Lower Colorado River Multi-Species Conservation Program

Balancing Resource Use and Conservation

Cibola Valley Conservation Area Annual Report Fiscal Year 2006

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

January 2008

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Lower Colorado River Multi-Species Conservation Program

Cibola Valley Conservation Area Annual Report Fiscal Year 2006

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January 2008

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Background

In 2002, the Bureau of Reclamation (Reclamation) prepared an initial assessment of the riparian restoration potential of the Cibola Valley Irrigation and Drainage District (CVIDD), a project study area of about 3,800 acres. The Mohave County Water Authority (MCWA) and the Hopi Tribe each purchased a portion of the Cibola Valley from CVIDD in December 2004. The Cibola Valley Conservation Area (CVCA), which is to be implemented as part of the Lower Colorado River Multi-Species Conservation Program (LCR MSCP), will utilize the lands now owned and managed by the MCWA. Mohave County Water Authority owns and manages 1,019 acres of active agricultural lands which have been made available for restoration by the LCR MSCP.

This report is being prepared to document the development and management of land cover types, present the results of monitoring, determine habitat credit, and make recommendations for future adaptive management of lands within CVCA and cover the period through October 2006.

1.0 General Site Information

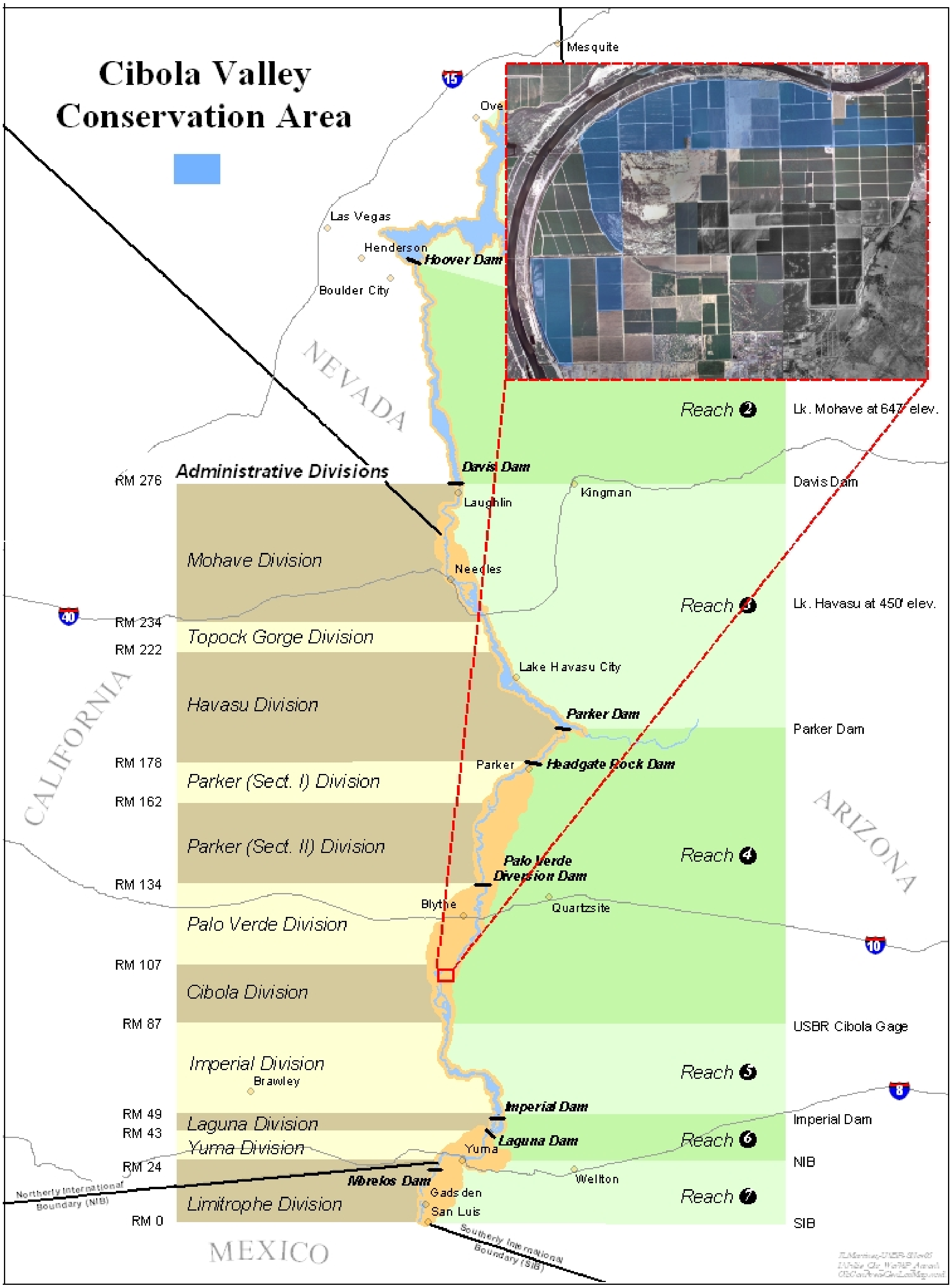
Cottonwood-willow land cover created within CVCA will be managed for the southwestern willow flycatcher (*Empidonax traillii extimus)* or SWFL, yellow-billed cuckoo (*Coccyzus americanus occidentalis*) or YBCU, and other species covered under the LCR MSCP. The creation of habitat includes both the establishment of native plants and the management of the vegetation and its structural type to meet performance standards for integrating seral stages of vegetation, moist soil, standing water, and open areas into mosaics of riparian vegetation.

Large habitat restoration sites such as CVCA are developed over a number of years and the restoration activities are divided into phases (see Appendix A). The *Cibola Valley Conservation Area Restoration Development Plan: Overview* provides an overview of the restoration potential of the site as well as the projected phasing of development.

1.1 Location

Cibola Valley Conservation Area is located in southwestern La Paz County, Arizona, about 15 miles south of Blythe, California. The valley encompasses the land inside an engineered bend of the lower Colorado River and a remnant oxbow on the west side of the river (Palo Verde Oxbow). The CVCA is farmed primarily for cotton and alfalfa. It is bordered to the south by Cibola NWR and on the east by unimproved land under the jurisdiction of the Bureau of Land Management (Figure 1). The river forms the north and west boundaries, except for the Palo Verde Oxbow, from river miles 98.8 to 104.9.

Figure 1. Location of Cibola Valley Conservation Area



1.2 Land Ownership

The property is owned by MCWA who will, in the short-term, be leasing this acreage to Reclamation to develop native land cover types. It is anticipated the property will be eventually managed by the Arizona Game & Fish Department (AGFD).

1.3 Water Availability

For the long-term, 2,919 acre-feet per year diversionary right of 4^{th} Priority Colorado River water will be available. Reclamation has an option to purchase 1,300 acre-feet per year from the MCWA's entitlement and 1,500 acre-feet per year from the Hopi Tribe's entitlement. In addition, Reclamation has a 4^{th} Priority entitlement for 118.94 acre-feet per year (Table 1).

Currently, 7,747 acre-feet per year diversionary right of combined 4^{th}, 5^{th}, and 6^{th} Priority Colorado River water is available for lease from MCWA to the LCR MSCP to accommodate the higher water diversions required to establish habitat.

Table 1. Water Entitlement and Priority

Term	Entitlement	Priority
Long-Term		
Purchase option from MCWA entitlement	1,300 acre-feet/year	4th
Purchase option from Hopi Tribe entitlement	1,500 acre-feet/year	4th
Reclamation entitlement	119 acre-feet/year	4th
Long-Term Total	2,919 acre-feet/year	
Short-Term		
Multi-year lease from MCWA entitlement	5,997 acre-feet/year	4th
Multi-year lease from MCWA entitlement	750 acre-feet/year	5th
Multi-year lease from MCWA entitlement	1,000 acre-feet/year	6th
Short-Term Total	7,747 acre-feet/year	

1.4 Land Use Agreement

A Land Use Agreement for Restoration Activities has been drafted between Reclamation and AGFD and when signed will assure the availability of land and water resources for the 50-year term of the program.

2.0 Current Year Habitat Creation Activities

2.1 FY2006 Planting

The purpose of Phase 1 was to create 64 acres of cottonwood-willow habitat and to plant a 22-acre riparian nursery to provide plant material for future riparian restoration efforts. Although 91 acres were leased, due to roads and irrigation canals, a total of 86 acres were actually planted.

Proposed Planting

The original CVCA proposed field layout in Appendix B and the nursery (Appendix C) had two planting concepts in different orientations to the irrigation gates, to evaluate different irrigation methods. The planting concept was to duplicate fields for comparison purposes. Fields A and D were meant to be identical as were fields B and C. Originally fields B and C were duplicate designs with plants oriented in east-west rows. This design was an attempt to evaluate the efficiency and effectiveness of utilizing the proximity of the irrigation gates to the plant species. This design would allow for the delivery of water first to the most water-intensive plant species (e.g. coyote willow in an area identified for moist soils management). The water would then flow through to plant species that require less water (e.g. Goodding's willow and Fremont cottonwood).

Planted

The CVCA Phase 1 fields had originally been planted in cotton. A local farmer was contracted by Reclamation to prepare the fields for planting in the spring of 2006 and to provide required farming and irrigation services (Figure 2). Field preparation began in March 2006, and consisted of disking, ripping, plowing, land planning, land leveling, and border disking. The existing fields were laser-leveled with a 1-2% slope to ensure an even distribution of irrigation water. The fields were laser leveled to ensure complete and even coverage from flood irrigation. An alfalfa cover crop was planted and fertilizer (11-52-0) was added.

Figure 2. Farmer Preparing Fields for Planting

The original orientations of berms (borders) in fields B, C, and F were modified to run in a north-south direction to allow for sufficient gravity flow of irrigation water, as presented in the "as-built" in Appendix D. Each field was divided into manageable "checks". In an attempt to determine an optimal tree density, inline spacing densities within each check varied during the planting process, as depicted in Table 2.

