

# Lower Colorado River Multi-Species Conservation Program



*Balancing Resource Use and Conservation*

## 'Ahakhav Tribal Preserve: Annual Report 2008



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  
City of Bullhead City  
City of Lake Havasu City  
City of Mesa  
City of Somerton  
City of Yuma  
Electrical District No. 3, Pinal County, Arizona  
Golden Shores Water Conservation District  
Mohave County Water Authority  
Mohave Valley Irrigation and Drainage District  
Mohave Water Conservation District  
North Gila Valley Irrigation and Drainage District  
Town of Fredonia  
Town of Thatcher  
Town of Wickenburg  
Salt River Project Agricultural Improvement and Power District  
Unit "B" Irrigation and Drainage District  
Wellton-Mohawk Irrigation and Drainage District  
Yuma County Water Users' Association  
Yuma Irrigation District  
Yuma Mesa Irrigation and Drainage District

## **Other Interested Parties Participant Group**

QuadState County Government Coalition  
Desert Wildlife Unlimited

## **California Participant Group**

California Department of Fish and Game  
City of Needles  
Coachella Valley Water District  
Colorado River Board of California  
Bard Water District  
Imperial Irrigation District  
Los Angeles Department of Water and Power  
Palo Verde Irrigation District  
San Diego County Water Authority  
Southern California Edison Company  
Southern California Public Power Authority  
The Metropolitan Water District of Southern California

## **Nevada Participant Group**

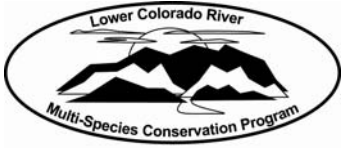
Colorado River Commission of Nevada  
Nevada Department of Wildlife  
Southern Nevada Water Authority  
Colorado River Commission Power Users  
Basic Water Company

## **Native American Participant Group**

Hualapai Tribe  
Colorado River Indian Tribes

## **Conservation Participant Group**

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



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## 'Ahakhav Tribal Preserve: Annual Report 2008

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

April 2010

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# Executive Summary

The purpose of this annual report is to summarize all activities that occurred on the 'Ahakhav Tribal Preserve from October 1, 2007 through September 30, 2008. Contained within this document are sections describing land and water ownership, status of the land use agreement, planned habitat areas, and the monitoring data for the 154 acres of established land cover types.

Since 2001, the Preserve and the Bureau of Reclamation have been working together to develop Lower Colorado River Multi-Species Conservation Program (LCR MSCP) covered species habitat as well as examine alternative planting, irrigation weed control, seed collection, and site maintenance techniques.

The Preserve administration and LCR MSCP management are currently discussing a 50-year land use agreement for the purpose of creating LCR MSCP covered species habitat on the Preserve. Once approved, a development schedule as well as roles and responsibilities by each party will be agreed upon. The land use agreement would be in effect through April 2055.

CRIT 9 (154 acres) is currently being managed for LCR MSCP covered species. LCR MSCP covered species already present on the Preserve include: vermilion flycatcher (*Pyrocephalus rubinus*), Gila woodpecker (*Melanerpes uropygialis*), western yellow bat (*Lasiurus xanthinus*) and the California leaf-nosed bat (*Macrotus californicus*).

# Background

Since 2001, Bureau of Reclamation's Lower Colorado Region has been assisting the Colorado River Indian Tribes (CRIT) at the 'Ahakhav Tribal Preserve (Preserve) in their efforts to restore native habitat on their lands.

Vegetation and LCR MSCP covered species monitoring of established land cover type described in this document is being conducted by Reclamation and Reclamation's contractors. Monitoring on the Preserve will be consistent with established protocols adopted by the LCR MSCP.

Since the inception of the Lower Colorado River Multi-Species Conservation Program, the program has budgeted and described activities conducted on the Preserve within the annual work plan process. This report is being prepared to document the development and management of native land cover types and record monitoring data for Fiscal Year 2008.

## 1.0 General Site Information

The sites reserved for LCR MSCP habitat development are known as CRIT 9 (154 acres), CRIT 10 (54 acres) and CRIT 11 (60 acres). At the time of this writing CRIT 9 is the only established land cover type being maintained and monitored for the program's covered species.

Large conservation areas such as the Preserve are developed over a number of years and can ultimately be managed to benefit multiple covered species. Currently, CRIT 9 has been established and is continually maintained. CRIT 10 is scheduled for fiscal year 2011 development and CRIT11 is scheduled for fiscal year 2012 development.

At the present time, the area is being considered for management of yellow-billed cuckoo and, potentially, southwestern willow flycatcher. LCR MSCP covered species already present on the Preserve consists of: vermilion flycatcher (*Pyrocephalus rubinus*), Gila woodpecker (*Melanerpes uropygialis*), western yellow bat (*Lasiurus xanthinus*), and the California leaf-nosed bat (*Macrotus californicus*).

### 1.1 Purpose

The purpose of the research and development grant is to utilize two project areas (CRIT 9 and CRIT 10) to demonstrate different techniques for planting, irrigation, weed control, seed collection, and site maintenance. All work will be done in an effort to find the most cost effective, successful, and efficient methods for re-vegetating riparian habitat in sandy soil environments on the Lower Colorado River. Restored habitat is targeted to support Lower Colorado River Multi-Species Conservation Plan (LCR MSCP) covered species.

Additionally, the Colorado River Indian Tribes (CRIT) has an interest in utilizing the re-vegetation sites for environmental education, low-impact recreation, and native arts. Re-vegetation sites will be used to illustrate the relationship between habitat, wildlife, and humans and to illustrate the importance of native resources to native peoples and wildlife.

## **1.2 Location/Description**

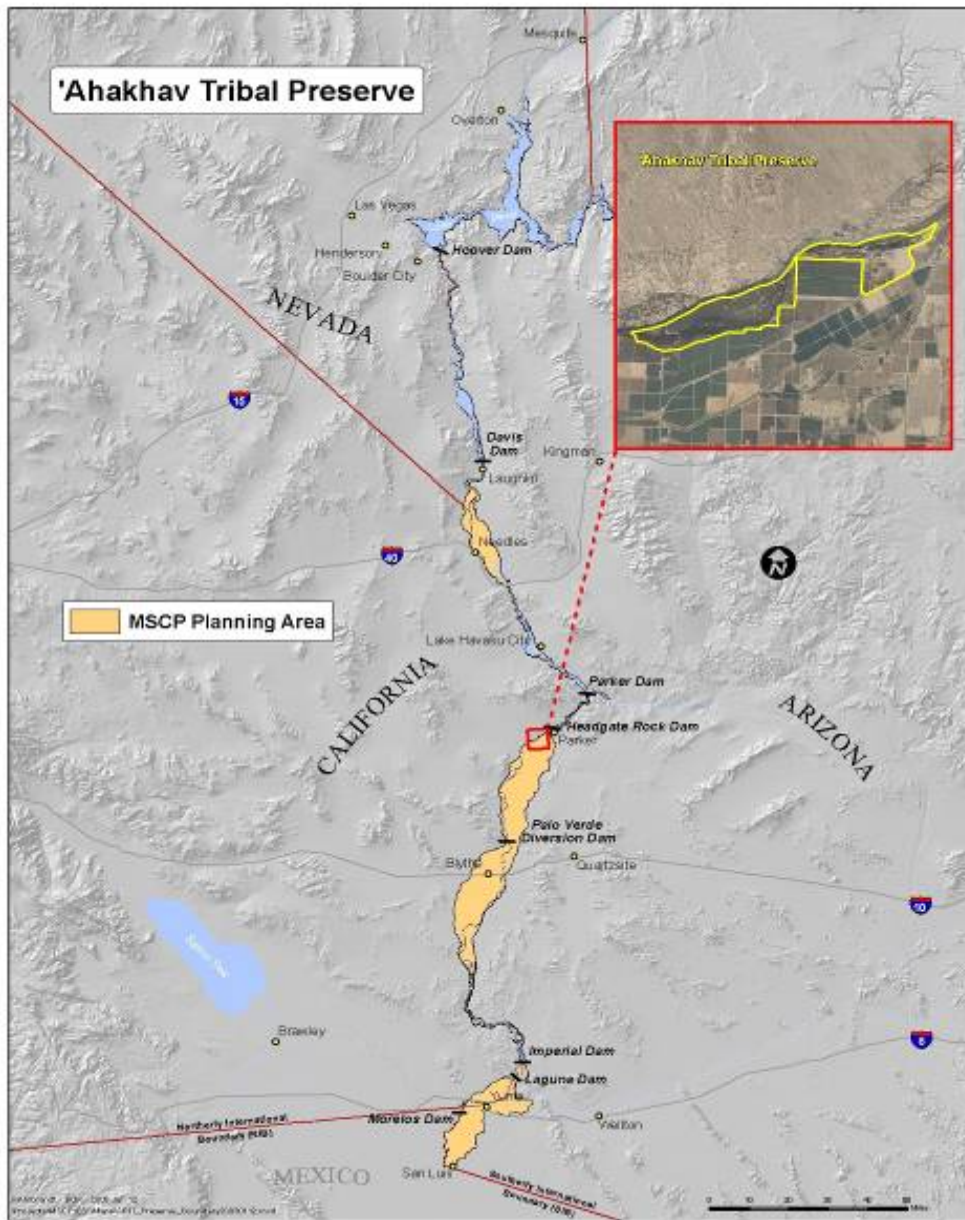
The project site is located on the Colorado River Indian Tribes Reservation south of Parker, Arizona. The Colorado River Tribal Council approved the 'Ahakhav Tribal Preserve in special session through Tribal Resolution #168-95 in August 1995. The Resolution was created to protect fish and wildlife resources and provide educational and outreach opportunities for the local community.

