



# Lower Colorado River Multi-Species Conservation Program

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*Balancing Resource Use and Conservation*

## **PROGRAM HIGHLIGHTS** **2005 - 2015**





## Letter from the Program Manager

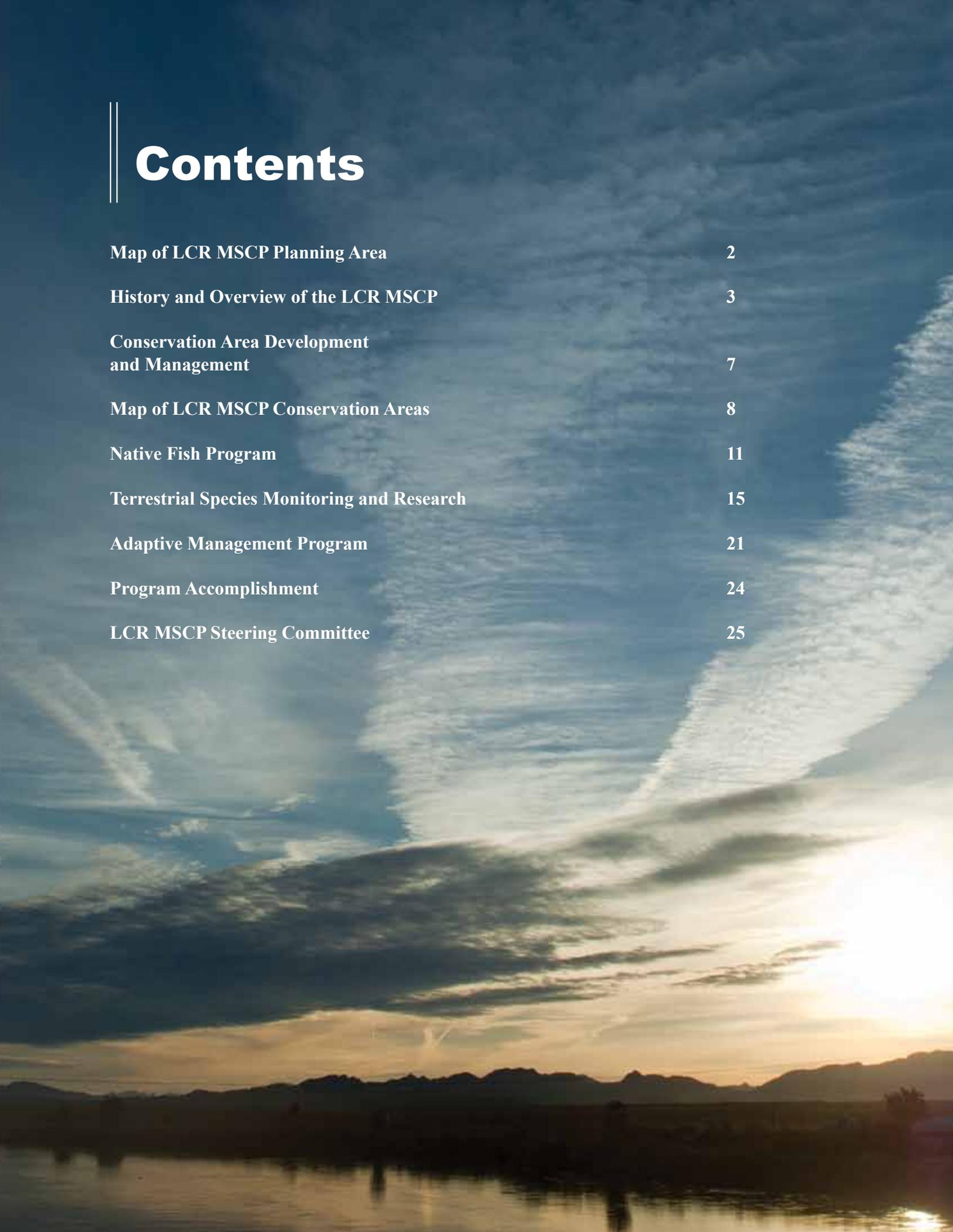
On April 4, 2005, the Lower Colorado River Multi-Species Conservation Program (LCR MSCP) documents were signed by the Secretary of the U.S. Department of the Interior and representatives from 41 different non-Federal entities in Arizona, California, and Nevada. These documents culminated 10 years of planning among the partners, resulting in a program that balances the use of lower Colorado River water resources along with the conservation of native species and their habitats. Federal fiscal year 2015 marks the 10th year of LCR MSCP implementation.

The LCR MSCP Habitat Conservation Plan (HCP) describes conservation measures for 31 native species, including birds, fish, mammals, reptiles, amphibians, insects, and plants once commonly found along the Colorado River. The Bureau of Reclamation, as lead implementing agency for the LCR MSCP, is responsible for implementing these conservation measures. I am proud to say that implementation has met or exceeded all goals expected within the first 10 years with many remarkable successes being documented.

The success of the LCR MSCP is due to the efforts of many individuals and groups since 1995. The foresight of the people involved in long, arduous planning sessions resulted in a program that has clear goals and objectives. The documents and agreements developed during program planning also have the flexibility required for successful implementation of the HCP. Since implementation of the program began in 2005, the hard work, dedication, and professionalism of the LCR MSCP staff have resulted in this enviable success. However, the success is not just measured in on-the-ground results. The ability of the LCR MSCP Steering Committee, currently consisting of 57 different agencies and entities, to work toward solutions to meet our common goals sets a standard for all future multi-agency endeavors.

