4.8	0.05	0.22	14.9	0.21	0.59	8.3	0.08	0.28
Ash-throated flycatcher	19.0	0.19	0.40	6.4	0.06	0.25	11.1	0.14	0.42
Barn swallow	2.4	0.02	0.15	2.1	0.02	0.15	0.0	0.00	0.00
Bewick's wren	4.8	0.05	0.22	0.0	0.00	0.00	25.0	0.39	0.80
Black-chinned hummingbird	45.2	0.57	0.74	46.8	0.51	0.59	75.0	1.08	0.81
Black-headed grosbeak	69.0	1.00	0.88	61.7	0.74	0.67	44.4	0.56	0.81
Black-necked stilt	2.4	0.02	0.15	0.0	0.00	0.00	0.0	0.00	0.00
Blue grosbeak	33.3	0.40	0.63	21.3	0.26	0.53	8.3	0.11	0.40
Black phoebe	0.0	0.00	0.00	2.1	0.02	0.15	0.0	0.00	0.00
Brown-headed cowbird	66.7	1.36	1.43	36.2	0.66	1.13	58.3	0.86	0.96
Bushtit	0.0	0.00	0.00	2.1	0.11	0.73	5.6	0.17	0.85
Common grackle	0.0	0.00	0.00	0.0	0.00	0.00	2.8	0.06	0.33
Common yellowthroat	19.0	0.19	0.40	10.6	0.11	0.31	16.7	0.17	0.38
Cooper's hawk	0.0	0.00	0.00	0.0	0.00	0.00	8.3	0.08	0.28
Downy woodpecker	0.0	0.00	0.00	2.1	0.02	0.15	0.0	0.00	0.00
European starling	2.4	0.02	0.15	2.1	0.02	0.15	2.8	0.06	0.33
Gambel's quail	0.0	0.00	0.00	2.1	0.02	0.15	0.0	0.00	0.00
Gray catbird	26.2	0.26	0.45	48.9	0.53	0.58	36.1	0.50	0.74
Hairy woodpecker	0.0	0.00	0.00	4.3	0.04	0.20	0.0	0.00	0.00
House finch	2.4	0.02	0.15	0.0	0.00	0.00	0.0	0.00	0.00
Killdeer	2.4	0.02	0.15	0.0	0.00	0.00	0.0	0.00	0.00
Ladder-backed woodpecker	0.0	0.00	0.00	0.0	0.00	0.00	8.3	0.08	0.28
Lesser goldfinch	2.4	0.05	0.31	0.0	0.00	0.00	0.0	0.00	0.00
Mourning dove	4.8	0.67	0.90	61.7	0.96	0.88	58.3	1.36	1.64
Northern flicker	19.0	0.21	0.47	10.6	0.11	0.31	22.2	0.25	0.50
Northern mockingbird	2.4	0.05	0.31	0.0	0.00	0.00	0.0	0.00	0.00
Red-tailed hawk	4.8	0.05	0.22	0.0	0.00	0.00	0.0	0.00	0.00
Red-winged blackbird	9.5	0.12	0.40	6.4	0.06	0.25	16.7	0.42	1.16
Ring-necked pheasant	4.8	0.05	0.22	4.2	0.04	0.20	16.7	0.28	0.78
Say's phoebe	2.4	0.02	0.15	0.0	0.00	0.00	0.0	0.00	0.00
Snowy egret	0.0	0.00	0.00	2.1	0.02	0.15	0.0	0.00	0.00
Spotted sandpiper	4.8	0.05	0.22	0.0	0.00	0.00	0.0	0.00	0.00
Spotted towhee	50.0	0.69	0.84	80.8	0.91	0.54	61.1	0.94	0.89
Turkey vulture	19.0	0.67	1.72	8.5	0.36	1.28	0.0	0.00	0.00
Western kingbird	11.9	0.19	0.59	17.0	0.19	0.45	30.6	0.56	0.91
Western wood pewee	0.0	0.00	0.00	2.1	0.02	0.15	5.6	0.06	0.23
Western tanager	2.4	0.02	0.15	0.0	0.00	0.00	0.0	0.00	0.00
White-breasted nuthatch	7.1	0.07	0.26	17.0	0.17	0.38	0.0	0.00	0.00
White-winged dove	0.0	0.00	0.00	0.0	0.00	0.00	5.6	0.06	0.23
Yellow-breasted chat	76.2	1.26	0.91	70.2	1.13	1.03	38.9	0.47	0.70

Future Desired Conditions Area

Table 6 provides data on the relative abundance of individual species for the Future Desired Conditions Area in 2006 and 2007. A total of 24 species was detected during point counts conducted in these 2 years. The most common species in 2006 were comprised of a variety of swallows, including bank, barn, and violet-green, as well as the

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

<i>Desired conditions area</i>	2006 n=36			2007 n=24		
	% Plots	Mean	SD	% Plots	Mean	SD
Bank swallow	19.4	0.50	1.13	0.0	0.00	0.00
Barn swallow	30.6	0.69	1.14	0.0	0.00	0.00
Black-chinned hummingbird	38.9	0.56	0.77	66.7	0.83	0.70
Black-headed grosbeak	5.6	0.11	0.52	8.3	0.13	0.45
Blue grosbeak	27.8	0.36	0.64	62.5	0.79	0.72
Brown-headed cowbird	25.0	0.44	0.84	41.7	0.54	0.72
Bushtit	5.6	0.22	0.96	4.2	0.08	0.41
Common yellowthroat	13.9	0.17	0.45	33.3	0.42	0.65
Gray catbird	5.6	0.06	0.23	16.7	0.21	0.51
Indigo bunting	11.1	0.17	0.51	8.3	0.08	0.28
Lesser goldfinch	0.0	0.00	0.00	4.2	0.08	0.41
Mourning dove	2.8	0.03	0.17	0.0	0.00	0.00
Northern rough-winged swallow	0.0	0.00	0.00	4.2	0.08	0.41
Red-winged blackbird	0.0	0.00	0.00	8.3	0.17	0.64
Ring-necked pheasant	11.1	0.11	0.32	0.0	0.00	0.00
Sandhill crane	2.8	0.03	0.17	0.0	0.00	0.00
Snowy egret	0.0	0.00	0.00	4.2	0.04	0.20
Spotted sandpiper	0.0	0.00	0.00	4.2	0.08	0.41
Spotted towhee	36.1	0.39	0.55	79.2	1.17	0.87
Summer tanager	2.8	0.03	0.17	0.0	0.00	0.00
Unidentified swallow	22.2	0.47	1.00	0.0	0.00	0.00
Violet-green swallow	22.2	0.64	1.27	0.0	0.00	0.00
Western wood pewee	0.0	0.00	0.00	12.5	0.13	0.34
Yellow-breasted chat	13.9	0.14	0.35	41.7	0.54	0.72

black-chinned hummingbird. In 2007, the most abundant species were the spotted towhee, black-chinned hummingbird, and blue grosbeak.

When comparing the 2 years of point count data in this area, the mean number of detections for all species was 4.00 in 2007, which was significantly higher than 2.94 in 2006 (Table 2). Abundance of mid-story species and birds was also significantly higher in 2007 than in 2006; mean detections of mid-story species per point were 0.92 in 2006 and 1.96 in 2007; mean detections of mid-story birds per point were 1.36 in 2006 and 2.75 in 2007. These results appear to indicate that species diversity and mid-story habitat may be improving within the Future Desired Conditions Area. Water species and birds were significantly more abundant in 2006 (0.67 species and 1.64 birds) than in 2007 (0.21 species and 0.38 birds). Bird species within the water guild were dominated by a variety of swallows in 2006 that were not detected in 2007.

