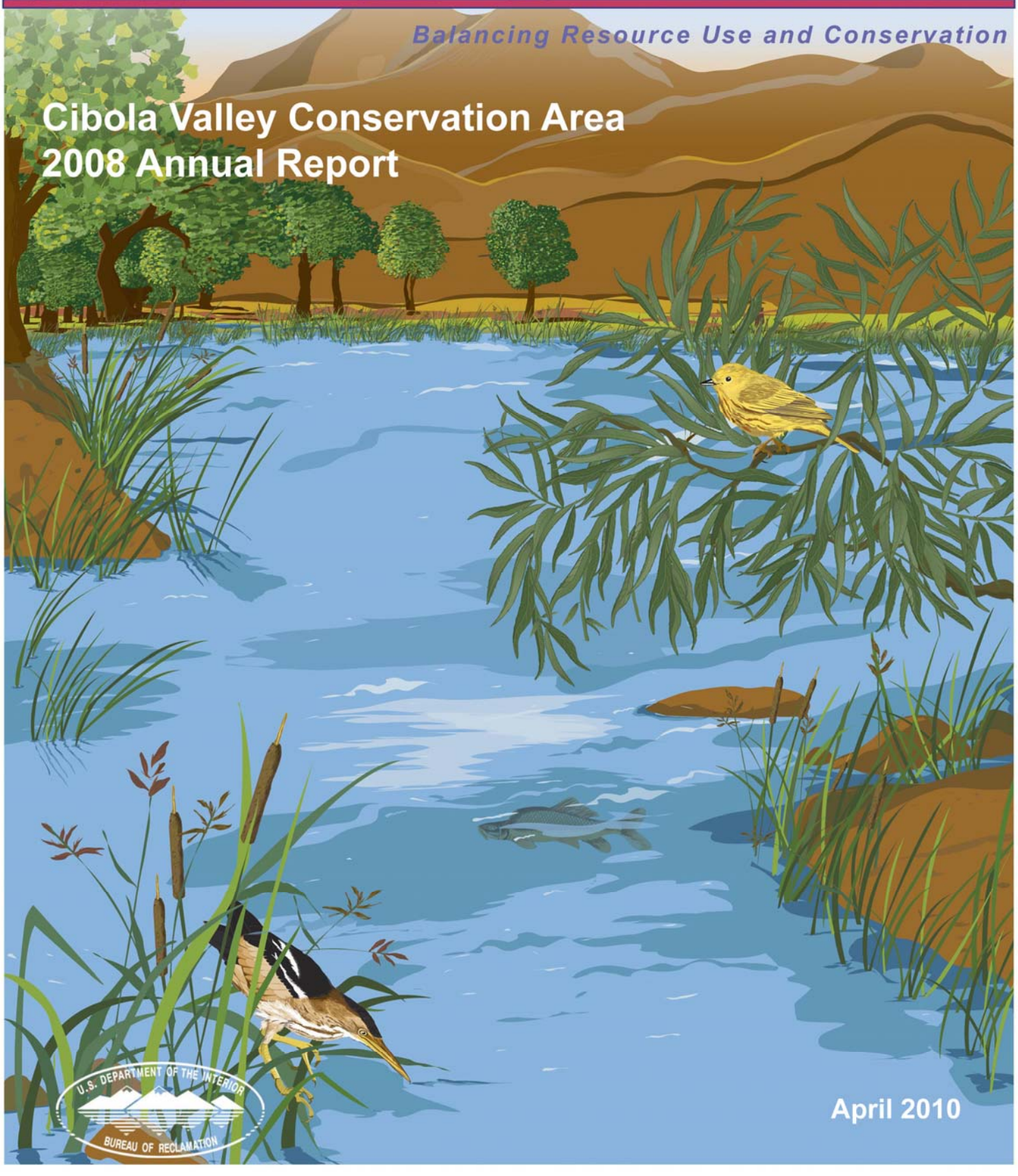
Lower Colorado River Multi-Species Conservation Program

Balancing Resource Use and Conservation



Cibola Valley Conservation Area 2008 Annual Report

April 2010

Lower Colorado River Multi-Species Conservation Program Steering Committee Members

Federal Participant Group

Bureau of Reclamation
U.S. Fish and Wildlife Service
National Park Service
Bureau of Land Management
Bureau of Indian Affairs
Western Area Power Administration

Arizona Participant Group

Arizona Department of Water Resources
Arizona Electric Power Cooperative, Inc.
Arizona Game and Fish Department
Arizona Power Authority
Central Arizona Water Conservation District
Cibola Valley Irrigation and Drainage District
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City of Lake Havasu City
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Electrical District No. 3, Pinal County, Arizona
Golden Shores Water Conservation District
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Mohave Valley Irrigation and Drainage District
Mohave Water Conservation District
North Gila Valley Irrigation and Drainage District
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Salt River Project Agricultural Improvement and Power District
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Yuma County Water Users' Association
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QuadState County Government Coalition
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Bard Water District
Imperial Irrigation District
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Hualapai Tribe
Colorado River Indian Tribes

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Ducks Unlimited
Lower Colorado River RC&D Area, Inc.
The Nature Conservancy

Lower Colorado River Multi-Species Conservation Program

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Lower Colorado River
Multi-Species Conservation Program
Bureau of Reclamation
Lower Colorado Region
Boulder City, Nevada
http://www.lcrmscp.gov

April 2010

Background

In 2002, the Bureau of Reclamation (Reclamation) secured 1,309 acres of land within the Cibola Valley Irrigation and Drainage District (CVIDD) in southwestern Arizona and established the Cibola Valley Conservation Area (CVCA). In September 2007, the property was conveyed to the Arizona Game and Fish Department (AGFD) through an agreement among AGFD, Reclamation, the Mohave County Water Authority (MCWA), and The Conservation Fund. Under the agreement, AGFD retains title to the property and leases the land and water rights to Reclamation until April 5, 2055 as part of the Lower Colorado River Multi-Species Conservation Program (LCR MSCP).

In September 2008 a Memorandum of Understanding (MOU) was signed between Reclamation and AGFD that assures availability of land and water resources for the 50-year term of the LCR MSCP. This MOU changed the name to the Cibola Valley Conservation and Wildlife Area (CVCWA).

Large habitat restoration sites such as CVCWA are developed over a number of years with restoration activities divided into phases as shown in Figure 1. The report, *Cibola Valley Conservation Area Restoration Development Plan: Overview*, provides a summary of site and projected phase implementation.

In Fiscal Year (FY) 2006, Reclamation planted Phase 1, consisting of a 22-acre native plant nursery and approximately 64 acres of cottonwood-willow habitat. Phase 2 was originally scheduled for implementation in early spring of FY07 as reported in *CVCA Restoration Development Plan: Phase 2*, but was delayed for one year to in an attempt to eradicate the seed bank for the invasive plant, ivyleaf morning-glory. Phase 3 was planted in FY07 as reported in *CVCA Restoration Development Plan: Phase 3.* Phase 2, a 70-acre parcel, was planted in March 2008 with approximately 160,000 coyote willow (*Salix exigua*), Goodding's willow (*Salix gooddingii*), and Fremont cottonwood (*Populus fremontii*), in accordance with the *CVCA Restoration Development Plan: Phase 2* (reports are available on the LCR MSCP Web site.)

This report documents the development and management of land cover types through October 2008, presents the results of monitoring, determines habitat credit, and makes recommendations for future adaptive management of lands within CVCA.

1.0 Site Information

Cottonwood-willow land cover created within CVCWA will be managed for the southwestern willow flycatcher (*Empidonax traillii extimus)* (SWFL), yellow-billed cuckoo (*Coccyzus americanus occidentalis*) (YBCU), and other species covered under the LCR MSCP. As part of habitat creation, native plant communities are established and managed to meet performance standards for integrating seral stages of vegetation, moist soil, standing water, and open areas into mosaics of riparian habitat.

