



Lower Colorado River Multi-Species Conservation Program

Balancing Resource Use and Conservation

Palo Verde Ecological Reserve Fiscal Year 2013 Annual Report



May 2017

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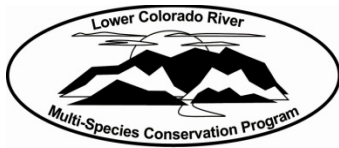
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Lower Colorado River Multi-Species Conservation Program

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ACRONYMS AND ABBREVIATIONS

CDFW	California Department of Fish and Wildlife
COB	confirmed breeding territory
CRCR	Colorado River cotton rat (<i>Sigmodon arizonae plenus</i>)
FY	fiscal year
HCP	Habitat Conservation Plan
LCR MSCP	Lower Colorado River Multi-Species Conservation Program
PRB	probable breeding territory
POS	possible breeding territory
PVER	Palo Verde Ecological Reserve
PVID	Palo Verde Irrigation District
Reclamation	Bureau of Reclamation

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1.0 INTRODUCTION

This annual report summarizes all activities that have occurred at the Palo Verde Ecological Reserve (PVER) from October 1, 2012, through September 30, 2013, Federal fiscal year (FY) 2013, and projected activities for FY14. Water usage is presented for the calendar year, January 1 through December 31, 2013, consistent with water accounting reporting.

1.1 Background

The PVER encompasses 1,352 acres of the historical flood plain of the Colorado River near Blythe, California. Formerly, the property was known as the Riverview Ranch and was owned by the Travis family. The ranch was acquired by the Trust for Public Lands in 2004 to offset degradation of wildlife habitat along the lower Colorado River. On September 3, 2004, the property was conveyed to the State of California. California identified up to 1,300 acres of active agricultural lands on this property for habitat restoration under the Lower Colorado River Multi-Species Conservation Program (LCR MSCP), a 50-year multi-partner program administered by the Bureau of Reclamation (Reclamation) (LCR MSCP 2004).

The California Department of Fish and Wildlife (CDFW) and the LCR MSCP jointly planned the conversion of portions of the PVER from agricultural crops to a mix of native plant species. Now that planting is completed, the created habitats will be managed for species covered under the LCR MSCP throughout the 50-year life of the program. Existing infrastructure consists primarily of an irrigation system comprised of 9.2 miles of lined and unlined irrigation ditches and associated slide gates, a 100-horsepower electric pump, and approximately 14 miles of access roads. All the acreage had been in agricultural crops—grain, small melons, and alfalfa—since the late 1930s.

The project was developed using a phased approach over an 8-year period (figure 1), with final planting completed in 2013. An overview restoration development plan for the entire site was completed in 2006 (Reclamation 2007) and modified in 2009.