Statistically, this area is similar to the Cleared/Overbank Area in regards to the abundance of the total species and birds and within most of the guilds. The Cleared/Overbank Area generally had more ground shrub, dense shrub, and water bird species, and the Future Desired Conditions Area had a higher abundance of mid-story bird species, as described above and in Table 4. This area was chosen as a reference site for point counts due to habitat conditions that are potentially similar to the

Cleared/Overbank Area (i.e., adjacent to the river, overbank flooding, developing vegetation). The mid-story habitat in this area could potentially be a good gauge for monitoring the success of restoration at the Cleared/Overbank Area.

Site Comparison Area

Abundance data for the species guilds at the San Marcial Site Comparison Area are displayed in Table 3 for comparison purposes. In 2003, the numbers of species and individual birds at the San Marcial site—6.59 and 13.83, respectively—were much greater than at the Cleared/Overbank Area, which were 1.79 and 2.75, respectively. The San Marcial site generally had higher numbers of detections within the guilds with the exception of the number of canopy birds and the number of water species, which were higher in the Cleared/Overbank Area in 2003. Edge species and birds were comparable between areas. In 2007, although the numbers of species and birds detected per point were still higher in the San Marcial area—5.56 and 15.43, respectively, the numbers of species and birds at the Cleared/Overbank Area—3.81 and 7.83, respectively, were approaching values at the comparison site area. Among the guilds, the San Marcial site had greater numbers except within the edge and ground shrub species and birds, which were greater in the Cleared/Overbank Area. Water species were comparable between areas in this same year.

In 2003, the number of bird species detected per point at the Cleared/Overbank Area was 27 percent of that at the San Marcial Site Comparison Area. This percentage increased considerably to 68 percent in 2007. The number of individual birds detected per point at the Cleared/Overbank Area also increased over time from 20 percent of the San Marcial Site Comparison Area in 2003 to 51 percent of the San Marcial Site Comparison Area in 2007. Within the mid-story group, an indicator guild for the SWFL, the number of mid-story species detected per point at the Cleared/Overbank Area was 34 percent of the same value at the San Marcial site in 2007. The number of mid-story birds detected per point at the Cleared/Overbank Area was 40 percent of the San Marcial Site Comparison Area in 2007.

Southwestern Willow Flycatcher Surveys

In 2007, 2 migrant SWFLs were detected within the boundaries of the LLRS. One of these detections was incidental and was not documented during a formal survey. A total of 12 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 no detections were made at these sites during the subsequent surveys, and the detections occurred 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 2007. The overbank flooding and high

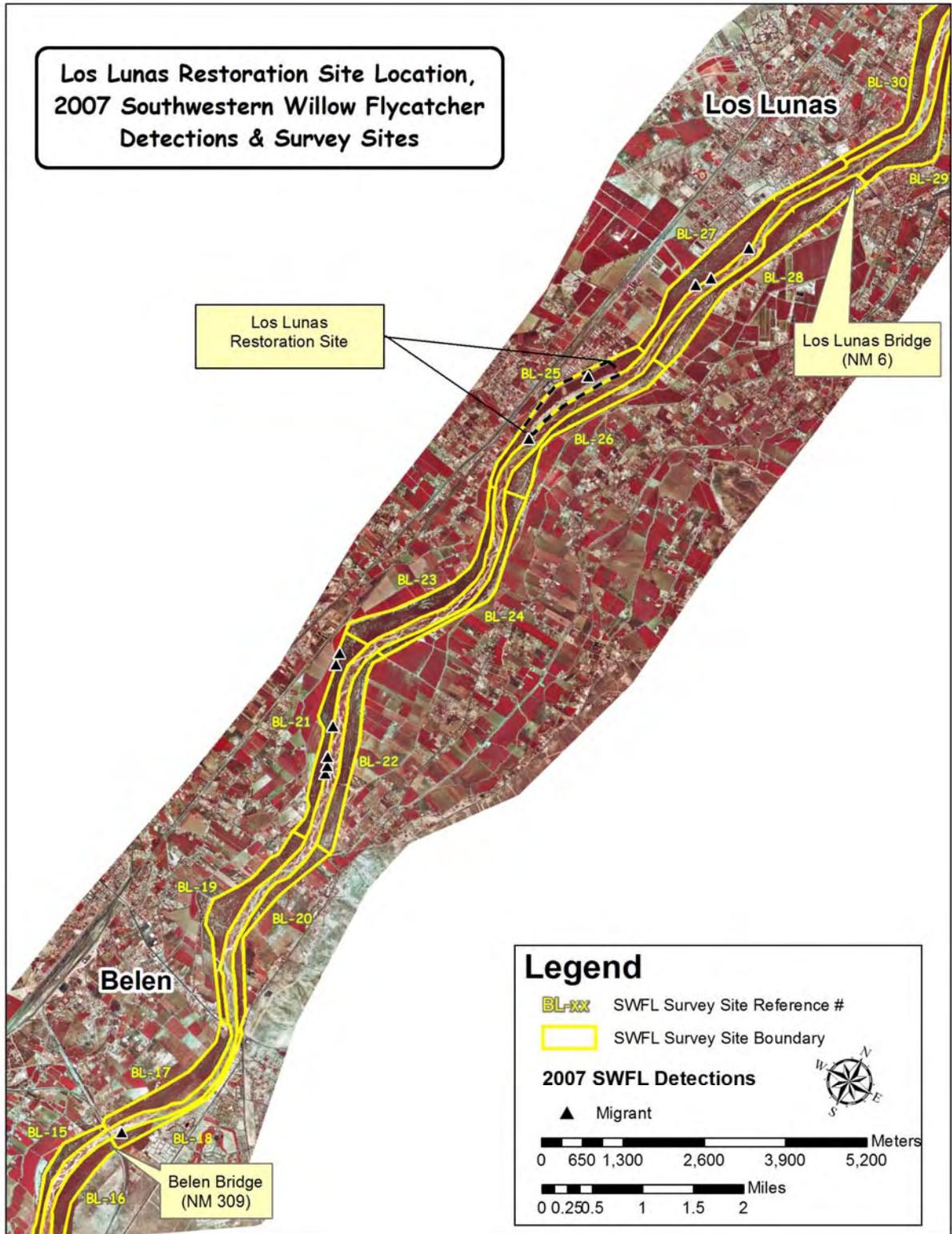


Figure 12. SWFL detections in the Belen reach in the vicinity of LLRS.

ground water levels during the runoff period of 2005 established stands of germinating riparian plants. Based on vegetation monitoring, the area has been productive in terms of developing native overstory habitat, and suitable SWFL breeding habitat could potentially develop there in time if the current trend continues. 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 north of the Sevilleta NWR. 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 46 annual and perennial species over the five year monitoring period (Table 7). See Appendix D for scientific names of all the plant species detected within the transects.

Total plant cover (i.e. shrubs, grasses, and forbs) in the herbaceous layer increased from 32.1 percent in 2003 to 58.8 percent in 2007 (Figure 13). This change was significant as indicated by statistical analysis comparing paired samples (refer to Table 8 for P-values). Mean differences and standard deviations of paired samples between years are shown in Table 9. Total cover of plant litter was 4.4 percent in 2003 and remained relatively stable until 2007, when it significantly increased to 23.4 percent. Total cover of bare ground was on a decreasing trend from 63.5 percent in 2003 to 17.8 percent in 2007, which was also a significant difference. When statistically comparing consecutive years, total plant cover increased significantly from 2003 to 2004, leveled off from 2004 to 2005, then increased significantly again from 2005 to 2006 (Table 8). There was a significant decrease from 2006 to 2007, though there was still a general increase in total cover over the study period. In 2007, total cover of litter was significantly higher than in all other years. Finally, there were significant decreases in the percentage of bare soil from 2003 to 2004 and from 2005 to 2006.

The change in methodology for collecting vegetation data this year probably affected shrub values more than other vegetation types. The 2007 shrub understory data was most comparable to the first four years of data collection, when shrub species were generally less than a meter tall, and provided an indication of current regeneration of shrub species at the site. The 2007 overstory data (Table 10) was more comparable to the 2006 total shrub cover data, when woody plant species were taller and were often the first plant that was intercepted during data collection, giving a pretty complete record of shrub species but not necessarily of the herbaceous species. The average height of overstory shrubs by species is also shown in Table 10. 2007 was the first year that height data was collected.