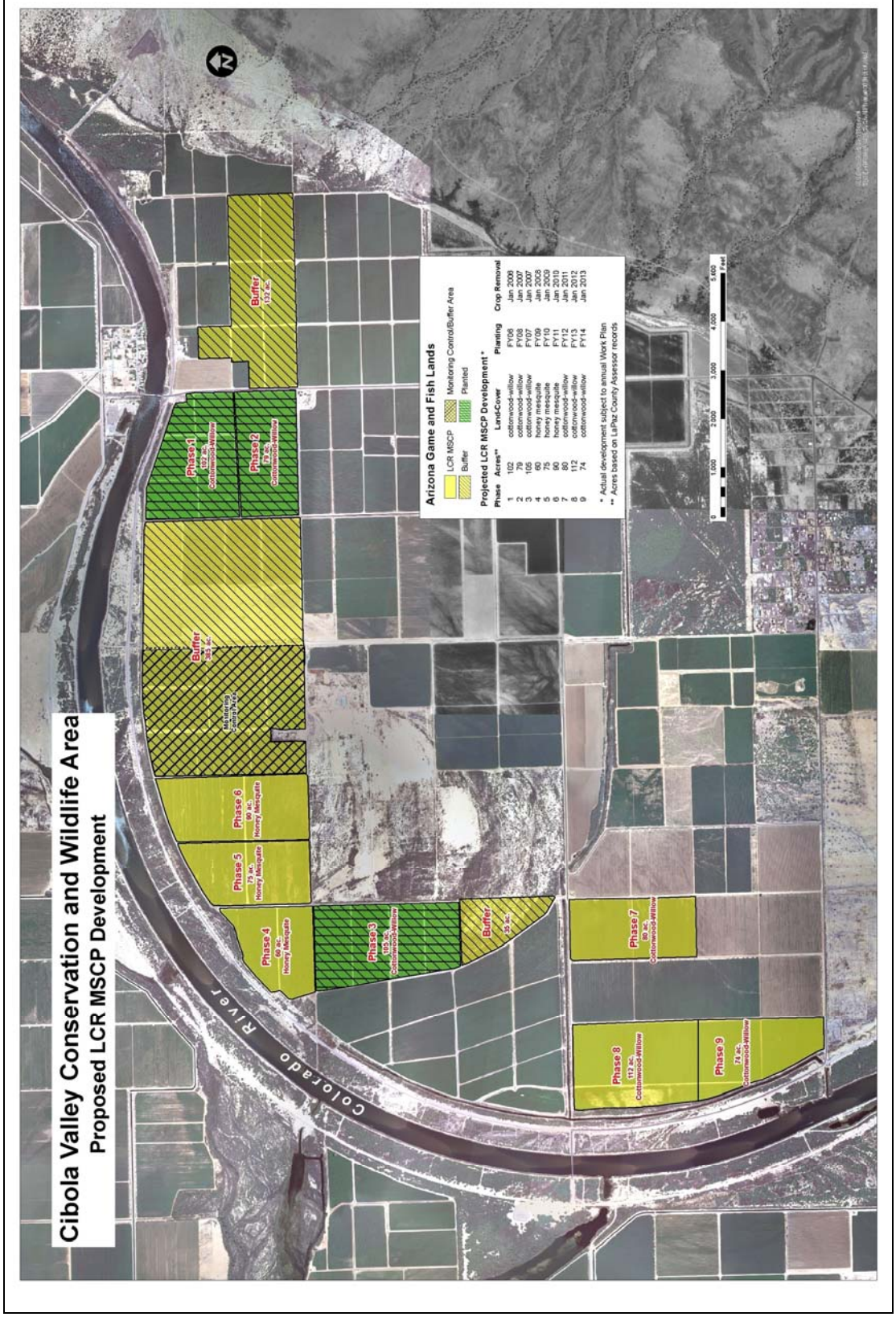


Figure 1: Current Phase Map of Cibola Valley Conservation and Wildlife Area

1.1 Location

The 1,309-acre CVCWA is located in southwestern La Paz County, Arizona, which is approximately 15 miles south of Blythe, California. Cibola 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). Farmed primarily for cotton and alfalfa, CVCWA is bordered to the south by Cibola National Wildlife Refuge and on the east by unimproved land under the jurisdiction of the Bureau of Land Management. The river forms the north and west boundaries, except for the Palo Verde Oxbow, from river miles 98.8 to 104.9.

1.2 Land Ownership

AGFD acquired CVCWA land and water rights in 2007 and 2008 through multiple agreements involving AGFD, Reclamation, MCWA, The Conservation Fund, and the Hopi Tribe. Through these agreements, AGFD acquired CVCWA fee title and water entitlements, and agreed to manage the site. The entitlements are subject to an existing long-term lease of the land and water rights to Reclamation through April 5, 2055 as part of the LCR MSCP. Short-term leases of the land to farmers for crop production also exist on portions of the acquired land.

1.3 Agreements

A Land Use Agreement was signed between Reclamation and AGFD that assures availability of land and water resources for the 50-year term of the program.

1.4 Water Availability

For the long-term, 2,838 acre-feet per year diversionary right of 4th Priority Colorado River water is available. Reclamation has an option to purchase 1,300 acre-feet per year from the AGFD's entitlement and 1,419 acre-feet per year from the Hopi Tribe's entitlement. In addition, Reclamation has a 4th Priority entitlement for 118.94 acre-feet per year (Table 1).

Additionally, a 7,747 acre-feet diversionary right of combined 4th, 5th, and 6th Priority Colorado River water is currently available for lease each year 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 AGFD entitlement	1,300 acre-feet/year	4th
Purchase option from Hopi Tribe entitlement	1,419 acre-feet/year	4th
Reclamation entitlement	119 acre-feet/year	4th
Long-Term Total	2,838 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	

2.0 2008 Habitat Development

2.1 Planting

Phase 2 development of CVCWA will create additional coverage of riparian habitat designed to mimic the historical landscape patterns of plant communities along the LCR and create an integrated mosaic of habitats. Phase 2 encompasses approximately 72 acres; however, 67 acres were actually planted due to the infrastructure needed to accomplish this project, which includes roads, borders, and irrigation canals.

In the spring of 2008, a local farmer contracted by Reclamation to prepare the fields for planting by disking, ripping, plowing, land leveling, and border disking. This phase was divided into 10 manageable fields, or checks, averaging approximately 6 acres in size. They are separated by berms, or borders, to control the irrigation water as depicted in Figure 2. In March, soil samples were taken by a contracted crop consultant in Phase 2. As a result of the soil sampling, an application of fertilizer (10-34-0) and UN-32 were added to the irrigation water prior to planting.

Greenheart Farms Inc. (Arroyo Grande, California) propagated, delivered, and planted the native trees in Phase 2. The trees were routed through the firm's Yuma, Arizona nursery, and delivered to CVCWA in trailers. The cottonwoods and willows were planted in north-south rows utilizing mass transplanting techniques. Approximately 39,000 Goodding's willow, 45,000 Fremont cottonwood, and 76,000 coyote willow were planted in 40-inch wide rows with 5-feet in-line spacing. Check 2-1 will be intermixed with 220 honey mesquite (*Procopis glandulosa "torreyanna"*) and 8,100 Atriplex (*Atriplex lentiformis*), planted on approximately 12-foot centers.

Figure 2: As-Built of Phase 2

Rather than applying a cover crop such as alfalfa in Phase 2, furrows were created 40-inches apart. A furrow is a long, narrow, shallow trench made in the ground by a plow. Native seedlings were planted on the tops of each of the furrows.

Alfalfa seed was applied in June, at the application rate of 10 pounds/acre in an attempt to eventually keep out morning-glory and other invasive weeds. Cover crops had been used in Phase 1 in an attempt to keep out invasive species; however, morning-glory did infest many areas in that phase. Invasive weeds were controlled in Phase 2 with the application of a pre-emergent herbicide and by mechanically cultivating the furrows during the first year of growth.

These furrows were cultivated a total of four times during the summer in an attempt to control the morning-glory and other weeds. A cultivator is a farm implement pulled by a tractor used for stirring and pulverizing the soil to remove weeds and to loosen the soil after the crop has begun to grow. Utilizing a cultivator kept the furrows weed free until the trees were too tall for the tractor and cultivator to clear.

Treflan, a pre-emergent herbicide, was applied just prior to planting of Phase 2 to control grass and broadleaf weeds. However, during the 2008 growing season, morning-glory invaded approximately 25 acres of Phase 2, approximately 15 acres in Phase 1, and 5 acres in Phase 3.

2.2 Phases 1–3

In Phase 1, a total of 86 acres were planted during FY06, which converted cotton agricultural fields into a native plant nursery and cottonwood-willow (CW) land cover type. In Phase 2, a total of 67 acres were planted during FY08 and 100 acres for Phase 3 during FY07. Figures 3-5 depict current aerial views of each phase.

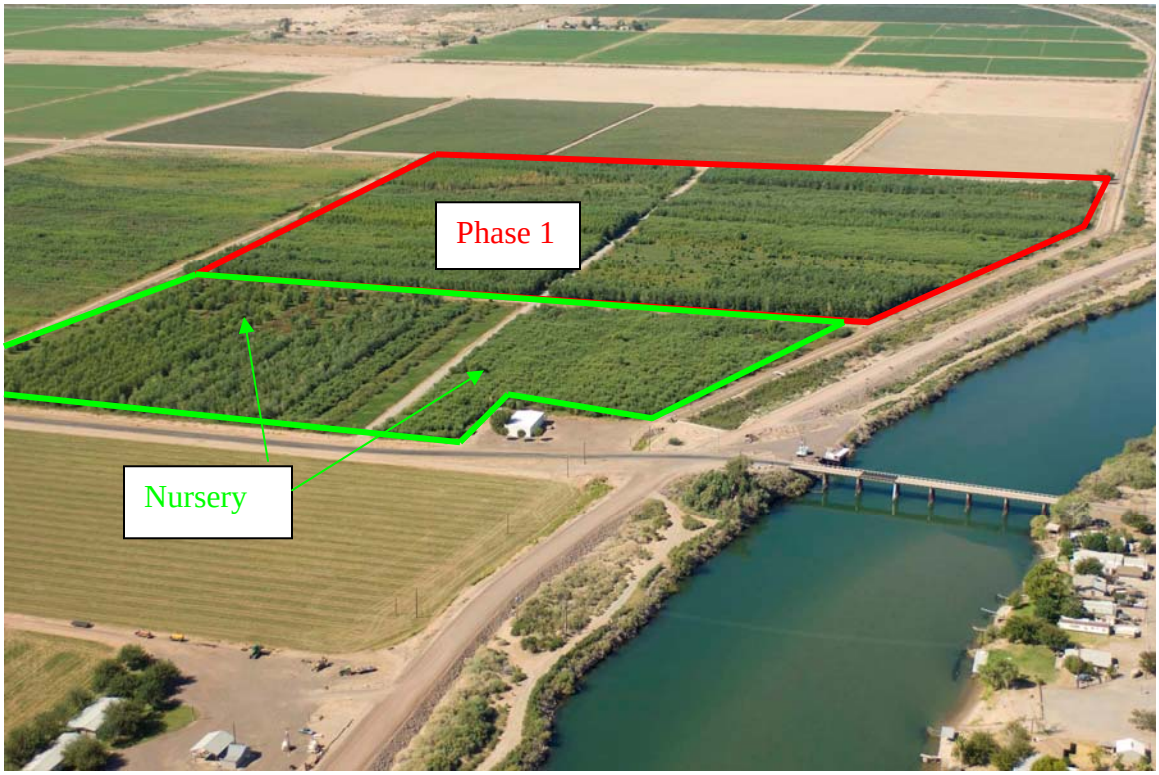


Figure 3: Aerial View of Phase 1 and Nursery

Figure 4: Aerial View of Phase 2

Figure 5: Aerial View of Phase 3

2.3 Ground Stabilization of Parcels 15 and 16

A 200-acre ground stabilization project, depicted in figures 6 and 7, which is located due west of phases 1 and 2, was initiated in fall of 2008. Blowing dust from adjacent barren fields causes environmental concerns for the neighboring farmers. In an effort to stabilize the soil, 80 acres will be planted with a mix of native seeds and sprinkler irrigated. The remaining 120 acres will be planted with a mesquite/*Atriplex* combination in the spring of 2009.