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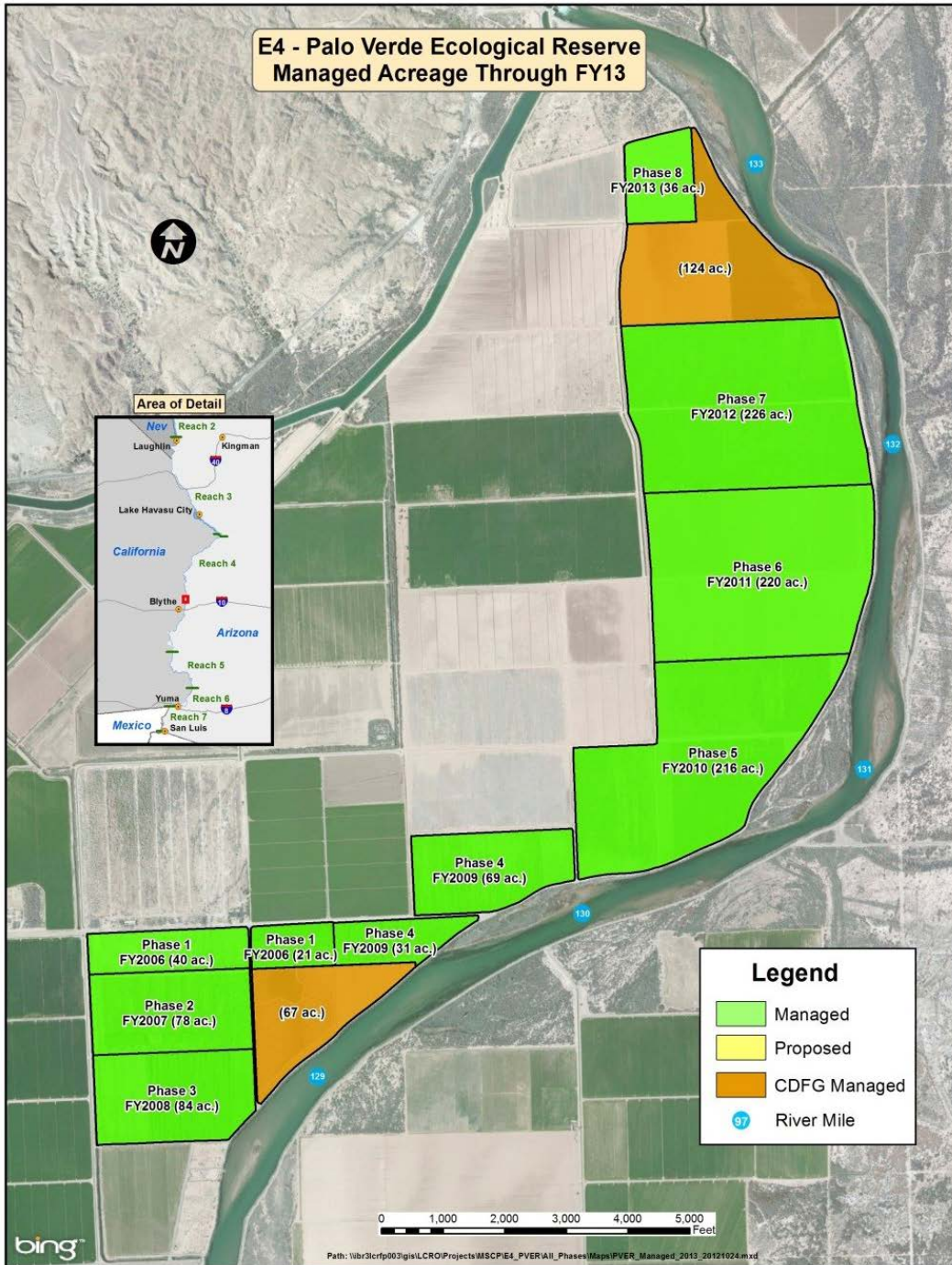


Figure 1.—PVER managed acreage, FY13.

2.0 CONSERVATION AREA INFORMATION

2.1 Purpose

The purpose of the development of the PVER is to convert 1,023 acres of agricultural land to riparian habitat that will be managed for the southwestern willow flycatcher (*Empidonax trailli extimus*) and other LCR MSCP covered species that utilize Fremont cottonwood-Goodding's willow (*Populus fremontii-Salix gooddingii*) (hereafter cottonwood-willow) and honey mesquite (*Prosopis glandulosa*) land cover types.

2.2 Location

The PVER is located in Reach 4, in southeastern Riverside County, California, approximately 5 miles north of Blythe, California. It is within the historic flood plain of the lower Colorado River and between River Miles 128 and 134 (see figure 1).

2.3 Land Ownership

The PVER is owned by the CDFW, which has dedicated 1,023 acres for the restoration and maintenance of native land cover types by the LCR MSCP. The CDFW manages two parcels for migratory waterfowl and upland game.

2.4 Water

The Palo Verde Irrigation District (PVID) has an entitlement to Colorado River water for use on up to 104,500 acres of land within the PVID pursuant to a contract between the United States and the PVID dated February 7, 1933. The CDFW, as a landowner within the PVID, has the right to order Colorado River water from the PVID for pumping through the PVID canal system to its fields. The CDFW has made Colorado River water available for irrigation of the native plants.

2.5 Agreements

A land use agreement was signed in 2007 by Reclamation and the CDFW to secure land and water for the PVER for the remainder of the 50-year LCR MSCP. The agreement outlines the rights and responsibilities of each partner in the project's development and maintenance.