Many challenges still need to be addressed over the next 40 years. Some challenges, such as completing the habitat creation and management requirements, will be a focus over the next 10 years. Others will not even be identified until they occur (such as the arrival of invasive, non-native quagga mussels in 2007). Large landscape concerns such as drought and climate change may also influence program implementation. The strength of the program is the flexibility inherent in the adaptive management process and the ability of the LCR MSCP and its partners to come together to find solutions. We look forward to working together with our partners to meet these future challenges.

**John Swett**  
**LCR MSCP Program Manager**



# Contents

<b>Map of LCR MSCP Planning Area</b>	<b>2</b>
<b>History and Overview of the LCR MSCP</b>	<b>3</b>
<b>Conservation Area Development and Management</b>	<b>7</b>
<b>Map of LCR MSCP Conservation Areas</b>	<b>8</b>
<b>Native Fish Program</b>	<b>11</b>
<b>Terrestrial Species Monitoring and Research</b>	<b>15</b>
<b>Adaptive Management Program</b>	<b>21</b>
<b>Program Accomplishment</b>	<b>24</b>
<b>LCR MSCP Steering Committee</b>	<b>25</b>

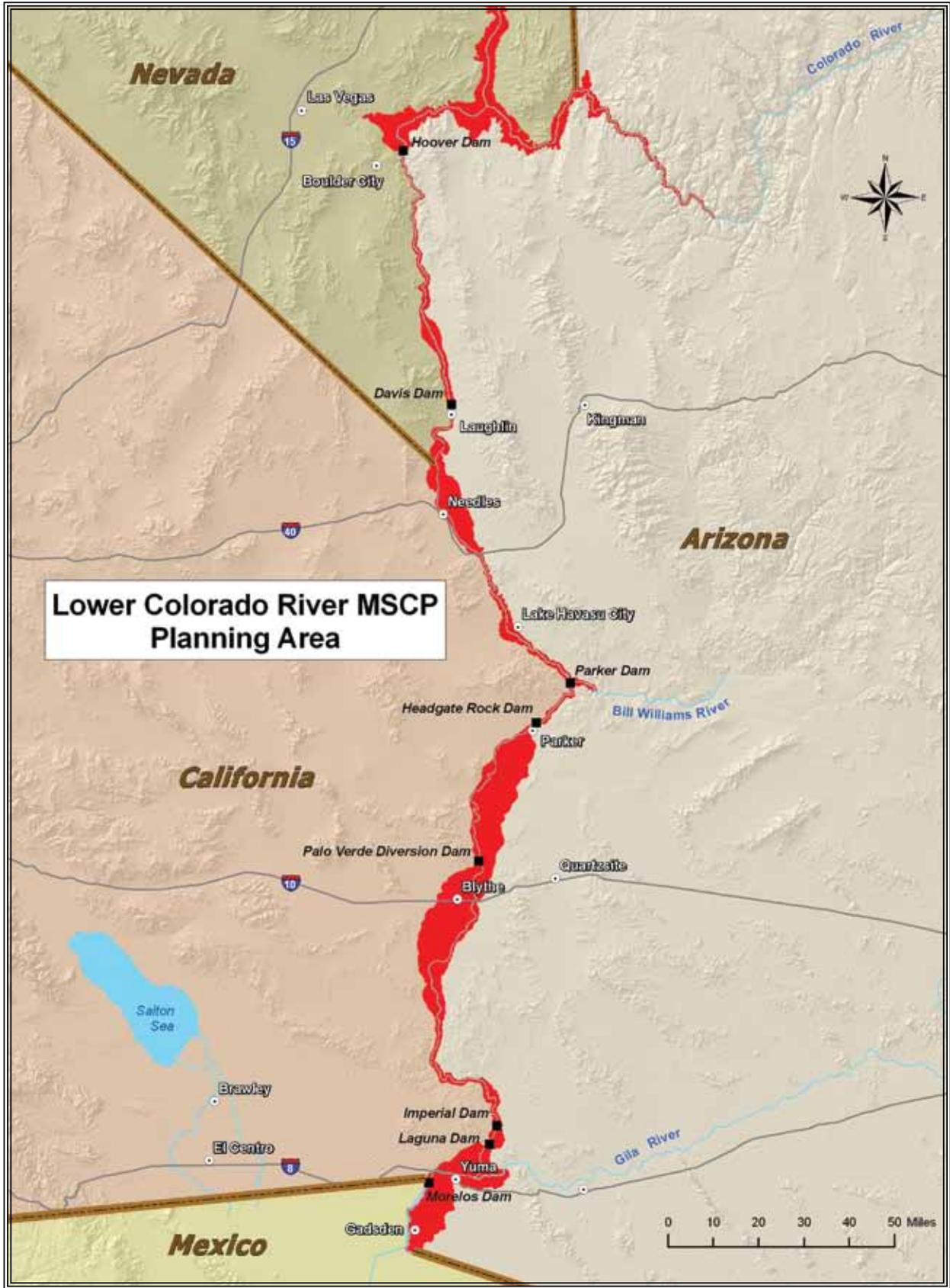
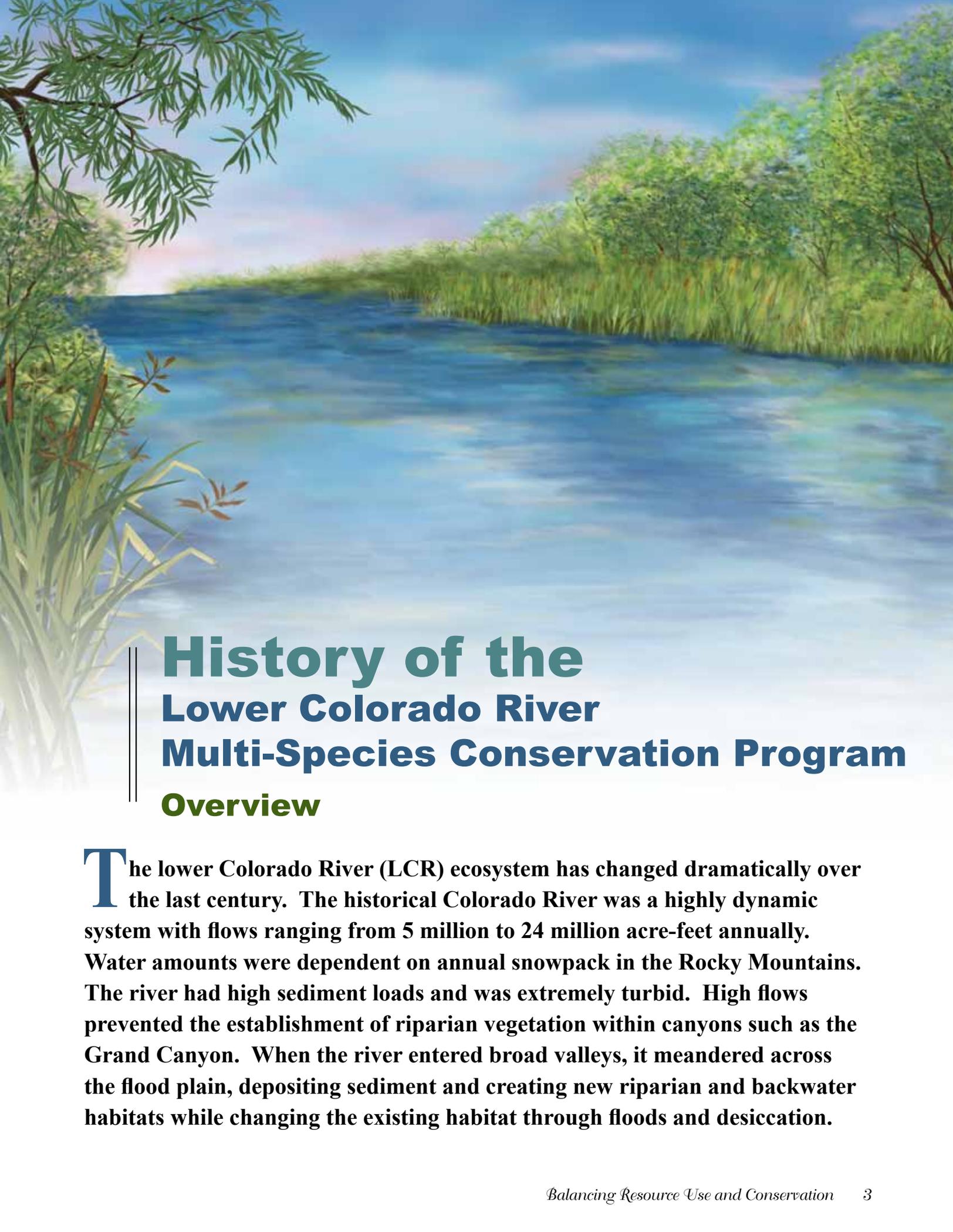