The 'Ahakhav Tribal Preserve is located within Reach 4 of the LCR MSCP Planning Area between river miles 173 and 174.

The legal descriptions of the current and proposed restoration sites are: Tracts 3798, 3799, 3800, 3805, 3806, 3807, and 3809 and undeveloped land forming the northwest corner of the described lands, all found within Section 10, T9N, R20W, and Section 15, T9N, R20W.



Figure 1. General location of the 'Ahakhav Tribal Preserve





## **1.3 Land Ownership**

The 'Ahakhav Tribal Preserve is an in-holding encompassed by the Colorado River Indian Tribes Reservation.

“The CRIT Reservation was created in 1865 by the Federal Government for “Indians of the Colorado and its tributaries,” originally for the Mohave and Chemehuevi, who had inhabited the area for centuries. People of the Hopi and Navajo Tribes were relocated to the reservation in later years, (<http://critonline.com>, 2008).”

## **1.4 Water Right Information**

The CRIT maintain a present perfected water right #2 in the state of Arizona of 662,402 acre feet. Water for the 'Ahakhav Tribal Preserve is made available by tribal council resolution through the Colorado River Indian Tribes Farm allocation. Irrigation water to be used for habitat development or maintenance will be reported annually.

## **1.5 Land Use Agreement**

Reclamation and CRIT are working together under a 5-year Cooperative Agreement signed in September 2004. This agreement, which expires in December 2009, specifies areas to be restored and outlines the roles and responsibilities of each partner. Quarterly coordination meetings between the Preserve and LCR MSCP staff ensure that all activities and reimbursable costs to be incurred are identified in advance. A 50-year Land Use Agreement has been drafted. Details of the agreement are still in the draft stage, but when finalized, will be presented to the LCR MSCP Steering Committee.

# **2.0 Habitat Development and Management**

## **2.1 CRIT 9 Habitat Management**

Five roads run through CRIT 9 and are maintained by periodically spreading gravel obtained from a local sand and gravel supplier. Irrigation canals and outlet gates were maintained throughout 2008. Maintenance included: clearing debris from canals, removal of sand in canals, removal of vegetation at canal outlets, and repair of irrigation canal panels.

Irrigation frequency and duration applied was closely analyzed in 2008. In an attempt to retain higher nutrients loads in soils and aide in tree vigor, fertilizers and reduced irrigation water were applied.

## 2.2 CRIT 10 Developments

In 2008, CRIT 10 was cleared and laser leveled. The leveled fields were planted with alfalfa and Sudangrass to serve as cover crops and reduce soil erosion. Nineteen acres on the east side were planted with Sudangrass, which grew for 90 days; these acres were then overplanted with alfalfa in winter of 2008. In January 2008, 31 acres of the western side were planted with alfalfa. Photo 1 shows CRIT 10 after being leveled prior to planting Sudangrass and alfalfa. Photos 2 And 3 show the two cover crops used on site for soil stabilization.



**Photo 1: CRIT 10 Laser leveled prior to planting**



**Photo 2. Alfalfa in CRIT 10, Section 5**



**Photo 3. Sudangrass in CRIT 10, Section 6**

The alfalfa will be allowed to grow, with consistent watering and control by grazing goats, until at least 2010. Prior to any replanting with native trees, a restoration and development and monitoring plan will be drafted for CRIT 10 and posted to the LCR MSCP Web site. This plan will guide the land cover type creation design and the steps and documentation required for spring 2011 planting.

## 2.3 CRIT 11 Developments

CRIT 11 is still in the development and planning stages, and no irrigation infrastructure currently services the site. The site is planned for development in Fiscal Year (FY) 2012. Engineering analysis utilizing adjacent canals will guide irrigation ditch construction.

## 2.4 CRIT 9 Irrigation

CRIT 9 is serviced by flood irrigation from two concrete-lined ditches. Sections 1 and 2 (83 acres) are flooded at a rate of approximately 1.6 acre-feet per hour.

During FY08, Sections 1 and 2 were irrigated for 1253.25 hours, which delivered 688.3 acre-feet for a total average of 8.3 acre-feet/acre. Sections 3 and 4 (71 acres) were flooded at a rate of approximately 1.0 acre-feet/hour. During FY08, these sections were irrigated for 749.5 hours, providing a total of 377 acre-feet for an average of 5.3 acre-feet/acre. For a detailed description of irrigation water applied and frequency for CRIT 9, see Appendix 1.

## 2.5 CRIT 10 Irrigation

The exit ports for CRIT 10 were cleaned of accumulated sand and brush, and prepared for flow in 2008. In January, the ports on the western side were excavated and reinforced with rocks to stabilize the banks and improve flow (Photos 4 and 5). In June and July, the ports on the eastern side were cleaned and prepared for irrigation.



**Photos 4 and 5. Work on CRIT 10 ports to prepare for water flow**

One pump, purchased in June 2006 (see *'Ahakhav Tribal Preserve Revegetation Research and Development Project: Annual Report 2007'* for details), pumped water in September from the weir gate into the canal to irrigate the eastern section of CRIT 10. In addition, improvements to the pumping system achieved a 31% labor cost savings.

## **2.6 CRIT 11 Irrigation**

CRIT 11 is still in the development and planning stages, and no irrigation infrastructure currently services the site. The site is planned for development in FY12. Engineering analysis utilizing adjacent canals will guide irrigation ditch construction.

## **2.7 General Site Maintenance**

In past years, the Preserve has installed posts and cable to detour thru-traffic within the CRIT 9 habitat areas. It is recommended that additional posts and cable be placed along roads throughout CRIT 10 to discourage public use.

## **2.8 Management of Existing Land Cover**

CRIT 9 (154 acres) is currently the only portion of the Preserve managed as LCR MSCP covered species land cover type. Management of the 154 acres is limited to routine maintenance. Maintenance activities conducted during 2008 included clearing and repairing of irrigation ditches, and installation of habitat boundary signage.

## **2.9 Wildland Fire Management**

Wildland fire management activities are coordinated through the Colorado River Indian Tribes' Wildland Fire Office. The Preserve is incorporated into the entire reservation's Fire Management Plan. CRIT Wildland maintains mutual aide agreements with multiple wildland fire agencies along the river. These agreements allow the use of other agencies' personnel and resources in the event of a large-scale wildland fire.

## **2.10 Law Enforcement**

Law enforcement regulations are handled through the Colorado River Indian Tribes Fish and Game Department. Examples of regulations the Fish and Game wardens enforce are use periods during authorized times, no hunting (except in designated areas), valid fishing and hunting licenses, no alcohol allowed within the Preserve, and vehicle access restrictions within the habitat areas.

## **2.11 Public Use**

Public use on the Preserve is limited to low impact recreational activities. Although hunting is not allowed within habitat areas, hunting is allowed on portions of the Preserve

not scheduled for habitat development. Examples of low impact recreation include wildlife watching, sport fishing, walking trail use, collection of native plant material for cultural uses, and education and outreach opportunities for the local community.

## 3.0 Monitoring

### 3.1 Microclimate Monitoring

The soils within CRIT 9 are too sandy to maintain moisture long after irrigation. It was suggested that the addition of some permanent moist soil within the cottonwood-willow may improve the microclimate and potentially attract willow flycatchers to the area. In November 2006, 85 plastic pools were installed within cottonwood-willow habitat at the 'Ahakhav Tribal Preserve's CRIT 9 restoration area. Along with the pools, cuttings of *Salix exigua* were densely planted in the vicinity and irrigation was increased to once per week. The intent was to compare microclimate data collected near each pool to data collected away from the pools to determine whether the addition of moist soil, combined with densely planted willow and additional irrigation, would have an effect on microclimate.

During installation of the microclimate monitoring equipment, it was noted that many of the pools, which were buried to their top rim and filled with sand, were becoming dislodged and/or damaged during flood irrigation. By early spring, it was also evident that the majority of the *S. exigua* planted around the pools did not survive. Although the pool component of the demonstration was discontinued, microclimate data from this cottonwood and willow habitat continues to be collected.