2.6 Public Use

The CDFW has the authority and is the lead to regulate hunting and recreation uses pursuant to CDFW statutes, regulations, and policies at the PVER. In cooperation with Reclamation, the CDFW coordinates its public use and related activities so they are compatible with management of the site for the LCR MSCP. Low-impact public uses such as wildlife watching, sport fishing, and education/outreach are expected at the PVER. However, these uses may be regulated depending on future occupation of the habitat by listed species.

2.7 Law Enforcement

The CDFW is responsible for law enforcement at the PVER. A LCR MSCP Conservation Area Specific Fire Management & Law Enforcement Strategy was finalized for the PVER (LCR MSCP 2010).

2.8 Wildfire Management

A LCR MSCP Conservation Area Specific Fire Management and Law Enforcement Strategy was finalized for the PVER (LCR MSCP 2010). The LCR MSCP will continue to work with local State and Federal fire agencies to reduce the risk of wildland fires and maintain clear lines of communication among agencies.

3.0 HABITAT DEVELOPMENT AND MANAGEMENT

In 2013, all the available acreage at the PVER was planted with riparian species. The site was planted in phases starting in 2006, with a native nursery, and every following year until Phase 8 was planted in 2013. The entire conservation area is now fully developed. Operations are transitioning from the development stage into the maintenance and monitoring stages.

3.1 Planting

3.1.1 Phases 1–8

Planting at the PVER was conducted in phases over multiple fiscal years (see figure 1). Table 1 provides a description of acreage established by fiscal year and phase. Table 2 summarizes the total number of trees, shrubs, and grasses planted at the PVER.

Table 1.—Phases 1–8 planted acres

Phase	Fiscal year	Acres planted	Land cover type	Cumulative total
1	2006	61	Cottonwood-willow	61
2	2007	78	Cottonwood-willow	139
3	2008	45	Cottonwood-willow	184
	2009	39	Cottonwood-willow	223
4	2009	100	Cottonwood-willow	323
5	2010	216	Cottonwood-willow	539
6	2011	220	Cottonwood-willow	759
7	2012	226	Cottonwood-willow	985
8	2012	38	Honey mesquite	1,023

Table 2.—Total number of trees, shrubs, and grasses planted in Phases 1–8

Year	Cottonwood	Goodding's willow	Coyote willow ¹	Mule fat ² / desert broom ³	Quailbush ⁴	Honey mesquite	Grasses
2006	600	600	600	0	0	600	0
2007	20,592	39,960	41,580	4,620	0	924	20,600
2008	38,010	18,601	68,954	5,600	12,421	1,780	0
2009	31,392	67,536	68,256	15,290	12,000	1,782	0
2010	75,657	188,649	100,657	20,747	24,340	1,825	0
2011	64,169	147,425	105,952	17,750	1,850	3,013	0
2012	133,289	173,720	90,830	14,807	1,000	3,580	0
2013	0	0	0	0	0	4,563	154,400
Total planted per species	363,709	636,491	476,829	78,814	51,611	18,067	175,000
Total plants	1,800,521						

¹ *Salix exigua*.

² *Baccharis salicifolia*.

³ *Baccharis sarothroides*.

⁴ *Atriplex lentiformis*.

3.2 Irrigation

The fields at the PVER are flood irrigated. Water usage for the PVER for the calendar year is reported from the Palo Verde Irrigation District's Water Order System. During 2013, 21,961 acre-feet (19.6 acre-feet per acre per year) of water was applied to the fields at the PVER. The water usage reported by the PVID does not reflect consumptive use or unmeasured return.

3.2.1 Irrigation Management

Materials were purchased in order to replace the pump platform in FY14. The pump stand will be relocated approximately 75 feet away from the existing structure. Both new 30-cubic-feet-per-second electric pumps will be moved to a new platform during the PVID's shutdown in December.

Since development of the conservation area is now complete, the management plan for the entire conservation area will be drafted.

3.3 Site Management

Normal road maintenance, such as grading and gravel road base replacement, was done as needed.

3.3.1 Weed Management

Invasive weeds and plant material adjacent to the irrigation canals were removed to protect the integrity of the concrete lining. Disking was done quarterly along the levee road. The disking extended 50 feet into the fields to reduce the risk of fire.

