Lower Colorado River Multi-Species Conservation Program

Balancing Resource Use and Conservation

Beal Lake Riparian Restoration Area
2010 Annual Report

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

April 2010

Lower Colorado River Multi-Species Conservation Program Steering Committee Members

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

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Arizona Game and Fish Department
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Mohave Valley Irrigation and Drainage District
Mohave Water Conservation District
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Salt River Project Agricultural Improvement and Power District
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Yuma County Water Users' Association
Yuma Irrigation District
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QuadState County Government Coalition
Desert Wildlife Unlimited

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California Department of Fish and Game
City of Needles
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Colorado River Board of California
Bard Water District
Imperial Irrigation District
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Lower Colorado River
Multi-Species Conservation Program

Beal Riparian and Marsh Restoration
2010 Annual Report

Prepared by:

LCR MSCP

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

April 2010

ACRONYMS AND ABBREVIATIONS

af	acre-feet
FY	fiscal year
HNWR	Havasu National Wildlife Refuge
LCR MSCP	Lower Colorado River Multi-Species Conservation Program
LCR	lower Colorado River
LUA	Land Use Agreement
m	meter(s)
m^2	square meter(s)
m^3	cubic meter(s)
ppm	parts per million
Reclamation	Bureau of Reclamation
USFWS	U.S. Fish and Wildlife Service

Symbols

%	percent

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BACKGROUND

To meet the conditions of compliance set forth by the 1997 Biological Opinion issued by the U.S. Fish and Wildlife Service (USFWS) under the guidance of the Endangered Species Act, the Bureau of Reclamation's Lower Colorado Regional Office (Reclamation), in partnership with the Havasu National Wildlife Refuge (HNWR), initiated the backwater improvement project at Beal Lake and subsequently the riparian restoration. Because the lake and adjacent lands were immediately available to Reclamation when the Lower Colorado River Multi-Species Conservation Program (LCR MSCP) began, the area was initially used to test and demonstrate restoration and management techniques.

In 2001, Beal Lake was dredged to create a refuge for native fishes. The dredge material was distributed over the adjacent area to be planted with native riparian vegetation the following year. The riparian restoration area was broken into two phases: the first started in 2002 and the second in 2004. Details on the plantings in each field can be found in the 2005 Annual Report. The project area, which is divided into fields that can be independently irrigated and managed, was designed to provide an area to test various riparian restoration methods and techniques for site preparation, planting, irrigation, monitoring, managing, and maintenance.

Years after using the area to test various methods of planting native vegetation, many of the fields developed into habitat used by several LCR MSCP covered species. At the end of the 2010 monitoring season, the Beal Lake riparian restoration site had nesting pairs of Sonoran yellow warbler, Arizona Bell's vireo, summer tanager, and yellow-billed cuckoo. Additionally, in April 2010, the site was confirmed as a LCR MSCP Conservation Area by the program's Steering Committee. This project results in approximately 107 acres (43.3 hectares) of cottonwood, willow, and mesquite land cover types, but also continues to contribute valuable information about restoration techniques and management practices.

GENERAL SITE INFORMATION

Purpose

The Beal Lake Conservation Area was developed both for native fishes and terrestrial wildlife species. The lake is managed for native fishes, including the razorback sucker and bonytail, whereas the riparian restoration area provides habitat for a wide variety of wildlife species. Site development, management, and monitoring are documented annually and analyzed to determine if conditions are appropriate for the species targeted by the LCR MSCP, specifically the southwestern willow flycatcher (*Empidonax trailii extimus*) and the yellow-billed cuckoo (*Coccyzuz americanus occidentalis*).

Location/Description

The Beal Lake riparian restoration area is located in Reach 3, between Beal Lake and lower Topock Marsh, on HNWR, near Needles, California. It is within the historic flood plain of the lower Colorado River (LCR) and adjacent to River Mile 237 on the Arizona side (figures 1 and 2).