#### Methods

Microclimate variables (temperature, dew point, absolute humidity, relative humidity) were measured with HOBO H8 Pro data loggers. The device combines an internal thermometer measuring temperature in degrees Celsius and degrees Fahrenheit, a relative humidity sensor, and a data logger that stores the information until it is downloaded. Measurements are recorded by date every 15 minutes.

On July 1, 2007, eight HOBO data loggers were installed within the restored habitat in CRIT 9. Each HOBO was installed within solar radiation shields and placed on electrical metal tubing at a height of 2 meters. The location of each HOBO was recorded with a GPS unit.

Microclimate data from 2007 and 2008 were examined and compared to microclimate goals recommended in McLeod et al. (2008). The data from McLeod et al. (2008) represents combined data collected at southwestern willow flycatcher nest sites and within the territories adjacent to the nest site. Data were recorded with the same type of equipment used at CRIT 9. McLeod et al. (2008) collected microclimate data for 14 days immediately after nests were vacated to minimize disturbance at the nest. The data from

CRIT 9 is averaged over the months of June, July, and August (the breeding season for SWFLs) only, as no nesting SWFLs were present.

## Results

Eleven microclimate variables were compared in Table 1. These variables were chosen for evaluation based on their high correlation with other variables or because they were the most useful in distinguishing SWFL use areas from non-use areas (McLeod et al. 2008). Of these 11 variables, mean daily temperature range and mean nocturnal vapor pressure are most likely to capture the important differences between occupied territories and non-use areas (McLeod et al. 2008).

**Table 1. Average Microclimate Measurements, Cottonwood-Willow, 'Ahakhav Tribal Preserve, 2007 and 2008, comparison with known SWFL Habitat**

	2007	2008	SWFL Habitat
Microclimate Variable	Mean +/- SE, n = 7	Mean +/- SE, n = 8	Mean +/- SE, n = 53
<b>TEMPERATURE</b>			
Mean maximum diurnal temperature (°C):	38.62 +/- 0.49	38.45 +/- 0.24	43.0 +/- 0.2
Mean diurnal temperature (°C)	32.37 +/- 0.32	31.51 +/- 0.09	31.1 +/- 0.01
Mean # of 15-min intervals above 41°C each day	1.41 +/- 0.51	1.07 +/- 0.26	4.5 +/- 0.3
Mean minimum nocturnal temperature °C	22.61 +/- 0.12	19.72 +/- 0.29	16.5 +/- 0.1
Mean nocturnal temperature °C	26.44 +/- 0.16	24.6 +/- 0.27	24.6 +/- 0.1
*Mean daily temperature range °C	16.01 +/- 0.49	18.73 +/- 0.49	19.6 +/- 0.2
<b>HUMIDITY</b>			
Mean diurnal relative humidity %	53.7 +/- 1.79	44.1 +/- 0.98	53.1 +/- 0.5
Mean diurnal vapor pressure (Pa)	2,423.49 +/- 63.90	1,873.83 +/- 38.8	2,20.2 +/- 26
Mean nocturnal relative humidity (%)	67.86 +/- 0.66	55.63 +/- 1.10	64.6 +/- 0.5
*Mean Nocturnal Vapor pressure (Pa)	2,324.92 +/- 22.39	1,740.24 +/- 25.1	1,964.7 +/- 20.6

## Discussion

Although there are differences in sample sizes and collection periods, this preliminary comparison is useful in showing how created cover types compare to habitat being utilized by SWFLs. Vegetation measures such as canopy height, vertical foliage density above the nest, percent basal area composed of native vegetation, number of shrub stems greater than 8 cm at Diameter Breast Height (DBH), and number of shrub stems less than 2.5 cm DBH are some of the variables that are directly correlated to microhabitat conditions (McLeod 2008).

Altering the vegetation significantly by increasing the stem density of the shrub layers is necessary in order to change the microclimate at CRIT 9. Although there are patches of existing *S. exigua* that are dense, these are limited; the species has likely reached its maximum dispersal and density within this site. Adding *S. exigua* cuttings was not very successful, likely due to the difficulty in irrigating such sandy soils, even in areas close to the irrigation ditch.

## 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.

At the CRIT-9 site 12 vegetation plots were established. For analysis, the data were divided into two groups based on the land cover type. Four plots were established in mesquite and eight plots were established in cottonwood-willow.

### Methods

#### **Overstory**

Within a 26.3-foot (8.0-m) plot radius of center, every live tree measuring at least 4.5 feet (1.37 m) in height and 5.0 inches (12.7 cm) 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) of 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 were 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) 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 was 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 was 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**

The horizontal canopy cover or crown closure 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**

At the CRIT-9 site, 12 vegetation plots were established: 8 plots in cottonwood willow and 4 plots in mesquite. For analysis, the data were divided into these two land cover types.

### **Overstory**

Results for the overstory measurements that were taken within 8 meters of plot center are summarized in Table 2 and Table 3.

**Table 2. Density of Trees per Land Cover Type**

Land Cover Type	# of Plots	Average Density	SE
Mesquite	4	110	17
Cottonwood-Willow	8	68	22
All Vegetation Plots	12	82	16

**Table 3. Height and DBH of Trees in Overstory**

Land Cover Type	# of Trees	Avg Height (m)	SD	SE	Avg DBH(cm)	SD	SE
Mesquite	22	5.7	1.1	0.2	19.3	4.9	1.1
Cottonwood-Willow	28	10.2	2.7	0.5	18.7	6.0	1.1
All Vegetation Points	50	8.2	3.1	0.4	19.0	5.5	0.8

### ***Shrubs and Intermediate Trees***

The density by land cover type for shrubs and intermediate trees measured within 5 meters of plot center is summarized in Table 4. Average height and DBH for these trees is summarized in Table 5.

**Table 4. Total Density per Land Cover Type**

<b>Land Cover Type</b>	<b># of Plots</b>	<b>Avg Tree Density</b>	<b>SE</b>
Mesquite	4	113	66
Cottonwood-Willow	8	631	444
All Vegetation Plots	12	458	299

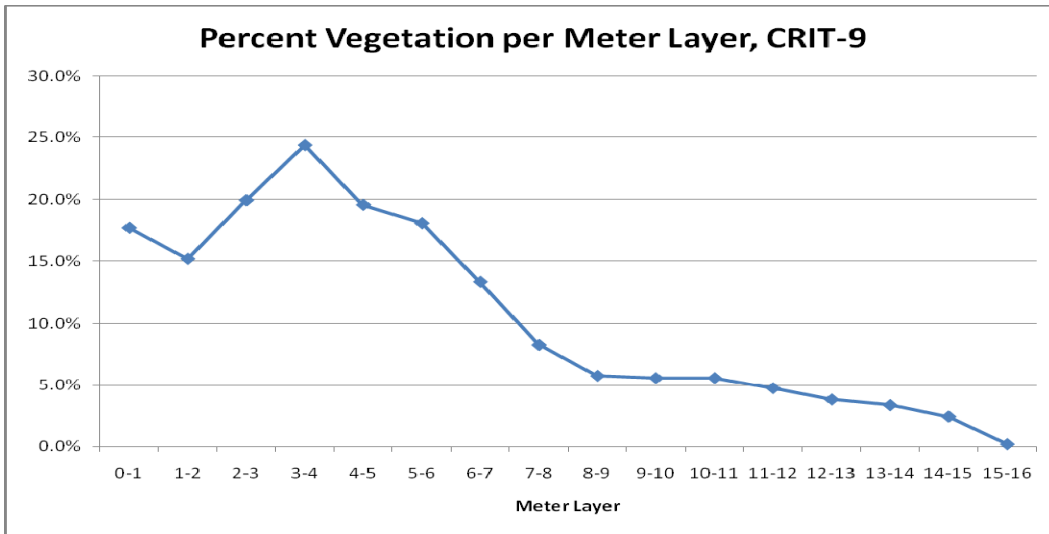
**Table 5. Average Height and DBH per Land Cover Type for Trees > 7.9 cm DBH**

<b>Land Cover Type</b>	<b># of Trees</b>	<b>Avg Height (m)</b>	<b>SE</b>	<b>Avg DBH (cm)</b>	<b>SE</b>
Mesquite	4	5.1	0.6	11.3	0.4
Cottonwood-Willow	6	5.7	0.3	9.3	0.8
All Trees	10	5.5	0.3	10.1	0.6

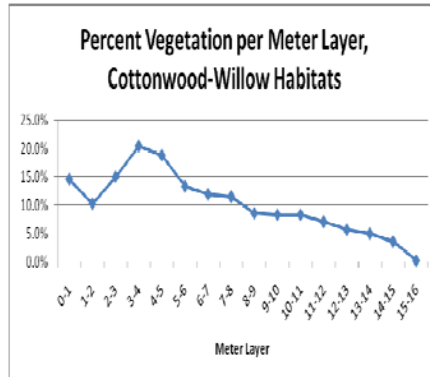
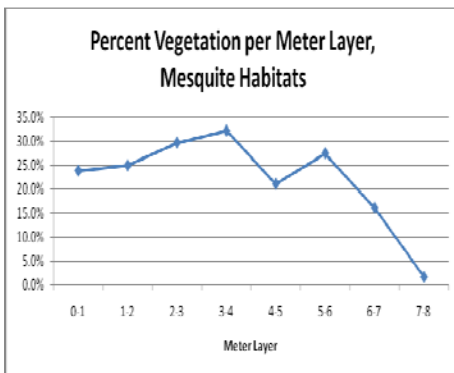
### ***Total Vegetation Volume***

Figures 2 and 3 depict the percent vegetation by meter layer for each land cover type and for the site as a whole. Figures 4 and 5 include the species composition by percent found in all habitat types combined and in the mesquite and cottonwood land cover types separately.