Table 7. Total and relative percent cover of individual plant species detected during monitoring of the River Transects in the LLRS, Middle Rio Grande, New Mexico.

	2003		2004		2005		2006		2007*	
	Total percent cover	Relative percent cover								
Coyote willow	0.6	1.8	1.0	1.5	1.9	3.1	4.7	6.2	0.5	0.9
Cottonwood	0.0	0.0	0.4	0.5	1.3	2.2	7.1	9.2	0.3	0.5
Gooddings willow	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1
Total native shrubs	0.6	1.8	1.4	2.0	3.2	5.3	11.9	15.5	0.9	1.5
Saltcedar	0.4	1.3	0.8	1.2	2.8	4.7	5.0	6.5	1.0	1.7
Russian olive	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.0	0.0
Total introduced shrubs	0.4	1.3	0.8	1.2	2.8	4.7	5.2	6.8	1.0	1.7
Fragrant flatsedge	1.7	5.4	3.5	5.2	8.4	13.8	0.5	0.7	0.9	1.6
Baltic rush	1.3	3.9	0.0	0.0	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	0.0	0.0
Witchgrass	1.1	3.4	5.2	7.7	4.4	7.1	0.8	1.0	0.4	0.7
Thin paspalum	0.4	1.3	0.4	0.6	1.6	2.6	4.7	6.1	7.6	13.0
Dropseed	2.2	7.0	6.7	9.9	0.0	0.0	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	0.2	0.3
Saltgrass	0.0	0.0	0.1	0.1	0.0	0.0	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	0.1	0.1
Sedge	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.1
Mexican sprangletop	0.0	0.0	0.0	0.0	1.1	1.8	2.5	3.2	0.1	0.1
Teal lovegrass	0.0	0.0	0.0	0.0	2.6	4.2	0.0	0.0	0.3	0.6
Barley foxtail	0.0	0.0	0.0	0.0	0.0	0.0	2.8	3.7	3.6	6.1
Squirreltail	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7	3.0
Common reed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	1.4
Flatsedge	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	2.0
Total native grasses	8.0	24.9	19.1	28.2	18.7	30.5	11.6	15.1	17.0	29.0
Barnyard grass	1.3	4.2	4.3	6.4	6.0	9.8	2.8	3.6	1.0	1.7
Rabbitfoot grass	1.6	4.9	4.5	6.7	2.8	4.6	0.1	0.1	2.0	3.4
Total introduced grasses	2.9	9.1	8.8	13.1	8.8	14.4	2.9	3.7	3.0	5.1
Horseweed	0.2	0.5	0.0	0.0	0.0	0.0	4.3	5.6	7.7	13.1
Common sunflower	7.9	24.7	13.9	20.6	0.3	0.4	3.9	5.1	1.1	1.8
Pale smartweed	0.8	2.3	1.2	1.8	0.2	0.3	5.9	7.7	1.0	1.7
Common cocklebur	0.3	0.8	3.3	4.9	17.9	29.4	8.1	10.5	10.3	17.4
Beggarstick	0.0	0.0	0.9	1.4	3.4	5.5	0.5	0.7	0.1	0.1
Spearleaf rabbitbrush	0.0	0.0	0.3	0.5	0.8	1.4	1.7	2.2	2.9	5.0
Clasping-leaf dogbane	0.0	0.0	0.0	0.0	0.3	0.4	0.2	0.2	0.9	1.6
Milkvetch	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.0	0.0
Pussytoes	0.0	0.0	0.0	0.0	0.0	0.0	1.2	1.5	0.6	1.0
Ragged marshelder	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.4	0.8
Hooker's evening primrose	0.0	0.0	0.0	0.0	0.0	0.0	1.2	1.5	0.0	0.0
Dodder	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0
Bundleflower	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.9
Total native forbs	9.2	28.3	19.6	29.2	22.9	37.4	27.5	35.7	25.5	43.4

2007 Monitoring Report for the Los Lunas Habitat Restoration Site

Table 7, cont.

	2003		2004		2005		2006		2007*	
	Total percent cover	Relative percent cover								
Lambsquarters	6.2	19.5	5.2	7.8	0.3	0.4	0.1	0.1	0.0	0.0
Kochia	0.5	1.6	3.6	5.3	3.8	6.3	4.2	5.5	2.8	4.7
Prickly lettuce	0.1	0.3	0.8	1.0	0.0	0.0	6.0	7.8	2.3	4.0
White sweetclover	4.2	13.2	7.1	10.5	0.4	0.6	6.8	8.9	4.7	7.9
Russian thistle	0.0	0.0	0.7	1.0	0.0	0.0	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	0.0	0.0
Wormwood	0.0	0.0	0.2	0.3	0.0	0.0	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	1.6	2.7
Prostrate amaranth	0.0	0.0	0.0	0.0	0.2	0.3	0.0	0.0	0.0	0.0
Goats head	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.0
Introduced forbs	11.0	34.6	17.8	26.3	4.8	7.7	17.8	23.2	11.4	19.3
Litter	4.4		5.2		7.3		5.5		23.4	
Bare soil	63.5		27.3		31.5		17.6		17.8	
Total cover	100.0	100.0								

* Began new methodology for collecting vegetation data; shrub spp. < 1m.

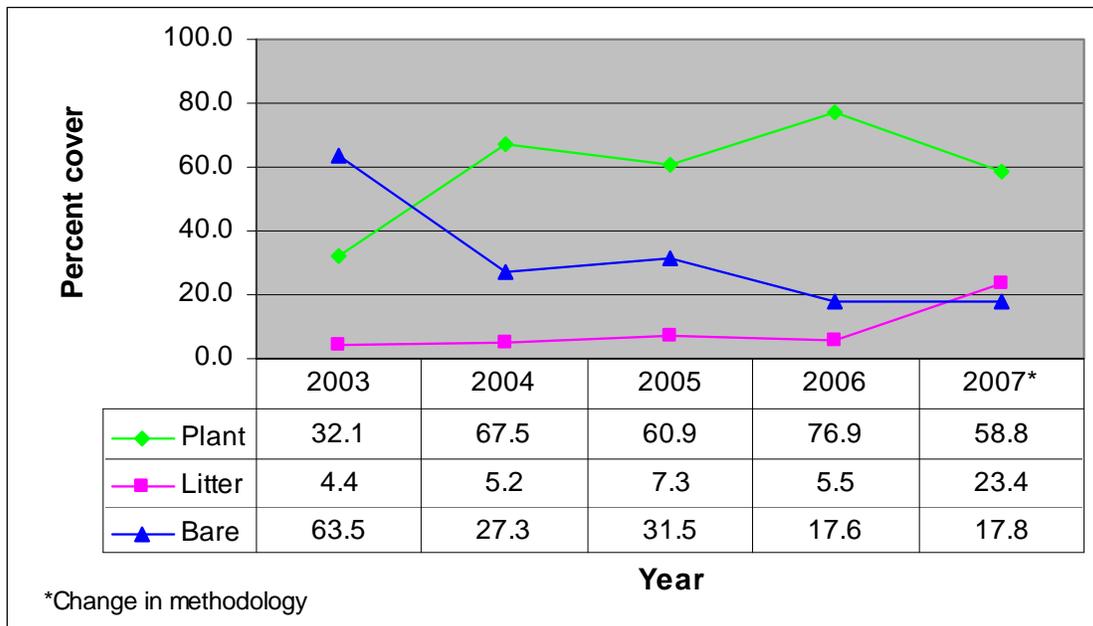


Figure 13. Total vegetation cover of river transects from 2003 to 2007 at the LLRS, middle Rio Grande, New Mexico.