Figure 1: Lower Colorado River MSCP Planning Area



# History of the Lower Colorado River Multi-Species Conservation Program

## Overview

**T**he lower Colorado River (LCR) ecosystem has changed dramatically over the last century. The historical Colorado River was a highly dynamic system with flows ranging from 5 million to 24 million acre-feet annually. Water amounts were dependent on annual snowpack in the Rocky Mountains. The river had high sediment loads and was extremely turbid. High flows prevented the establishment of riparian vegetation within canyons such as the Grand Canyon. When the river entered broad valleys, it meandered across the flood plain, depositing sediment and creating new riparian and backwater habitats while changing the existing habitat through floods and desiccation.

In the early 20th century, the Southwestern United States began expanding agricultural and municipal development. In order to ensure a sustainable water supply and develop the renewable power necessary for development, a series of dams and diversions were built along the LCR from Hoover Dam to the Republic of Mexico. Today, the Colorado River provides water for more than 25 million people and 3.5 million acres of agricultural land while producing 12 billion kilowatt-hours of energy annually. The changes to the ecosystem have resulted in a river that rarely floods, staying within channelized, armored bank lines over much of its length. Reduced flood frequency and sediment capture in reservoirs has changed the river from turbid to clear except in rare, localized events. Some species have adapted to the ecosystem changes readily, including species that were not historically found in the LCR ecosystem, while some native species have not fared as well.