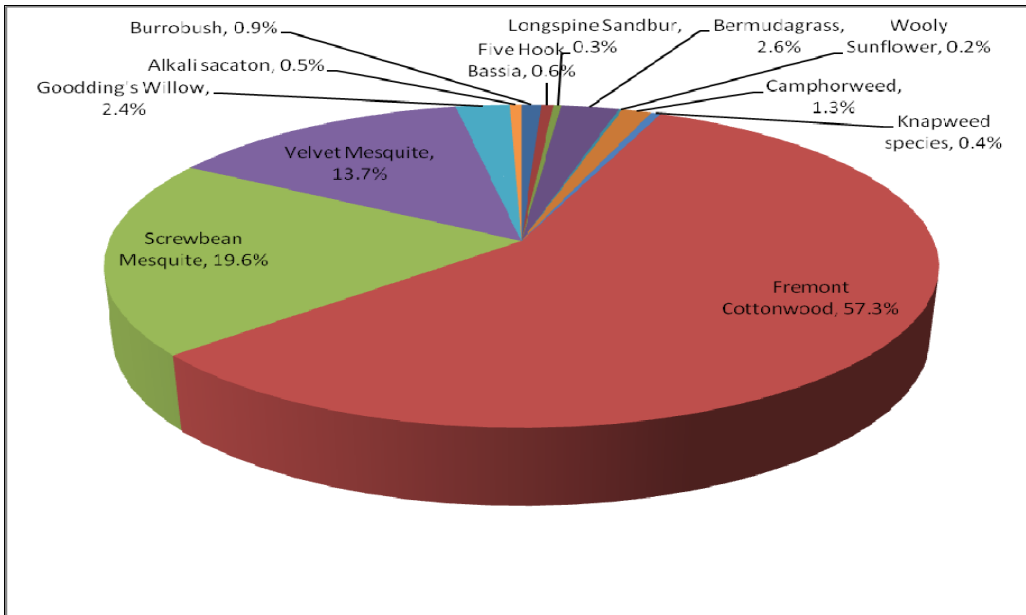
**Figure 2. Vegetation by Meter Layer; All Land Cover Types**



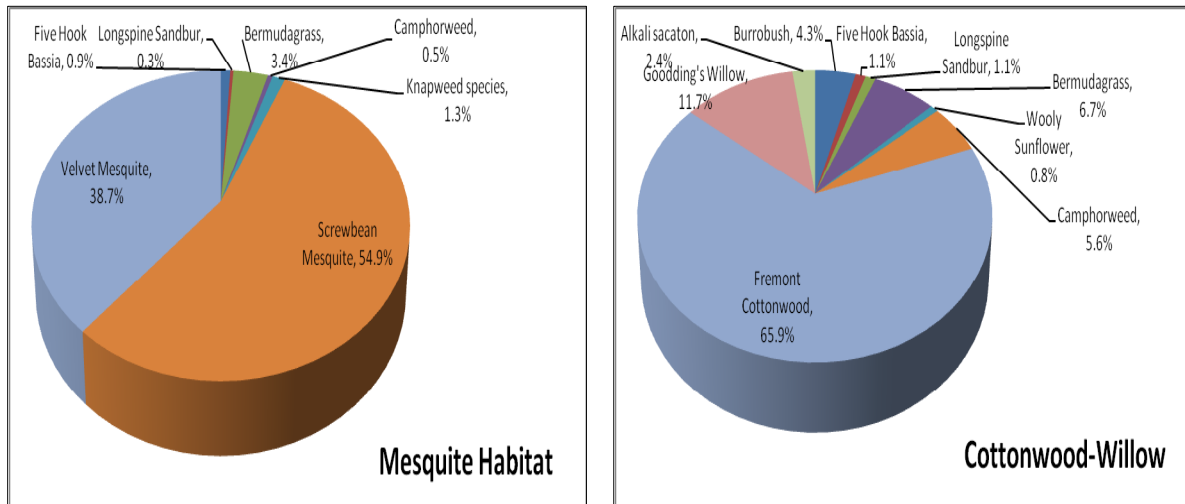
**Figure 3. Vegetation by Meter Layer of Mesquite and Cottonwood-Willow**



**Figure 4. Species Composition; All Land Cover Types**



**Figure 5. Species Composition by Percent for Mesquite and Cottonwood-Willow**



The total number of trees per acre, total vegetative ground cover, and crown closure is summarized in Table 6.

**Table 6. Vegetation Summary by Habitat Type**

Land Cover Type	# of Plots	Tree Density		Total Ground Cover		Crown Closure	
		Avg	SE	Avg	SE	Avg	SE
Mesquite	4	223	50	20.3%	13.3%	45.3%	6.0%
Cottonwood-Willow	8	699	432	24.1%	8.2%	37.5%	7.2%
All Vegetation Plots	12	540	290	22.8%	6.7%	40.1%	5.2%

## Discussion

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

## 3.3 Bat Surveys

Two techniques, capture surveys and acoustic monitoring, were conducted at the Ahakhav Tribal Preserve to monitor bat populations. They are discussed separately in this report.

### Acoustic Surveys

Post-development acoustic bat monitoring was initiated at the Ahakhav Preserve in April 2008. Nine sites were selected for monitoring: three in young cottonwood (<8cm DBH), three in mature cottonwood (>8 cm DBH), and three in mesquite stands. Thirty-six detector nights were completed with a total of 11,412 call files being collected and edited, and valid call files were identified to species or species groups. A total of 267 bat minutes were recorded for the four covered bat species, most of which were of California leaf-nosed 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 either to species or species group (Table 7). These calls are then converted into the number of minutes for which 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).

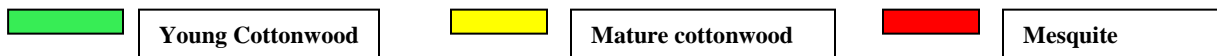
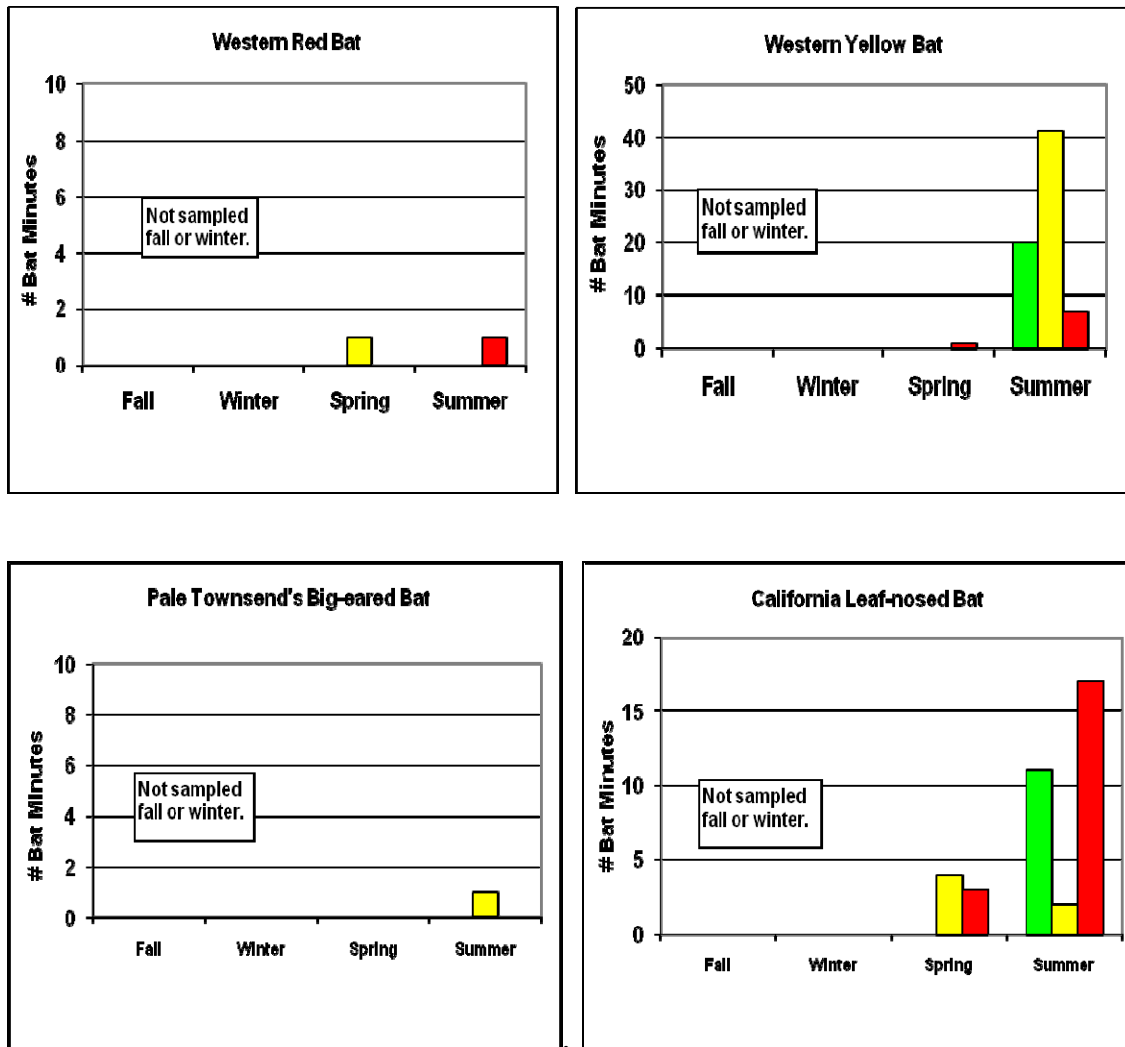
**Table 7. All species and species groups for bats identified at habitat creation areas**