Table 8. Statistical comparison of paired samples between Year 1 (2003) and Year 5 (2007) and between consecutive years of total cover of plant, litter, bare soil, and overstory shrubs and relative cover of vegetation types; River transects, LLRS, Middle Rio Grande, New Mexico. Alpha = 0.05.

Total cover	2003vs2004	2004vs2005	2005vs2006	2006vs2007	2003vs2007
Plant	03<04 P<0.001 ¹	04=05 P=0.239 ¹	05<06 P=0.021 ²	06>07 P<0.001 ¹	03<07 P<0.001 ¹
Litter	03=04 P=0.240 ²	04=05 P=0.918 ²	05=06 P=1.0 ²	06<07 P=0.003 ²	03<07 P<0.001 ¹
Bare	03>04 P<0.001 ¹	04=05 P=0.291 ¹	05>06 P=0.023 ²	06=07 P=0.920 ¹	03>07 P<0.001 ¹
Native shrub*	03=04 P=0.134 ²	04<05 P=0.027 ¹	05<06 P=0.002 ¹	06<07 P=0.002 ²	03<07 P=0.002 ²
Introduced shrub*	03=04 P=0.203 ²	04<05 P=0.029 ²	05=06 P=0.065 ²	06=07 P=0.645 ¹	03<07 P=0.005 ²
Relative cover	2003vs2004	2004vs2005	2005vs2006	2006vs2007	2003vs2007
Native shrub*	03=04 P=0.418 ²	04<05 P=0.013 ¹	05<06 P=0.005 ¹	06>07 P<0.001 ¹	03=07 P=0.554 ²
Introduced shrub*	03=04 P=1.0 ²	04<05 P=0.042 ²	05=06 P=0.083 ²	06>07 P=0.041 ²	03=07 P=0.801 ¹
Native grass	03=04 P=0.486 ¹	04=05 P=0.690 ¹	05>06 P=0.004 ¹	06<07 P=0.002 ¹	03=07 P=0.750 ¹
Introduced grass	03=04 P=0.292 ¹	04=05 P=0.770 ¹	05>06 P=0.025 ¹	06=07 P=0.477 ¹	03=07 P=0.138 ¹
Native forb	03=04 P=0.744 ¹	04=05 P=0.161 ¹	05=06 P=0.863 ¹	06=07 P=0.239 ¹	03<07 P=0.038 ¹
Introduced forb	03=04 P=0.075 ¹	04>05 P=0.020 ¹	05<06 P=0.007 ²	06=07 P=0.243 ¹	03>07 P=0.015 ¹
All native spp	03=04 P=0.239 ¹	04=05 P=0.050 ¹	05=06 P=0.079 ¹	06<07 P=0.032 ¹	03<07 P=0.001 ¹

¹Paired t-test; ²signed rank test

* Total shrub cover represents overstory woody vegetation and relative shrub cover represents understory (<1 m) woody vegetation.

Highlighted boxes = significant difference at the 95% confidence level

Table 9. Mean difference and standard deviation between paired samples comparing consecutive years and Year 1 (2003) to Year 5 (2007) of the study at the LLRS, Middle Rio Grande, New Mexico.

		03vs04	04vs05	05vs06	06vs07	03vs07
Total plant	Mean	-35.42	6.58	-16.00	18.17	-26.67
	SD	14.82	18.31	19.19	9.37	12.58
Total litter	Mean	-0.75	-2.17	1.83	-17.92	-19.00
	SD	7.62	11.23	10.49	7.32	9.81
Total bare	Mean	36.17	-4.17	13.92	-0.25	45.67
	SD	14.46	13.01	15.08	8.48	15.32
Native shrub overstory	Mean	-0.75	-1.92	-8.67	-10.87	-22.20
	SD	1.60	2.23	7.35	7.01	12.50
Introduced shrub overstory	Mean	-0.42	-2.00	-2.42	0.45	-4.38
	SD	1.00	3.04	4.94	3.29	5.31
Native shrub understory	Mean	-0.64	-3.51	-10.06	14.00	-0.21
	SD	3.25	4.10	9.94	10.31	4.57
Introduced shrub understory	Mean	0.18	-4.01	-1.50	4.95	-0.38
	SD	1.56	7.08	7.43	8.52	4.06
Native grass	Mean	-2.96	-1.75	16.14	-13.48	-2.05
	SD	14.23	14.82	15.38	11.42	27.48
Introduced grass	Mean	-3.46	-0.91	10.51	-1.38	4.76
	SD	10.82	10.51	14.09	6.52	10.30
Native forb	Mean	-2.11	-6.73	0.85	-7.54	-15.53
	SD	21.80	15.49	16.72	21.00	22.83
Introduced forb	Mean	8.96	16.92	-15.96	3.45	13.37
	SD	15.81	21.63	17.42	9.70	16.04
Native species	Mean	-5.72	-12.00	6.93	-6.98	-17.76
	SD	15.92	18.90	12.42	9.83	12.88

Table 10. Total percent cover and average height of woody overstory species (>1 m) in 2007 at the LLRS, Middle Rio Grande, New Mexico.

Woody plant species	Total percent cover	Average height (cm)
Coyote willow	7.4	162.5
Goodding's willow	0.3	163.3
Cottonwood	15.0	234.1
Native shrubs	22.7	
Saltcedar	4.3	231.8
Russian olive	0.6	285.0
Introduced shrubs	4.9	

Coyote willow and saltcedar were the only two shrub species detected every year since vegetation monitoring began in 2003. In 2007, cottonwood was the dominant woody species in the overstory canopy (Table 10) and salt cedar was the dominant woody species in the understory less than a meter (Table 7) based on cover.

Total cover of shrubs in Table 8 represents the overstory (>1 m), keeping in mind that shrubs probably did not reach heights greater than a meter until around 2006 so prior to this all woody species were included in total cover. The measure of total shrub cover is somewhat consistent over time since all shrubs were captured every year. The method for collecting this data did change, from point intercept to line intercept, however, with the latter being a more intensive method for capturing shrub and tree cover. Total cover of native shrubs was 0.6 percent in 2003 (Table 7), which was significantly lower than 22.7 percent (Tables 8 and 10) in 2007. When comparing total cover of native shrubs between consecutive years, there were significant increases from 2004 to 2007. Total cover of introduced shrubs was significantly lower in 2003, at 0.4, than in 2007, at 4.9. Comparisons of total cover of introduced shrubs between consecutive years indicated a significant increase from 2004 to 2005 only.

Relative plant cover by vegetation type from 2003 to 2007 is shown in Figure 14. As of this year, with the modification in methods, relative cover is used to represent understory shrubs (<1 m). Take note that cover data from 2006 was much higher since shrubs over 1 m tall were not yet recorded separately and this was the point that shrubs began reaching greater heights, so all size classes of shrubs were included. When comparing Year 1 of monitoring to Year 5, there was not a significant difference between relative cover of native shrubs in 2003 at 1.3 percent and in 2007 at 1.5 percent. Relative cover of native shrubs in comparisons between consecutive years showed significant differences, however, with relative cover significantly increasing from 2004 to 2006, then decreasing from 2006 to 2007. This decrease was due to the change in data collection methodology in 2007. There was also not a statistical difference in relative cover of introduced shrubs between 2003, at 1.4 percent, and 2007, at 1.7 percent. Relative cover of introduced shrubs increased significantly from 2004 to 2005, and decreased from 2006 to 2007 when comparing consecutive years, the decrease again due to the change in methodology.