Figure 6: Ground Stabilization Area

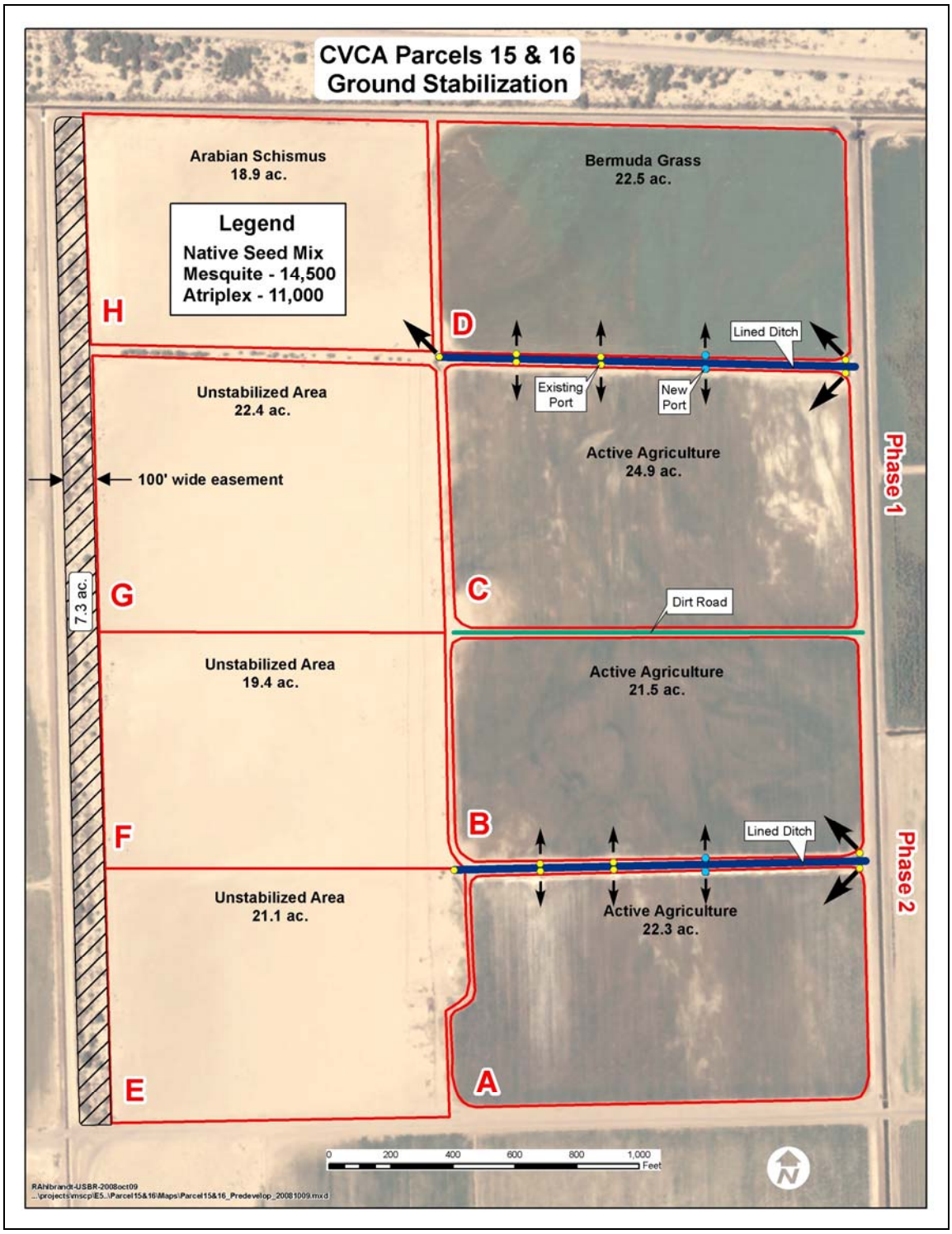


Figure 7: Ground Stabilization Site Map

2.3 Irrigation

Method

Flood irrigation was used to provide water to each field. Irrigation amounts applied in each phase were based on monthly invoices received by CVIDD. A crop consultant was contracted to recommend irrigation schedules and fertilizer applications. As a certified agronomist, he additionally conducted inspections, focusing on general plant health, evidence of disease, over-irrigation, under irrigation, water drainage, general nutrition, and insect and/or weed problems. Irrigation recommendations were sent directly to the contract farmer with specific irrigation regime instructions. During the growing season, the consultant tracked plant vigor by sampling and analyzing plant tissue for nitrogen levels and other nutrients as necessary. Reports were forwarded to Reclamation with recommendations for treatment, if needed.

Water Applied

Table 2 depicts the number of acre feet of water applied to each phase, by calendar year. These values are based on monthly invoices received by CVIDD.

Table 2: Irrigation Water Applied in 2008

	2006	2007			2008			
	Phase 1	Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3	Phase 4
	86 acres	86 acres	70 acres	101acres	86 acres	70 acres	101acres	60 acres
	af applied *	af applied *	af applied *	af applied *	af applied *	af applied *	af applied *	af applied *
March	0.00	96.40	0.00	145.16	94.76	53.84	102.07	0.00
April	111.11	82.11	15.99	91.59	53.02	71.18	12.38	0.00
May	80.93	75.42	28.91	76.33	157.45	17.80	160.97	36.49
June	146.07	87.62	25.01	110.47	157.54	66.93	86.17	0.00
July	151.84	152.75	31.71	125.92	232.15	38.48	91.41	33.60
August	141.46	120.23	57.90	113.27	172.53	51.85	136.85	0.00
September	147.78	195.02	0.00	152.39	106.23	37.49	80.03	0.00
October	84.10	26.38	0.00	9.39	3.70	0.00	39.29	0.00
November	31.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00
af/year	**894.72**	**835.93**	**159.52**	**824.52**	**977.37**	**337.56**	**709.18**	**70.10**
af/acre of phase	**10.40**	**9.72**	**2.28**	**8.16**	**11.36**	**4.82**	**7.02**	**1.17**

*af applied – represents the quantity of acre feet of irrigation water in acre feet applied to each phase.

The amount of water applied to the individual fields of phases 1 and 2 during 2008 is an approximation. During 2008 the irrigation system was modified, and it was difficult to measure the exact volume of water delivered to each of the adjacent fields.

When calculating the volume of water applied to each phase during 2008, it is most accurate to combine the volumes delivered to phases 1 and 2, as exactly how much water reached the individual phases is unknown.

2.3 Site Maintenance

There were no major improvements to this site with the exception of scheduled field maintenance. However, over the life of the program, additional site improvements are likely.

2.4 Management of Existing Land Cover

Weed Management

In May, ivyleaf morning-glory once again invaded the fields in Phases 1, Phase 2, and, to a smaller degree, Phase 3. The invasion was not as widespread as in the previous year. Several herbicides, including Caparol and Roundup, were tried unsuccessfully in prior years to control this aggressive plant. Field crews were also used in prior years to manually remove the morning-glory. In 2008, the decision was made not to disturb the ground surface, to allow the morning-glory to germinate naturally. Although engulfed with morning-glory, and pulled down to the ground, the native trees appear to recover in the next growing season without damage.

In addition to morning-glory, volunteer cotton has become an increasing problem. All phases to date were planted on fields that had previously been planted with cotton for years. These volunteer cotton plants, as mandated by Arizona state law, must be destroyed and removed each year by late January in an attempt to minimize the spread of the pink bollworm larvae. Reclamation is working in conjunction with the Arizona Cotton Research and Protection Council (ACRPC) in reference to the ongoing International Pink Bollworm Eradication Program. ACRPC's mission is to protect and maintain the viability of the Arizona cotton industry by conducting and sponsoring activities that provide growers with practical, economically sustainable technologies relating to cotton production or its protection. This includes programs of cotton pest control and/or eradication. ACRPC activities are funded through an annual assessment on each bale of cotton produced in Arizona.

Nursery Management

The species planted in the CVCWA native plant nursery include coyote willow, Goodding's willow, Fremont cottonwood, quailbush, and *Baccharis*. Most plants were planted 20 feet on center with alfalfa planted to provide ground cover. Cuttings were collected in December 2008 by Greenheart Nurseries for the upcoming planting.

University of Arizona

The University of Arizona was in the process of conducting a 3-year field experiment to evaluate the response of three native tree species to a variety of surface irrigation regimes and fertilization. As part of this activity, Phase 1 fields were thoroughly mapped using electromagnetic induction, which allows for spatial mapping of soil texture and salinity.

Whole plant measurements were made, including plant height, diameter, and leaf area index. During the growing season, leaf water potential and leaf gas exchange were to be measured monthly.

Unfortunately, during the internal review of the research agreement it was determined that the project had encountered certain field conditions that will not deliver the results as originally contemplated under the awarded agreement. The principal investigator from the university concurred, and as a result, the continuation of the research agreement was not in the best interest of either party and was therefore terminated.

3.0 FY08 Monitoring

Monitoring of Phase 1 for FY08 focused on pre-development, implementation monitoring, and species monitoring. 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 and habitat monitoring of vegetation, conducting post-development avian point counts, conducting post-development small mammal trapping, conducting post-development bat acoustic monitoring, and conducting species-specific monitoring for yellow-billed cuckoo and southwestern willow flycatcher. Abiotic and biotic habitat monitoring will be conducted in 2009, and the cavity nesting birds will be conducted once the vegetation reaches the proper conditions for these species. The sections below are organized by resource type and include a combination of both pre-development and post-development monitoring. A control site consisting of an agricultural alfalfa field is also being monitored concurrently as part of the Before-After-Control-Impact (BACI) monitoring design. Phases 1, 2, and 3 were agricultural fields before they were planted into cottonwood/willow land cover types.