Table 2. Phase 1 Tree Planting Densities

Field Check	Native Species	Inline Spacing	Acres
A-1	*Baccharis sarothroides*	8-foot	0.2
A-1	*Populus fremontii*	4-foot	2.5
A-2	*Populus fremontii*	3-foot	1.9
A-2	*Salix gooddingii*	7.5-foot	0.9
A-3	*Salix exigua*	9-foot	2.8
A-4	*Salix exigua*	9-foot	2.7
A-5	*Salix gooddingii*	7.5-foot	0.9
A-5	*Populus fremontii*	3-foot	1.8
A-6	*Populus fremontii*	4-foot	2.7
A-7	*Populus fremontii*	4-foot	0.1
A-7	*Baccharis sarothroides*	8-foot	0.1
B-1	*Salix exigua*	9-foot	5.7
B-2	NOT PLANTED		4.8
B-3	*Populus fremontii*	4-foot	4.5
B-4	*Baccharis sarothroides*	8-foot	0.4
C-1	*Baccharis sarothroides*	8-foot	0.2
C-1	*Populus fremontii*	5-foot	0.6
C-2	*Populus fremontii*	5-foot	4.4
C-3	*Salix gooddingii*	4-foot	4.4
C-4	*Salix exigua*	6.5-foot	4.4
D-1	*Populus fremontii*	4-foot	2.0
D-2	*Salix gooddingii*	4-foot	2.6
D-3	*Salix exigua*	6.5-foot	2.5
D-4	*Salix exigua*	6.5-foot	2.7
D-5	*Salix gooddingii*	4-foot	2.1
D-6	*Populus fremontii*	4-foot	2.6
D-7	*Populus fremontii*	4-foot	0.6
D-7	*Baccharis sarothroides*	8-foot	0.2

Nursery Activities

To accomplish a program with the scope of the LCR MSCP, vast amounts of native plant material are required for planting in each phase. It is essential to ensure that a mix of genetically known plant stock is available for future restoration activities; however, such a supply does not currently exist and purchasing individual plants is costly. The 22-acre

nursery will provide a consistent and readily accessible source of plant materials for additional phases of restoration at CVCA and future conservation areas.
The species planted include coyote willow, Goodding's willow, Fremont cottonwood, *Atriplex* spp., and *Baccharis* spp. Most plants were planted 20 feet on center, with the smaller bushes planted 10 feet on center. An alfalfa cover crop will also be planted and the nursery plants will be planted over the alfalfa. Table 3 represents the number of trees propagated by Greenheart Farms and actually planted in the two fields dedicated to establishing the nursery.

Table 3. Nursery Plant Stock

Field E (7.6 acres)

Scientific Name	Common Name	Inline Spacing	Number of Plants
Salix exigua	Coyote willow	20 ft	1, 012

Field F (14.9 acres)

Scientific Name	Common Name	Number of Rows & Spacing	Actual Number of Plants
Salix gooddingii	Goodding's willow	17 rows at 21-ft inline spacing	692
Populus fremontii	Fremont cottonwood	23 rows at 15-ft inline spacing	960
Baccharis salicifolia	Mule's fat	3 rows at 11-ft inline spacing	212
B. sarothroides	Desertbroom	2 rows at 12-ft inline spacing	112
Atriplex lentiformis	Quailbush	1 row at 15-ft inline spacing	54
A. canescens	Fourwing saltbush	1 row at 15-ft inline spacing	56
A. polycarpa	Cattle saltbush	1 row at 32-ft inline spacing	25

Greenheart Farms Inc. used their mass planter to plant Field E. Field F was planted by eight personnel from the Nevada Conservation Corp, who utilized a tree planter pulled by a tractor as depicted in Figure 3.

Figure 3. Tree Planter Used in Nursery Operations

Technique

Greenheart Farms Inc., located in Arroyo Grande, California, was awarded a contract for propagating, delivering, and mass planting the native trees. The trees were routed through their Yuma, Arizona nursery and delivered to CVCA in trailers. Approximately 200,000 trees were delivered (Figure 4).

Figure 4. Native Tree Stock Arrive in Trailers

Planting of the native trees commenced on 7 April 2006. Field C-2, consisting of 4.4 acres, was planted in 4 hours. As time progressed, the planting crew became more proficient, thus increasing the planting speed. Fields C-3 and C-4, both 4.4 acres each, were planted in 3 hours and 2 hours, respectively. Figure 5.

Figure 5. Automated Mass Planting of Cottonwoods

Figure 6 depicts the growth of the cottonwoods and the alfalfa cover crop after 1 month of growth. The cottonwood trees are approximately 1 foot in height, surrounded by the alfalfa cover crop. The photo clearly depicts the borders (running left to right), which channel and control the irrigation water applied in the fields.

Figure 6. Cottonwood Growth after 1 Month

Cover Crop

Alfalfa was chosen as the cover crop to use in Phase 1. It grows to a height of about 18 to 24 inches, adds nitrogen to the soil, is non-aggressive, will last for several years in areas that have not been shaded out by taller cottonwood-willows, and has a slow growth rate such that it should not compete with the newly planted trees. Lygus is not a problem with alfalfa unless it is cut. Aphids and thripes are insects that can be found in alfalfa, but generally will stay in the alfalfa and not move to another crop.

2.2 Irrigation

Method

Flood irrigation was used to saturate the soils at the appropriate seasons so as to leach the salts through the soil column and provide favorable conditions for natural regeneration. The cottonwood-willow land cover type will eventually become further saturated to provide moist soil conditions for prey insect production. The fields were irrigated in accordance with the schedule prepared by Reclamation. Later, a crop consultant was utilized to monitor the site and recommend slight irrigation regime changes.

Amount

Table 4 depicts the number of acre feet of water applied to each field. These values were based on monthly invoices received by Cibola Valley Irrigation and Drainage District. A total of 895 acre feet of irrigation water was applied to Phase 1. Dividing this number by 85.1 acres of irrigable land equates to approximately 10.5 acre feet of water per acre for the first year of growth.

Table 4. Irrigation Water Applied in Phase 1

CVCA Phase 1 Fields	A	B	C&D	E	F	Total
Acres	17.8	15.4	29.4	7.6	14.9	85.1
Month	**af applied ***	**af applied**	**af applied**	**af applied**	**af applied**	
April	18.4	26.4	35.1	9.8	21.4	111.1
May	19.4	15.3	28.3	9.4	8.6	81.0
June	35.5	28.4	46.7	14.3	21.2	146.1
July	33.0	26.0	57.0	15.2	20.7	151.9
August	30.5	24.8	53.3	13.4	19.5	141.5
September	31.4	25.0	57.1	14.4	19.9	147.8
October	0.0	25.6	19.7	23.7	15.2	84.2
November	14.8	4.3	12.3	0.0	0.0	31.4
Total	**183.0**	**175.8**	**309.5**	**100.2**	**126.5**	**895.0**

* af applied—represents the quantity of acre feet of irrigation water applied to that field.

Timing

An irrigation schedule was provided to the contract farmer to utilize as depicted in Table 5.

Table 5. Irrigation Frequency Schedule

Day/Week/Month	Frequency	Comments
Day of Planting	Immediately after planting	
March & April	Once a week	Or as necessary to keep root ball moist
May & June	Every 10 days	Or as necessary to keep root ball moist
July & August	Every 10-14 days	
September	Twice	
October	Twice	
November	Once	

Ground Water Depth Information

Figure 7. Photo of Piezometer

Two piezometers were installed to measure groundwater depths. Piezometer #1 was installed between fields A and B and had the following readings:

- 24 Feb 06 – 14.5 feet
- 15 Mar 06 – 14.2 feet
- 10 Apr 06 – 13.4 feet
- 25 May 06 – 12.5 feet
- 22 Jun 06 – 11.9 feet
- 21 Jul 06 – 11.0 feet

Piezometer #2 was installed between fields C and D and had the following readings:

- 24 Feb 06 – 13.5 feet
- 15 Mar 06 – 13.0 feet
- 10 Apr 06 – 12.5 feet
- 25 May 06 – 11.3 feet
- 22 Jun 06 – 10.3 feet
- 21 Jul 06 – 9.3 feet

2.3 Site Maintenance

There were no major improvements to this site with the exception of regular field maintenance. However, once the land and water are secured for the life of the program, additional site improvements are likely.

2.4 Management of Existing Land Cover

Field B-2, consisting of 4.8 acres, was not planted due to a shortage of *Salix gooddingii* plant stock from Greenheart Farms. The planting had to be delayed until the spring planting of 2007 to keep fields B and C similar in their layout and design. The alfalfa cover crop in Field B-2 was harvested regularly. In late May, some fields were invaded with ivyleaf morning-glory (*Ipomoea hederacea*). This invasive plant took over quickly and by mid-June, more than half of the fields were smothered with morning-glory. Figure 8, photo taken on 10 May 2006, shows the mowed Field B-2 separated by a border that is infested with morning-glory. The field to the right is Field B-1.

Figure 8. Fields B-2 (mowed) and B-1 (morning-glory)

As depicted in Figure 9, photo taken on 10 July 2006, the alfalfa is blooming and healthy; however, the morning-glory has established a good foothold and is engulfing anything upon which its vines can climb.

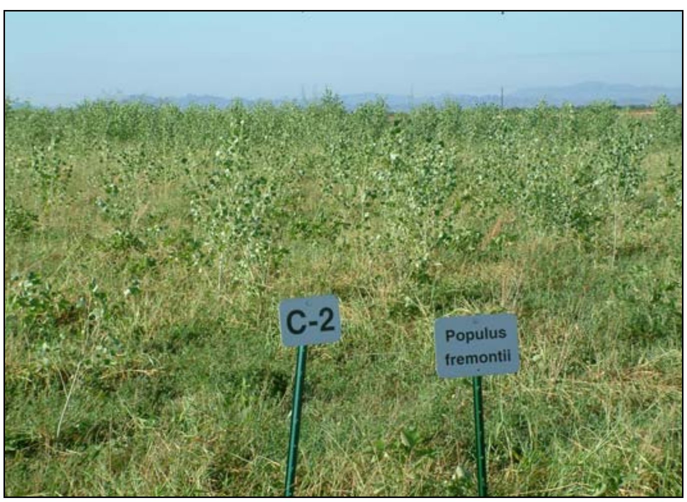
Figure 9. Ivyleaf Morning-glory Climbing *Salix exigua*

By late summer, the morning-glory had established a strong foothold in the fields and was threatening the native trees. Morning-glory climbs and smothers whatever it can climb upon. If nothing is available to climb up, it simply covers the ground in a dense mat. Figure 10, photo taken on 12 October 2006, depicts selected field areas which were mowed in October 2006 in an attempt to control the morning-glory. These fields will be evaluated for replanting next spring.

Figure 10. Results of Mowing Field D-6

By September 2006, most of the trees were more than 3 feet in height. The cottonwoods shown in C-2 (Figure 11) were planted at 5-foot inline spacing.