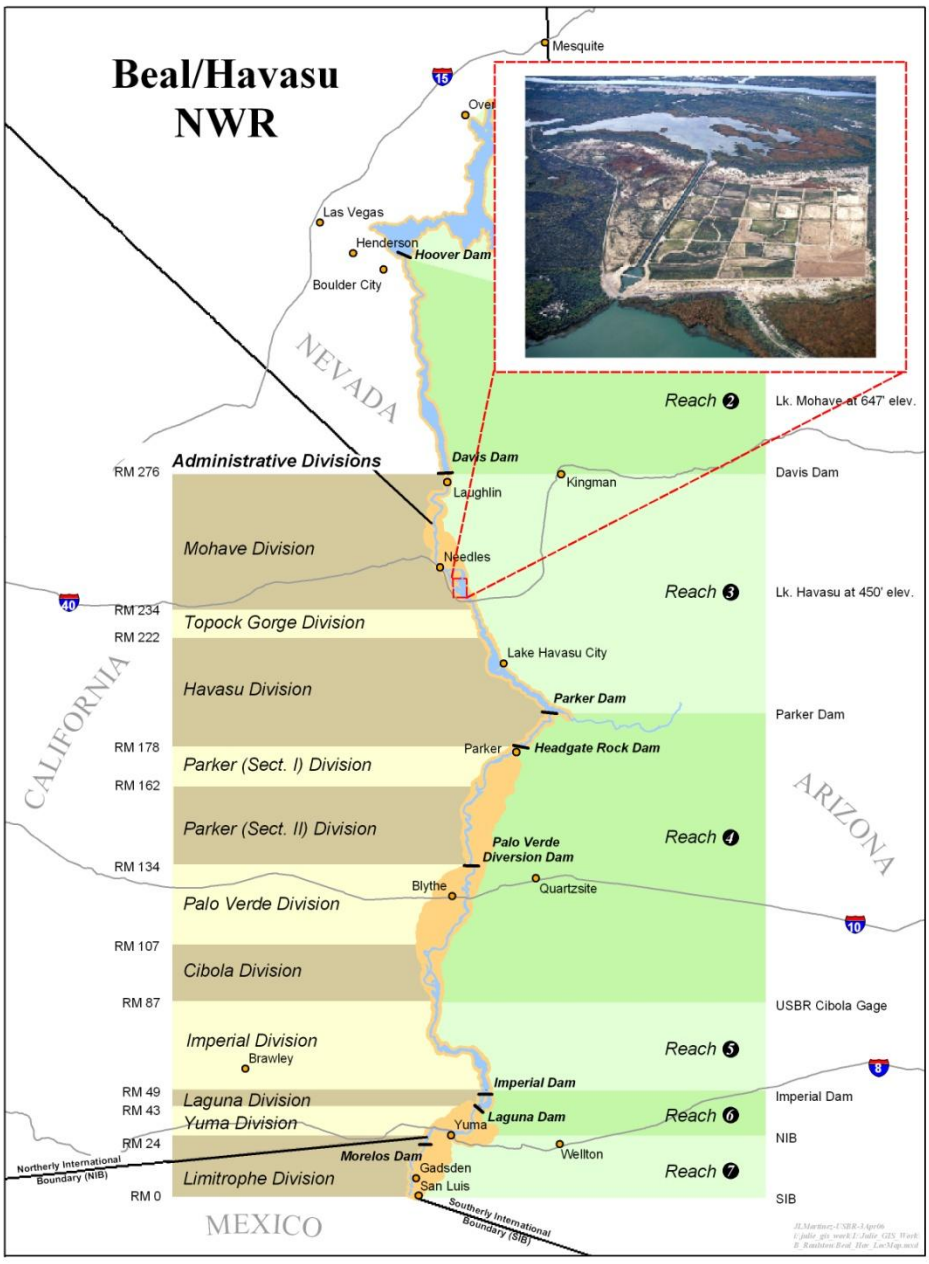

Figure 1.—Location of Beal Lake riparian restoration area.

Figure 2.—Aerial photo of the project, October 2008.

Land Ownership

The Beal Lake riparian restoration area is located on the HNWR, Arizona, which is owned and managed by the USFWS.

Havasu National Wildlife Refuge
317 Mesquite Ave.
Needles, CA 92363

Linda Miller, Refuge Manager
(760) 326-3853

Water Right Information

At the time HNWR was created, Topock Marsh was the primary attraction and focus of most refuge activities . HNWR possesses a 2nd and 3rd priority water entitlement provided by Supreme Court Decree No. (7) to fulfill the purposes of the refuge (Executive Order No. 8647 and Public Land Order No. 559). HNWR's entitlement of 37,339 acre-feet (af) per year consumptive use and 41,839 af diversionary right of Colorado River water is used to fill Topock Marsh through two instrumented inlet canals. The water used for irrigation at the Beal Lake riparian restoration area is supplied from Topock Marsh.