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 five years (based on data) are needed in order to determine shifts in soil salinity and nutrients. Soil sampling was conducted on phases 1 and 3, and prior to planting on Phase 2 to determine fertilizer needs.

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 being closed in 1935. The river dynamically meandered, depositing primarily sand and silt across the floodplain. The soil conditions within Phase 2 consist of one major category, Indio Silt Loam, comprising 100% of the site. Phase 2 is also classified as Prime Farmland.

Methods

Soil samples were taken on February 20, 2008 in Phase 2 prior to planting to determine baseline soil moisture, salinity, textural classification, and nutrients (including nitrates, ortho-phosphate, and ammonia). Twenty-eight sample points, evenly distributed, were located throughout the site. Soils were analyzed by an independent laboratory for all the above stated parameters.

Soil samples were taken October 3, 2008 in phases 1, 2, and 3 to determine fertilizer needs. Nutrients including nitrates, ortho-phosphate, and potassium were determined and a fertilizer mix was recommended for each phase.

Results

Soil sample parameters were considered adequate for good establishment of trees with the exception of nitrogen and phosphorus (Table 3) in Phase 2. Fertilizer recommendations in February 2008 included an application of a precision blend of urea, 11-52-0, and zinc sulfate prior to planting.

Table 3: Soil analysis of 28 samples on Phase 2

Nutrient (range of 28 samples)	Feb 2008	Mean	Sufficiency Range[1]
Nitrate (NO_3-N) (ppm)	9.7-26.1	19.5	20.0-30.0
Phosphorus (PO4-P) (Olsen Meth.) ppm	3.9-16.2	8.6	10.0-20.0
Potassium (ppm)	96-281	198.6	80.0-180.0
Ece (dS/cm)	0.73-3.72	1.6	4.00-8.00
Saturation (SP%)	34.1-47.1	42.3	30-70%
Zinc (ppm)	0.79 – 1.88	1.27	1.00-3.00

1. Sufficiency Range provided by Stanworth Crop Consultants

Soil sampling and leaf sampling were conducted in October 2008 for all three phases. It was determined that phosphorus and potassium were at adequate levels for cottonwood and willow plants. Nitrogen was adequate in Phase 1 but low in phases 2 and 3. It was suggested to water run 10 gallons of UN-32/AC to increase nitrogen in those phases.

3.2 Vegetation

In 2008, vegetation was monitored using an updated protocol that was designed to characterize current plant community composition and structure, monitor changes in plant community composition and structure over time, and determine when vegetation components meet defined habitat criteria needed for accomplishment of LCR MSCP conservation measures.

Initial habitat creation efforts have been designed to provide information on potential habitat mosaics. In order to evaluate different planting mosaics, vegetation monitoring

plots are being established using a stratified random sampling design. Permanent repeatable plots will be established within each habitat type to evaluate change in plant communities over time.

Survivorship of planted materials

Survivorship was conducted for Phase 2 after first year growth. Methods for this were changed to reduce time of collection and analysis of data. Original densities of each tree species in each field were gathered as the trees were planted (see Section 2.0 of this report). Densities of overstory and intermediate trees were then determined for the first growing season based on vegetation plots conducted in October and November 2008. Twenty vegetation survey points were conducted on Phase 2, and densities for each field and species were determined. These were then compared to the densities after planting. Survivorship was determined based on comparison of these densities.

Vegetation monitoring plots

Vegetation monitoring protocols have been tested through the first two years of LCR MSCP implementation. A final protocol was developed and implemented in 2008 and was conducted at phases 1, 2, and 3 and include measurements for overstory trees, shrub and intermediate trees, ground cover, crown closure, and total vegetation volume. In 2008, 42 vegetation plots were established and measured in phases 1, 2, and 3. Phase 1 contained 8 plots, Phase 2 contained 20 plots, and Phase 3 contained 14 plots.

Methods

Overstory

Within a 26.3 foot (8.0 m) radius circle from plot center, every live tree measuring at least 4.5 feet (1.37 m) in height and 5.0 inches (12.7 cm) at Diameter at Breast Height (DBH), was measured and recorded by species, total height, and DBH. Trees between 16.4 feet (5.0 m) and 26.3 feet (8.0 m) from plot center and at least 4.5 feet (1.37 m) in height and 3.1 to 4.9 inches (8.0-12.6 cm) DBH, was tallied by species. Trees that branched below 4.5 feet (1.37 m) in height were considered separate individuals and were measured independently if they met the above criteria. The number of stems greater than 1.0 inches (2.5 cm) at DBH was estimated.

Shrubs and Intermediate Trees

Within a 16.4 foot (5.0 m) radius circle around plot center, all woody stem saplings and shrubs were recorded. Any individual at least 4.5 feet (1.37 m) in height and 3.1 inches (8.0 cm) DBH was measured and recorded by species, height, and DBH. Any stem at least 4.5 feet (1.37 m) in height but less than 3.1 inches (8.0 cm) DBH was tallied by species and DBH class.

DBH was recorded by size classes: Class 1= <0.4 inches (<1 cm), Class 2 = 0.4-1.0 inches (1-2.5 cm), Class 3 = 1.1-2.2 inches (2.6-5.5 cm), and Class 4 = 2.3-3.1 inches (5.6-7.9 cm). No DBH measurements were taken on trees less than 4.5 feet (1.37 m) in height; these were tallied by species only.

Ground Cover

The ground cover and herbaceous component of each site were estimated using the line-intercept method. Four 32.8-foot (10-m) lines were established from the center of each fixed plot in the four cardinal directions. The horizontal, linear length of each herbaceous plant that intercepts the transect line was measured and recorded by species. Areas along each transect that were covered by woody debris, bare ground, rock, or woody stem were measured and recorded as such.

Crown Closure

Crown closure, the measure of the horizontal canopy cover, was measured along the same line transects established to monitor ground cover. An estimate of canopy cover was made every 16.4 feet (5.0 m) using a spherical densitometer.

Total Vegetation Volume

Total vegetation volume (TVV) was measured to describe foliage height diversity by height class for each sample plot (Mills et al. 1991). Along the line transects established to monitor ground cover and crown closure, TVV was estimated every 16.4 feet (5.0 m) with a 7.5-meter survey rod extended through the canopy. TVV was estimated for each meter height class throughout the stand and for the entire site.

Results

There were 14 plots surveyed in CVCWA Phase 2 that were in the first year of growth. No trees taller than 4.5 feet and larger than 3.1 inches in DBH were present in any of the plots. The actual planting plan of CVCWA is presented in Table 4. Average density for all of Phase 2 was 2,907 trees/acre after planting. Average density after the first year's growth was 1,108 trees/acre. Average overall height was 4.29 m and average overall DBH was 9.56 cm (4.35 inches) after the first growing season. The total density numbers are equal to the numbers in the shrub and intermediate trees section because no large overstory trees were present in the plots (Table 5).

Table 4: Phase 2 Actual Planting Plan

Check #	2-1	2-2	2-3	2-4	2-5	2-6	2-7	2-8	2-9	2-10
Acres	6.3	6.2	6.2	6.4	6.4	6.3	6.4	6.5	6.5	7.2
# Trees planted	8,136	23,280	18,800	19,008	20,736	19,008	20,304	21,600	17,400	27,994
Density Trees/acre	1,291	3,582	2,892	2,837	3,095	2,880	3,030	3,176	2,559	3,733

Table 5: Phase 2 Densities

CVCWA 2 Habitat Type	*Tree Density*		*Total Ground Cover*		*Crown Closure*	
	Avg	**SE**	**Avg**	**SE**	**Avg**	**SE**
Mesquite/Atriplex	450	450	94.1%	2.1%	5.9%	3.2%
Goodding's willow/cottonwood	1,813	537	71.5%	16.6%	59.6%	14.2%
Coyote willow/Goodding's willow	1,113	426	95.0%	1.9%	37.4%	7.7%
Coyote willow/cottonwood	850	206	89%	9.3%	31.2%	11.2%
All Planted Habitats	**1,108**	**221**	**88.3%**	**20.1%**	**36.8%**	**6.0%**

Vegetation Habitat Monitoring

A total of eight vegetation plots were established in Phase 1, including two in Goodding's willow, two in coyote willow, two in cottonwood, and two within areas treated for morning-glory. A total of 14 vegetation monitoring plots were established throughout Phase 3, with two plots in each planting regime: cottonwood, Goodding's willow, coyote willow, cottonwood/Goodding's willow mix, *Baccharis*, and cottonwood-coyote willow mix. Average height and DBH for Phase 1 is 7.6 m and 19.6 cm, respectively. Average height and DBH for Phase 3 is 6.9 m and 15.1 cm, respectively. Average height and DBH for phases 1 and 3 by habitat type are summarized in tables 6-9. The total number of trees per acre, total vegetative ground cover, and crown closure for phases 1 and 3 are summarized in tables 6-9.