Figure 11. Cottonwoods in September 2006



University of Arizona

The University of Arizona is undertaking a study to determine the quantity of irrigation water necessary to support native tree establishment. The objective of this research is to look at the soil, water, and plant relationships of willow and cottonwood species used during habitat restoration. The intent of the study is to characterize the water use of the willow and cottonwood species by monitoring tree stomatal conductance, leaf water potential, sap flow, and soil water content within and below the root zone. Soil moisture probes were installed and instrumented in the CVCA fields during the third week of May. These instruments, along with a weather station, allow the measurement of soil moisture and weather conditions (figures 12 and 13).

Figure 12. U of A Instrumenting Fields

Figure 13. Weather Station at CVCA

Crop Consultants

A local crop consultant was used to provide irrigation scheduling, soil analysis, and plant analysis. Fields were to be checked weekly from August to end of November. Field observations were made for soil moisture depletion, water holding capacity, plant available water, and general appearance of plant growth and vigor. Additionally, soil and plant samples were taken from each field to be tested for complete analysis of nutrient content.

3.0 FY 2006 Monitoring

Monitoring of Phase 1 for 2006 focused on pre-development, implementation monitoring, and some species monitoring as discussed in the *Cibola Valley Conservation Area Restoration Development Plan: Phase 1*. Pre-development monitoring consisted of taking soil samples, conducting avian point counts, conducting small mammal trapping, and conducting bat acoustic monitoring. Implementation monitoring consisted of additional soil sampling, conducting initial survivorship of vegetation, conducting post-development avian point counts, conducting post-development small mammal trapping, and conducting post-development bat acoustic monitoring. Abiotic and biotic habitat monitoring will be conducted beginning in 2008, and monitoring for certain species such as the yellow-billed cuckoo, southwestern willow flycatcher, and the cavity nesting birds will be conducted once the vegetation reaches the proper conditions for these species. The following sections are organized by resource type and include a combination of both pre-development and post-development monitoring.

3.1 Soils

Creation of habitat is dependent on many factors, including soil salinity and nutrients, especially in a flood-irrigated environment where these elements could shift over time. Reference conditions are needed before planting of native vegetation occurs to appropriately assess what species types are right for soil conditions. Yearly samples for the first 5 years (based on data) are needed in order to determine shifts in soil salinity and nutrients. Soil sampling was conducted prior to planting, and then once during the growing season.

Soil Information

Located within the historic floodplain of the LCR, the soils on the site were primarily deposited by numerous historic flood events that occurred prior to Hoover Dam floodgates being closed in 1935. The river dynamically meandered, depositing primarily sand and silt across the floodplain.

The soil conditions within Phase 1 consist of four major categories:

- Indio Silt Loam – comprising approximately 56% of the site, located in fields B, D, E, and the western half of Field F.
- Lagunita Loamy Sand – comprising approximately 5% of the site, located in fields A-1 and A-2.
- Lagunita Silt Loam – comprising approximately 32% of the site, located in the rest of Field A and all of Field C.
- Ripley Silt Loam – comprising approximately 7% of the site, located on the eastern edge of nursery Field F.

Samples were taken by Reclamation to provide textural analysis to the University of Arizona's soil moisture monitoring project (Figure 14).

Figure 14. Soil Samples Taken by Reclamation

Methods

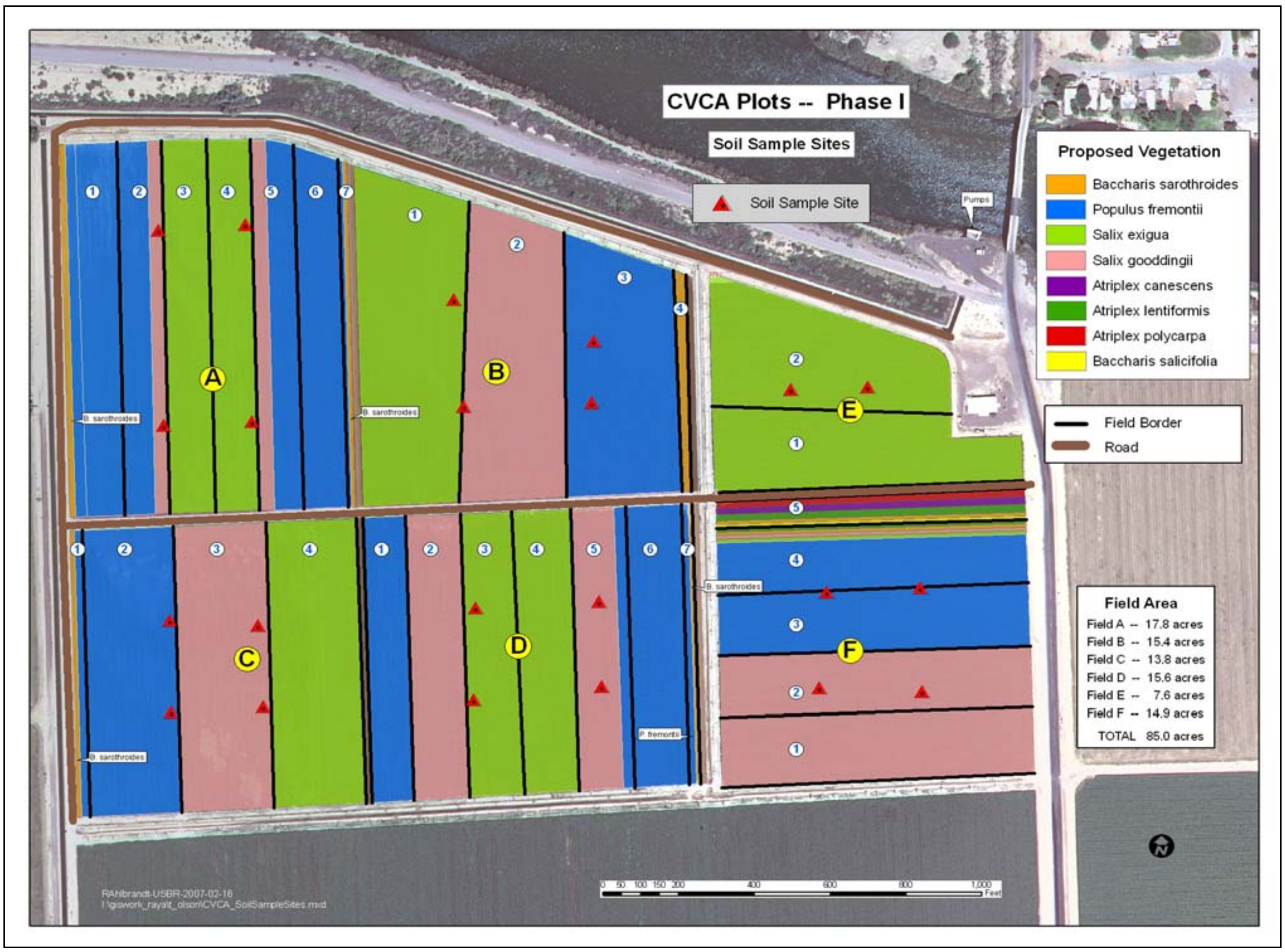
Soil samples were taken 22-24 February 2006 in each field prior to planting to determine baseline soil moisture, pH, salinity, textural classification, and nutrients (including nitrates, ortho-phosphate, and ammonia). Four sample points, evenly distributed, were located on fields A, B, C, D, and F, and two sample points were located on Field E. Three grab samples were taken for each point at surface, 1-foot, and 3-foot depths, for a total of 66 soil samples. Soils were analyzed by an independent laboratory for the stated parameters.

Before samples were taken, all leaves, grass, and other debris were removed from the area where soil was collected. A grab sample was taken at surface, 1-foot, and 3-foot intervals. A grab sample refers to an individual sample, collected at a particular time and place (Csuros 1994). For the surface sample, soil was excavated to approximately 6-8 inches, or one auger bucket in depth, and soil was placed into a new Ziploc bag. The sample was double bagged and the date, sample number, collected by, site collected, and depth were written on the Ziploc bag in permanent marker (Csuros 1994). For 1-foot samples, the sampling auger was marked at the 1-foot depth and soil was discarded up to the mark. Soil was then excavated from 1-foot depth until the auger bucket was full, and the soil was placed into a Ziploc bag. The sample was double bagged, and the date,

sample number, collected by, site collected, and depth were recorded on the Ziploc bag in permanent marker. The 3-foot samples were conducted by marking the auger at the 3-foot depth, and the sampling method was repeated.
The location of each sample was recorded by GPS, and all information was recorded in a field notebook including date, collected by, site collected, point collected, depth, UTM, soil sample number, field conditions such as weather, and requested analytical parameters (Figure 15).

On 22 September 2006, additional soil samples were taken in all fields at surface level utilizing the grab sample technique to determine adequacy of nutrients for plant survival during the growing season. Tissue samples were also taken to determine causes for cottonwood stress and die-off. Nutrients analyzed included potassium, total nitrogen, total phosphorus, calcium, magnesium, sodium, iron, manganese, zinc, and copper, along with EC for salinity and pH.

Figure 15. Soil Sample Sites on Phase 1



Results

Soil sample parameters were considered adequate for good establishment of trees for pre-samples taken in February and samples taken in September (Table 6). All were within optimum range except for the nitrates, which were below optimum, and the pH levels, which were above optimum. Nutrient levels in the plant tissue tested in September were all within optimal range. Fertilizer recommendations included an application of Ammonium Sulfate (21-0-0) run in the irrigation water at 10 gallons/acre as recommended by Stanworth Crop Consultants.