<b>Common Name</b>	<b>Scientific Name</b>	<b>Species Code</b>
<b>Individual Species</b>		
Pallid bat	<i>Antrozous pallidus</i>	Anpa
Townsend's big-eared bat	<i>Corynorhinus townsendii</i>	Coto
Western red bat	<i>Lasiurus blossevillii</i>	Labl
Yellow bat	<i>Lasiurus xanthinus</i>	Laxn
California leaf-nosed bat	<i>Macrotus californicus</i>	Maca
Hoary bat	<i>Lasiurus cinereus</i>	Laci
Pocketed free-tailed bat	<i>Nyctinomops femorosaccus</i>	Nyfe
Big free-tailed bat	<i>Nyctinomops macrotis</i>	Nyma
Mastiff bat	<i>Eumops perotis</i>	Eupe
Western pipistrelle	<i>Parastrellus hesperus</i>	Pahe
Cave myotis	<i>Myotis velifer</i>	Myve
<b>Species Groups:</b>		
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	
<b>Species included in the groups listed above:</b>		
Big brown bat	<i>Eptesicus fuscus</i>	Epfu
Mexican free-tailed bat	<i>Tadarida brasiliensis</i>	Tabr
California myotis	<i>Myotis californicus</i>	Myca
Yuma myotis	<i>Myotis yumanensis</i>	Myyu

## Results

Two western red bat minutes were recorded at the Ahakhav Preserve, one during spring in mature cottonwood and one during summer in mesquite (Figure 6). A total of 68 western yellow bat minutes were recorded at the Preserve. This was by far the greatest number of western yellow bat minutes recorded at any of the habitat creation areas. The Palo Verde Ecological Reserve habitat creation area, with 22 bat minutes, was the only other area to approach the number of bat minutes recorded at the Preserve. Yellow bat minutes at the other six habitat creation areas ranged from 1 to 6 minutes. Most of the yellow bat minutes at the Preserve were recorded in mature cottonwood during July (40), with a significant amount recorded in the young cottonwood habitat in July (20). There was one minute of bat activity for the Pale Townsend's big-eared bat recorded during the summer in the mesquite habitat. The California leaf-nosed bat had 37 minutes of bat activity. Most of the activity was during the summer in the young cottonwood and mesquite habitat.

Figure 6. Mean number of bat minutes in the three habitat types monitored at the preserve (scales vary depending on species)



An index of relative bat activity was developed in young cottonwood, mature cottonwood, and mesquite habitats using the total number of bat minutes for each species and species group (Table 8). The cave myotis (Myve), 45-55 kHz, and 25-30 kHz phonic groups in general had the highest relative abundance. The four covered bat species comprised a small relative abundance of the overall bat community at the Ahakhav Preserve. The western yellow bat (Laxa) had one of the highest occurrences at any of the habitat creation areas, with the mature cottonwood receiving the highest percentage of activity.



The Ahakhav Preserve is unique among the seven habitat creation areas currently being monitored because of the high numbers of minutes for the cave myotis (Myve), the pocketed free-tailed bat (Nyfe), and the mastiff bat (Eupe). LCR MSCP monitoring conducted at CRIT 9 has shown the highest numbers of observed bat species compared to bat numbers from other conservation areas currently under development.

**Table 8. Index of relative bat activity for three habitat types**

Young Cottonwood		Mature Cottonwood		Mesquite	
Species/Species Groups	%	Species/Species Groups	%	Species/Species Group	%
Myve	28.9	Myve	53.2	45-55 kHz	35.9
45-55kHz	21.0	25-30 kHz	19.4	Myve	26.9
Pahe	16.1	45-55 kHz	15.9	Pahe	17.4
25-30kHz	14.1	Pahe	5.7	Nyfe	8.0
Nyfe	12.2	Nyfe	2.4	25-30 kHz	6.3
Eupe	4.6	Laxa	1.7	Eupe	2.2
20kHz	2.2	20 kHz	0.7	Maca	1.4
Laxa	0.6	Eupe	0.5	20 kHz	1.1
Maca	0.3	Maca	0.3	Laxa	0.6
Coto	0.0	Coto	0.1	Coto	0.0
Labl	0.0	Labl	0.0	Labl	0.1
Laci	0.0	Laci	0.0	Laci	0.0
	100%		100%		100%

## Capture Surveys

### *Methods*

In 2008, capture surveys were conducted on April 2, May 5, July 16, August 25, September 3, and September 22. The survey in August was not completed due to a thunderstorm and was repeated on September 3.

Capture techniques included the use of mist nets and harp traps. The number and size of mist nets varied between sites depending on habitat. Both 19.7-ft (6-m) by 8.5-ft (2.6-m), and 39.4-ft (12-m) by 8.5-ft (2.6-m) wide nets (Avinet, Inc.) made of 50-denier nylon with a 1.5-in (38-mm) mesh size were used. Single, double, and triple-stacked nets were used. Stacked nets are constructed by stacking single nets on top of each other using poles and a pulley system (Bat Management and Conservation, Inc.). Depending on the width of the corridor, either 6-m or 12-m wide nets were used. Harp traps were also used to capture bats. The Faunatech Austbat harp trap is 6 ft (1.8 m) wide and has 45 ft<sup>2</sup> (4.2 m<sup>2</sup>) of capture area. It is used when bats can be captured by being funneled into a narrow corridor.

In general, nets and traps are set where bats are observed and/or in areas most likely to be used as flyways. At the 'Ahakhav Preserve, corridors between planted areas were chosen for trapping. One site consisted of a triple net set up and one consisted of a harp trap, a

double net and a single net. During netting, an Anabat SD-1 bat detector (Titley Electronics, Inc.) was connected to an HP iPAQ pocket PC in order to obtain voucher calls of captured bats upon release, as well as to determine changes in activity during the trapping period. This acoustic data was also used later to determine whether any MSCP covered species were in the area of the nets, but not captured.