## Lower Colorado River Multi-Species Conservation Program

Since 1967, seven species native to the lower Colorado ecosystem have been listed as threatened or endangered under the Endangered Species Act (ESA). The Yuma clapper rail, recently renamed Yuma Ridgway's rail, is native to marsh habitat found along the LCR. It was listed in 1967 under the Endangered Species Preservation Act of 1966, a precursor to the current ESA. The Mojave population of desert tortoise was listed as threatened in 1990. Three native fish species, the bonytail, razorback sucker, and humpback chub, were all listed as endangered under the ESA by 1991. Critical habitat was designated for the bonytail and razorback sucker in 1994, including areas of the LCR. In 1995, the southwestern willow flycatcher, a neo-tropical migratory bird that breeds in riparian habitat, was listed as endangered, with critical habitat being designated in 2013. The Western Distinct Population Segment of the yellow-billed cuckoo, also a neo-tropical migratory bird that breeds in riparian habitat, was listed as threatened in 2014.

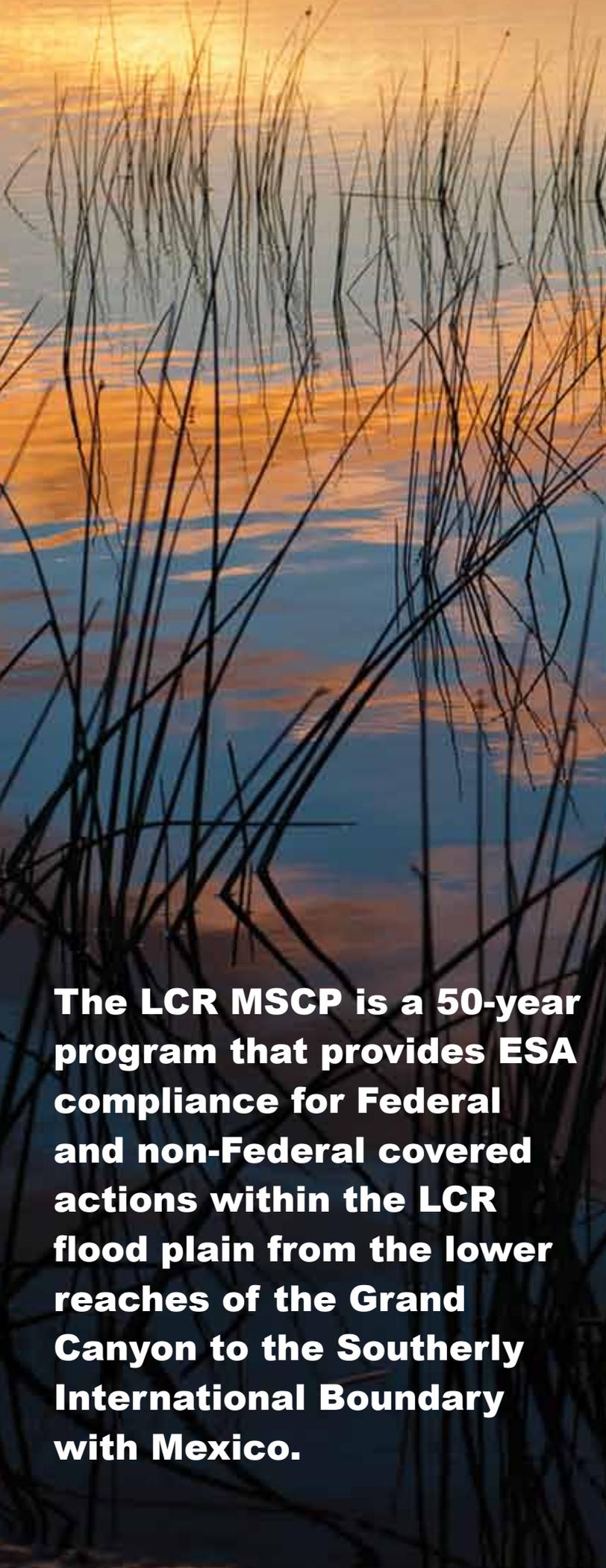


**Razorback sucker**

Critical habitat for the yellow-billed cuckoo has not been designated.

After critical habitat for the bonytail and razorback sucker was designated by the U.S. Fish and Wildlife Service (USFWS) in 1994, representatives from Federal and non-Federal agencies responsible for water and power management along the LCR met to discuss a comprehensive plan to conserve native species and their habitats in compliance with the ESA. This meeting was the genesis of the LCR MSCP, a unique program that seeks to balance the use of Colorado River water resources with the conservation of native species and their habitats. While the LCR MSCP was being developed over the next 10 years, the Bureau of Reclamation (Reclamation) received a Biological and Conference Opinion from the USFWS that covered routine operation and maintenance activities. This Biological Opinion, issued in 1997 and extended in 2002, provided ESA compliance for these activities and directed the stakeholders to develop and implement the LCR MSCP. In April 2005, U.S. Department of the Interior Secretary Gale Norton and representatives from 41 non-Federal agencies within Arizona, California, and Nevada signed the documents to implement the LCR MSCP.