Table 6. Soil Sample Results for CVCA

Field A - Surface			
Nutrient	**Feb/March**	**Sept.**	**Sufficiency Range[1]**
Organic Matter %	0.6-1.4	n/a	
Phosphorus (Olsen Method)	8.0-14.0	16.5-18.4	10.0-20.0
Potassium (ppm)	40-135	152-194	80.0-165.0
Magnesium (ppm)	148-351	375-378	40.0-125.0
Calcium (ppm)	1655-2492	3647-3914	300.0-600.0
Sodium (ppm)	42-104	113-114	100.0-200.0
pH	7.8-8.1	7.9-8.0	6.5-7.5
Field B			
Organic Matter %	0.1-2.6	n/a	
Phosphorus (Olsen Method)	6.0-13.0	10.2-17.0	10.0-20.0
Potassium	35-200	228-258	80.0-165.0
Magnesium	216-519	330-335	40.0-125.0
Calcium	1940-2878	4372-5112	300.0-600.0
Sodium	58-1113	113-129	100.0-200.0
pH	8.0-8.5	7.9-8.0	6.5-7.5
Field C			
Organic Matter %	0.2-1.2	n/a	
Phosphorus (Olsen Method)	4.0-18.0	9.7-11.7	10.0-20.0
Potassium	25.0-102.0	135-159	80.0-165.0
Magnesium	80.0-296.0	271-361	40.0-125.0
Calcium	839-2304	3601-4663	300.0-600.0
Sodium	33-108	72-110	100.0-200.0
pH	8.0-8.8	8.0-8.0	6.5-7.5
Field D			
Organic Matter %	0.8-2.7	n/a	
Phosphorus (Olsen Method)	4.0-26.0	9.7-11.7	10.0-20.0
Potassium	27-202	135-159	80.0-165.0
Magnesium	299-636	271-361	40.0-125.0
Calcium	2257-2983	3601-4663	300.0-600.0
Sodium	82-621	72-110	100.0-200.0
pH	8.0-8.5	8.0-8.0	6.5-7.5

Field E			
Organic Matter %	0.6-1.3	n/a	
Phosphorus (Olsen Method)	5.0-12.0	7.1-10.2	10.0-20.0
Potassium	48-80	156-159	80.0-165.0
Magnesium	133-207	299-306	40.0-125.0
Calcium	2012-1590	5418-6372	300.0-600.0
Sodium	32-64	73-87	100.0-200.0
pH	8.0-8.4	8.0-8.0	6.5-7.5

Field F

Nutrient	Feb/March	Sept	Sufficiency Range[1]
Organic Matter %	1.6-0.3	n/a	
Phosphorus (Olsen Method)	4.0-28.0	12.2-21.3	10.0-20.0
Potassium	35-162	181-309	80.0-165.0
Magnesium	152-442	368-466	40.0-125.0
Calcium	1885-2616	3187-4628	300.0-600.0
Sodium	35-457	80-157	100.0-200.0
pH	8.0-8.6	8.0-8.0	6.5-7.5

1. Sufficiency Range provided by Stanworth Crop Consultants

Discussion

During the middle of the growing season, several cottonwoods appeared to be stressed and had tip dieback in Field A. Potential causes were over/under watering, disease, or lack of nutrients. Tissue samples were obtained to determine if nutrients were lacking and all parameters were in the optimum to high range; thus, nutrients were not a factor in the stressing of the cottonwoods. Disease was also ruled out by tissue samples. It is still unknown as to whether the irrigation regime was the cause. Irrigation will be monitored closely in this field to determine the optimum watering regime for the trees.

3.2 Vegetation

Phase 1 was monitored to determine whether necessary land cover types have been established in accordance to the site restoration plan. Initial success was measured in year one to determine mortality associated with restoration-related factors such as planting shock, seed viability, water availability, soil conditions, or competition. Past monitoring efforts have indicated that most mortality caused by restoration-related factors occurs within the first year (BR unpublished data).

Methods

Phase 1 was planted on 7-11 April 2006. Initial vegetation counts were conducted in each field (A, B, C, D) on 20-21 April 2006. Fields E and F were not counted as they will be used for nursery stock. Each field was broken into plots such as A1, A2, and A3 for ease of counting and for irrigation purposes. Total number of rows was counted for each plot, and every 10th row was counted to estimate the number of trees in each plot and extrapolated to each field and all of Phase 1.

On 7-8 November 2006, initial survival tree counts were taken on all fields and plots except B2, which was not planted. Every 10th row was used as a sample transect. Within each sample transect, every tree was counted and recorded by species. Diameter at breast height (DBH, measured at 1.37 meters above the ground on the uphill side of the tree), height, and tree condition (live/dead) was recorded for every 100th tree sampled. The DBH was measured to the nearest 0.1 centimeter. Trees were measured using a telescoping level rod and recorded to the nearest 0.1 meter. An individual tree was considered live if live leaves were observed, new tip or branch growth was observed, or if the cambium layer was alive at a point just above the root collar. A tree was considered dead if the cambium layer was dead completely around the bole of the tree at a point just above the root collar.

Because of an infestation of morning-glory (*Ipomoea hederacea*), many of the trees were lying down. If these trees exhibited live leaves, branch growth, or if the cambium layer was alive, the tree was counted as live. There were some plots that were mowed due to the morning-glory infestation. If the plots were partially mowed, trees were counted. If the whole plot was mowed, a cursory walkthrough was taken and if no noticeable trees were alive, the whole plot was considered dead.

All data were entered into an Excel spreadsheet. Given that uniformity in planting (machine planted) was high, estimates of total tree counts were extrapolated by taking the number of trees in each transect (row) per plot times the number of rows in a plot. This was then extrapolated for all of Phase 1. A comparison was then made between the initial vegetation counts and those taken in the fall to get a percent survival per plot and per tree species, and a total for Phase 1.

Results

Approximately 116,280 plants were living 2 weeks after planting in April 2006. Of these, approximately 58,620 were cottonwoods (*Populus fremontii*), 26,740 were Goodding's willow, 29,810 were coyote willow, and 1,100 were *Baccharis* (Table 7).

Overall survival for all of Phase 1 was approximately 36%. *Salix exigua* and *Salix gooddingii*, the two willow species, had the greatest survival at 45% and 40%, respectively (Table 7). Portions of plots C and D had the greatest survival with total plots at approximately 43% and 38%, respectively (Table 8).

Plots A6 and A7 were mowed due to heavy infestation of morning-glory; thus, there was 0% survival and these fields will be replanted. Plots B1, B3, C4, D3, D4, D5, D6, and D7 were all partially mowed. Plots D1 and D2 also had heavy infestation of morning-glory but were not mowed so as to allow later comparison with areas that were mowed (Appendix E).

Average DBH per species rounded to nearest tenth was: cottonwood, 1.0 cm; Goodding's willow, 0.5 cm; and coyote willow, 0.8 cm. Average height per species rounded to nearest tenth was: cottonwood, 2.0 m; Goodding's willow, 1.7 m; and coyote willow, 1.7 m.

Table 7. Estimated Survival After 1 Year of Growth

	After Planting	1st Fall Survivorship	% Survival
Total Estimated number of plants for Phase 1	116276	41931	36%
Total Estimated *Baccharis* spp.	1106	250	23%
Total Estimated *Populus fremontii*	58619	17595	30%
Total Estimated *Salix gooddingii*	26742	10778	40%
Total Estimated *Salix exigua*	29809	13308	45%

Table 8. Estimated Survival Numbers per Plot by Field

Plot Number	April 2006 Estimated # Plants	November 2006 Estimated # Plants	Percent 1st summer survival
A1	10220	4105	40%
A2	6542	2375	36%
A3	4689	1932	41%
A4	3576	2175	61%
A5	5976	1482	25%
A6	6657	0	0%
A7	1106	0	0%
Total Field A	**38766**	**12069**	**31%**
B1	5623	3808	68%
B2	N/A	N/A	N/A
B3	9625	1136	12%
Total Field B	**15248**	**4944**	**32%**
C1	1127	90	8%
C2	9212	5390	59%
C3	11072	4522	41%
C4	7458	2304	31%
Total Field C	**28869**	**12306**	**43%**
D1	5170	3683	71%
D2	7240	4500	62%
D3	4095	1873	46%
D4	4370	1216	28%
D5	5712	896	16%
D6	5985	432	7%
D7	821	12	1%
Total Field D	**33393**	**12612**	**38%**

Discussion

Ivyleaf morning-glory (*Ipomoea hederacea*) was a major weed problem and overtook more than 70% of the fields planted in 2006. This species is an annual, is often cultivated as an ornamental (Whitson et al. 2000), and is listed on Arizona's Noxious Weed List (http://plants.usda.gov). The species is a native to tropical America and can be found throughout the southwestern states. It has a taproot with stems up to 20 feet long. The entire plant is hairy and the leaves vary in shape from heart-shaped, to barely angular three lobed, to very deeply three lobed, and may even have five finger-like lobes. Flowers can be blue, purple, or whitish, 1 to 1 ¾ inches long, and in clusters of one to five. The globe-shaped seedpod is yellowish and contains four seeds (Shreve and Wiggins 1964, Whitson et al. 1992).

The plants wind themselves around the small trees and pull them to the ground. Most of the mortality was caused by either direct competition with morning-glory or through mowing of areas that were heavily infested with the morning-glory. During the surveys in November, it was observed that although several trees were pulled to the ground, they were still alive underneath the morning-glory. Future surveys will show whether these plants can overcome the infestation or whether the stress will cause additional mortality. Survival data from 2006 may change in 2007, and survival may even increase due to potential stump sprouting or other plant recovery from morning-glory infestation.