Land Use Agreement

A Land Use Agreement (LUA) was executed in 2010 between Reclamation and the USFWS to secure land and water for the conservation area for the remainder of the 50-year LCR MSCP. The LUA outlines the rights and responsibilities of each partner in the project's development and maintenance.

HABITAT DEVELOPMENT AND MANAGEMENT

Planting and Fertilizing

No new planting occurred at the Beal Lake riparian restoration area during 2010.

During June 2010 soil samples were taken in cells H, L, and B and analyzed by a contracted crop consultant. The samples indicated that nitrogen, phosphorous, potassium, and zinc levels were all still below optimal levels (table 1). Tissue samples were also taken and analyzed. Similar nutrient deficiencies were found in the tissue samples with the addition of manganese (table 2). A mixture of UN-32, 10-34-0, zinc chelate, and manganese chelate was prescribed and applied using the fertigation system during September and October 2010.

Table 1.—Soil analysis report, July 2010

Area	Irrigation frequency	NO_3-N	PO4-P	K	Zn
		Olsen/ppm[1]			DTPA/ppm
Cell H	Twice a month	1.0	2.9	80	1.61
Cell L	Once a week	1.0	1.0	31	0.81
Cell B	Once a month	1.0	1.0	45	0.59
Optimum range		**10.0–20.0**	**10.0–15.0**	**100.0-200.0**	**1.0–3.0**

[1] Parts per million.

Table 2.—Tissue analysis report, July 2010

Area	Irrigation frequency	N	P	K	Mn
		Nitric acid/%			Nitric acid/ppm
Cell H	Twice a month	0.473	0.088	2.93	19.7
Cell L	Once a week	1.062	0.092	1.34	68.3
Cell B	Once a month	0.462	0.095	1.60	12.6
Optimum range		**2.2–2.6**	**0.2–0.5**	**0.8–1.5**	**30–200**

Irrigation

Beal Lake riparian restoration area is flood irrigated with one alfalfa valve per field Fields are irrigated on different schedules to minimize irrigation while keeping the central area wet (figure 3). In an effort to attract southwestern willow flycatchers to the site, the three fields in the center (K, L, P) are irrigated once a week throughout the breeding season to keep ambient conditions under the tree canopy moist. Irrigation regimes for the surrounding fields are based on vegetation species' requirements or planting dates. Cottonwood and willow were irrigated more frequently than mesquites, and fields planted more recently are irrigated more frequently than older, established vegetation. A total of 1,313 af were applied to the project in 2010 (table 3) compared to 1,224 af in 2009.

Figure 3.—2010 irrigation schedule.

Table 3.—Acre-feet of water applied per month at Beal Lake riparian restoration area in 2010

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
AF applied			127*	143	156	149	158	179	169	154	78*	

* Irrigation did not occur through the entire month.	Calculated total water use for 2009 (acre-feet)	1,313
	Average water use per week (acre-feet)	37.5

Onsite Personnel

Through a 2006 Interagency Agreement, Reclamation funded a position for a USFWS employee at HNWR to manage the site through 2009. The employee began work in May 2007 and left the position in June 2008. Members of Reclamation's Yuma facilities maintenance crew were utilized to temporarily perform irrigation and site maintenance tasks for the remaining 2008 irrigation season as well as the entire 2009 season (March–October). At the end of 2009, a request to extend the terms of the Interagency Agreement until 2011 was filed, as irrigation and maintenance services were still needed on site. However, with the refuge staff in flux, USFWS was still unable to dedicate an employee to the funded tasks in 2010. In an effort to assist with onsite responsibilities, USFWS supplied a Student Conservation Association volunteer that Yuma trained and then alternated irrigation duties with every other week.

Due to the remote location of the site on USFWS's property, along with the recent turnover in the refuge's staff, it has been difficult to fill the management and maintenance position at the Beal Lake riparian restoration area. Nevertheless, steps are being taken to ensure that a refuge affiliate is assigned to cover management and maintenance duties in 2011.