3.3.2 Pest Management

No pest management was needed this year.

3.3.3 Nursery Management

Plant material was collected from the nursery for planting at other LCR MSCP conservation areas.

4.0 MONITORING

4.1 Avian Monitoring

Avian monitoring in FY13 included surveys for southwestern willow flycatchers, yellow-billed cuckoos (*Coccyzus americanus occidentalis*), and riparian breeding birds.

4.1.1 Southwestern Willow Flycatcher Surveys

PVER Phases 2 and 3 restoration sites were surveyed five times during FY13. No breeding or resident southwestern willow flycatchers were detected. Migrant willow flycatchers (*Empidonax trailli*) were detected in May and June. Most birds detected after June 24 or individuals detected repeatedly before June 24 are considered to be southwestern willow flycatchers. Birds detected before June 24 and those detected only once after June 24 are considered migrant willow flycatchers (McLeod and Pellegrini 2014).

4.1.2 Yellow-billed Cuckoo Surveys

Five surveys for yellow-billed cuckoos were conducted in PVER Phases 1–5 from June through August 2013. Twenty-six individuals were detected in June, 35 individuals were detected between July 1–9, 45 individuals were detected between July 15–23, 46 individuals were detected between July 26–31, and 41 individuals were detected in August. There were 16 possible (POS) pairs, 5 probable (PRB) pairs, and 13 confirmed (COB) pairs (table 3) breeding at the habitat conservation area in 2013. Thirteen nests were found at the PVER; all but 1 (12) fledged at least 1 young. This included a nest found in Phase 7 (planted in 2012) in a cottonwood already over 20 feet tall (McNeil and Tracy 2013).

Table 3.—Yellow-billed cuckoo territories at the PVER

Year	POS ¹	PRB ²	COB ³
2008	1	0	0
2009	0	0	2
2010	2	1	2
2011	5	2	10
2012	9	6	24
2013	16	5	13

¹ Possible breeding territory (POS) = Two or more total detections in an area during two survey periods and at least 10 days apart.

² Probable breeding territory (PRB) = POS territory plus yellow-billed cuckoos observed carrying food, traveling as a pair, or exchanging vocalizations.

³ Confirmed breeding territory (COB) = Observation of copulation, stick carry, nest, or fledgling.

4.1.3 General Avian Surveys

Bird surveys were conducted on habitat conservation areas with more than 2 years' growth using a double sampling area search method to determine their use by breeding LCR MSCP riparian covered avian species. General bird surveys resulted in the detection of 16 species (261 pairs) of birds breeding within the habitat at the PVER. Covered species included the following: one summer tanager (*Pirangra rubra*) pair and two Sonoran yellow warbler (*Dendroica petechia sonorana* = *Setophaga petechia sonorana*) pairs breeding in Phase 4; Sonoran yellow warblers present in Phases 1–5, and summer tanagers present in Phases 1 and 6. Neither summer tanagers nor Sonoran yellow warblers were confirmed breeding (Great Basin Bird Observatory 2014).

4.2 Small Mammal Monitoring

4.2.1 Bat Monitoring

Acoustic and capture survey methods were used to monitor bats to document the presence of species using the conservation area and to determine the age, sex, and reproductive status of bats that can be captured.

4.2.1.1 Acoustic Surveys

Two long-term bat monitoring stations were operated at the PVER: PVER1, located in Phase 2, was established in April 2012, and PVER2 was established on March 15, 2013, in Phase 7. Tables 4 and 5 summarize the total number of bat minutes by month for the four LCR MSCP covered and evaluation bat species in 2013. A bat minute is the number of minutes that at least one bat call was recorded for a species regardless of how many calls were recorded within any 1-minute interval. This reduces the bias of a single bat being recorded multiple times within a single minute. All four LCR MSCP covered and evaluation species were detected (Broderick 2016).

4.2.1.2 Capture Surveys

Bats were captured using mist nets at the PVER 1 night per month from May to September. Three LCR MSCP species were detected: California leaf-nosed bats (*Macrotus californicus*), western red bats (*Lasiurus blossevillii*), and western yellow bats (*Lasiurus xanthinus*) (table 6). The highest captures of yellow bats occurred in August due to migration and mating activity; all males captured were reproductively active (Calvert 2016).