Figure 16. Morning-glory on Sign

Figure 17. Morning-glory Infestation at CVCA

3.3 Birds

Methods

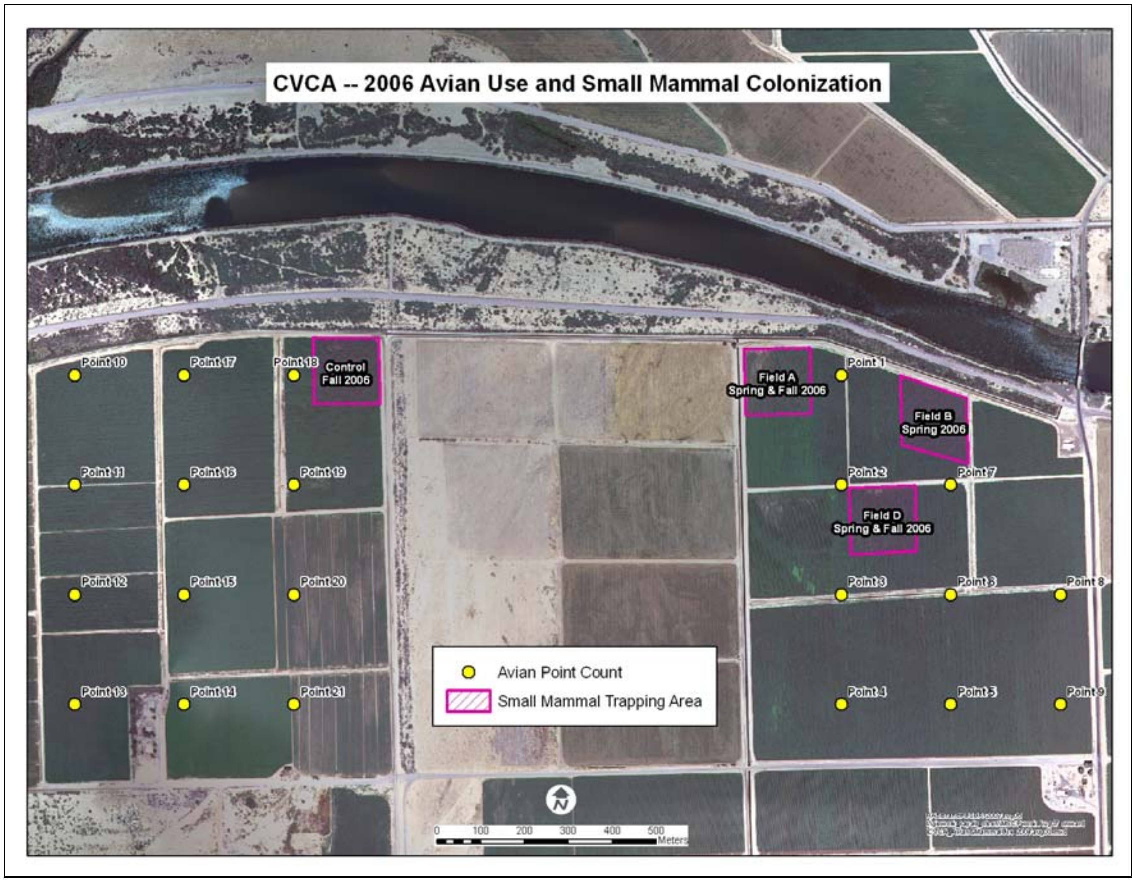
A standardized point count protocol established by Great Basin Bird Observatory (Great Basin Bird Observatory 2003) was used to monitor avian use. Point counts were conducted during breeding season (May through July) for avian species on Phase 1 after planting, Phase 2 as pre-monitoring, and at the Control site. The Control site will be used as a comparison in time throughout the development of CVCA. Phase 1 consisted of first-year planted cottonwoods, Goodding's willows, and coyote willows. Phase 2 was planted in cotton, and the Control site was planted in alfalfa (Figure 18). Point counts were conducted utilizing the same protocols at all three locations for direct comparison. Pre-restoration point counts were not initiated on Phase 1 due to time constraints, and were established during post-restoration monitoring. Phase 1 was compared to pre-restoration monitoring of Phase 2 immediately south of Phase 1, and to the Control site approximately 1 mile west of Phase 1.

Points were established along a randomly selected transect. Ten points were conducted per transect at an interval of 250 meters between points. Because of limited area, Phase 1 and Phase 2 were combined into one transect, with Phase 1 having five points, and Phase 2 having five points. The Control site contained a full transect of 10 points.

All birds observed aurally or visually were recorded by species, distance from plot center (0-50 meters, 50-100 meters, >100 meters), and time interval (0-3 minutes, 3-5 minutes, 5-10 minutes). Bird activity was also characterized (mating/nesting evidence, flyover, family group, singing, calling, territorial display, observed, mated pair) and recorded. Individuals were only recorded once, with movements marked on the data sheet. Point counts were conducted between one-half hour before sunrise and 10:00 a.m. (PST).

Surveys were not conducted during heavy precipitation, dense fog, or high winds (25-30 mph or 5-6 on the Beaufort scale). Site/transect/point number, surveyor name, date, sky code, wind code, UTM coordinates, and start time were recorded. Bird observations were recorded using AOU species codes; however, summary tables from each point listed the entire common name of each species observed.

Figure 18. 2006 Avian Point Counts and Small Mammal Trapping Locations

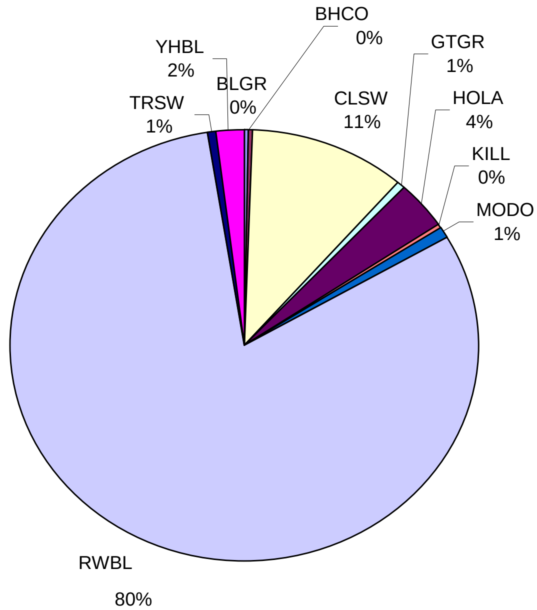


Results

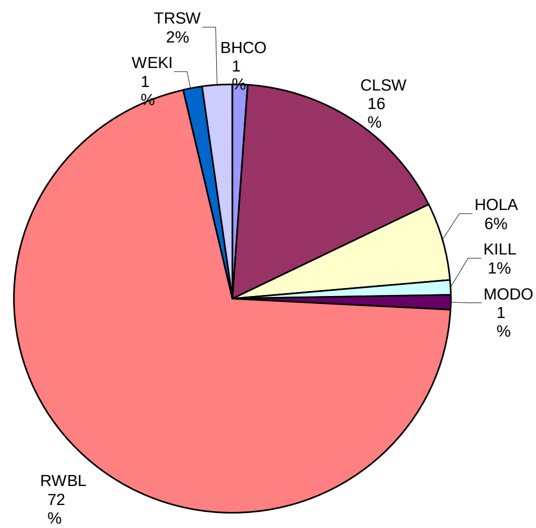
Twenty five avian species, totaling 781 observations were recorded. One Arizona's Bell's vireo, an LCR MSCP covered species, was detected on the Control site. Phase 1 point counts detected a total of 10 species, comprising mainly red-winged blackbirds and cliff swallows. Phase 2 included a total of 8 species, again comprising mainly red-winged blackbirds and cliff swallows. The Control site point counts detected 24 different species, with red-winged blackbirds, horned larks, and cliff swallows as the most abundant species. Species richness and ecological diversity were greatest at the Control site. Figure 19 summarizes the average relative abundance for each phase and the Control site. Table 9 gives a comparison of the average relative abundance between the phases and the Control site. Table 10 gives a comparison of species richness and ecological diversity, and Table 11 contains a species list of all observed species.

Figure 19. Average Relative Abundance for Phase 1, Phase 2, and Control Site.

Average Relative Abundance of Avian Species, Phase 1



Average Relative Abundance of Avian Species, Phase 2



Average Relative Abundance of Avian Species, Control Site

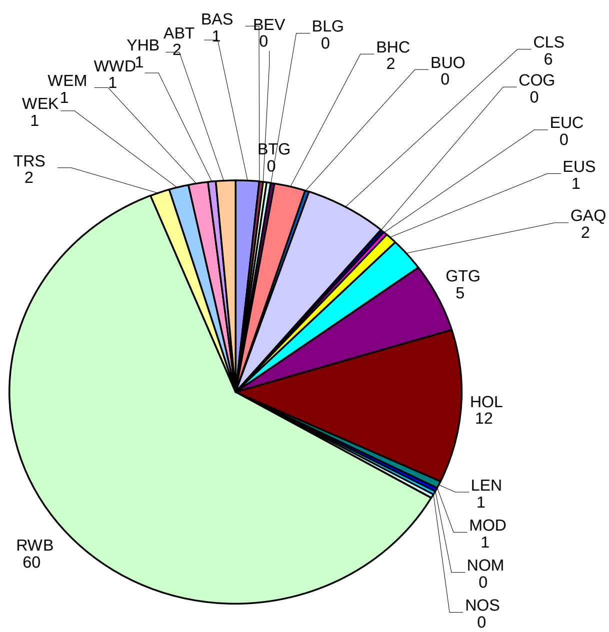


Table 9. Comparison of Average Relative Abundance Between Phase 1, Phase 2, and Control Site

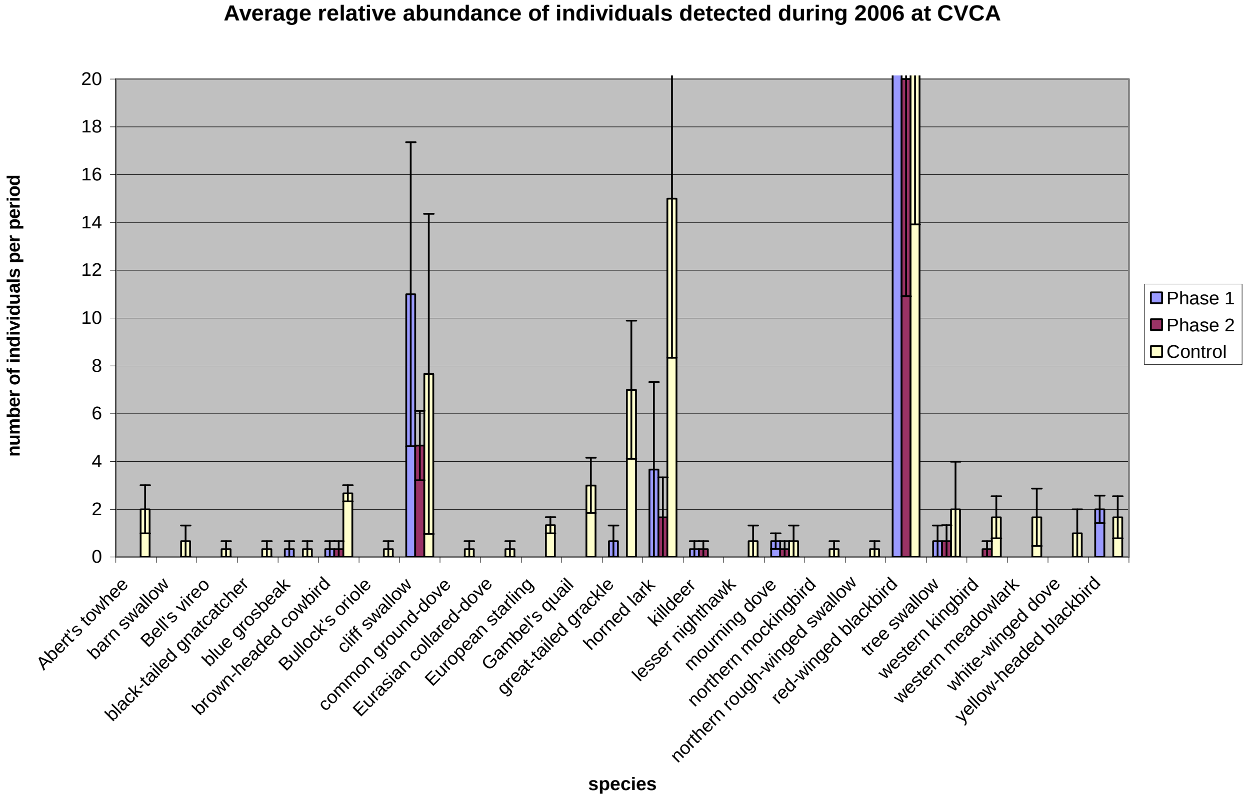


Table 10. Species Richness and Diversity by Phase and Control Site

Project phase	Average number of individuals/ period	Cumulative Species Richness (S)	Ecological Species Diversity (N_1)	Evenness (E)
Total Phase 1	102.33	10	2.14	0.33
Total Phase 2	28.33	8	2.73	0.48
Total Control	129.67	24	5.10	0.51