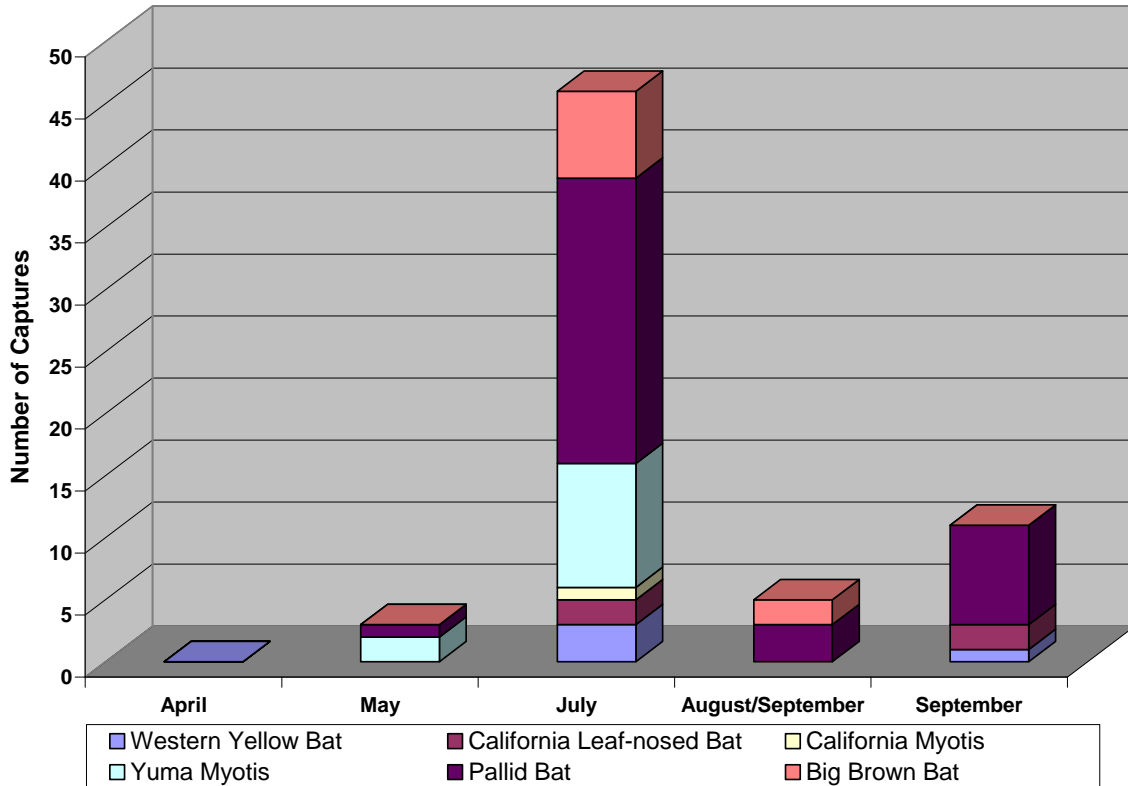
**Results**

A total of 65 bats of six species were captured at ‘Ahakhav in 2008 (Figure 7). The pallid bat had the highest capture rate. Two LCR MSCP covered species were captured: the western yellow bat and the California leaf-nosed bat. The July survey had the most captures and highest species richness. One of the leaf-nosed bats captured in July was a reproductive female, and the yellow bat captured in September was a reproductive male.

**Table 9. Total Captures, All Surveys, 2008**

Species	April	May	July	August/September	September	Totals
Western Yellow Bat	0	0	3	0	1	4
California Leaf-nosed Bat	0	0	2	0	2	4
California Myotis	0	0	1	0	0	1
Yuma Myotis	0	2	10	0	0	12
Pallid Bat	0	1	23	3	8	35
Big Brown Bat	0	0	7	2	0	9
Totals	0	3	46	5	11	65

**Figure 7. Number Captures by Species and Survey Month**



**Discussion**

This was the second year bat capture surveys were conducted at the ‘Ahakhav Preserve. Yellow bats and leaf-nosed bats have been captured both years. This was the first year a reproductively active yellow bat was captured. The cave myotis (*Myotis velifer*) and Mexican free-tailed bat (*Tadarida brasiliensis*) were captured in 2007 but not in 2008, although both were recorded acoustically during the surveys. Free-tailed bats normally fly higher than the nets, and therefore, are not commonly captured.

Over the past two years, the ‘Ahakhav Preserve has had the most captures and the highest species richness of all of the habitat creation areas (Calvert in press). This is probably due to both the size of the area, and the maturity of the habitat.

Bat capture surveys will continue in 2009. Surveys periods will begin in May and continue once a month through September.

**3.4 System-wide Avian Monitoring**

Restoration of habitat at the ‘Ahakhav Preserve began prior to the implementation of the LCR MSCP. Various surveys have been conducted since, including single species surveys for yellow-billed cuckoos and willow flycatchers. All data reported here were

collected post-development. A system-wide avian survey was implemented in 2007 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 reported here has been summarized for the CRIT 9 area of the Preserve specifically. Complete data for all habitat conservation areas and more detailed methods and results will be available in the report, *System Monitoring for Riparian Obligate Avian Species (Work Task D6) and Avian Use of Restoration Sites (Work Task F2)* (GBBO 2008, in prep). Single species surveys were conducted at the Preserve for yellow-billed cuckoo (*Coccyzus americanus occidentalis*), elf owl (*Micrathen whitneyi*), and the southwestern willow flycatcher (*Empidonax traillii extimus*). Results of these surveys are reported in separate sections of this report.

## **Methods**

Avian use of the Colorado River Indian Tribe's CRIT 9 habitat creation area was monitored during the breeding season of 2008 using intensive avian area search surveys. This method produced a complete census of birds breeding at the plot, allowing the calculation of an unbiased density estimate of breeding birds (GBBO 2008). The objectives of monitoring were to obtain accurate densities of breeding birds and to obtain an estimate of non-breeding birds utilizing the created habitat.

Eight intensive area search surveys were conducted at each plot during the 2008 breeding season. The 85-acre (34-ha) CRIT 9 Habitat Restoration Area was split into plots that could be adequately covered in one morning. All surveys took place between April 28 and June 27, the peak breeding season of riparian obligate birds along the lower Colorado River (GBBO 2008). Surveys started at sunrise and ended no later than 12:00 p.m.

Birds were identified to species, age (juvenile or adult), and sex by plumage and behavior and any breeding evidence observed was recorded. Territorial spot mapping of all breeding pairs during each visit was used to record evidence of breeding, along with other evidence such as nest building and food carrying. If confirmed breeding evidence was obtained on a survey or probable breeding evidence was confirmed on three separate surveys, birds were considered breeding on the site. All other birds were labeled as non-breeders (GBBO 2008). Birds flying over the plot or sighted incidentally are excluded from this report, but can be found in the GBBO (2008) report.

## **Results**

Eight intensive area search surveys were conducted at CRIT 9 at each plot. There were 40 pairs of birds comprising 18 species that were detected breeding, including two LCR MSCP covered species, the vermilion flycatcher (*Pyrocephalus rubinus*) and the summer tanager (*Piranga rubra*). The mourning dove (*Zenaida macroura*) and Abert's towhee (*Pipilo aberti*) were the most abundant species detected (Table 10) (GBBO 2008).

On average, 65 birds per survey were detected at CRIT 9 that were not confirmed breeding within the project boundaries (Table 2) (GBBO 2008).

**Table 10. Intensive Area Search Surveys: Breeding Pairs Detected by Species (GBBO 2008)**

COTTONWOOD/WILLOW		MESQUITE	
Species	Number of Territories	Species	Number of Territories
mourning dove	5	mourning dove	10
Abert's towhee	4	Abert's towhee	3
Lucy's warbler	2	Gambel's quail	2
blue grosbeak	1	verdin	2
Bullock's oriole	1	vermilion flycatcher	2
house finch	1	house finch	1
summer tanager	1	Lucy's warbler	1
verdin	1	northern mockingbird	1
white-winged dove	1	Say's phoebe	1

**Table 11. Intensive Area Search Surveys: Non-breeding Birds**

Species	Number of individual birds	Species	Number of individual birds
mourning dove	11.5	western kingbird	0.9
house finch	8.1	northern rough-winged swallow	0.6
white-winged dove	5.8	yellow-breasted chat	0.5
Wilson's warbler	5.6	black-chinned hummingbird	0.4
Gambel's quail	3.5	black phoebe	0.4
great-tailed grackle	3.5	double-crested cormorant	0.4
western flycatcher	3.2	ladder-backed woodpecker	0.4
ash-throated flycatcher	2.6	great egret	0.4
Bullock's oriole	2.0	warbling vireo	0.4
verdin	2.0	brown-headed cowbird	0.3
red-winged blackbird	1.9	Anna's hummingbird	0.1
Abert's towhee	1.7	black-tailed gnatcatcher	0.1
cliff swallow	1.7	<i>Empidonax</i> spp.	0.1
Lucy's warbler	1.5	house wren	0.1
Pacific-slope flycatcher	1.4	lesser nighthawk	0.1
hummingbird species	1.2	Great blue heron	0.1
western wood-pewee	1.1	greater roadrunner	0.1
willow flycatcher	1.1	MacGillivray's warbler	0.1
vermilion flycatcher	1.1	northern harrier	0.1
yellow-headed blackbird	1.0	Say's phoebe	0.1
		Townsend's warbler	0.1

### 3.5 Southwestern Willow Flycatcher Surveys

#### Methods

To elicit responses from willow flycatchers, conspecific vocalizations from previously recorded southwestern willow flycatchers 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 May 15 and 31, at least one survey between June 1 and 15, and three additional surveys between June 16 and July 25. Surveys were separated by a minimum of five days whenever logistically possible. Field personnel surveyed 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 9:00 a.m. Surveyors stopped every 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, water, and moist soils were noted during all surveys.