Site Maintenance

Fertilizer was applied to the fields through the irrigation water using the fertigation system that was installed last year. The irrigation pump was operated for 877 hours during fiscal year (FY) 2010 compared to 848 hours in 2009. Routine maintenance was performed on the pump throughout the year. Saltcedar (*tamarisk* spp.) eradication and weed control on the rock structure and around the irrigation valves continued.

MONITORING

Vegetation Monitoring

A new monitoring protocol was implemented in 2010 at the Beal Lake riparian restoration area. Vegetation data were collected within several parameters to evaluate vegetation composition and structure from the ground layer to the upper canopy layer. Parameters included tree and shrub density, tree heights, canopy closure, vegetation "hits to pole," ground cover, and distance to nearest surface water. Detailed descriptions of sampling design, methodology, analyses, and discussion can be found in the report, Results from 2010 Vegetation Monitoring at Four Multi-Species Conservation Program Habitat Creation Sites.

In 2010, trees with height estimates represented 18 percent (%) of total trees within plots. The average heights of all tree species combined are shown in table 4 along with averages by species. Cottonwood trees averaged 8.8 (standard error [SE]± 0.2) meters (m); screwbean mesquite averaged 5.0 m (±0.12), and honey mesquite averaged 5.2 m (± 0.3). Screwbean mesquite was much more abundant at the site than honey mesquite (98% and 2%, respectively). Gooding's willow and coyote willow were present within the plots, but none were estimated for height based on size class (methods are detailed in the final vegetation monitoring report).

Table 4.—Height and density estimates for trees and shrubs at Beal Lake riparian restoration area

n=13; n refers to number of plots unless otherwise noted. Popfre = *Populus fremontii*; Salgoo = *Salix gooddingii*; Salexi = *Salix exigua*; Propub = *Prosopis pubescens* and *Progla* = *P. glandulosa*

Trees			Shrubs		
Parameter	**Species**		**Parameter**	**Species**	
Average height (SE) range	All species	n=187* 6.0 (0.2) 1.0-12.0	Average height (SE) range	All species	n=95* 2.4 (0.04) 1.5-4.5
	Popfre	n=47* 8.8 (0.2) 6.4-12.0		Bacsar	n=7 * 2.4 (0.2) 1.5-2.9
	Salgoo	0.0		Pluser	n=86* 2.4 (0.02) 1.6-2.5
	Salexi	0.0		Tamarix	n=2* 3.2 (1.4) 1.8-4.5
	Progla	n=20* 5.2 (0.3) 1.2-7.4			
	Propub	n=120* 5.0 (0.12) 1.9-7.4			
Mean number of trees/plot (SE) range	All species	93.0 (35.8) (15.0-42.0)	Mean number of shrubs/plot (SE) range	All species	146.5 (25.3) 6.0-320.0
	Popfre	14.0 (5.0) (0.0-54.0)		Bacsar	16.8 (12.9) 0.0-170.0
	Salgoo	2.2 (1.1) (0.0-11.0)		Pluser	118.3 (24.5) 0.0-320.0
	Salexi	2.0 (1.3) (0.0-17.0)		Tamarix	11.4 (6.2) 0.0-81.0
	Progla	1.5 (1.3) (0.0-17.0)			
	Propub	73.3 (37.8) (0.0-442.0)			
Estimated trees/acre Estimated trees/site (34 monitored acres)	All species	2,530/86,044	Estimated shrubs/acre Estimated shrubs/site (34 monitored acres)	All species	7,904/268,737
	Popfre	680/23,114		Bacsar	905/30,769
	Salgoo	116/3,952		Pluser	6,385/217,078
	Salexi	108/3,669		Tamarix	614/20,889
	Prosopis	1,466/49,844			

* n for tree heights represents the number of trees measured; heights from two size classes were measured in 2010.

Density is presented as average trees per plot, estimated number of trees per acre, and estimated number of trees per site (table 4). The mean number of trees per plot (all species combined) was 93.0 (SE±35.8). Screwbean mesquite was the most abundant at 73.3 (±37.8) trees per plot, followed by cottonwood at 14.0 (±5.0), Gooding's willow at 2.2 (±1.1), coyote willow at 2.0 (±1.3), and honey mesquite at 1.5 (±1.3) trees per plot.