Table 4.—Total bat minutes at monitoring station PVER1 (Phase 2) for FY13

Month	Western red bat ¹	Western yellow bat ²	California leaf-nosed bat ³	Pale Townsend's big-eared bat ⁴
October	176	3	0	0
November	278	0	1	0
December	172	1	2	0
January	15	0	0	0
February	1	0	0	0
March	109	3	3	0
April	90	10	0	0
May	166	86	0	1
June	288	514	1	0
July	138	509	0	1
August	133	328	1	2
September	69	25	1	0

¹ *Lasiurus blossevillii*.

² *Lasiurus xanthinus*.

³ *Macrotus californicus*.

⁴ *Corynorhinus townsendii* = *Plecotus townsendii pallescens* = *Corynorhinus townsendii*.

Table 5.—Total bat minutes at monitoring station PVER2 (Phase 7) for FY13¹

Month	Western red bat ²	Western yellow bat ³	California leaf-nosed bat ⁴	Pale Townsend's big-eared bat ⁵
March	6	1	0	0
April	4	2	0	0
May	8	12	2	0
June	5	13	0	1
July	1	0	0	0
August	4	16	0	0
September	0	0	0	0

¹ Sampling began on March 15, 2013.

² *Lasiurus blossevillii*.

³ *Lasiurus xanthinus*.

⁴ *Macrotus californicus*.

⁵ *Corynorhinus townsendii* = *Plecotus townsendii pallescens* = *Corynorhinus townsendii*.

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Table 6.—Bat species captured at the PVER, 2010–13
(LCR MSCP species in bold)

Species	2010	2011	2012	2013
California leaf-nosed bat	0	5	1	1
Western red bat	3	5	6	1
Western yellow bat	12	9	10	12
Big brown bat (<i>Eptesicus fuscus</i>)	154	75	70	107
California myotis (<i>Myotis californicus</i>)	3	2	1	1
Canyon bat (<i>Parastrellus hesperus</i>)	0	0	0	1
Cave myotis (<i>Myotis velifer</i>)	31	10	14	8
Mexican free-tailed bat (<i>Tadarida brasiliensis</i>)	2	2	5	1
Pallid bat (<i>Antrozous pallidus</i>)	7	23	10	10
Pocketed free-tailed bat (<i>Nyctinomops femorosacca</i>)	4	0	0	0
Western mastiff bat (<i>Eumops perotis</i>)	0	1	0	0
Yuma myotis (<i>Myotis yumanensis</i>)	13	4	7	4
Totals	229	136	124	146

4.2.2 Rodent Monitoring

Live trapping was conducted on March 28 and November 8, 2013, to determine the presence of the Colorado River cotton rat (*Sigmodon arizonae plenus*) at PVER Phases 4, 5, and 6. Sixty traps were placed in each phase each night. Two Colorado River cotton rats were captured in PVER Phase 4 and two in PVER Phase 5 in spring. In fall, two cotton rats were captured in Phase 6 (Hill and Calvert 2016).

4.3 MacNeill’s Sootywing Skipper Monitoring

Surveys for MacNeill’s sootywing skippers (*Pholisora graciellae* = *Hesperopsis graciellae* [MacNeill]) were conducted in June, July, August, and September 2013. A total of 98 MacNeill’s sootywing skippers were documented in PVER Phases 4, 5, and 6 (Nelson, in press).

5.0 HABITAT CREATION AND CONSERVATION MEASURE ACCOMPLISHMENT

5.1 Vegetation Monitoring

Vegetation measurements were collected to evaluate the vegetation structure from the ground to the upper canopy. Parameters included tree and shrub density, tree height, and canopy closure.

The tree density in cottonwood-willow plots (cottonwood, Goodding's willow, and coyote willow [*Salix exigua*] [stem density]) ranged from 10–13,960 trees/stems per acre. The shrub density (quailbush [*Atriplex lentiformis*], willow baccharis [*Baccharis salicina*], desert broom [*Baccharis sarothroides*], mule fat [*Baccharis salicifolia*], and saltcedar [*Tamarix* spp.]) per plot ranged from 2–324 shrubs per acre. Cottonwood, Goodding's willow, and mesquite tree heights ranged from 0.8–23.5 meters. The average canopy closure measured at each plot ranged from 0–100 percent.