The LCR MSCP is a 50-year program that provides ESA compliance for



**The LCR MSCP is a 50-year program that provides ESA compliance for Federal and non-Federal covered actions within the LCR flood plain from the lower reaches of the Grand Canyon to the Southerly International Boundary with Mexico.**

Federal and non-Federal covered actions within the LCR flood plain from the lower reaches of the Grand Canyon to the Southerly International Boundary with Mexico. Covered actions include the delivery of 9 million acre-feet of water, power production from six dams located along the LCR, and maintenance activities associated with river operations. The goals of the program are to conserve habitat and work toward the recovery of currently listed ESA threatened and endangered species, reduce the likelihood that additional species found along the LCR will be listed under the ESA, accommodate current water and power production, optimize future water and power



**Yellow-billed cuckoo**

development consistent with the law, and provide the basis for incidental take authorization under the ESA by implementing a Habitat Conservation Plan (HCP).

Reclamation is the lead implementing agency for the LCR MSCP. Partnership involvement occurs primarily through the LCR MSCP Steering Committee, which provides input and oversight functions in support of implementation. The committee currently is comprised of 57 different entities, including State and Federal agencies, water and power agencies, Native American Tribes, municipalities, conservation groups, and other interested parties. Non-Federal agencies that required ESA Section 10 compliance for covered activities pay half the program costs, and the Federal Government pays the other half.



**MacNeill's sootywing skipper**

## The Habitat Conservation Plan

The HCP is a comprehensive plan designed to help achieve the goals of the LCR MSCP by conserving native species and their habitats. The HCP defines the purpose of the program, lists covered activities, describes the LCR ecosystem historically and at the time of program implementation, analyzes the impacts of covered activities on native species and their habitat, and defines the conservation measures being implemented to offset these impacts. It describes conservation measures for 26 covered species and 5 evaluation species. Covered species are species currently listed under the ESA or are species protected or listed as sensitive by Arizona, California, or Nevada that could be affected by covered activities. Evaluation species require additional information before being added to the covered species list. Covered species include fish, birds, mammals, reptiles, amphibians, plants, and an insect.

The HCP describes general and species-specific conservation measures designed to conserve covered species and their habitat within the LCR MSCP planning area. The planning area stretches from the lower Grand Canyon to the Southerly International Boundary with Mexico, including the historical flood plain of the LCR. The ROD extended the area to include the lower reaches of several tributaries for implementation purposes. The HCP also describes how these conservation measures are interrelated to provide an ecosystem approach to conservation. Major components include augmenting native fish populations, conducting research on species and habitat, monitoring species populations and habitats throughout the program area, creating and managing new habitat, protecting existing habitat, and managing the program using adaptive management principals to ensure effective conservation.

Numerous agreements and documents were signed to implement the LCR MSCP and included the Funding and Management Agreement, which defines the roles and responsibilities for management, implementation, and funding of the program; the Implementing Agreement, which ensures implementation of the HCP by Federal and non-Federal parties; the Record of Decision (ROD), which approves the Federal actions required to implement the program; the LCR MSCP Steering Committee By-Laws, which describe the roles and responsibilities of the Steering Committee; and the HCP.

Over the first 10 years of program implementation, several additional LCR MSCP documents have been created to address uncertainties. The Existing Habitat Maintenance Fund outlines the strategy to provide funding to maintain habitat that existed at the beginning of the program. Implementation of projects under this fund begins in 2016. The Remedial Measures Fund provides a contingency fund to implement actions required to offset potential changed circumstances identified in the HCP. A Land and Water Fund has been created to set aside the funding necessary to acquire land and water to meet HCP requirements.



# Conservation Area Development and Management Overview

**T**he maintenance of existing habitat and the development and management of new habitat are integral components of the LCR MSCP. Historically, riparian, marsh, and backwater habitats were abundant in the broad alluvial flood plains found along the LCR. The river created a dynamic ecosystem where habitat mosaics were created, maintained, and changed annually, depending on river flows. However, river management, conversion of habitat to urban developments and agriculture, introduction of invasive species, and increased wildfire frequency have reduced and altered these habitats over the last 100 years. By maintaining existing habitat and creating new habitat for native species, the LCR MSCP will reduce the likelihood of additional species needing ESA protection along the LCR.