The total estimated number of trees (all species) per acre was 2,530. The "trees per acre" calculation was extrapolated to Beal's monitored acreage (34), which was estimated at 86,044 trees. Estimates by species are presented in table 4.

The mean number of shrubs per plot (all species combined) was 146.5 (±25.3; table 4). Arrowweed was by far the dominant shrub species with 118.3 (±24.5) shrubs per plot, followed by willow baccharis at 16.8 (±12.9) and saltcedar at 11.4 (±6.2).

The total estimated number of shrubs (all species) per acre was 7,904. The "shrubs per acre" calculation was extrapolated to Beal's monitored acreage (34), which was estimated at 268,737 shrubs. Estimates by species are presented in table 4.

Mean canopy closure is presented in table 5. The average across all plots at Beal Lake riparian restoration area was 78.8% (±7.4%), with values ranging from 3.8 to 98.4% cover.

Mean total vegetation volume at Beal Lake riparian restoration area was 0.13 (± 0.02); values were on the low end of known values from other studies in similar habitat (reportedly ranging between 0.1–1.1m^3/m^2; table 5).

In order to visualize vegetation structure at Beal Lake riparian restoration area, foliar density, calculated from "hits to pole" data, is presented by meter layer (figure 4). Vegetation was present in all meter layers up through 9 meters. Vegetation meter layers 1–3 had the highest number of hits, which reflects the high densities of shrub species found at the site.

Ground cover estimates for live vegetation, litter, bare ground, and dead are presented in table 5. Litter and dead categories differ in that litter is no longer attached to the ground. Average litter cover was 53.7% (±8.2), followed by bare ground at 39.6% (±8.9), and live vegetation at 1.9% (±1.8); it should be noted that only one plot (#34) had live vegetation at the time of the survey (alone, plot #34 averaged 23.5% [±20.4%] live vegetation cover). There were minimal dead plants and no rock/gravel present in the plots.

The distance to nearest irrigation valve and the distance to surface water (excluding irrigation) was measured using digital aerial imagery and ArcMap software. The nearest surface water was Beal Lake riparian restoration area (table 5).

Table 5.—Summary of additional habitat characteristics at Beal Lake riparian restoration area
n=13 (number of plots)

Parameter	
Average % canopy closure (SE) range	78.8 (7.4) 3.8-98.4
Total vegetation volume (m^3/m^2) (SE) range	0.13 (0.02) 0.02-0.30
Average % cover – Live vegetation (SE) range	1.9 (1.8) 0-23.5
Average % cover – Litter (SE) range	53.7 (8.2) 2.5-91.3
Average % cover – Bare ground (SE) range	39.6 (8.9) 2.8-97.5
Average % cover – Dead (SE) range	0.1 (0.1) 0.0-1.9
Average distance to surface water (m) (SE) range	409.9 (24.8) 254-566
Average distance to irrigation valve (m) (SE) range	67.7 (±9.7) 33-145