#### Results

SWCA surveyed two areas of the 'Ahakhav Tribal Preserve including Deer Island and Willow Beach. They also visited the CRIT 9 Restoration Area. No willow flycatchers were detected at Willow Beach after three survey visits of 1.5 observer hours. Cowbirds were detected on two surveys, and no evidence of livestock use was present. At the Deer Island site, one unpaired resident flycatcher was observed, and another flycatcher, for which residency was not confirmed, was observed from May 21 through June 6. The resident flycatcher was banded, but pairing or nesting was not confirmed. Cowbirds were detected on all visits. No willow flycatchers were observed at CRIT 9.

#### Discussion

CRIT 9 contains extremely sandy soils and a portion of the site is flood-irrigated weekly. Due to the soil type, the habitat only stays inundated for approximately one day. The inability to keep the habitat inundated for more than a day is disadvantageous to attracting breeding southwestern willow flycatchers. Unless dense structure and water underneath the stand improves, this site will no longer be surveyed by SWCA, but may be surveyed by CRIT or Reclamation biologists in 2009.

Willow Beach consists of an area of planted Fremont cottonwood bordering a backwater channel. The backwater channel is lined with seep willow (*Baccharis* sp.) and the edges of the restoration site have areas of tamarisk and mesquite. Surface water was present in the backwater channel and in a small pond during site visits in June and July, but because of the sparse vegetation, this site does not resemble suitable flycatcher habitat and further surveys will not be conducted.

The Deer Island site consists of a narrow strip of mixed native vegetation on the edge of a long backwater slough with extensive areas of cattails. Dense woody vegetation occurs in a strip approximately 5 m wide on the edge of the slough, and consists of tamarisk and screwbean mesquite up to 6 m in height with an understory of arrowweed. Although extensive areas of inundated and saturated soils exist, the water did not extend into the woody vegetation. Because flycatchers were found at this site in 2008 and it has potential for additional flycatcher use, it will be surveyed by SWCA in 2009.

### **3.6 Yellow-billed Cuckoo Surveys**

#### **Methods and Results**

Yellow-billed cuckoos were surveyed by Southern Sierra Research Station (SSRS). The survey involved using a tape-playback method in which surveyors broadcast a recorded cuckoo call at predetermined intervals along a predetermined route within appropriate riparian habitat.

The 'Ahakhav Tribal Preserve was surveyed five times during the 2008 field season. Five cuckoos were detected: four individuals on July 1 and one individual on July 22.

#### **Discussion**

Surveys and attempts to capture cuckoos will continue in 2009. Although no definitive breeding activity was observed (stick carry or nest building, food carry, nesting behavior, etc.), the length of time that birds were present (a minimum of 22 days) during the height of the breeding season suggests possible breeding activity at this site by one or more breeding pairs.

### **3.7 Elf Owl Surveys**

#### **Methods**

Survey sites were selected based on the 2004 vegetation maps, and aerial photography, historic locations, and previous incidental sightings. Site reconnaissance was conducted to determine whether habitat surveyed in the past was still present and accessible. Habitat that contained patches of CW I and II, and HM III and IV greater than 5 acres (2 ha) and located within reaches 3-5 were selected from the 2004 vegetation maps using ArcMap Geographic Info Systems (GIS). This included any previously restored areas matching these criteria.

Elf owls were surveyed following a protocol developed by the Arizona Game and Fish Department<sup>1</sup>. Multiple call stations were established every 492 ft (150 m) when feasible. At each call station, high quality elf owl calls were broadcast. All surveys were conducted between 30 minutes after sunset and 1:00 a.m. Surveys were stopped or did not occur in the event of rain or if wind exceeded 12 mph (19 kph). At CRIT 9, surveys were conducted on March 25, April 30, and May 20, 2008.

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<sup>1</sup> Michael Ingraldi (mingraldi@frontiernet.net) and Shawn Lowery, Arizona Game and Fish Department, 5000 West Carefree Highway, 602-942-3000



## **Results**

No elf owls were detected at CRIT 9. On the first survey night of March 25, two barn owls, one screech owl, and one great-horned owl responded to the elf owl call or were heard incidentally during the surveys.

## **Discussion**

The habitat at CRIT 9 likely does not contain nesting cavities to attract elf owls. Because elf owls are secondary cavity nesters, cavities excavated by woodpeckers need to be present within the habitat. As the habitat matures, woodpeckers may move into it and begin this process. In addition, if populations are limited to the Bill Williams River, which is suspected, there may not be enough recruitment to populate other areas. In 2009, the same 21 sites will be surveyed to collect additional baseline presence/absence data prior to initiating further studies. Studies on detection probability and response rates are being considered for future work. Once this basic information is known, the use of nest boxes may be examined.

# **4.0 Established Land Cover & 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 CRIT 9 includes cottonwood-willow II and mesquite III, as defined by Anderson and Ohmart (1976, 1984). The cottonwood-willow II structure type is described as having one layer of vegetation with the bulk of the volume 6 m (6.5 ft) tall or greater. Mesquite III is described as having one layer of vegetation with the bulk of the volume between 2-6 m (6.5-20 ft) tall.

# **5.0 Adaptive Management Recommendations**

## **5.1 Operations and Maintenance**

The site will be operated and maintained by the 'Ahakhav Tribal Preserve staff, with input from the Bureau of Reclamation.

## **5.2 Soil Management**

Soils at CRIT 9 are sandy and difficult to irrigate. Soil texture is likely the reason the buried pools were dislodged so easily during irrigation. In addition, over-irrigation of sandy soils may flush nutrients required by vegetation. Irrigation should be sufficient to

control soil salinity. The use of soil amendments to increase water holding capacity is being explored under a separate study.

### **5.3 Water Management**

Management recommendations for the 2009 breeding season are to target LCR MSCP species that do not require as much soil moisture as southwestern willow flycatchers. Summer tanagers and vermilion flycatchers were confirmed nesting in 2008, and yellow-billed cuckoos were present and suspected of nesting. Irrigation will be managed to maintain the current vegetation and control soil salinity. This should be sufficient for these other avian species as well. Surveys for these species will continue using system-wide and species-specific protocols to document any changes that may occur.

### **5.4 Structural Management**

The habitat present in CRIT 9 was planted beginning in 2001, and is maturing into cottonwood I and II and mesquite III and IV. This habitat type is of value to many LCR MSCP covered species. It is recommended that CRIT 9 be managed as mature cottonwood, willow, and mesquite habitat. Other locations at CRIT may be more suitable for SWFL habitat. Attempts to increase the density of the vegetation by planting additional coyote willow cuttings and maintain patches of moist soil using plastic pools were not successful in 2007 and 2008. Many of the coyote willow cuttings did not survive. It has also been observed that many of the previously planted cottonwoods are infested with fungal wetwood and may not survive.

If these trees and others furthest from the irrigation source die, they should be replaced by mesquite due to the difficulty in providing irrigation to such sandy areas. Both mesquite and cottonwood are important for summer tanagers, yellow-billed cuckoos, elf owls, woodpeckers, and vermilion flycatchers.

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## Appendix 1: Irrigation Schedule CRIT 9

CRIT 9 is fed by flood irrigation from two concrete-lined ditches. Sections 1 and 2 (83 acres) are flooded at a rate of approximately 1.6 acre-feet per hour. During FY08, sections 1 and 2 were irrigated for 1253.25 hours and 688.3 acre-feet for a total average of 8.3 acre-feet/acre (Table 1).

**Table 1. Total Irrigation for sections 1 & 2**

Date	Section	Hrs Irrigated	Date	Section	Hrs Irrigated
11/8/2007	1	13.5	6/25/2008	2	27.5
	2	8	6/26/2008	1	25.75
11/9/2007	1	9.5	6/26/2008	2	3.25
	2	15.5	7/2/2008	1	14
2/21/08	1	22.25	7/2/2008	2	16.25
	2	12	7/3/2008	1	23.25
2/22/08	1	17.5	7/3/2008	2	3.5
2/28/2008	1	9.25	7/9/2008	1	10
3/1/2008	2	15	7/9/2008	2	20
3/7/2008	2	14	7/10/2008	1	29.5
3/19/2008	2	0.75	7/10/2008	2	2.5
3/20/2008	2	21	7/23/2008	1	7.5
4/18/2008	1	14.25	7/23/2008	2	17.25
4/19/2008	1	21.25	7/24/2008	1	4
4/24/2008	1	19.25	7/24/2008	2	43.5
4/25/2008	1	4.25	7/25/2008	1	11.5
	2	3.5	8/7/2008	1	9
4/28/2008	1	11	8/7/2008	2	21.25
	2	16	8/8/2008	1	16.5
4/29/2008	1	3	8/8/2008	2	30.25
	2	30.5	8/26/2008	1	28.25
5/6/2008	2	65.5	8/26/2008	2	22
5/7/2008	1	17	8/27/2008	1	6
	2	50	8/27/2008	2	20.5
5/14/2008	1	16.25	9/10/2008	1	16.25
5/28/2008	1	9	9/10/2008	2	20.75
	2	21.5	9/11/2008	1	26.25
5/29/2008	1	29.25	9/11/2008	2	22.75
	2	14	9/23/2008	1	17.25
6/4/2008	1	9.75	9/23/2008	2	21
6/12/2008	1	16.75	9/24/2008	1	35.25
6/18/2008	1	7.25	9/24/2008	2	46
6/18/2008	2	8	9/25/2008	1	13.75
6/19/2008	1	10	9/25/2008	2	12.5
6/19/2008	2	49			
6/25/2008	1	4			

Sections 3 and 4 (71 acres) are flooded at a rate of approximately 1.0 acre-feet/hour. During FY08, these sections were irrigated for 749.5 hours, providing a total of 377 acre-feet for an average of 5.3 acre-feet/acre (Table 2).