Table 11. Avian Species Recorded at CVCA

Common Names	Scientific Name	AOU Code
Abert's towhee	*Pipilo aberti*	ABTO
Bell's vireo	*Vireo bellii*	BEVI
Barn swallow	*Hirundo rustica*	BARS
Black-tailed gnatcatcher	*Polioptila melanura*	BTGN
Blue grosbeak	*Passerina caerulea*	BLGR
Brown-headed cowbird	*Molothrus ater*	BHCO
Bullock's oriole	*Icterus bullockii*	BUOR
Cliff swallow	*Petrochelidon pyrrhonota*	CLSW
Common ground-dove	*Columbina passerine*	COGD
Eurasian collared-dove	*Streptopelia decaocto*	ECDO
European starling	*Sturnus vulgaris*	EUST
Gambel's quail	*Callipepla gambelii*	GAQU
Great-tailed grackle	*Quiscalus mexicanus*	GTGR
Horned lark	*Eremophila alpestris*	HOLA
Killdeer	*Charadrius vociferous*	KILL
Lesser nighthawk	*Chordeiles acutipennis*	LENI
Mourning dove	*Zenaida macroura*	MODO
Northern mockingbird	*Mimus polyglottos*	NOMO
Northern rough-winged swallow	*Stelgidopteryx serripennis*	NRWS
Red-winged blackbird	*Agelaius phoeniceus*	RWBL
Tree swallow	*Tachycineta bicolor*	TRSW
Western kingbird	*Tyrannus verticalis*	WEKI
Western meadowlark	*Sturnella neglecta*	WEME
White-winged dove	*Zenaida asiatica*	WWDO
Yellow-headed blackbird	*Xanthocephalus xanthocephalus*	YHBL

Discussion

Vegetation differed in all three areas studies. Phase 1 consisted of first-year planted cottonwoods, Goodding’s willows, and coyote willows. Phase 2 was planted in cotton, and the Control site was planted in alfalfa. Differences in vegetation type may account for differences in species abundance and diversity between sites. The alfalfa at the Control site has been in place for several years, while the cotton was planted in summer 2006, and the tree species in Phase 1 were planted during the spring of 2006. It is hypothesized that as the tree species grow into habitat, the relative abundance and diversity will increase, as shown by other creation sites such as Cibola Nature Trail Restoration Site and Pratt Restoration Site (Bureau of Reclamation 2006).

3.4 Bats

Pilot acoustic bat surveys utilizing Anabat bat detectors were conducted in April 2006 at Cibola Valley Conservation Area and surrounding locations. The pilot surveys were conducted to obtain pre-restoration data on bat use of the restoration site and reference areas around the restoration site, and to demonstrate the utility of acoustic surveys as part of a long-term post-restoration bat monitoring program. Data, results, and discussion presented here were obtained from the document *Post-Development Bat Monitoring of Restoration Sites Along the Lower Colorado River, Acoustic Bat Survey Pilot Study, April 2006* prepared by Reclamation's Denver Technical Service Center (Bureau of Reclamation, 2007). Additional data was collected in November 2006, but has not been fully analyzed. This data will be included in the 2007 annual report.

Methods

The Cibola Valley Conservation Area and surrounding area were sampled on 4 April 2006 at the following locations: Area 1, Field A; Area 2, Field B; Area 3, Nature Trail; Area 4, Saltcedar by Lower Colorado River; Area 5, CVCA Control site; and Area 6, Farmer's House.

Acoustic bat surveys were conducted using Anabat II bat detectors coupled to a zero-crossing analysis interface module (ZCAIM). Bat calls were recorded directly onto compact flash cards. Ten units were deployed simultaneously in adjacent habitats and run continuously from dusk to dawn, recording all bat calls during an 11-hour period. The units were retrieved and downloaded the following day and relocated to the next study area. The Farmer's House and the Saltcedar sites were monitored to determine what other roosting bats and foraging bats were in the area. These will not be monitored in the future. The Control site will be used for long-term comparison of restored agricultural sites and is planted in alfalfa.

Minimum frequency, duration, and shape of each call sequence (bat pass) were compared with reference calls from libraries of positively identified bats from throughout the western United States, following the method outlined in Thomas et al. (1987). A bat pass is defined as a call sequence of duration greater than 0.5 milliseconds (ms) and consisting of more than two individual calls (Thomas 1998; O'Farell and Gannon 1999).

Results

The six areas sampled within the CVCA and the surrounding area contained approximately 10 species or species groups (Table 12), and overall had relatively low bat activity as measured by total bat passes per night and bat passes per hour. Table 13 shows the relative abundance of bat species and species groups. The western pipistrelle (PIPHES) was the most abundant species present, followed by the species group of western pipistrelle/California *Myotis*/Yuma *Myotis* (PIPHES/MYOCAL/MYOYUM), and the big brown bat (EPTFUS). Some species with similar calls that cannot be distinguished using the AnaBat recorders were grouped (e.g. 40-Khz *Myotis*) (Table 12). Those species that have unique identifiable calls were separated in the tables below.

Some sampled areas were reduced in habitat complexity and consisted of bare dirt fields (Field A with a total of 10 bat passes, Field B with 3 bat passes, and the Control site with 9 bat passes). Both the Saltcedar stand (17 bat passes) and the area by the Farmer's House (17 bat passes) consisted of more complex habitat, either in the form of mature saltcedar or various shade trees and buildings around the Farmer's House (Table 14).

Table 12. Bat Species and Species Groups Identified at Study Sites

Common Name	Scientific Name	Species Code
Pallid bat	*Antrozous pallidus*	ANTPAL
Big brown bat	*Eptesicus fuscus*	EPTFUS
EPTFUS/TADBRA	Species Group	EPTFUS/TADBRA
Hoary Bat	*Lasiurus cinereus*	LASCIN
40 Khz Myotis	Species Group	40 Khz Myotis
Yuma Myotis	*Myotis yumanensis*	MYOYUM
Pocketed Free-tailed Bat	*Nyctinomops femorosacus*	NYCFEM
Western Pipistrelle	*Pipistrellus hesperus*	PIPHES
PIPHES/MYOCAL/MYOYUM	Species Group	PIPHES/MYOCAL/MYOYUM
Mexican Free-tailed Bat	*Tadarida brasiliensis*	TADBRA

Table 13. Relative Abundance of Bat Species—Cibola Valley Conservation Area

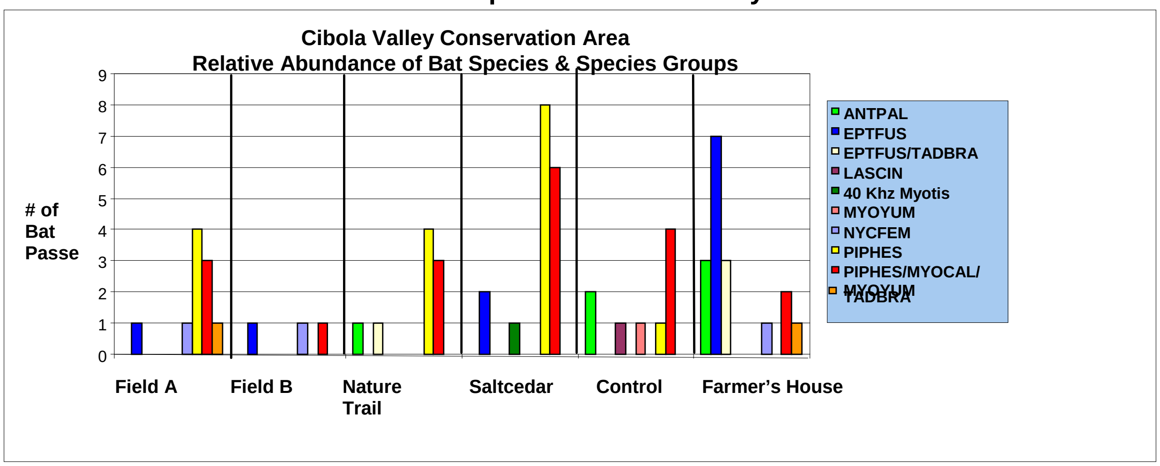


Table 14. Data Summary for Pilot Acoustic Bat Surveys

Area	Number of Bat Passes/Night	Number of Bat Passes/Hr.	Number of Spp. Or Spp Groups
#1 CVCA Field A	10	0.91	5
#2 CVCA Field B	3	0.27	3
#3 Nature Trail	9	0.82	4
#4 Saltcedar	17	1.55	4
#5 CVCA Control	9	0.82	5
#6 Farmer's House	17	1.55	6

Discussion

This pilot study and pre-restoration monitoring indicates that acoustic surveys utilizing Anabat detectors can provide useful data in comparing restoration sites, both among sites as well as at a particular site over time. The most powerful application for an intensive monitoring program is to utilize a combination of techniques and equipment. The Anabat system is excellent in recording all bat passes that occur in an area, recording the time of the bat pass as well. This feature allows the collection of a full range of bat activity in a given site. It is apparent that among the bat species present on the Lower Colorado River, a fair number of species have overlapping calls, forcing the bat passes to be categorized into species groups. Sonobat has excellent resolution, recording a full spectrum sonogram, which can greatly assist in identifying bats to species. However, the downside is the large size of the files results in acquiring only a small portion of the total bat passes that occur in an area. Sonobat detectors may be used in the future to subsample bat passes to provide an indication of the species present.

3.5 Small Mammals

Presence/absence survey methods are used to determine which species utilize a specific site and whether restoration efforts change the species composition of a site. If presence/absence surveys are conducted both before and after a site is restored to native habitat it can be determined what, if any, species are eliminated, and what species colonize a site after restoration. To determine colonization of a site by new species, trapping must be conducted over time, near the same time of year as trapping was conducted before restoration occurred. Surveys over several seasons of the year are conducted to more fully survey for all species, some of which may have differing activity rates dependent upon the season and temperature.