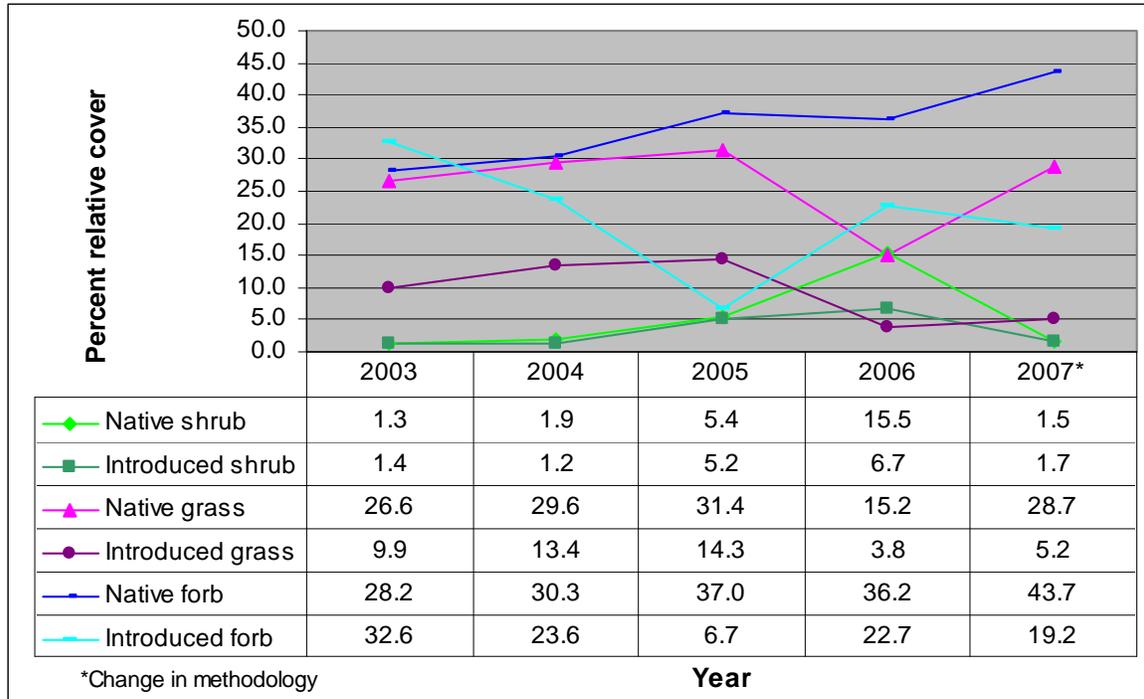


Figure 14. Percent relative cover of vegetation types from 2003 to 2007 at the LLRS, Middle Rio Grande, New Mexico.

Both native and introduced shrubs have followed a similar pattern over time, steadily increasing in total cover. Cover of native shrubs has increased at greater rates than introduced shrubs, especially within the last two years of monitoring. Flooding of the site in 2005 could have led to the robust development of native stands in these past few years.

Fragrant flatsedge, witchgrass, barnyard grass, and rabbitfoot grass were consistently among the highest average cover of grass and grass-like species found during the sampling period from 2003 to 2005. In 2007, the most common grass species shifted to thin paspalum, barley foxtail, rabbitfoot grass, and squirreltail. Total cover of native grasses increased from 8.0 percent to 17.0 percent from 2003 to 2007, with a peak cover of 19.1 percent in 2004. Total cover of introduced grasses remained stable over time at 2.9 percent in 2003 to 3.0 percent in 2007. The maximum cover was 8.8 percent in both 2004 and 2005.

Relative cover of native grasses increased from 26.6 percent in 2003 to 28.7 percent in 2007, which was not a statistically significant change between the first and last years of monitoring. Comparisons between consecutive years indicated a statistically significant decrease in 2006. Relative cover of introduced grasses decreased from 9.9 percent in 2003 to 5.2 percent in 2007, which was also not significant. Relative cover of introduced grasses between consecutive years showed a significant drop from 2005 to 2006.

Native and introduced grasses also followed similar patterns over time, with cover increasing gradually through 2005, then dropping considerably in 2006 with a rise again

in 2007 that especially increased within the native grasses. The rise in relative cover of grasses in 2007 could be attributed to the change in methodology this year, when herbaceous species were better captured than in the previous year. Native species consistently had higher coverage than introduced species over the years.

The most common forb species shifted from sunflowers, lambsquarters, and white sweetclover in 2003 to common cocklebur, horseweed, and white sweet clover in 2007. Total cover of native forbs increased from 9.2 percent to 25.5 percent from 2003 to 2007. Introduced forbs remained relatively stable at 11.0 percent total cover to 11.4 percent over the sampling period, though there were highs of 17.8 percent in 2004 and 2006.

The percent cover of native forbs relative to other species was significantly lower at 28.2 percent in 2003 than at 43.7 percent in 2007. There were, however, no significant differences when comparing relative cover of native forbs between consecutive years, which indicated a gradual rise in cover over the years. Relative cover of introduced forbs decreased from 32.6 percent in the first year of monitoring to 19.2 percent in the last year, which was also a significant change. There was a significant decrease in the relative cover of introduced forbs in 2005, with a subsequent statistical increase in 2006.

Native and introduced forbs showed opposite trends from each other. Relative cover of native forbs slowly increased until 2005, then decreased slightly in 2006 but increased again in 2007. Introduced forbs decreased in cover from 2003 to 2005, then increased in 2006 but slightly decreased again in 2007. Flooding in the spring of 2005 appeared to effect composition and cover of forbs at the site. The significant 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 significantly while native forb species had a small decrease. The overall trend in relative cover of forbs is a general increase in native species and decrease in introduced species over time.

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, 66.6 percent in 2006 and 73.9 percent in 2007. There was a significant difference when comparing Year 1 of monitoring to Year 5. The native species composition increased significantly between 2006 and 2007 when comparing consecutive years. Although much of the native vegetative cover is composed of predominately weedy species, like common cocklebur and horseweed, this condition is more desirable than a plant population dominated by invasive exotic species. The total percent cover for saltcedar after 5 years of monitoring was 5.3 percent (understory plus overstory), 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 but not in 2007.

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 2007 is summarized in Table 11. Data from the northern, middle, and southern wells were 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).

The level of ground water at the LLRS correlates closely with flows in the river, indicating a hydrologic regime influenced by the riverine system at the site. Records from the monitoring well readings were valuable in explaining the shift in vegetation composition following the period of inundation in 2005.

Photo Stations

Photos taken in 2003, 2004, 2005, 2006 and 2007 are shown for comparison purposes in Appendix E.

2007 Monitoring Report for the Los Lunas Habitat Restoration Site

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

Date	Well number (depth of well)										
	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
11/30/06	41.5	36.0	29.5	24.5	15.0	13.0	17.5	33.0	23.5	46.5	40.5
01/27/06	43.5	36.5	26.0	31.5	21.5	18.5	22.0	36.5	31.5	53.0	45.5
02/26/07	43.0	36.0	25.5	31.0	21.0	18.0	21.5	36.0	31.0	52.5	45.0
03/28/07	29.0	24.0	15.0	22.5	9.5	7.5	12.0	28.0	20.0	42.0	36.0

2007 Monitoring Report for the Los Lunas Habitat Restoration Site

Date	Well number (depth of well)										
	N1 (62)	N2 (62)	N3 (60.5)	N4 (64)	M1 (59)	M2 (61)	M3 (59)	M4 (61)	S1 (56)	S2 (61.5)	S3 (69)
04/29/07	46.5	37.5	25.5	28.5	29.5	24.0	26.0	37.5	36.0	56.5	47.0
05/31/07	27.5	21.5	17.5	25.0	10.5	9.5	14.5	32.5	20.0	56.5	38.0
06/29/07	50.0	41.5	28.0	29.0	37.5	32.5	34.5	43.0	42.5	dry	51.5
07/31/07	51.5	44.0	31.5	33.0	36.5	32.0	35.5	46.0	41.5	dry	53.5
08/31/07	56.0	47.0	33.0	31.0	42.0	36.0	38.5	45.5	47.0	dry	54.0
09/28/07	57.5	47.0	34.5	35.0	42.5	36.5	38.5	47.5	47.5	dry	56.5
10/30/07	51.0	44.0	31.0	34.5	34.0	33.0	39.5	50.0	43.0	dry	54.5