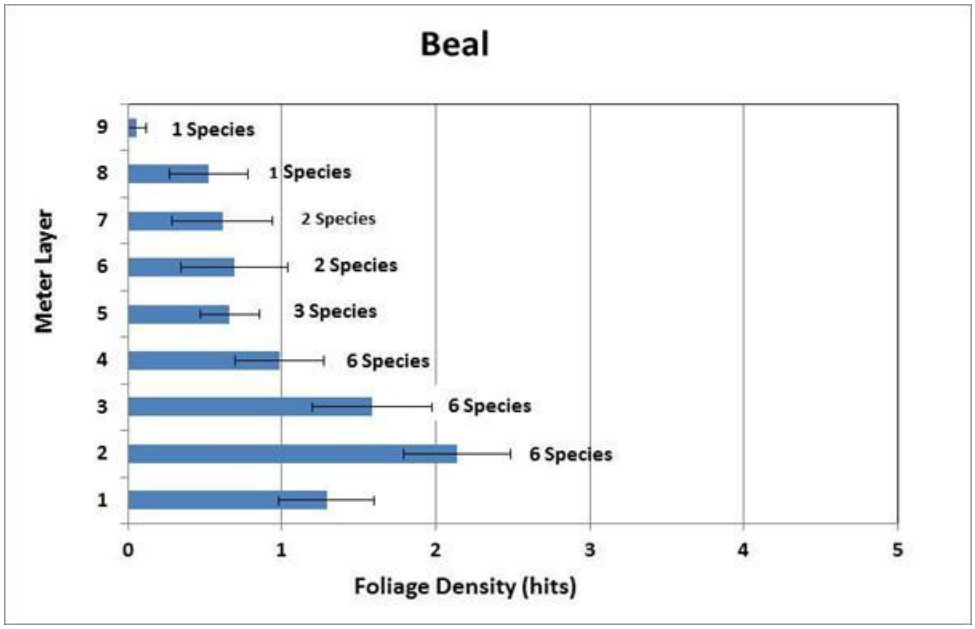

Figure 4.—Vertical foliage density at Beal Lake riparian restoration area. Vegetation hits were first averaged by meter layer within plots and then averaged by meter layer across plots (±SE).

Detailed descriptions of sampling design, methodology, analyses, and discussion can be found in the report, Results from 2010 Vegetation Monitoring at Four Multi-Species Conservation Program Habitat Creation Sites.

Insect Monitoring

Arthropods, insects, and spiders were collected during April–August 2010 to examine external protein. Nitrogen concentration of arthropod prey may influence establishment and nesting success of insectivorous birds. Arthropods were collected from different plant species, identified, and examined for external protein. External protein was associated with nitrogen content.

Small Mammal Monitoring

Beal Lake riparian restoration area was trapped in the winter of 2009/2010. Line transects were run for a total of 74 trap nights. No *Sigmodon* species were captured. For more detailed methods and results, refer to the report, Small Mammal Colonization at Habitat Creation Areas along the Lower Colorado River: 2010 (Neiswenter 2011).

Bat Monitoring

Acoustic and capture survey methods were used to monitor bats at Beal Lake riparian restoration area.

Acoustic Surveys

Anabat bat detectors were deployed across Beal Lake riparian restoration area quarterly to determine bat activity across habitat types. A total of 72 detector nights were completed in 9 monitoring sites in 2010. Bat activity is expressed in call minutes, which indicates that a given species is present if it is recorded at least once within a 1-minute period. Table 6 lists the raw data for the total number of call minutes for LCR MSCP covered bat species plus all other bat species across all sampling years in cottonwood, willow, and mesquite habitats. It provides a very general view of the number of minutes of bat activity for the four LCR MSCP covered bat species in comparison to the entire bat community at habitat creation areas. A slight increase in western red bat activity was observed in 2010. For a detailed analysis of this data, see the report, Post-Development Bat Monitoring of Habitat Creation Areas along the Lower Colorado River – 2010 Acoustic Surveys.

Table 6.—Total number of call minutes recorded for LCR MSCP covered bat species plus all other bat species recorded at the Beal Lake riparian restoration area from FY07 through FY10

Species	FY07	FY08	FY09	FY10	All Years
Western red bat	3	3	3	14	23
Western yellow bat	5	2	1	5	13
California leaf-nosed bat	4	4	7	4	19
Townsend's big-eared bat	1	0	4	2	7
All other species	2,040	3,012	3,782	2,910	11,744
Total call minutes	**2,053**	**3,021**	**3,797**	**2,935**	**11,806**

The permanent bat station located at Beal Lake riparian restoration area was operated from October 1, 2009, through July 29, 2010. An unexpected malfunction occurred in the Anabat SD1 detector when the internal battery discharged without warning. However, data were recorded flawlessly from October 1 through July 29. In spite of the loss of data from August 1 to September 30, FY10 showed a dramatic increase in the number of red bat minutes from 0 in 2008 to 86 for the entire year for 2009 to 527 for the 10 months that were sampled in 2010 (table 7). Yellow bat minutes also increased from 4 in 2008, 6 in 2009, and 21 in 2010 (table 7). For a detailed analysis of these data, see the report, Post-Development Bat Monitoring of Habitat Creation Areas along the Lower Colorado River – 2010 Acoustic Surveys (Broderick 2011).