Table 6. Average height and DBH for Phase 1 overstory by habitat type and by phase

Habitat	Species	# of trees	avg height (m)	SD	SE	avg DBH (cm)	SD	SE
Morning-glory treated area	cottonwood	25	7.0	0.8	0.2	15.6	1.7	0.3
Cottonwood	cottonwood	42	8.8	1.6	0.2	28.6	9.3	1.4
Coyote Willow	coyote willow	4	5.2	0.3	0.1	13.5	0.6	0.3
Goodding's Willow	goodding's willow	55	9.3	0.8	0.1	20.7	5.5	0.7

Table 7. Average height and DBH for Phase 3 overstory by habitat type and by phase

Habitat	Species	# of trees	ave height (m)	SD	SE	avg DBH (cm)	SD	SE
Goodding's willow-cw	cottonwood	7	7.0	0.24	0.09	13.9	0.89	0.34
Goodding's willow	Goodding's willow	32	6.7	0.49	0.09	13.9	0.92	0.16
Coyote willow	Goodding's willow	1	6.9	n/a	n/a	15.5	n/a	n/a
Cottonwood	cottonwood	10	6.4	0.44	0.14	13.5	0.58	0.18
Baccharis	cottonwood	5	7.7	0.60	0.27	18.6	4.39	1.96

Table 8. Tree density, total ground cover, and crown closure by habitat type and all of Phase 1

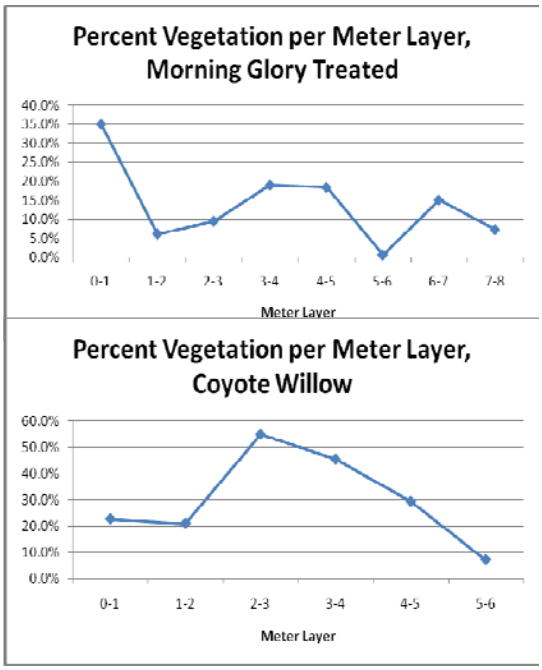
CVCWA 1 Habitat Type	*Tree Density*		*Total Ground Cover*		*Crown Closure*	
	Avg	**SE**	**Avg**	**SE**	**Avg**	**SE**
Morning-glory treated area	775	125	70.1%	21.1%	58.6%	38.7%
Cottonwood	420	20	18.8%	18.8%	86.6%	3.8%
Coyote Willow	7665	1915	73.1%	26.9%	95.2%	4.8%
Goodding's Willow	775	695	66%	33.8%	85.6%	14.4%
All Planted Habitats	**650**	**1211**	**57.1%**	**12.9%**	**81.5%**	**9.5%**

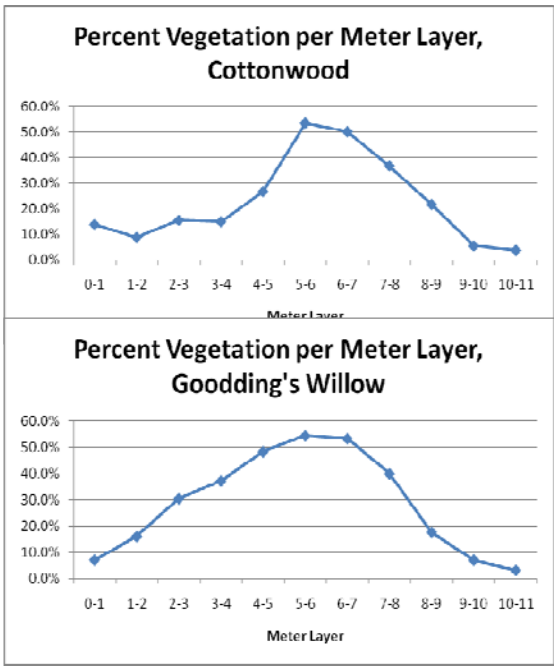
Table 9. Tree density, total ground cover, and crown closure by habitat type and all of Phase 3.

CVCWA 3 Habitat Type	*Tree Density*		*Total Ground Cover*		*Crown Closure*	
	Avg	**SE**	**Avg**	**SE**	**Avg**	**SE**
Goodding's willow/cw	2420	170	81.4%	18.6%	84.2%	9.8%
Goodding's willow	1520	35	65.0%	21.8%	98.0%	2.0%
Coyote willow-cottonwood	9350	2300	91.1%	4.2%	77.6%	1.1%
Coyote willow	4135	2335	100%	0.0%	34.8%	25.2%
Cottonwood	1775	75	52.0%	48.0%	95.3%	2.3%
Baccharis	9750	9630	100.0%	0.0%	46.5%	2.4%
All Planted Habitats	**4838**	**1625**	**81.6%**	**15.4%**	**72.8%**	**8.0%**

Total Vegetation Volume and species composition for phases 1 and 3 are presented in figures 8-11 below.

Figure 8: Vegetation Volume by Habitat Type in Phase 1





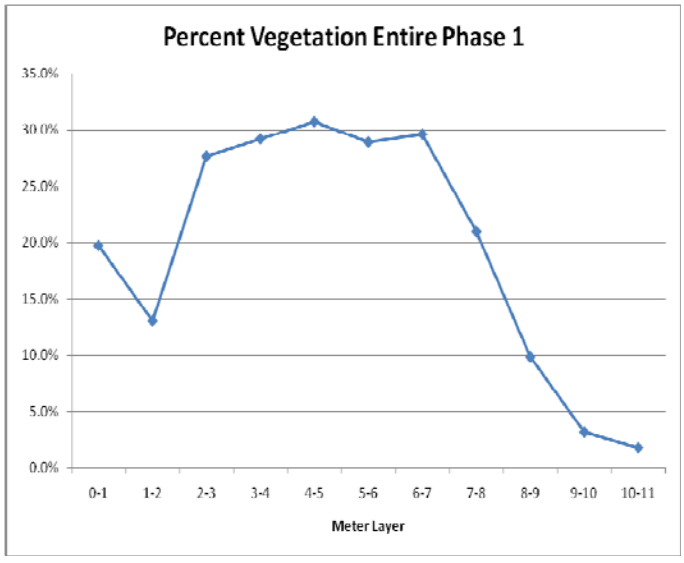


Figure 9: Species Composition of Entire Phase 1

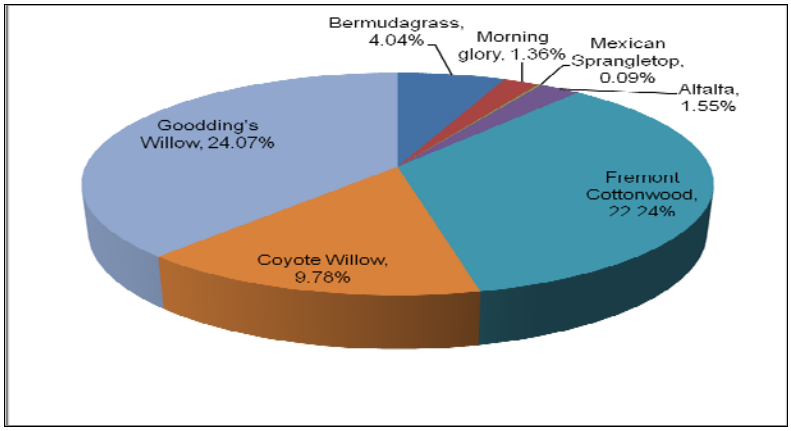


Figure 10: Species Composition of Entire Phase 3

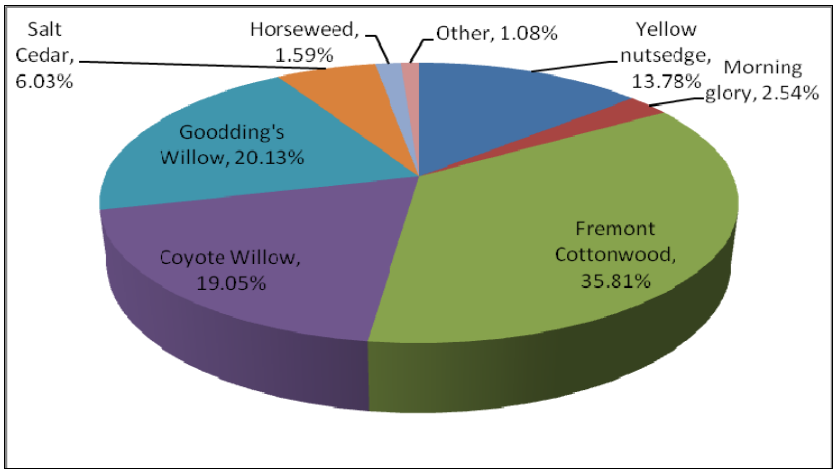
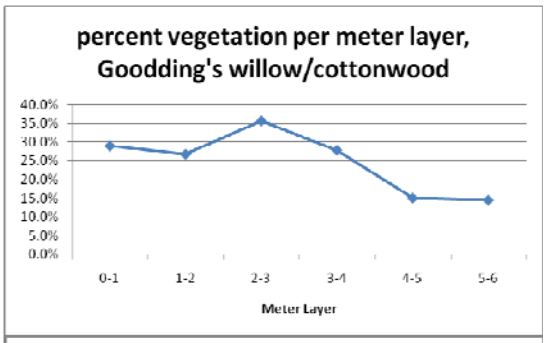
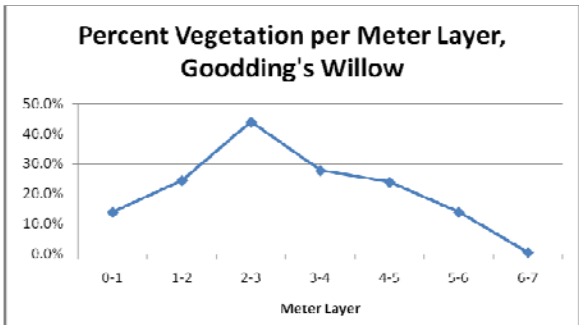
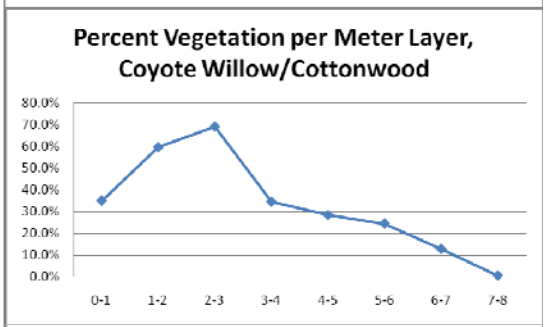
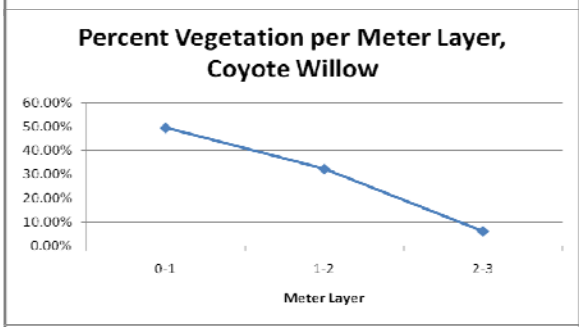