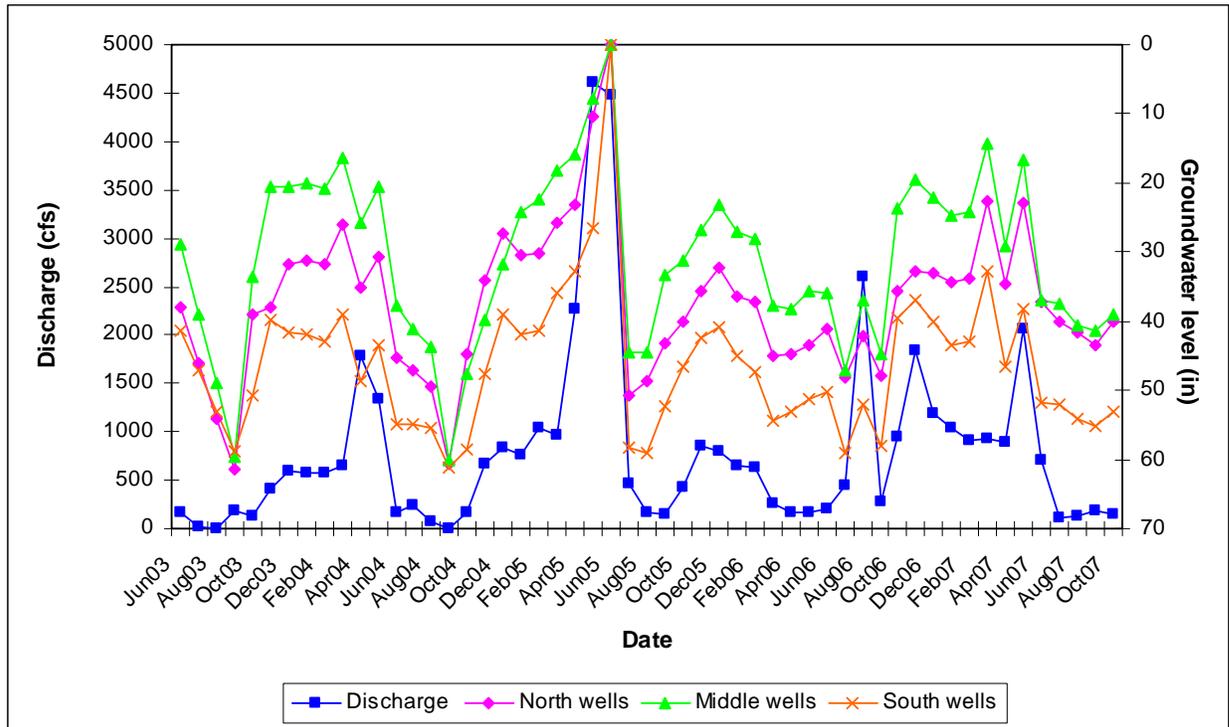


Figure 15. Discharge in CFS of the Rio Grande at San Acacia, New Mexico, and average ground water levels in inches at the LLRS, New Mexico.

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 in 2006 and 2007, particularly in willow and cottonwood. The decrease in sunflowers over time is also apparent from the photos. 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 5-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 follow 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. Due to dramatic changes in geomorphology of the San Marcial area between 2005-2007, future comparison with LLRS may not be warranted.

The abundance and diversity of breeding dense shrub, edge, ground shrub, and mid-story species in this plot have increased during monitoring. As stated, the mid-story guild serves as an indicator for SWFL habitat. Although the number of detections per point of mid-story species increased at the Cleared/Overbank Area, values are still not at the levels of the Desired Future Conditions and Burned plots. As woody riparian plants develop height and density suitable for nesting substrate and cover in the Cleared/Overbank Area, mid-story habitat vital to SWFLs should continue to increase. It is therefore important to continue avian monitoring to track the abundance of bird species between sites and over time. Nevertheless, suitability for stopover habitat for migrating landbirds is probably developing much faster.

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 includes the Desired Future Conditions plot, which has stands of understory riparian vegetation near the active river channel that is interspersed with high flow channels. This year the monitoring plan resumed point counts at the Burned Area to track development in a broader area within the LLRS and to provide another reference site. Point counts in both plots should continue to be compared with the Cleared/Overbank Area.

Finally, bird guilds were revised this year based on nesting habitat. These guilds are consistent with point count data that Reclamation is collecting on the middle Rio Grande and it is recommended that they continue to be used in further analysis.

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.

Monitoring should be continued at the established vegetation transects. Changes in vegetative structure will be documented and this information 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. The species was not documented in 2007. Pepperweed and other invasive species should continue to be closely monitored to allow for early control if treatment is needed.

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 Los Lunas Restoration Site are evident in photos taken over the 5 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

Bird Species Guilds Detected During Point Counts at the Los Lunas and San Marcial Sites

Bird species guilds detected during point counts										
SPECIES	Scientific name	Canopy	Cavity	Dense shrub	Edge	Ground shrub	Invasive	Mid-story	Open-ing	Water
American avocet	<i>Recurvirostra americana</i>									X
American crow	<i>Corvus brachyrhynchos</i>				X					
American kestrel	<i>Falco sparverius sparverius</i>		X							
American robin	<i>Turdus migratorius</i>							X		
Ash-throated flycatcher	<i>Myiarchus cinerascens</i>		X							
Barn swallow	<i>Hirundo rustica</i>								X	
Bank swallow	<i>Riparia riparia</i>									X
Bewick's wren	<i>Thryomanes bewickii</i>		X							
Black phoebe	<i>Sayornis nigricans</i>									X
Black-chinned hummingbird	<i>Archilochus alexandri</i>				X					
Black-crowned night heron	<i>Nycticorax nycticorax</i>									X
Black-headed grosbeak	<i>Pheucticus melanocephalus</i>							X		
Black-necked stilt	<i>Himantopus mexicanus</i>									X
Blue grosbeak	<i>Guiraca caerulea</i>					X				
Blue-winged teal	<i>Anas discors</i>									X
Brewer's blackbird	<i>Euphagus cyanocephalus</i>				X					
Brown-headed cowbird	<i>Molothrus ater</i>							X		
Cassin's finch	<i>Carpodacus cassinii</i>	X								
Cattle egret	<i>Bubulcus ibis</i>									X
Common bushtit	<i>Psaltriparus minimus</i>							X		
Common grackle	<i>Quiscalus quiscula</i>				X					
Common yellowthroat	<i>Geothlypis trichas</i>			X						
Cooper's hawk	<i>Accipiter cooperii</i>	X								
Downy woodpecker	<i>Picoides pubescens</i>		X							
European starling	<i>Sturnus vulgaris</i>						X			
Gadwall	<i>Anas strepera</i>									X
Gambel's quail	<i>Callipepla gambelii</i>					X				
Gray catbird	<i>Dumetella carolinensis</i>							X		
Great-blue heron	<i>Ardea herodias</i>									X
Great-tailed grackle	<i>Quiscalus mexicanus</i>	X								
Hairy woodpecker	<i>Picoides villosus</i>		X							
House finch	<i>Carpodacus mexicanus</i>							X		
Indigo bunting	<i>Passerina</i>				X					