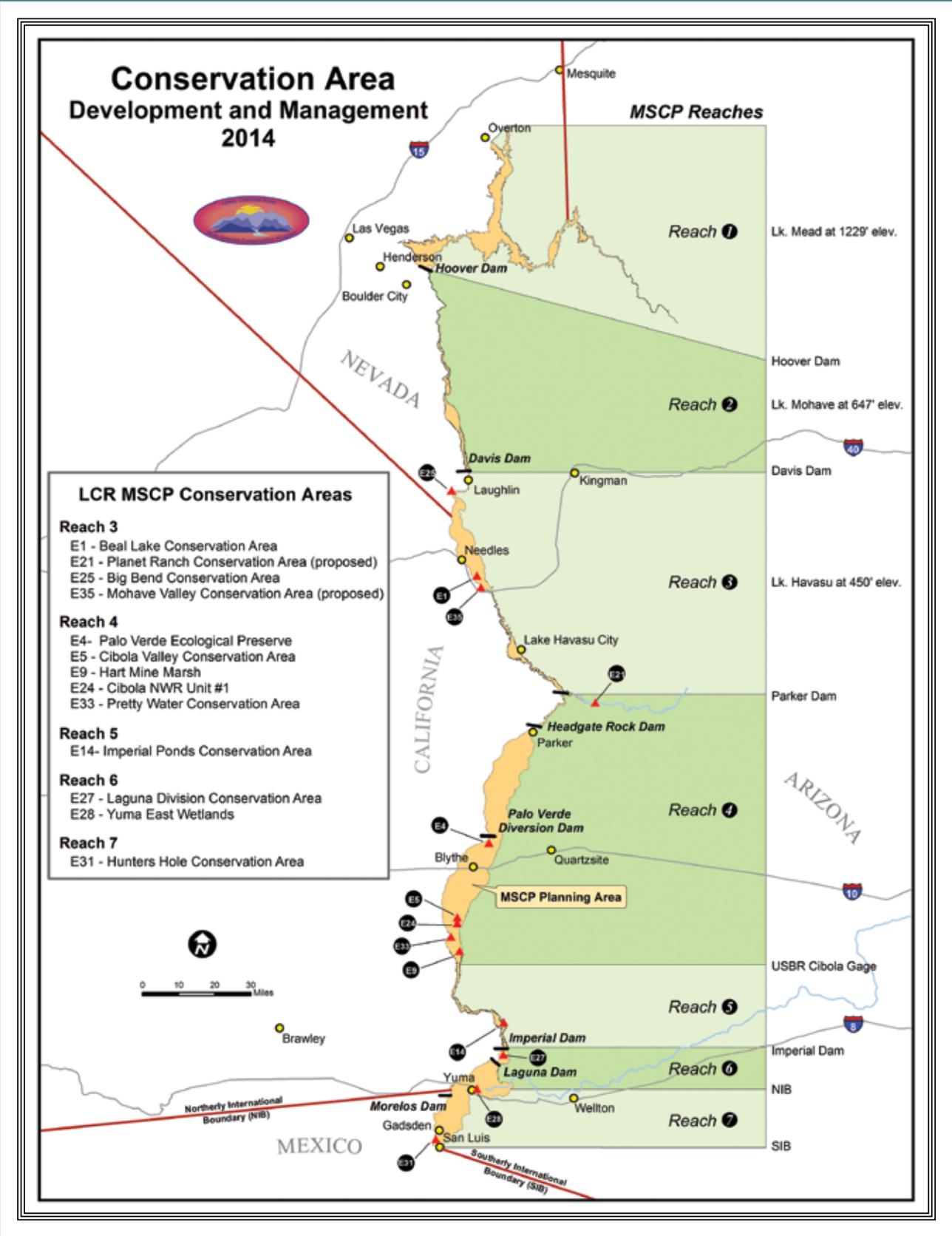


Figure 2: Map of conservation areas

## Habitat Creation And Management

Twenty covered species have conservation measures that direct the program to create and manage habitat. While these species have specific acreage goals tied to specific habitat types, the goal is to not build separate areas for each species but rather to design habitat mosaics so that multiple species will benefit from each new conservation area. The LCR MSCP will design, create, and manage a minimum of 8,132 acres of new habitat for covered species with four land cover types: cottonwood-willow riparian forest, honey mesquite woodland, marsh, and backwaters. These new habitats are designated as “conservation areas” under the management of the LCR MSCP as stipulated in the HCP.

The development and management of new conservation areas follows a process that has been approved by the LCR MSCP Steering Committee. Many conservation areas are established on lands managed by partner agencies; however, private land and water can also be acquired by the LCR MSCP with Steering Committee approval. When a new conservation area is proposed, Reclamation enters into an agreement, typically a Land Use Agreement or lease, which specifies the roles and responsibilities of each party and secures the site as a LCR MSCP conservation area for the life of the program. Reclamation is responsible for designing, constructing, and managing the conservation area for the program after coordination with the landowner or partner agency.

New restoration techniques were needed to develop habitat mosaics at the size and scale required by the program, so research was conducted to help develop these techniques. Additional restoration research will be required as new issues arise during the management of the sites. The design and management of a conservation area incorporates the best scientific data available at the time. Information is obtained



**Twenty covered species have conservation measures that direct the program to create and manage habitat.**

**Beal Lake Conservation Area**



**Imperial Ponds Conservation Area**

from research and monitoring activities for the covered species targeted for each habitat type. These data are used to design new conservation areas as well as to manage existing conservation areas through the adaptive management process. Data help determine important aspects of the design such as density, plant composition, ground cover, habitat complexity, and water management.

In the first 10 years of program implementation, 11 conservation areas have been established and

**Table 1: Summary of acres established through Fiscal Year 2015**

	COTTONWOOD-	MESQUITE	MARSH	BACKWATERS	
ARIZONA	1,639	894	330	80	2,943
CALIFORNIA	1,020	686	0	0	1,706
NEVADA	0	0	0	15	15
TOTAL	2,659	1,580	330	95	4,664

range in size from a 15-acre backwater to several conservation areas that encompass over 1,000 acres of different habitat mosaics. Conservation areas have been established in Arizona, California, and Nevada and are spread throughout the LCR MSCP planning area (figure 2). By the end of 2015, the LCR MSCP will have established over 4,600 acres of required land cover types, which is almost three times the amount expected in the implementation schedule described in the HCP (table 1).