Methods

Presence/absence surveys were conducted on Phase 1 (fields A, B, and D) on 28 February and 1-2 March 2006 prior to planting of Phase 1. Trapping was conducted in plowed fields with no vegetation. Surveys were also conducted at both Phase I (fields A and D) and the Control site on 7-9 November 2006. Fields A and D contained cottonwood and willow trees with a thick understory of morning-glory. The Control site contained alfalfa. The general presence/absence survey trapping protocol that was followed was based on Wilson et. al (1996). Trapping was conducted at night to capture nocturnal small mammals utilizing the site. Traps were placed in parallel, linear transects of approximately 150 meters in length, with transects located 15 meters apart. A trap station was located at every 10 meters along the transect with one trap located at each trap station. A trap night was equal to one trap set out for one night of trapping.

Results

A total of 934 trap nights were conducted during 2006. A total of four deer mice (*Peromyscus maniculatus)* were captured in February-March 2006, and one deer mouse was captured in November 2006. A breakdown of the trap nights and captures is included in Table 15.

Table 15. Trap Nights and Number of Small Mammal Captures for 2006 on Phase 1

Date	Field	Trap nights	Species	Number
2/28/2006	A	180	*Peromyscus maniculatus*	2
3/1/2006	B	124	*Peromyscus maniculatus*	1
3/2/2006	D	180	*Peromyscus maniculatus*	1
11/7/2006	A	120	None	0
11/8/2006	D	135	*Peromyscus maniculatus*	1
11/9/2006	Control	195	None	0
Total		**934**	***Peromyscus maniculatus***	**5**

Discussion

Pre-monitoring trapping indicated that fields devoid of vegetation are not conducive to heavy small mammal use, as only four deer mice were captured. Limited data has been obtained for both the Control site and Phase 1 after planting of trees. Additional trapping is needed to determine presence/absence of small mammals in these locations. Similar results were obtained from pre-monitoring of the Palo Verde Ecological Reserve in which no small mammals were located after 180 trap nights (unpublished data).

4.0 Established Land Cover & Habitat Credit

Established Land Cover

Phase 1 and the Nursery were planted in the spring of 2006. The current condition reported here was observed in December 2006. Phase 1 comprises six fields. Each field is further divided into checks. Checks in Phase 1 range in size from 0.2 to 5.7 acres (0.08-2.3 ha). Checks are separated from adjacent checks by earthen borders. Fields are separated from each other by irrigation ditches. The fields exhibit very little aspect and are all very level. Generally, one target species was planted per check, resulting in fields with target species arranged in large uniform blocks or stripes.

Overstory

All planted checks in Phase 1 are described as even-aged, monotypic, early seral, and tightly spaced. The cottonwood (*Populus fremontii*) and willow (*Salix gooddingii* and *S. exigua*) are typically evenly spaced with a relatively uniform height of approximately 4.5-7 feet (1.4-2.1 meters). *Baccharis sarothroides* was also planted. It is relatively small, less than 1 foot (0.3 m) in height, and either hidden within or overtopped by herbaceous groundcover. Fields are similarly described as even-aged and early seral; however, one field may have up to three target species present in large uniform blocks (checks). The Nursery fields are similar to the Phase 1 fields except they are less dense. Trees were planted a little farther apart and crowns are not crowded and open grown as a result (see Table 2 and Table 3).

Understory

The dense, contiguous, herbaceous understory mainly comprises alfalfa, Bermuda grass, and morning-glory with very little exposed bare soil. The understory is approximately 1.5 feet (0.5 m) tall. Alfalfa (*Medicago* spp.) was established as a cover crop.

Invaders

Ivyleaf morning-glory (*Ipomoea hederacea*) has successfully invaded several checks. This unwanted weed apparently was present in the residual seedbank. In some areas morning-glory is blanketing and wrapping itself vigorously around cottonwood and willow trees. It is capable of bending these young trees over and flattening them to the ground. Bermuda grass (*Cynodon dactylon*) has also successfully formed thick continuous stands in several checks.

Habitat Credit

The current land cover in Phase 1 and the Nursery is not yet mature enough to be considered for Habitat Credit. It could be loosely described as cottonwood-willow VI, as defined by Anderson and Ohmart (1976, 1984). The cottonwood-willow VI structure type is described as having one layer of vegetation with the bulk of the volume between 0 and 2 m (0-6.5 ft) tall.

5.0 Adaptive Management Recommendations

5.1 General

Specific management methods, techniques, and/or agreements will be addressed in each phase-specific management plan. These management plans will include elements such as habitat objectives, monitoring requirements, land cover type management, targeted covered species habitat management, infrastructure maintenance, water management, wildfire management, noxious weed control, and pesticide use. Specific land cover type management activities will be further developed for each phase as the vegetation approaches a stage that indicates it is successfully established.

Successful creation of the cottonwood-willow land cover type requires that the physical processes that determine habitat structure and dynamics in riparian systems be mimicked as much as possible. As a part of the implementation program for Phase 3, specific habitat objectives, design, and management criteria are being developed. The elements considered for Phase 3 included, but were not limited to:

- Analyze inline spacing, which was varied in Phase 1, to determine the optimum spacing for creating large blocks of cottonwood-willow necessary to provide habitats for southwestern willow flycatcher and other covered species
- Not to plant a cover crop, but to limit establishment of morning-glory by applying preemergents prior to planting to keep out nonnative species, in an attempt to maintain habitat quality for associated covered species
- Vary irrigation regimes in Phase 1 to determine the optimum irrigation schedule for the already planted cottonwood-willow
- Integrate cottonwoods planted with willows in planting designs to provide an integrated mosaic of cottonwood-willow habitat
- Replant mowed areas in Phase 1 in an attempt to reestablish SWFL habitat

5.2 Operations and Maintenance

There was no irrigation canal repair work or road work scheduled for Fiscal Year 2006. Future work is anticipated to maintain irrigation canals and to repair service roads.

5.3 Management of Existing Habitat/Vegetation

The first year of the project is primarily dedicated to allowing the young transplants to grow and mature as fast as possible. Work activity will be a combination of active monitoring and analyzing information obtained from the University of Arizona studies.

Through the adaptive management process, certain parameters will be systematically adjusted to produce ideal cottonwood-willow habitat. Some of these parameters include:

- Monitoring the irrigation regime to determine the required amount of irrigation water
- Controlling unexpected invasive infestations, whether insects, bacteria, or morning-glory, by use of mechanical or chemical applications

5.4 Soil Management

Soil characteristics and textures will continue to be sampled and analyzed annually or more often as required.

5.5 Water Management

Irrigation water will continue to be applied as determined by Reclamation or contracted crop consultants. Monitoring and observation of soil moisture and other site conditions will provide the data necessary to determine an appropriate irrigation schedule.

5.6 Wildfire Management

As guided by commitments in the HCP, wildfire management practices on CVCA will:

- Reduce the risk of the loss of created habitat to wildfire by providing resources to suppress wildfires (e.g., contributing to and integrating with local, State, and Federal agency fire management plans)
- Incorporate designs to contain wildfire and facilitate rapid response to suppress fires (e.g., fire management plans would be an element of each conservation area management plan)
- Implement land management and habitat creation measures to support the reestablishment of native vegetation that is lost to wildfire.

Specific agreements and/or methods will be addressed in each phase-specific design and management plan.

5.7 Law Enforcement

After the property is secured for the life of the program, appropriate agencies will patrol CVCA regularly by land and river to enforce all applicable laws. Specific agreements and/or methods have not been finalized at this time.

5.8 Public Use

No recommendations needed.