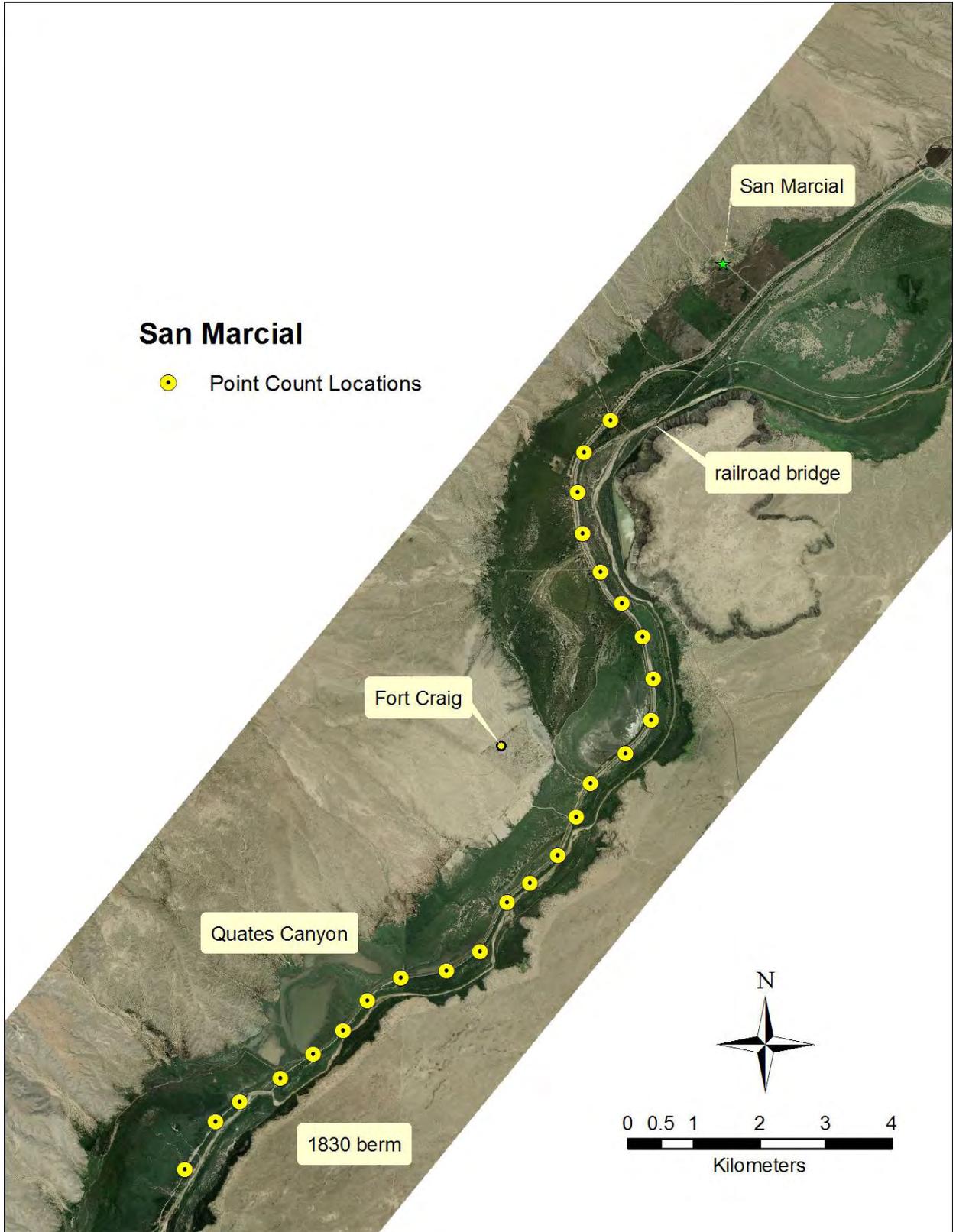
Bird species guilds detected during point counts										
SPECIES	Scientific name	Canopy	Cavity	Dense shrub	Edge	Ground shrub	Invasive	Mid-story	Open-ing	Water
	<i>cyanea</i>									
Killdeer	<i>Charadrius vociferus</i>					X				
Ladder-backed woodpecker	<i>Picoides scalaris</i>		X							
Lesser goldfinch	<i>Carduelis psaltria</i>							X		
Loggerhead shrike	<i>Lanius ludovicianus</i>								X	
Mallard	<i>Anas platyrhynchos</i>									X
Mourning dove	<i>Zenaida macroura</i>					X				
Northern flicker	<i>Colaptes auratus</i>		X							
Northern mockingbird	<i>Mimus polyglottos</i>				X					
Northern rough-winged swallow	<i>Stelgidopteryx serripennis</i>									X
Red-tailed hawk	<i>Buteo jamaicensis</i>	X								
Red-winged blackbird	<i>Agelaius phoeniceus</i>									X
Ring-necked pheasant	<i>Phasianus colchicus</i>					X				
Sandhill crane	<i>Grus canadensis</i>									X
Say's phoebe	<i>Sayornis saya</i>				X					
Snowy egret	<i>Egretta thula</i>									X
Spotted sandpiper	<i>Actitis macularia</i>									X
Spotted towhee	<i>Pipilo maculatus</i>							X		
Summer tanager	<i>Piranga rubra</i>	X								
Turkey vulture	<i>Cathartes aura</i>	X								
Unidentified swallow										X
Violet-green swallow	<i>Tachycineta thalassina</i>									X
Western kingbird	<i>Tyrannus verticalis</i>				X					
Western tanager	<i>Piranga ludoviciana</i>	X								
Western wood pewee	<i>Contopus sordidulus</i>	X								
White-breasted nuthatch	<i>Sitta carolinensis</i>		X							
White-winged dove	<i>Zenaida asiatica</i>							X		
Yellow-breasted chat	<i>Icteria virens</i>							X		

APPENDIX B

San Marcial Comparison Site Point Count Locations

San Marcial

● Point Count Locations



APPENDIX C

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 WIFL 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. <u>B. Norris</u> _____ _____ _____	Date <u>5/22/07</u> Start <u>6:45am</u> Stop <u>9:45am</u> Total hrs <u>3.0</u>	1	0	0	N	Y	N	Francoise Leonard detected a WIFL on 5/27 at 3pm during non-formal survey. Incidental detection, no tape played.
2. <u>F. Leonard</u> _____ _____ _____	Date <u>6/7/07</u> Start <u>6:30am</u> Stop <u>9:15am</u> Total hrs <u>3.0</u>	0	0	0	N	Y	N	No WIFLs in site.
3. <u>K. Fenton</u> _____ _____ _____	Date <u>6/26/07</u> Start <u>6:45am</u> Stop <u>9:45am</u> Total hrs <u>3.0</u>	0	0	0	N	Y	N	No WIFLs in site.
4 _____ _____ _____ _____	Date _____ Start _____ Stop _____ Total hrs _____							
5 _____ _____ _____ _____	Date _____ Start _____ Stop _____ Total hrs _____							
Overall Site Summary (Total resident WIFLs only)		Adults 0	Pairs 0	Territories 0	Nests 0	Were any WIFLs color-banded? Yes No If yes, report color combination(s) in the comments section on back of form		
Total survey hrs <u>8.5</u>								

Reporting Individual Darrell Ahlers Date Report Completed 8/31/07
 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 8/31/07

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)