Table 7.—Total number of call minutes recorded for the two focal and two evaluation species at the Beal Lake riparian restoration area permanent bat monitoring station for FY10

Species	**FY08** Apr. 8, 2008 Sept. 30, 2008	**FY09** Oct. 1, 2009 Sept. 30, 2010	**FY10** Oct. 1, 2009 July 29, 2010	All years
Western red bat	0	86	527	613
Western yellow bat	4	6	21	31
California leaf-nosed bat	6	3	12	21
Townsend's big-eared bat	2	5	6	13
Total call minutes	**12**	**100**	**566**	**678**

Avian Monitoring

Surveys of habitat creation sites with more than 2 years' growth to determine their use for breeding by other LCR MSCP avian species were conducted using an intensive area search method. In 2010, Beal Lake riparian restoration area was split into four area search plots. The Arizona Bell's vireo (*Vireo bellii arizonae*), Sonoran yellow warbler (*Dendroica petechia sonorana*) and summer tanager (*Pirangra rubra*) were confirmed breeding (table 8). Details of the intensive area search method and further results are found in the Annual Report on the Lower Colorado River Riparian Bird Surveys, 2010 (Great Basin Bird Observatory 2011).

Table 8.—LCR MSCP avian species detected at Beal Lake riparian restoration area, 2010

LCR MSCP covered species detected	Number of confirmed breeding pairs
Arizona Bell's vireo	20
Sonoran yellow warbler	12
Summer tanager	2
Western yellow-billed cuckoo	1
Southwestern willow flycatcher	0

Five surveys for western yellow-billed cuckoos (*Coccyzus americanus occidentalis*) were conducted at Beal Lake riparian restoration area. Surveys were conducted between mid-June and the end of August, spaced 12 to 20 days apart, and took place between sunrise and 12 p.m. or until temperatures reached 40 degrees Celsius (104 degrees Fahrenheit). Call-playback, described by Johnson et al. (1981) and Gaines and Laymon (1984), was used to increase the probability of detection. Data were also collected on nesting, microhabitat, vegetation, and arthropods (McNeil et al. 2009). Three cuckoos were detected midway through the season. One nest was found, and a pair successfully fledged one young from it. It is unknown what became of the third cuckoo. The nest was located in a 10-m-tall cottonwood tree approximately 5 m from the ground. The bird was banded prior to fledging. Numerous attempts to capture and band the adults were not successful. For more detailed methods and results, refer to the report, Yellow-billed Cuckoo Distribution, Abundance and Habitat Use on the Lower Colorado River and Tributaries, 2010 Annual Report (McNeil et al. 2011).

No breeding southwestern willow flycatchers (*Empidonax trailli extimus*) were detected at Beal Lake riparian restoration area (table 8), and all birds were detected before June 16 when birds are considered to be residents. Three willow flycatchers (*Empidonax trailli*) were detected, and the site was surveyed five

separate times. For more detailed methods and results, refer to the report, Southwestern Willow Flycatcher Surveys, Demography, and Ecology along the lower Colorado River and Tributaries, 2010 (McLeod and Pellegrini 2011).

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 (LCR MSCP, 2007). The Adaptive Management Program's role is to ensure habitat creation sites are biologically effective and fulfill the conservation measures outlined in the Habitat Conservation Plan for 26 covered species and potentially benefit 5 evaluation species. Post-development monitoring and species research results will be used to adaptively manage habitat creation sites after initial implementation. Once monitoring data are collected over a few years and then analyzed for the Beal Lake Conservation Area, recommendations may be made through the adaptive management process for site improvements in the future.

In 2010, a new vegetation monitoring protocol was initiated. The data have been reviewed and recommendations made to include monitoring throughout the site, where statistical inferences will be made. Management makes recommendations and management decisions for the entire site.

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APPENDIX 1

Complete Species List – Beal Lake Riparian Restoration Area

Common Name	Scientific Name
Colorado River cotton rat	*Sigmodon arizonae plenus*
Yuma hispid cotton rat	*Sigmodon hispidus eremicus*
California leaf-nosed bat	*Macrotus californicus*
Townsend's big-eared bat	*Corynorhinus townsendii*
Western red bat	*Lasiurus blossevillii*
Western yellow bat	*Lasiurus xanthinus*
Arizona Bell's vireo	*Vireo bellii arizonae*
Sonoran yellow warbler	*Dendroica petechia sonorana*
summer tanager	*Piranga rubra*
Willow flycatcher	*trailii extimus*
Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*