5.2 Abiotic Monitoring

In 2012, a soil moisture pilot study was initiated to serve as a demonstration of how the LCR MSCP may use existing monitoring technology to monitor soil moisture in select areas within conservation areas. Soil moisture monitoring continued at PVER Phase 2, recording irrigation distribution and the temporal dynamics of moist soils. Following the pilot study, management recommendations may be made to establish a network for soil moisture monitoring within conservation areas.

5.3 Evaluation of the PVER

The process for habitat creation conservation measure accomplishment was finalized in October 2011 (LCR MSCP 2011). All areas within the PVER were designed to benefit covered species at the landscape level.

To meet species habitat creation requirements, the Habitat Conservation Plan (HCP) provides goals for habitat creation based on land cover types. These land cover types are described using the Anderson and Ohmart vegetation classification system (Anderson and Ohmart 1976, 1984a, 1984b). In 2013, the PVER supported 283 acres of cottonwood-willow structure type I, 216 acres of cottonwood-willow structure type II, 220 acres of cottonwood-willow structure type III, 226 acres of cottonwood-willow structure type IV, 40 acres of honey mesquite structure type III, and 38 acres of honey mesquite structure type VI. Table 7 shows how much habitat is creditable for each of the targeted covered species at the PVER. A total of 10 species with habitat creation goals have creditable acres at the PVER. These species (including their corresponding conservation measure acronym) are the: western red bat (WRBA2), yellow-billed cuckoo (YBCU1), elf owl (*Micrathene whitneyi*) (ELOW1), gilded flicker (*Colaptes chrysoides*) (GIFL1), Gila woodpecker (GIWO1), vermilion flycatcher (*Pyrocephalus rubinus*) (VEFL1), Arizona Bell's vireo (*Vireo bellii arizonae*) (BEV11), Sonoran yellow warbler (YWAR1), summer tanager (SUTA1), and the MacNeill's sootywing skipper (MNSW2).

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Table 7.—Species-specific habitat creation conservation measure creditable total acres, 2013

Species-specific habitat creation conservation measure	WIFL1	WRBA2	WYBA3	CRCR2	YBCU1	ELOW1	GIFL1	GIWO1	VEFL1	BEV11	YWAR1	SUTA1	MNSW2
Creditable acres in 2013	0 ¹	0	0 ²	0 ³	0	0	0	0	0	0	0	0	0
Total – including previous years	0	499	0	0	499	499	499	935	935	476	935	499	40

¹ Although the PVER provides the appropriate structure type (cottonwood-willow I–IV) as defined in WIFL1 of the HCP, Reclamation is in the process of gathering the appropriate hydrologic data to determine saturated soils, moist soils, or slow-moving water. Once this has been determined, the PVER will be evaluated.

² Reclamation is in the process of determining the foraging and roosting habitat for the western yellow bat (WYBA). Once this has been determined, the PVER will be evaluated.

³ The preliminary data suggest the Colorado River cotton rat (CRCR) uses both cottonwood-willow and fringe marsh habitats. Reclamation is in the process of evaluating data collected to determine the marsh and cottonwood-willow habitat uses by the CRCR.

6.0 ADAPTIVE MANAGEMENT RECOMMENDATIONS

Adaptive management relies on the initial receipt of new information, the analysis of that information, and the incorporation of the new information into the design and/or direction of future project work (Reclamation 2007). Under the Adaptive Management Program, conservation areas will be assessed for biological effectiveness and whether they fulfill the conservation measures outlined in the HCP for 26 covered species and if they potentially benefit 5 evaluation species. Post-development monitoring and species research results will be used to adaptively manage conservation areas after initial implementation. Once monitoring data are collected over a few years, and then analyzed for the PVER, recommendations may be made through the adaptive management process for site improvements in the future. Currently, there are no adaptive management recommendations for the PVER.