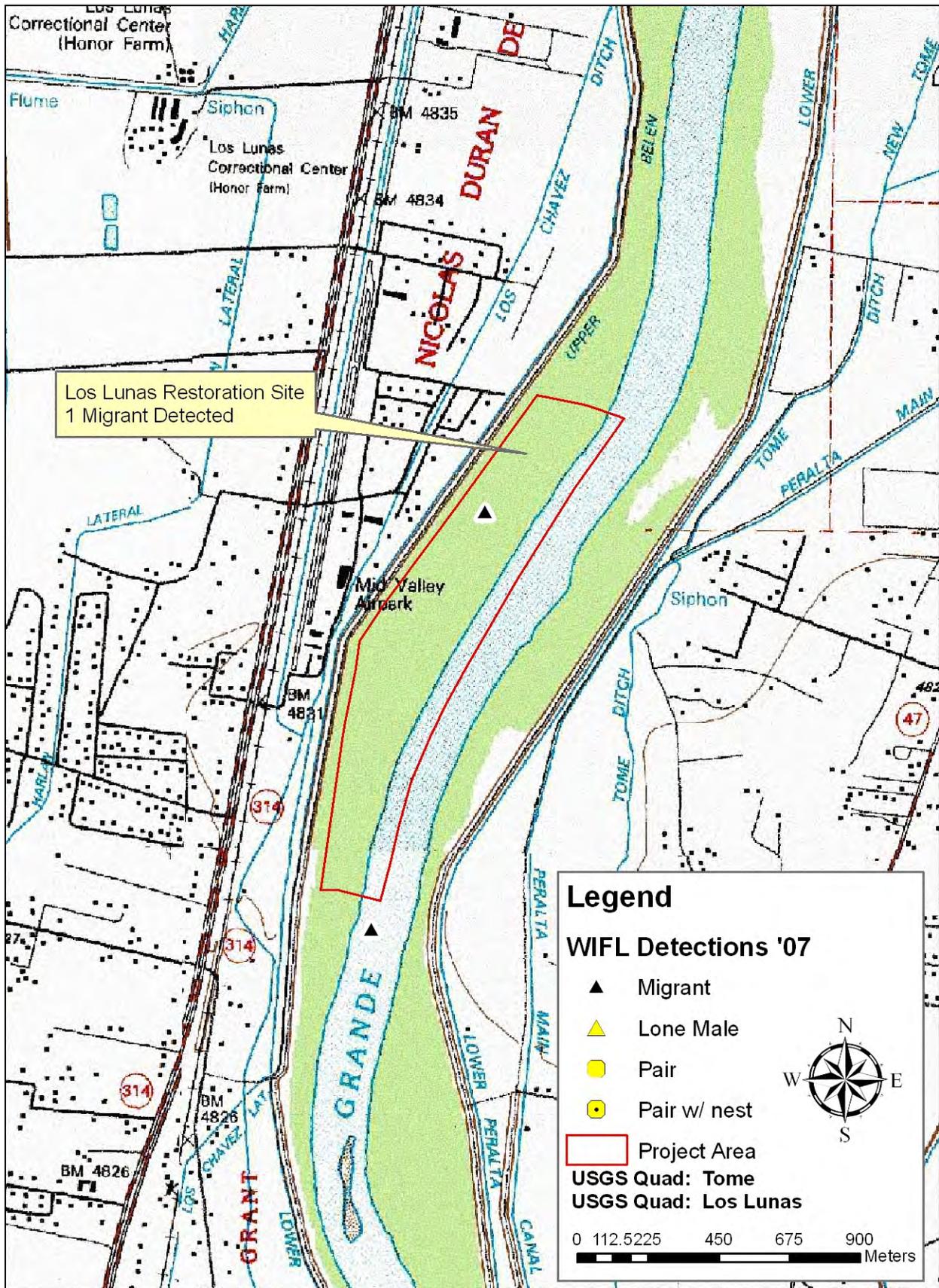
Did hydrological conditions change significantly among visits (did the site flood or dry out)? Yes / No (circle one)
 If yes, describe in comments section below.

Remember to attach a copy of a USGS quad/topographical map (REQUIRED) of the survey area, outlining the survey site and location of WIFL 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)

WIFL Detection Locations:

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



Appendix D

Common and Scientific Names of Plants Detected in River Transects

Code	Scientific name	Common name	Lifeform
AMBL	<i>Amaranthus blitoides</i>	Prostrate amaranth	IF
ANSP	<i>Antennaria</i> sp.	Pussytoes	NF
APCA	<i>Apocynum cannabinum</i>	Clasping-leaf dogbane	NF
ARAB	<i>Artemisia absinthium</i>	Wormwood	IF
ASSP	<i>Astragalus</i> sp.	Milkvetch	NF
BIFR	<i>Bidens frondosa</i>	Beggarstick	NF
CASP	<i>Carex</i> sp.	Sedge	NG
CHAL	<i>Chenopodium album</i>	Lambsquarters	IF
CHLI	<i>Chrysothamnus linifolius</i>	Spearleaf rabbitbrush	NF
COCA	<i>Conyza canadensis</i>	Horseweed	NF
CUSP	<i>Cuscuta</i> sp.	Dodder	NF
CYOD	<i>Cyperus odoratus</i>	Fragrant flatsedge	NG
CYSP	<i>Cyperus</i> sp.	Flatsedge	NG
DEIL	<i>Desmanthus illinoensis</i>	Bundleflower	NF
DISP	<i>Distichlis spicata</i>	Saltgrass	NG
ECCR	<i>Echinochloa crus-galli</i>	Barnyard grass	IG
ELAN	<i>Eleagnus angustifolia</i>	Russian olive	IS
ELPA	<i>Eleocharis palustris</i>	Common spikerush	NG
ELEL	<i>Elymus elemoides</i>	Squirreltail	NG
ERHY	<i>Eragrostis hypnoides</i>	Teal lovegrass	NG
HEAM	<i>Hedosyne ambrosifolia</i>	Ragged marshelder	NF
HEAN	<i>Helianthus annuus</i>	Common sunflower	NF
HOJU	<i>Hordeum jubatum</i>	Barley foxtail	NG
JUBA	<i>Juncus balticus</i>	Baltic rush	NG
KOSC	<i>Kochia scoparia</i>	Kochia	IF
LASP	<i>Lactuca serriola</i>	Prickly lettuce	IF
LELA	<i>Lepidium latifolium</i>	Perennial pepperweed	IF
LEFU	<i>Leptochloa fusca</i>	Mexican sprangletop	NG
MEAL	<i>Melilotus albus</i>	White sweetclover	IF
MURA	<i>Muhlenbergia racemosa</i>	Muhly	NG
OEEL	<i>Oenothera elata</i>	Hooker's evening primrose	NF
PACA	<i>Panicum capillare</i>	Witchgrass	NG
PASE	<i>Paspalum setaceum</i>	Thin paspalum	NG
PHAU	<i>Phragmites australis</i>	Common reed	NG
POSP	<i>Poa</i> sp.	Bluegrass	NG
POLA	<i>Polygonum lapathifolium</i>	Pale smartweed	NF
POMO	<i>Polypogon monspeliensis</i>	Rabbitfoot grass	IG
PODE	<i>Populus deltoides</i>	Cottonwood	NS
RUCR	<i>Rumex crispis</i>	Curly dock	IF
SAEX	<i>Salix exigua</i>	Coyote willow	NS
SAGO	<i>Salix gooddingii</i>	Gooddings willow	NS
SAIB	<i>Salsola iberica</i>	Russian thistle	IF
SPSP	<i>Sporobolus</i> sp.	Dropseed	NG
TARA	<i>Tamarix</i> spp.	Saltcedar	IS
TRTE	<i>Tribulus terrestris</i>	Goats head	IF
XAST	<i>Xanthium strumarium</i>	Common cocklebur	NF

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

APPENDIX E

**Photo Stations
2003 - 2007**

Photo Station 1 - Facing North



2003



2004



2005



2006



2007

Photo Station 1 – Facing River



2003



2005



2006



2007

Photo Station 1 – Facing South



2003



2004



2005



2006



2007

Photo Station 2 – Facing North



2003



2004



2005



2006



2007

Photo Station 2 – Facing River



2003



2005



2006



2007

Photo Station 2 – Facing South



2003



2004



2005



2006



2007

Photo Station 3 – Facing North



2003



2004



2005



2006



2007

Photo Station 3 - Facing South



2003



2004



2005



2006



2007

Photo Station 4 – Facing North



2003



2004



2005



2006



2007

Photo Station 4 – Facing South



2003



2004



2005



2006



2007

Photo Station 5 – Facing North



2003



2004



2005



2006



2007

Photo Station 5 – Facing South



2003



2004



2005



2006



2007

Photo Station 6 – Facing North



2004



2005



2006



2007

Photo Station 6 – Facing South



2003



2004



2005



2006



2007

Photo Station 7 – Facing North



2003



2004



2005



2006



2007

Photo Station 8 - Pond



2003



2004



2005



2006



2007

Photo Station 9 – Facing South



2003



2004



2005



2006



2007

Photo Station 10 – Facing North



2003



2004



2005



2006



2007