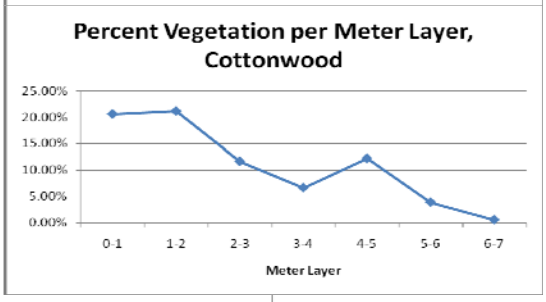
Figure 11: Total Vegetation Volume by Habitat Type for Phase 3, and for Entire Phase 3

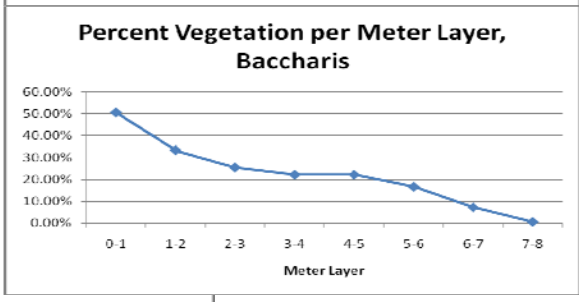


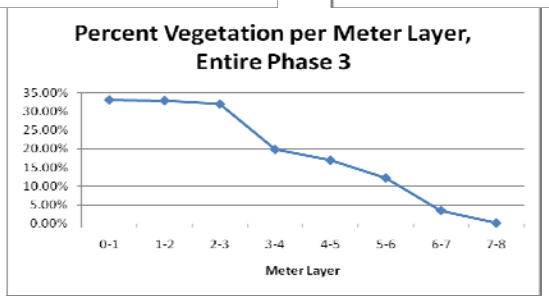












Discussion
This is the first year vegetation has been surveyed using this protocol; therefore, not enough data has been collected yet to compare results with those being gathered for individual covered species, such as the southwestern willow flycatcher.

The methods used to determine density of planted areas may lack the sensitivity to detect some species that are planted sparsely, plants with little foliage, or plants that are hidden by surrounding grasses or exotic species. Portions of Phase 2 were covered with morning-glory; thus, density may be under represented.

3.3 Small Mammals

Background
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. Based on presence-absence survey results of small mammal trapping conducted since 2004, trapping is now focusing on habitat patches similar to what is present where cotton rats have been located (Dodge 2006, Calvert 2007). For *Sigmodon arizonae plenus*, this includes a dense herbaceous understory dominated by tall grasses where cotton rats can create runways. In 2007 and 2008, trapping to collect data on areas prior to their conversion from agriculture to riparian cover types was conducted. Fallowed cotton fields and actively farmed alfalfa fields were surveyed for small mammals (Calvert 2007, Calvert 2008 in prep). No cotton rats were documented utilizing either of these pre-development cover types.

Methods
A general description of methods for all small mammal trapping can be found in Calvert (2007). Methods specific to CVCWA are described here. Presence/absence surveys were conducted on February 26, 2008 for Phase 1 and Phase 3, and on December 9-11, 2008 on phases 1, 2, and 3, and the control site. General presence/absence survey trapping protocol was based on Wilson et al. (1996). Trapping was conducted at night in order to capture nocturnal small mammals utilizing the site. Traps were placed in parallel, linear transects of approximately 150 meters in length. A trap station was located at every 10 meters along transect with one trap located at each trap station. A trap night is equal to one trap set out for one night of trapping.

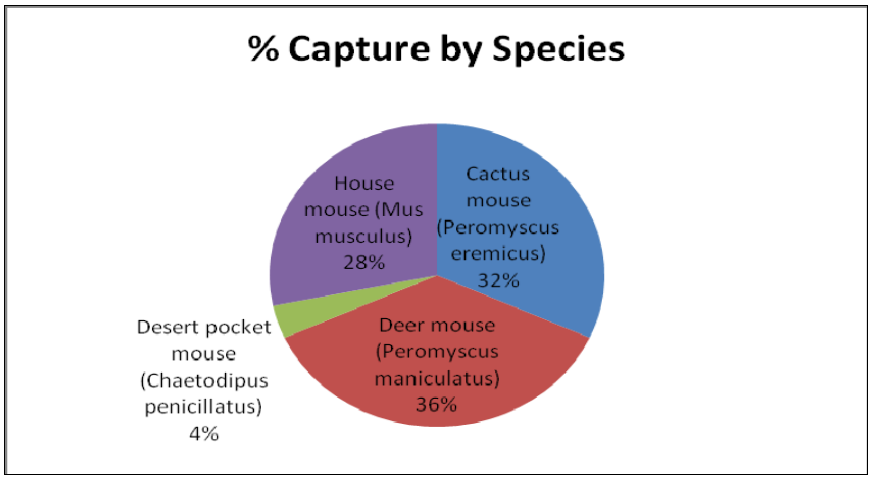
Results
A total of 1,155 trap nights were conducted during 2008 on phases 1, 2, and 3, and the control site. During the spring survey only one cactus mouse (*Peromyscus eremicus*) was captured on Phase 1, and two deer mice (*Peromyscus maniculatus)* and two cactus mice were captured on Phase 3. During December 2008, three small mammals were captured on Phase 1, 47 were captured on Phase 2, 30 were captured on Phase 3, and 0 were captured on the control site. No LCR MSCP small mammal species were trapped at any of the phases or the control site.

A breakdown of the trap nights and captures is included in Table 10. Total capture rates by phase and by species are presented in Figure 12. For additional details see *Small Mammal Trapping Report 2008.*

Table 10: Capture rates by phase and by species for CVCWA in 2007

Species	Phase 1	Phase 2	Phase 3	Control	Totals
Cactus mouse (*Peromyscus eremicus*)	1	7	19	0	27
Deer mouse (*Peromyscus maniculatus*)	2	16	13	0	31
Desert pocket mouse (*Chaetodipus penicillatus*)	0	2	1	0	3
House mouse (*Mus musculus*)	1	22	1	0	24
Totals	4	47	34	0	85
# of Traps	450	150	450	105	
Capture %	0.9%	31.3%	7.6%	0.0%	7.4%

Figure 12: Percent capture by species



Discussion

Although no LCR MSCP covered small mammal species were trapped at CVCWA in 2008, there has been an increase in capture rates since 2006. Small mammals are re-colonizing the site, and exotic house mice are decreasing while deer mice and cactus mice are increasing.

3.4 Bats

Methods

Up to 12 Anabat bat detectors were deployed two nights quarterly from dusk to dawn within a given habitat creation area for a total of four surveys (eight nights) per year. Bat detectors record the echolocation calls a bat makes as it passes by the detector. The minimum frequency, duration, and shape of each call are compared with reference calls to identify bats to species or species group (Table 11). These calls are then converted into the number of minutes that each species/species group is recorded, which is then used to create activity indices. These indices are a proportion of bat minutes per species/species group divided by the total number of bat minutes. Two metrics are given in this report to characterize bat use of the riparian restoration and adjacent habitats: total number of bat minutes for the four covered and evaluation species, and indices of relative bat activity for all species/species groups. For a thorough overview of all bat activity within each habitat creation area see Broderick (in press).

Table 11: All species and species groups for bats identified at habitat creation areas.

Common Name	Scientific Name	Species Code
Individual Species		
Pallid bat	*Antrozous pallidus*	Anpa
Townsend's big-eared bat	*Corynorhinus townsendii*	Coto
Western red bat	*Lasiurus blossevillii*	Labl
Yellow bat	*Lasiurus xanthinus*	Laxn
California leaf-nosed bat	*Macrotus californicus*	Maca
Hoary bat	*Lasiurus cinereus*	Laci
Pocketed free-tailed bat	*Nyctinomops femorosaccus*	Nyfe
Mastiff bat	*Eumops perotis*	Eupe
Western pipistrelle	*Parastrellus hesperus*	Pahe
Cave Myotis	*Myotis velifer*	Myve
Species Groups:		
20 Khz	Overlapping calls of Nyfe, Nyma, Laci, Tabr	
25-30 Khz	Overlapping calls of Epfu, Tabr, Anpa	
35 Khz	Various calls at 35 khz primarily Anpa, Myve, Laxa	
40 Khz	Primarily Myve	
45-55 Khz	Overlapping calls of Myca, Myyu, and some Pahe	
Species included in the groups listed above:		
Big brown bat	*Eptesicus fuscus*	Epfu
Mexican free-tailed bat	*Tadarida brasiliensis*	Tabr
California myotis	*Myotis californicus*	Myca
Yuma myotis	*Myotis yumanensis*	Myyu

Results

Exploratory surveys following the sampling protocol established in 2007 were continued at CVCWA during the October 2007 and February 2008 sampling periods. A new sampling protocol was established in early 2008, which focused sampling on three young

cottonwood stands in Phase 1 and Phase 3, two non-treated agricultural fields, and two young mesquite stands for the April and July 2008 sampling periods. The mesquite habitat, however, became problematic mid-way through sampling as one of the Phase 3 mesquite stands failed and was cleared and a Phase 4 mesquite habitat was not due to be planted in a reasonable time frame for the post-development bat monitoring effort. The mesquite habitat monitoring sites were moved to the Cibola National Wildlife Refuge Farm Unit #1 during the FY09 sampling.