LITERATURE CITED

- Anderson, B.W. and R.D. Ohmart. 1976. Vegetation Type Maps of the Lower Colorado River from Davis Dam to the Southerly International Boundary, Final Report. Bureau of Reclamation, Lower Colorado Region, Boulder City, Nevada.
- _____. 1984a. Vegetation Management Study for the Enhancement of Wildlife Along the Lower Colorado River, Final Report. Bureau of Reclamation, Lower Colorado Region, Boulder City, Nevada.
- _____. 1984b. Lower Colorado River Riparian Methods of Quantifying Vegetation Communities to Prepare Type Maps, Final Report. Bureau of Reclamation, Lower Colorado Region, Boulder City, Nevada.
- Broderick, S. 2016. Post-Development Acoustic Bat Monitoring, 2012–2014 Results. Annual report submitted to the Lower Colorado River Multi-Species Conservation Program, Bureau of Reclamation, Boulder City, Nevada, by the Bureau of Reclamation, Technical Service Center, Denver, Colorado.
- Bureau of Reclamation (Reclamation). 2007. Palo Verde Ecological Reserve Restoration Development Plan: Overview. Bureau of Reclamation, Boulder City, Nevada.
- Calvert, A. 2016. Post-Development Bat Monitoring of Conservation Areas and the 'Ahakhav Tribal Preserve Along the Lower Colorado River – 2013–2014 Capture Surveys. Annual report prepared by the Bureau of Reclamation, Lower Colorado River Multi-Species Conservation Program, Boulder City, Nevada.
- Great Basin Bird Observatory. 2014. Final Report on the Lower Colorado River Riparian Bird Surveys, 2013. Report prepared for the Lower Colorado River Multi-Species Conservation Program by the Great Basin Bird Observatory, Reno, Nevada.
- Hill, J. and A. Calvert. 2016. Post-Development and System Monitoring of Rodent Populations: 2012–2014. Annual report prepared by the Bureau of Reclamation, Lower Colorado River Multi-Species Conservation Program, Boulder City, Nevada.
- Lower Colorado River Multi-Species Conservation Program. 2004. Lower Colorado River Multi-Species Conservation Program, Volumes 1–V. Final. December 17 (J&S 00450.00). Sacramento, California.
http://www.lcrmscp.gov/steer_committee/regulatory_compliance.html

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- _____. 2007. Final Science Strategy. Lower Colorado River Multi-Species Conservation Program, Bureau of Reclamation, Lower Colorado Region, Boulder City, Nevada.
- _____. 2010. Lower Colorado River Multi-Species Conservation Program Fire Management & Law Enforcement Strategy. Lower Colorado River Multi-Species Conservation Program, Bureau of Reclamation, Lower Colorado Region, Boulder City, Nevada.
- _____. 2011. Final Habitat Creation Conservation Measure Accomplishment Tracking Process. Lower Colorado River Multi-Species Conservation Program, Bureau of Reclamation, Lower Colorado Region, Boulder City, Nevada.
- McLeod, M.A. and A. Pellegrini. 2014. Southwestern Willow Flycatcher Surveys, Demography, and Ecology Along the Lower Colorado River and Tributaries, 2013 Annual Report. Submitted to the Bureau of Reclamation, Boulder City, Nevada, by SWCA Environmental Consultants, Flagstaff, Arizona, under contract number GS-10F-0209L. 181 p. + attachments.
- McNeil, S.E. and D. Tracy. 2013. Yellow-billed Cuckoo Distribution, Abundance and Habitat Use on the Lower Colorado River and Tributaries. Report prepared for the Lower Colorado River Multi-Species Conservation Program by the Southern Sierra Research Station, Weldon, California.
- Nelson, S.M., R. Wydoski, and S.F. Pucherelli. In press. Survey and Habitat Characterization for MacNeill's Sootywing, 2013 Annual Report. Report prepared for the Lower Colorado River Multi-Species Conservation Program by the Bureau of Reclamation, Technical Service Center, Ecological Research and Investigations Group, Denver, Colorado.
- Pair, C.H., W.E. Heinz, R. Crawford, and K.R. Frost. 1975. Sprinkler Irrigation (Fourth Edition). The Irrigation Association, 13975 Connecticut Avenue, Silver Springs, Maryland 20906. 553 p.