**Table 2. Total Irrigation for sections 3 & 4**

<b>Date</b>	<b>Section</b>	<b>Hrs Irrigated</b>	<b>Date</b>	<b>Section</b>	<b>Hrs Irrigated</b>
11/15/07	3	15.5	7/18/2008	3	6
11/16/07	3	15.5	7/18/2008	4	2
11/28/07	4	8.5	7/21/2008	3	8
11/29/07	3	16	8/13/2008	3	7.75
11/30/07	4	19.5	8/13/2008	4	28.5
2/15/2008	3	7	8/14/2008	3	16
2/21/2008	3	9.5	9/3/2008	3	21.25
2/22/2008	3	17.5	9/3/2008	4	8
2/28/2008	3	0.5	9/4/2008	3	12.5
2/29/2008	3	24	9/4/2008	4	3.5
3/1/2008	3	16	9/16/2008	3	2
3/6/2008	4	20.5	9/16/2008	4	20
3/7/2008	4	22.25	9/17/2008	3	28.5
3/19/2008	4	24	9/17/2008	4	19
4/24/2008	3	7.5	9/18/2008	3	18
4/25/2008	3	7.75	9/18/2008	4	4.5
4/30/2008	4	19.25	7/17/2008	3	10.5
5/1/2008	3	6.5	7/17/2008	4	13.5
	4	10.25			
5/6/2008	3	15			
	4	7			
5/7/2008	3	28			
	4	3			
5/27/2008	3	13			
	4	11.75			
5/28/2008	3	22			
6/11/2008	3	14			
6/11/2008	4	11.5			
6/12/2008	3	19			
6/12/2008	4	8			
6/13/2008	3	17			
6/13/2008	4	13.5			
6/19/2008	3	16			
6/20/2008	3	3.5			
6/20/2008	4	4.5			
26-Jun	3	7.5			
6/26/2008	4	12.5			
6/27/2008	4	8			
7/16/2008	3	12			
7/16/2008	4	5.75			

Sections 5 and 6 (50 acres) are flooded at approximately 0.8 acre-feet/hr. During FY08, these sections were irrigated for 1231.5 hours, providing a total of 660.4 acre-feet for an average of 13.2 acre-feet/acre (Table 3).

**Table 3. Total Irrigation for Sections 5 & 6**

<b>Date</b>	<b>Section</b>	<b>Hrs Irrigated</b>	<b>Date</b>	<b>Section</b>	<b>Hrs Irrigated</b>
2/28/2008	5	10.25	7/21/2008	5	4
2/29/2008	5	24	7/22/2008	5	26
3/1/2008	5	0.75	7/23/2008	5	24.75
3/6/2008	5	14.75	7/25/2008	5	18
3/7/2008	5	9.25	7/30/2008	5	10
3/19/2008	5	13.5	7/30/2008	6	6
3/20/2008	5	10	7/31/2008	5	12.5
3/27/2008	5	14.5	7/31/2008	6	14.5
3/28/2008	5	16.25	8/1/2008	5	8
4/4/2008	5	15	8/1/2008	6	14.5
4/5/2008	5	17	8/2/2008	5	9
4/11/2008	5	15	8/2/2008	6	16.5
4/12/2008	5	3	8/6/2008	5	6.5
4/18/2008	5	14.5	8/6/2008	6	6.75
4/19/2008	5	5	8/7/2008	5	11
4/28/2008	5	17	8/7/2008	6	13
4/29/2008	5	9	8/8/2008	5	19.25
5/1/2008	5	11.25	8/8/2008	6	11.75
5/8/2008	5	8.5	8/9/2008	5	6
5/13/2008	5	8	8/9/2008	6	4
5/14/2008	5	14.25	8/13/2008	5	10.75
5/27/2008	5	26	8/13/2008	6	5
5/28/2008	5	19.5	8/14/2008	5	10
6/4/2008	5	15	8/14/2008	6	19.5
6/5/2008	5	9.25	8/15/2008	5	25.75
6/11/2008	5	15.5	8/18/2008	5	9.25
6/12/2008	5	8	8/18/2008	6	6.75
6/18/2008	5	18	8/19/2008	5	32.5
6/19/2008	5	1	8/19/2008	6	8
6/25/2008	5	16	8/20/2008	5	23.75
6/26/2008	5	5	8/20/2008	6	5.75
6/30/2008	5	16	8/25/2008	5	19.5
7/1/2008	5	4.75	8/25/2008	6	11.25
7/2/2008	5	12	8/26/2008	5	19.75
7/3/2008	5	4	8/26/2008	6	12.25
7/9/2008	5	14.25	8/27/2008	5	8
7/10/2008	5	5	8/27/2008	6	4.5
7/16/2008	5	18	9/3/2008	5	8
7/17/2008	5	2.5	9/3/2008	6	3.75
7/18/2008	5	8.5	9/4/2008	5	26.75
9/4/2008	6	15.25			
9/5/2008	5	21.75			

9/5/2008	6	9.25
9/10/2008	5	17
9/10/2008	6	16
9/11/2008	5	24.75
9/11/2008	6	16
9/12/2008	5	4
9/12/2008	6	10.5
9/16/2008	5	14.25
9/16/2008	6	11
9/17/2008	5	18.25
9/17/2008	6	6.75
9/23/2008	5	13.25
9/23/2008	6	9.5
9/24/2008	5	27.75
9/24/2008	6	14.5



## Appendix 2: Complete Species List CRIT 9

<b>Common Name</b>	<b>Scientific Name</b>
great blue heron	<i>Ardea herodias</i>
great egret	<i>Ardea alba</i>
northern harrier	<i>Circus cyaneus</i>
Gambel's quail	<i>Callipepla gambelii</i>
white-winged dove	<i>Zenaida asiatica</i>
mourning dove	<i>Zenaida macroura</i>
greater roadrunner	<i>Geococcyx californianus</i>
black-chinned hummingbird	<i>Archilochus alexandri</i>
Anna's hummingbird	<i>Calypte anna</i>
ladder-backed woodpecker	<i>Picoides scalaris</i>
western wood-pewee	<i>Contopus sordidulus</i>
willow flycatcher	<i>Empidonax trailii</i>
pacific-slope flycatcher	<i>Empidonax difficilis</i>
black phoebe	<i>Sayornis nigricans</i>
Say's phoebe	<i>Sayornis saya</i>
vermillion flycatcher	<i>Pyrocephalus rubinus</i>
ash-throated flycatcher	<i>Myiarchus cinerascens</i>
western kingbird	<i>Tyrannus verticalis</i>
Arizona Bell's vireo	<i>Vireo bellii arizonae</i>
warbling vireo	<i>Vireo gilvus</i>
northern rough-winged swallow	<i>Stelgidopteryx serripennis</i>
cliff swallow	<i>Petrochelidon pyrrhonota</i>
verdin	<i>Auriparus flaviceps</i>
house wren	<i>Troglodytes aedon</i>
black-tailed gnatcatcher	<i>Polioptila melanura</i>
northern mockingbird	<i>Mimus polyglottos</i>
Lucy's warbler	<i>Vermivora luciae</i>
Sonoran yellow warbler	<i>Dendroica petechia sonorana</i>
Townsend's warbler	<i>Dendroica townsendi</i>
MacGillivray's warbler	<i>Oporornis tolmiei</i>
Wilson's warbler	<i>Wilsonia pusilla</i>
yellow-breasted chat	<i>Icteria virens</i>
summer tanager	<i>Piranga rubra</i>
Abert's towhee	<i>Pipilo aberti</i>
blue grosbeak	<i>Passerina caerulea</i>
red-winged blackbird	<i>Agelaius phoeniceus</i>
great-tailed grackle	<i>Quiscalus mexicanus</i>
brown-headed cowbird	<i>Molothrus ater</i>
Bullock's oriole	<i>Icterus bullockii</i>
house finch	<i>Carpodacus mexicanus</i>