## Future Challenges

Additional conservation areas will need to be developed and managed to meet the goals of the LCR MSCP. The limited availability of land and water for new conservation areas, especially in California, has been identified as an issue to be addressed in order to meet these goals. Conservation area management will continue to evolve as guidelines are developed and modified based on the knowledge acquired from research and post-development monitoring. Management issues, such as optimizing available water to create and manage habitat at conservation areas or managing habitat mosaics for different species needs that may conflict with one another, will become important as the program moves forward. Habitat management techniques will need to be developed and tested so they can address the needs of multiple species at landscape to patch-size scales.





# Native Fish Program Overview

**T**he LCR MSCP will implement conservation measures for four native fish species found in the LCR ecosystem. The primary focus is to increase native fish populations by creating new habitat for razorback sucker, bonytail, and flannelmouth sucker and by implementing a razorback sucker and bonytail population augmentation program. Research projects are designed to provide information to increase survivorship, maintain genetic variability, and better manage these species and their habitats. Monitoring is conducted to determine if these actions result in new or larger native fish populations. A separate conservation measure provides funding to support ongoing conservation of the humpback chub in the Grand Canyon.

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## Fish Augmentation

The razorback sucker and bonytail are both listed as endangered under the ESA. The LCR MSCP fish augmentation program is designed to conserve the existing populations of these fish and to contribute toward their recovery by increasing existing populations, establishing populations in areas where they were no longer found, and populating newly created backwater habitat. The LCR MSCP has a goal to provide the effort to stock approximately 660,000 razorback suckers and 620,000 bonytail in the LCR. Since non-native fish predation has been identified as one of the primary causes for the decline of native fish populations in the LCR, it is necessary to grow fish to at least a sub-adult life stage before they are stocked into the river to reduce loss due to predation.

The first step in any fish augmentation program is to establish several sources of genetically diverse fish whose progeny can be used to augment existing populations. Currently, the USFWS maintains the only brood stock for bonytail at the Southwestern Native Aquatic Resources and Recovery Center (SNARRC) in Roswell, New Mexico. Plans are underway to create a second



Humpback chub

brood stock. The razorback sucker population found in Lake Mohave represents the most genetically diverse population of this species in the world and is used as a brood stock by the LCR MSCP. Each year, tens of thousands of razorback larvae are collected at Lake Mohave during the spawning season and brought to State and Federal hatcheries to be raised for the program. A secondary brood stock for razorback suckers is maintained at SNARRC where fish are also raised for the LCR MSCP. Once razorback suckers and bonytail reach minimum stocking size, they are released into the LCR and adjacent backwaters. A portion of these razorbacks are released into Lake Mohave to maintain the wild brood stock. Stocking events are coordinated with the USFWS, State natural resource agencies, and landowners to facilitate coordination of management, monitoring, and research activities.

Through 2015, it is anticipated that approximately 153,000 razorback suckers and 76,000 bonytail will have been raised and stocked back into the LCR (table 2). An additional 114,000 razorbacks will have been stocked into Lake Mohave to maintain genetic diversity of this important brood stock. These stocking accomplishments met or exceeded the target goals for each species and river reach for the first 10 years of program implementation except for bonytail stocking in river



**The razorback sucker population found in Lake Mohave represents the most genetically diverse population of this species in the world and is used as a brood stock by the LCR MSCP.**

reaches downstream from Parker Dam. A potential concern with survivorship in these reaches was raised after monitoring data were analyzed, so stocking has been postponed to allow further monitoring and research.

In 2007, the invasive quagga mussel was discovered in Lake Mead and has spread throughout the LCR. This infestation has created changes in the augmentation program, but the inherent flexibility of the program allowed us to continue to meet augmentation goals.



**Razorback sucker**

## **Fish Monitoring and Research**

A robust monitoring and research program is a necessary component for successful implementation of the LCR MSCP. Data gathered from monitoring and research projects provide information for the adaptive management process. Adaptive management allows the program to be flexible so that conservation can be accomplished in an effective and efficient manner based on the most current information available. These concepts are especially important in the native fish program. System monitoring data are used to develop population estimates and identify new or unknown populations of fish. These data are used to identify potential issues and limiting factors that may affect the fish augmentation strategy. Monitoring at LCR MSCP conservation

**Table 2: Summary of native fish stocking anticipated through Fiscal Year 2015**

SPECIES	LAKE MOHAVE	DAVIS - PARKER	BELOW PARKER	TOTAL	AUGMENTATION TOTAL
<b>RAZORBACK SUCKER</b>	<b>114,626*</b>	<b>72,865</b>	<b>79,736</b>	<b>267,227</b>	<b>152,601</b>
<b>BONYTAIL</b>	<b>0</b>	<b>55,403</b>	<b>20,733</b>	<b>76,136</b>	<b>76,136</b>
<b>TOTAL</b>	<b>114,626*</b>	<b>128,268</b>	<b>100,469</b>	<b>343,363</b>	<b>228,737</b>

**\*Don't count towards augmentation goals-separate conservation measure**



areas developed for native fish also provides data to help design future conservation areas and to successfully manage these sites. Research conducted by the LCR MSCP over the first 10 years has helped refine new monitoring techniques that provide more data than traditional monitoring methods. Remote sensing units can provide data over a longer time period in areas that are difficult to monitor using trammel nets, electrofishing, or other techniques. Remote sensing has the added benefit of decreasing handling stress associated with other methods. Sonic tag technology, while very invasive, provides a reliable method for monitoring individual fish as they move throughout the river. Using these techniques, biologists have been able to monitor and study razorback suckers in Lake Mead. They have found that razorback suckers are persisting in Lake Mead and have found additional spawning populations through the use of sonic tags. Biologists also have observed increased population estimates between Davis and Parker Dams since the razorback augmentation program

was initiated. Some detections of bonytail have also been observed at the confluence of the Bill Williams River and Lake Havasu.