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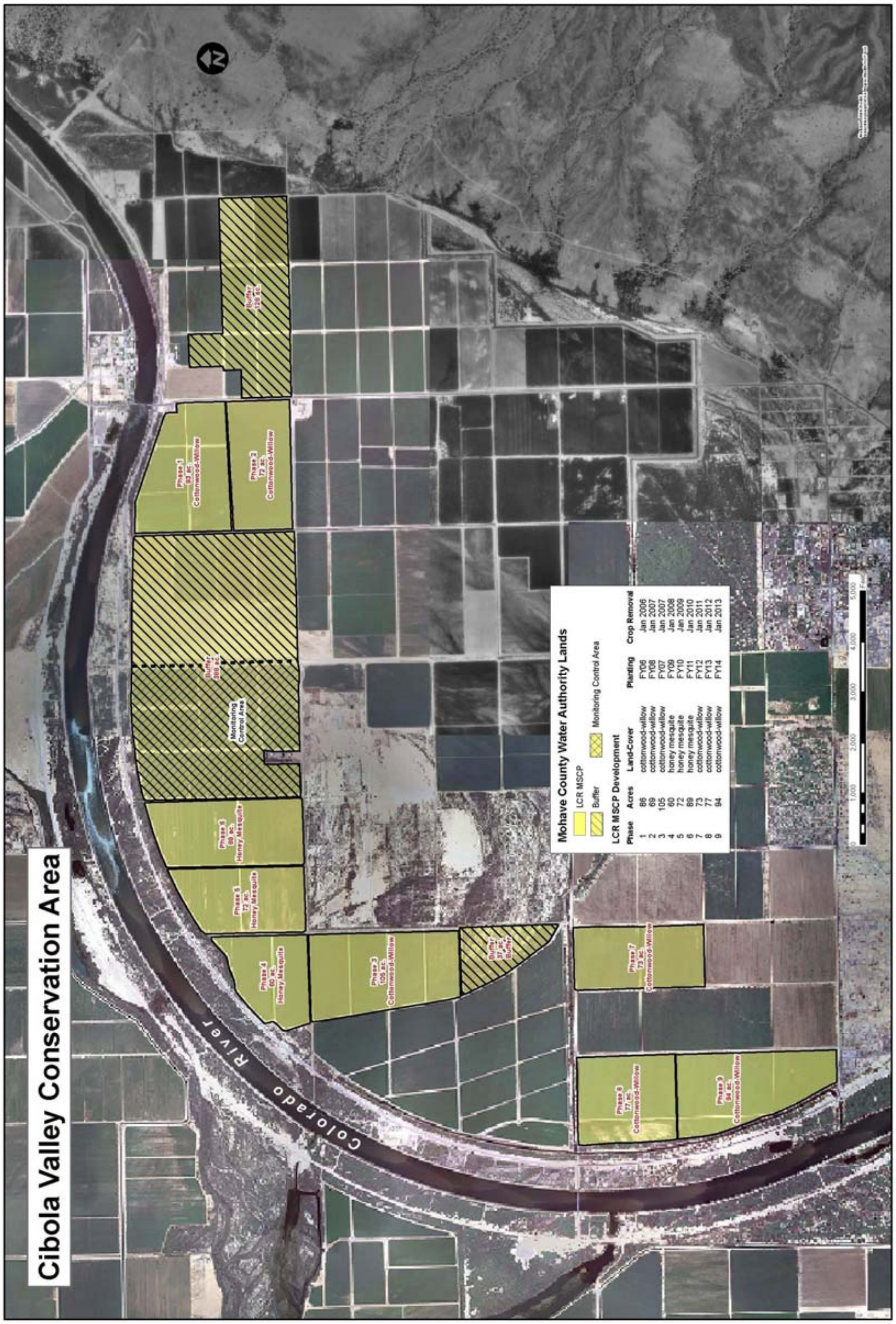
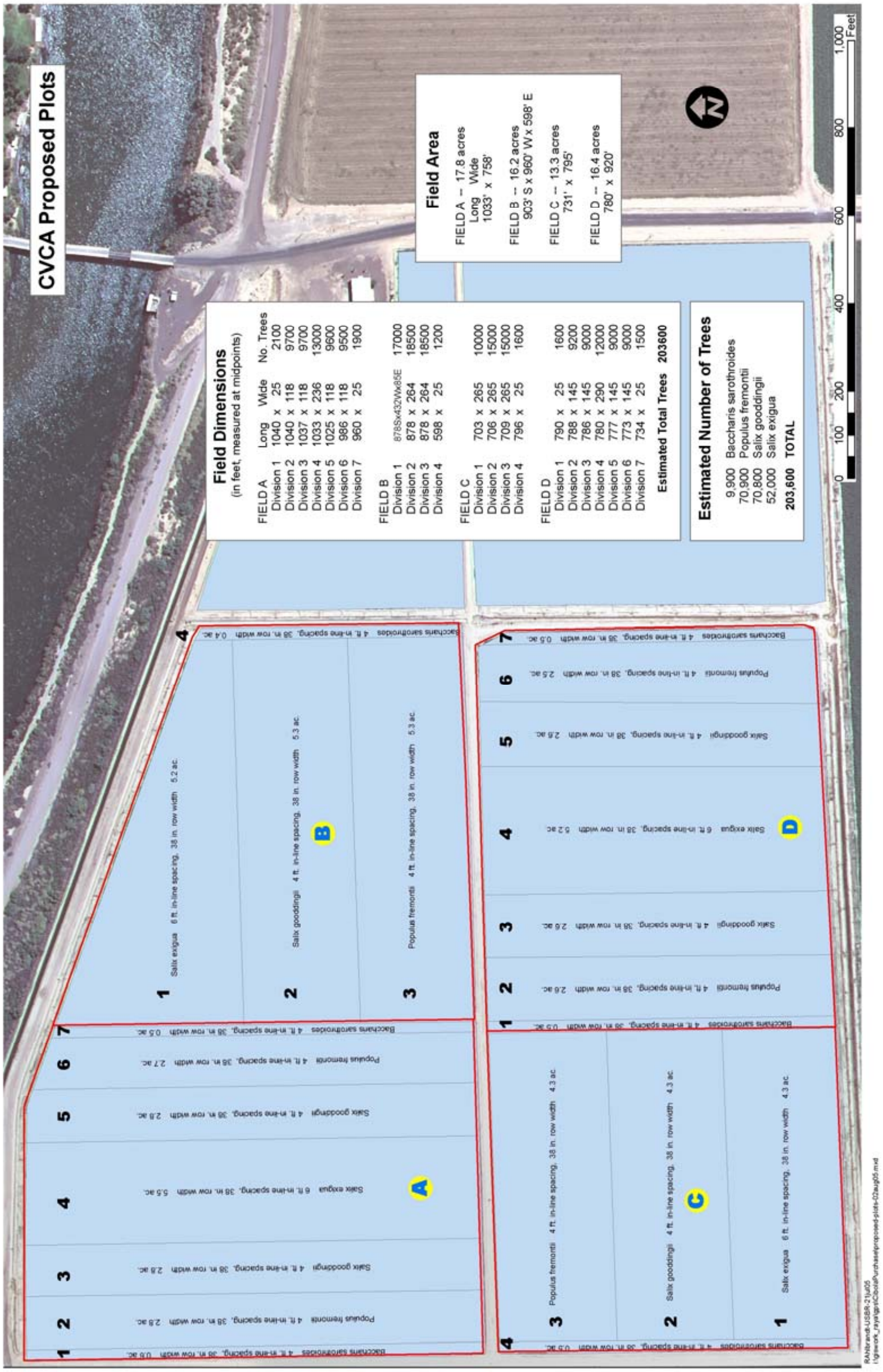
Appendix A. Cibola Valley Conservation Area



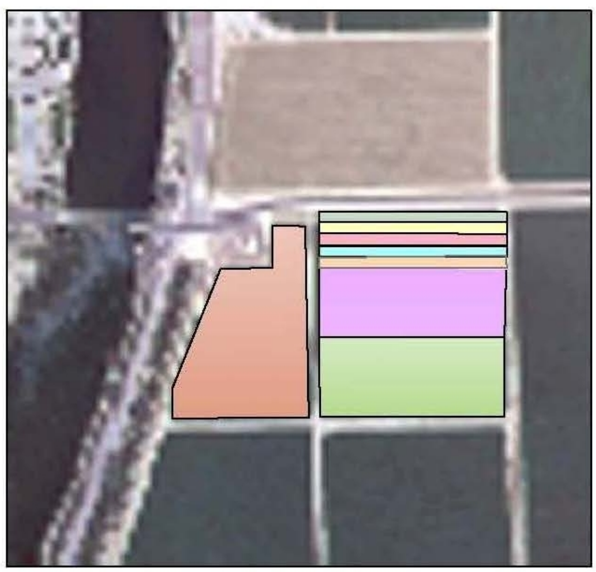
Appendix B. Cibola Valley Conservation Area Proposed Field Layout



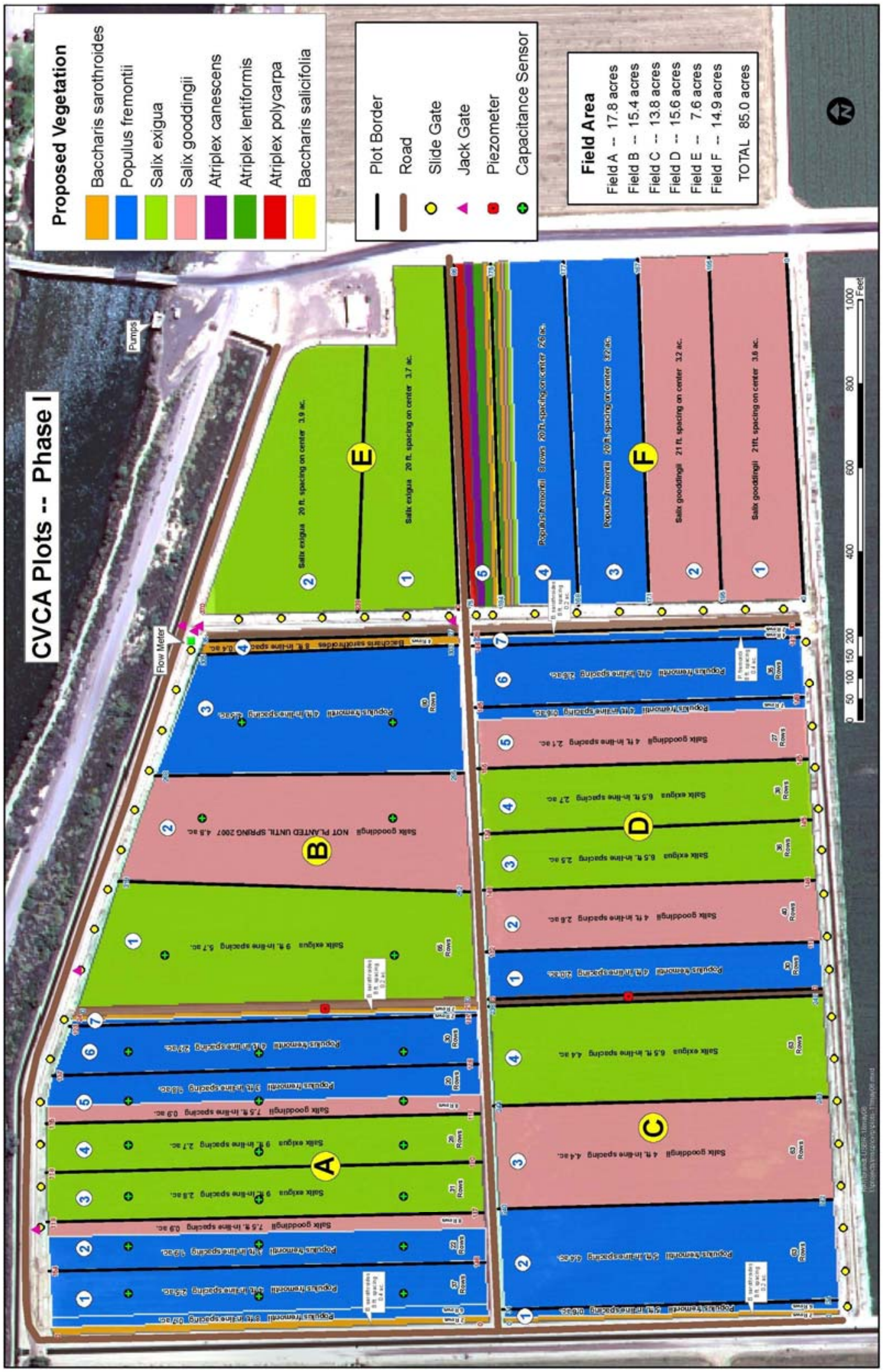
Appendix C. Cibola Valley Conservation Area Proposed Nursery Layout

Cibola Valley Conservation Area
Nursery Planting Plan

Total #	Species	Feet on center	Acreage
800	Coyote willow Salix exigua	20	7.6
700	Godding's willow Salix gooddingii	20	6.4
650	Cottonwood Populus fremontii	20	6.0
100	Mule's fat Baccharis salicifolia	10	0.5
100	Desertbroom B. sarothroides	10	0.5
50	Quailbush Atriplex lentiformis	20	0.5
50	Four wing saltbush Atriplex canescens	20	0.5
50	Cattle saltbush Atriplex polycarpa	20	0.5



Appendix D. Cibola Valley Conservation Area As-Built



Appendix E. Cibola Valley Conservation Area Mowed Areas

Appendix F. Cibola Valley Conservation Area Phases 1-3