The young cottonwood-willow stands at CVCWA exhibited phenomenal growth during FY08. While this was a desireable situation from a habitat perspective, it became problematic for acoustic bat sampling. An extraordinary amount of cicada and cricket noise occurred over the entire night during warm weather periods, resulting in some data loss. Additionally, finding optimal positions for the Anabat detector locations as the stands grew rapidly became problematic. Sampling along the edges of the stands captures a somewhat different set of bats than sampling in the interior of a stand. Additionally, the stands were extremely dense, rendering sampling within stands difficult. Experimentation during the fall of 2008 resulted in developing a sampling protocol that elevates detectors up to 40 ft above the canopy, while maintaining the location and aspect. This serves the dual purpose of reducing insect noise interference and lessening the edge effect.

In spite of some fairly significant data losses due to insect noise, 19,722 call files were obtained during 41 detector nights in eight CVCWA monitoring sites. The call files were edited and identified to species or species group. Bat minutes were calculated for each species and species group. A total of 121 bat minutes were recorded for the four covered bat species, the majority of which were California leaf-nosed bats.

Total Number of Bat Minutes for Covered and Evaluation Species

No minutes of bat activity were recorded for the western red bat or Townsend's big-eared bat during any season or habitat during FY08 (Figures 13 and 15). Three minutes of activity were recorded in agricultural sites for the western yellow bat in July (Fig. 14). Eleven minutes of bat activity were recorded for the California leaf-nosed bat in restoration sites in July and 4 minutes were recorded in October (Fig. 16). One minute was recorded in April and 1 minute was recorded in July in agricultural habitat. The fairly significant data losses due to insect noise may have influenced these results.

Seasonal habitat use of riparian and adjacent habitats by the four covered and evaluation bat species for the Cibola Valley Conservation Area

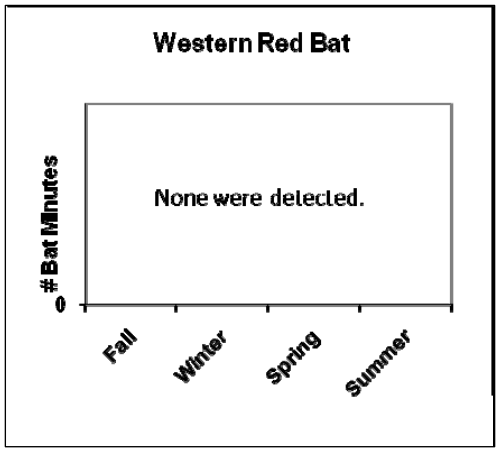


Figure 13 . Western red bat.

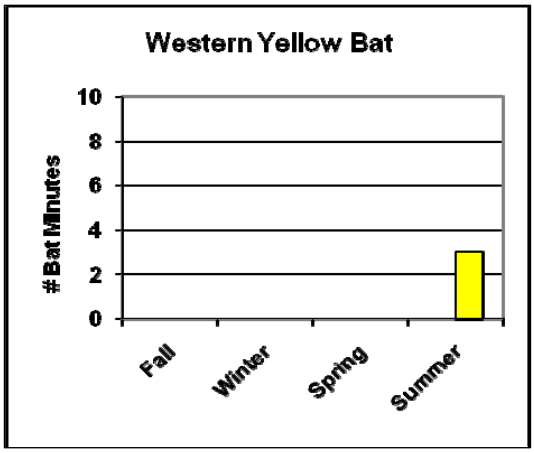


Figure 14 . Western yellow bat.

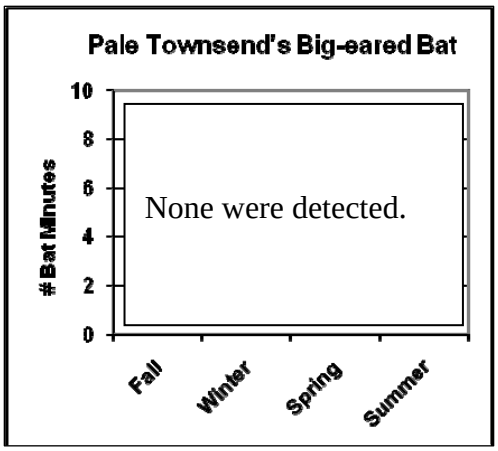


Figure 15. Pale Townsend's big-eared bat.

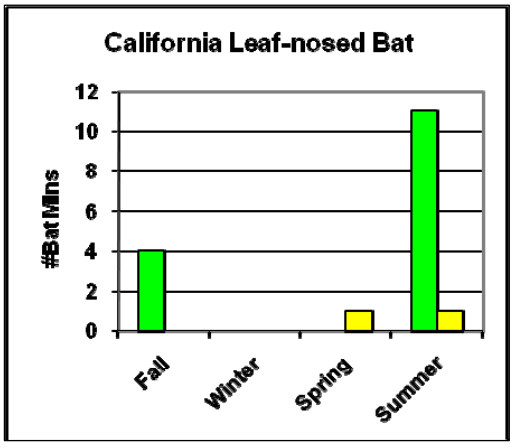


Figure 16. California leaf-nosed bat.

Legend:

Riparian Restoration Sites

Agriculture

Index of Relative Bat Activity

An index of relative bat activity was developed for riparian restoration sites and for the adjacent habitats using the total number of bat minutes for each species and phonic group (Table 12). Western pipistrelles, and the 25-30 Khz and 45-55 Khz phonic groups, comprised the highest percentages of the overall bat community for the riparian restoration sites. The mastiff bat (Eupe) and cave myotis (Myve) comprised 2.7% of the bat activity in restoration sites. California leaf-nosed bats comprised the sixth-highest percentage for the restored sites (1.5%) and the ninth-highest for adjacent habitats

(0.2%). Western red bats were not detected at the restoration sites or the adjacent habitats. Western yellow bat minutes comprised 0.4% of the adjacent habitats, with none being recorded for the restoration sites. Townsend's big-eared bat minutes made up 0.2% of the relative abundance for restoration sites and none were recorded for adjacent habitats.

Table 12. Index of relative bat activity for riparian restoration sites compared with adjacent habitat sites for the Cibola Valley Conservation Area.

Restoration		Adjacent Habitats	
	%		%
25-30Khz	38.8	25-30Khz	37.6
45-55Khz	37.0	Pahe	31.3
Pahe	14.7	45-55Khz	27.4
Eupe	2.7	Myve	1.5
Myve	2.7	Nyfe	0.9
Maca	1.5	20Khz	0.4
20Khz	1.4	Laxa	0.4
Nyfe	0.7	Laci	0.2
Laci	0.4	Maca	0.2
Coto	0.2	Coto	0.0
Labl	0.0	Eupe	0.0
Laxa	0.0	Labl	0.0

Discussion

Bat use has increased throughout all phases. Future monitoring may include a stationary acoustic monitoring system placed in either Phase 1 or Phase 3 for year-round monitoring of bat activity. This will give an indication of how much the site is utilized by these species. Also, this site may be included in the netting of bats in order to determine better use by red and yellow bats. Netting, in association with acoustics, has been helpful in further locating exact usage of the site, and has indicated that open corridors through the habitat are utilized by bats for foraging.

3.5 Birds

Three types of avian surveys were conducted at CVCWA. General avian surveys were conducted for the other six LCR MSCP avian covered species and all non-covered avian species. Single species surveys were conducted for the SWFL and YBCU.

3.5.1 Avian Surveys

In 2007, a system-wide avian survey was implemented in order to develop a baseline inventory of bird populations within the LCR MSCP area (Bart and Manning 2008). Within this overall study plan, data for CVCWA has been summarized here. Complete data for the LCR and more detailed methods and results will be available in the report

entitled, *System Monitoring for Riparian Obligate Avian Species (Work Task D6) and Avian Use of Restoration Sites (Work Task F2)* (GBBO 2008, in prep).

Methods

Two types of surveys were used for avian monitoring based on the age of habitats at CVCWA. Rapid area search surveys were conducted on pre-development plots (agricultural or unplanted fields) or plots planted with cottonwood and willow (*Populus fremontii*/*Salix* spp.) trees in their first year of growth. This type of survey included two visits to each site and results in an index of relative abundance (GBBO 2008). Results of rapid area searches are reported here as an average of detections per survey. Intensive area search surveys were conducted on post-development plots (i.e., cottonwood and willow habitat in at least the second year of growth). Eight visits were made to each intensive area search plot and all bird activity was recorded. Outcomes from intensive area searches resulted in an unbiased density estimate for breeding birds and an index of abundance for non-breeding birds (GBBO 2008). Due to the small numbers detected, breeding birds are reported as pairs per survey rather than densities. Information on the determination of breeding status and other methods can be found in GBBO (2008).

Rapid surveys were conducted on Phase 2 as it was in its first growing season. Rapid surveys were also conducted on phases 5 and 6 as they are still in agriculture and considered pre-development. Intensive surveys were conducted post-development on phases 1 and 3, as Phase 1 was in its third growing season and Phase 3 was in its second growing season.

Results

Pre-development and first year monitoring. Two rapid area search surveys were conducted at CVCWA Phase 5 (5 June and 23 June) and Phase 6 (4 June and 23 June) during the breeding season of 2008. An average of 67 birds per survey were detected. Eight species were detected; the red-winged blackbird (*Agelaius phoeniceus*) was the most abundant (GBBO 2008).

Two rapid area search surveys were conducted at CVCWA Phase 2 (April 30 and June 18) during the breeding season of 2008. An average of 83 birds per survey was detected. Sixteen species were detected; the red-winged blackbird and house finch (*Carpodacus mexicanus*) were the most abundant (GBBO 2008).

Post-development monitoring 2nd year of growth and older. Eight intensive area search surveys were conducted at CVCWA phases 1 and 3 at each plot (May 3 to June 29) during the breeding season of 2008. There were 59 pairs of birds comprising 12 species detected breeding at these phases. One LCR MSCP covered species, the Sonoran yellow warbler (*Dendroica petechia sonorana*) was detected breeding at these phases. The blue grosbeak (*Passerina caerulea*) was the most abundant species detected (Table 13) (GBBO 2008). There was an average of 140 birds per survey detected at phases 1 and 3 that were not breeding at these phases (GBBO 2008). A complete species list of all birds found at CVCWA during all surveys is in Table 14 (GBBO 2008).

Table 13. Number of breeding pairs detected during intensive area search surveys, per species, at CVCWA phase 1 (85 ac (34 ha)) and 3 (101 ac (41 ha)), breeding season 2008 (GBBO 2008).

Species	Number of Territories	Species	Number of Territories
Phase 1		Gambel's quail	1
song sparrow	13	western kingbird	1
blue grosbeak	11	white-winged dove	1
Abert's towhee	5	**Phase 3**	
Bullock's oriole	3	blue grosbeak	6
house finch	4	Abert's towhee	4
common yellowthroat	2	mourning dove	1
mourning dove	2	song sparrow	1
Sonoran yellow warbler	3	white-winged dove	1

Table 14. Species list of all birds found during all surveys at CVCWA

Common Name	Scientific Name
American kestrel	*Falco sparverius*
Gambel's quail	*Callipepla gambelii*
killdeer	*Charadrius vociferus*
black-necked stilt	*Himantopus mexicanus*
white-winged dove	*Zenaida asiatica*
mourning dove	*Zenaida macroura*
Inca dove	*Columbina inca*
greater roadrunner	*Geococcyx californianus*
great-horned owl	*Bubo virginianus*
lesser nighthawk	*Chordeiles acutipennis*
black-chinned hummingbird	*Archilochus alexandri*
Anna's hummingbird	*Calypte anna*
ladder-backed woodpecker	*Picoides scalaris*
olive-sided flycatcher	*Contopus cooperi*
western wood-pewee	*Contopus sordidulus*
willow flycatcher	*Empidonax trailii*
pacific-slope flycatcher	*Empidonax difficilis*
ash-throated flycatcher	*Myiarchus cinerascens*
western kingbird	*Tyrannus verticalis*
Arizona Bell's vireo	*Vireo bellii arizonae*
warbling vireo	*Vireo gilvus*
horned lark	*Eremophila alpestris*
northern rough-winged swallow	*Stelgidopteryx serripennis*
bank swallow	*Riparia riparia*
verdin	*Auriparus flaviceps*
black-tailed gnatcatcher	*Polioptila melanura*
European starling	*Sturnus vulgaris*
Lucy's warbler	*Vermivora luciae*
Sonoran yellow warbler	*Dendroica petechia sonorana*
yellow warbler	*Dendroica petechia*
yellow-rumped warbler	*Dendroica coronata*
Townsend's warbler	*Dendroica townsendi*

Table 14 cont.

Common Name	Scientific Name
common yellowthroat	*Geothlypis trichas*
Wilson's warbler	*Wilsonia pusilla*
yellow-breasted chat	*Icteria virens*
summer tanager	*Piranga rubra*
western tanager	*Piranga ludoviciana*
Abert's towhee	*Pipilo aberti*
song sparrow	*Melospiza melodia*
white-crowned sparrow	*Zonotrichia leucophrys*
blue grosbeak	*Passerina caerulea*
dickcissel	*Spiza americana*
red-winged blackbird	*Agelaius phoeniceus*
western meadowlark	*Sturnella neglecta*
yellow-headed blackbird	*Xanthocephalus xanthocephalus*
great-tailed grackle	*Quiscalus mexicanus*
brown-headed cowbird	*Molothrus ater*
Bullock's oriole	*Icterus bullockii*
house finch	*Carpodacus mexicanus*

3.5.2 Southwestern Willow Flycatcher Surveys

Methods

To elicit responses from willow flycatchers (*Empidonax traillii*), conspecific vocalizations from previously recorded SWFLs were broadcast during the 2008 breeding season. Surveys were performed according to established methods from Sogge et al. (1997), and a five-survey protocol was followed as recommended by the U.S. Fish and Wildlife Service (USFWS 2000). One survey was completed between 15 and 31 May, at least one survey was completed between 1 and 15 June, and three additional surveys were completed between 16 June and 25 July. Surveys were separated by a minimum of 5 days whenever logistically possible. Field personnel conducted surveys within the habitat wherever possible, using a portable CD or MP3 player coupled with a mini-speaker. Biologists performed surveys beginning one-half hour before sunrise and ending by 09:00 a.m. Surveyors stopped every 98-131 ft (30-40 m) and broadcast willow flycatcher primary song (*fitz-bew*) and calls (*breets*). If a willow flycatcher was observed and did not respond to the initial song and call, other territorial calls (*breets, creets, wee-oos, whitts*) were played. Surveyors recorded all willow flycatchers observed visually and audibly, behavioral activities, and location. If territories were established or pairs observed, nest searches were conducted. Biologists utilized standard detection forms to record observations. The presence of brown-headed cowbirds (*Molothrus ater*), water, and moist soils were noted during all surveys.

Results

Two willow flycatchers were detected at CVCWA on 18 June. These individuals likely were migrants and were not detected on subsequent visits to the site. SWCA environmental consultants surveyed the project five times, totaling 8.3 observer-hours,

and large flocks of brown-headed cowbirds were detected on all surveys (McLeod et al. 2008).

Discussion

Phase 1 of CVCWA was surveyed for willow flycatchers for the first time in 2008. The stands are relatively young, and were watered to maintain moist soil throughout the southwestern willow flycatcher breeding season. Future surveys will continue for this species in 2009, and will be expanded to include Phase 3.

3.5.3 Yellow-billed Cuckoo Surveys

Methods

Yellow-billed cuckoos were surveyed on five dates at CVCWA between 10 June and 29 August 2008. The survey involved using a tape-playback method in which surveyors broadcast a recorded cuckoo call at pre-determined intervals along a pre-determined route within appropriate riparian habitat. Complete results of all surveys conducted on the LCR in 2008 will be available in the 2008 Yellow-billed Cuckoo Report.

Results

Results for the presence/absence surveys of cuckoos at CVCWA are listed in Table 15.

Table 15: Cuckoo Survey Results

Date/# Cuckoos	Date/# Cuckoos	Date/# Cuckoos	Date/# Cuckoos	Date/# Cuckoos
11 June/0	24 June/4	15 July/2	6 August/4	29 August/4

Nesting was documented at three locations within CVCWA. One nest with three eggs was found on 15 July. All three eggs hatched and all three hatchlings fledged successfully. The nest tree was a cottonwood with a height of 10.5 m and a Diameter at Breast Height of 10 cm. The nest was located at a height of 2.7 m. This nest was found in Phase 1, which was planted in spring 2007. Use of this early successional habitat by cuckoos is surprising, as they are more typically found in mature stands of cottonwood.

A second nest with two eggs was found on 6 August in very close proximity to the first nest, and was believed to belong to the same nesting pair of cuckoos. One egg hatched, but the nest was depredated shortly after, resulting in no successful fledglings.

A second pair of adult cuckoos was repeatedly seen in Phase 2 throughout the breeding season. Phase 2 is approximately 700 meters from Phase 3. These birds were observed at the same time the pair in Phase 3 was being watched, confirming it was indeed a separate pair. Although no nest was found, nesting was confirmed by the observance of an approximately 2-week-old fledgling and an adult on July 8. Several attempts were made

to capture cuckoos at CVCWA for the purpose of attaching radio tags, but none were successful.

Discussion

Phase 1 of CVCWA was surveyed for yellow-billed cuckoos for the first time in 2008. The stands are relatively young, and were watered to maintain moist soil throughout the cuckoo breeding season. This was the first time cuckoos have nested in an LCR MSCP creation site. Future surveys will continue for this species in 2009, and will be expanded to include Phase 3.

4.0 Established Land Cover and Habitat Credit

The process for Habitat Credit has not been finalized. Once the process is finalized, information in this section will be utilized to establish credit.

The land cover for Phase 1 is cottonwood-willow III, as defined by Anderson and Ohmart (1976, 1984). The cottonwood-willow III structure type is described as having one layer of vegetation with the bulk of the volume between 2 m and 6 m (6.5 ft and 20 ft) tall. Phase 2 and Phase 3 land cover classification is 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 ft and 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.

It is assumed that 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 phases 1, 2, and 3, specific habitat objectives, design, and management criteria are in the

process of being refined. The elements considered for 2009 planting of Phase 4 included, but were not limited to the following:

- The ground will be prepared for planting by disking, laser leveling, and creating furrows in preparation for hand planting of 1-gallon potted mesquites.
- Smaller *Atriplex* plants will also be hand-planted between the mesquite.
- *Atriplex* will be planted in furrows with a plant in-line spacing of 15 feet and a furrow row spacing of 18 feet wide.
- This wide furrow spacing saves irrigation water and allows for a tractor to disk invasive saltcedar, weeds, and volunteer cotton that grow between the planted furrows. A cover crop will not be applied.
- A consultant will be utilized to take soil samples, and recommend irrigation schedules and fertilizer applications. During the growing season, the consultant will track plant vigor by sampling and analyzing plant tissue for nitrogen levels and other nutrients as necessary.

5.2 Operations and Maintenance

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

5.3 Management of Existing Habitat/Vegetation

The first year is primarily dedicated to allowing the young transplants to grow and mature as fast as possible. 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 in order to determine the required amount of irrigation water
- Controlling unexpected invasive infestations, whether it is 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 at least annually or as required.

5.5 Water Management

Irrigation water will continue to be applied as determined by Reclamation or contracted crop consultants. Monitoring 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 CVCWA 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 CVCWA 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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