Research has also begun in an effort to improve long-term survivability of stocked fish. Research has focused on the improved health and condition of stocked fish, stocking techniques, and habitat complexity. Razorback sucker, bonytail, and flannelmouth sucker habitat requirements, such as water quality parameters, have also been studied so that habitat created for these species can be designed and managed using the best available scientific information.

## Future Challenges

The existence of a small, self-sustaining population of razorback suckers in Lake Mead and the increased population of razorbacks between Davis and Parker Dams is encouraging; however, additional research and monitoring is needed to increase survivorship of stocked fish and to determine the stocking success in other reaches of the river. Backwater habitat creation strategies are being investigated to determine the most effective techniques to provide the habitat complexity and water quality parameters needed for successful native fish management in these conservation areas.



# Terrestrial Species Monitoring and Research

## Overview

**T**he HCP describes conservation measures for 27 covered and evaluation species that spend at least part of their life cycle in terrestrial, riparian, or marsh habitats along the LCR. In compliance with the conservation measures, the LCR MSCP is required to create and manage habitat for 17 of these species. An extensive research and monitoring program is necessary to effectively create, manage, and protect habitat to provide species conservation.

Research and monitoring has been conducted along the LCR and many other riverine ecosystems throughout the Southwestern United States for decades; however, the objectives varied among projects. For some LCR MSCP species, especially ESA listed species, numerous studies and monitoring programs have been designed to learn life history information and population status. Yet, the information necessary to create and manage habitat for these species was often unavailable. For other species covered under the program, little was known about the natural history, population status, and habitat requirements when the HCP was written. The LCR MSCP used existing survey protocols and data when possible to conduct research and monitoring and developed new monitoring protocols and study designs when necessary.

There are three fundamental purposes of the LCR MSCP research and monitoring program: (1) species and habitat related research projects, (2) system monitoring of species and their habitats, and (3) monitoring of conservation areas developed as covered species habitat. Species research is conducted to learn the habitat requirements of each covered species, the factors that may limit their ability to maintain viable populations along the LCR, and the best management practices for creating and managing their habitat. System



**Arizona Bell's vireo**

monitoring is designed to collect information on existing populations and habitats to evaluate population status, distribution, colonization, migration, and other important ecological parameters over time within the LCR ecosystem. Monitoring habitat characteristics and species response within conservation areas provides the information necessary to design future conservation areas and to effectively manage these sites for native species.

Eleven conservation areas have been established since 2005 and encompass over 4,600 acres of riparian, marsh, and backwater habitats. The response by many of the targeted terrestrial, riparian, and marsh species has been remarkable. The following is a summary of the important accomplishments for each species group.

## Riparian Birds

Nine covered species are native birds that spend at least some of their life cycle using riparian habitat along the LCR. Since 2005, nine conservation areas have been designed to create a mosaic of different land cover types to provide habitat for native bird species. LCR MSCP species research projects have provided data used to design these conservation areas. Post-development monitoring data from each site have



**Southwestern willow flycatcher**



**The yellow-billed cuckoo, which was listed as threatened under the ESA in 2014, has responded to newly created riparian habitat.**

helped document the response of riparian birds to these newly created habitats.

The yellow-billed cuckoo, which was listed as threatened under the ESA in 2014, has responded to newly created riparian habitat. Successful breeding has been documented at Cibola National Wildlife Refuge Unit #1 Conservation Area,



Gila woodpecker

Photo by Amy Leist, GBBO

Cibola Valley Conservation Area, and Palo Verde Ecological Reserve. Territorial birds have also been detected at Beal Lake Conservation Area, Yuma East Wetlands, and Hunters Hole Conservation Area. New riparian habitat established at Laguna Division Conservation Area may also attract cuckoos as it matures. Research and monitoring results have shown that cuckoos use LCR MSCP conservation areas within 3 years of establishment, sooner than what existing literature had reported. Prior to 2005, the only large, known population of cuckoos was detected in mature riparian forests located on the Bill Williams River National Wildlife Refuge, with a few scattered pairs located elsewhere on the LCR.



Least bittern

Photo by Amy Leist, GBBO

Today, almost 90 percent of cuckoo territories detected within the LCR ecosystem occur within created habitat at LCR MSCP conservation areas.

The southwestern willow flycatcher is a neo-tropical, migratory bird that uses dense, wet riparian forests for breeding habitat. It was listed as endangered under the ESA in 1995, with critical habitat being designated in 2013. Research and monitoring has been conducted along the LCR since 1996. Habitat requirements derived from these data have been used in the design of LCR MSCP conservation areas. While migratory willow flycatchers have been detected using LCR MSCP conservation areas, and several birds have been observed singing during breeding season, successful nesting has not yet been documented. Research and system monitoring activities continue to provide information to improve LCR MSCP habitat creation efforts.

With additional monitoring efforts, LCR MSCP covered bird species have been detected using numerous conservation areas. Sonoran yellow warblers, Arizona Bell's vireos, summer tanagers, and Gila woodpeckers have all been detected using conservation areas during breeding season.

Research focused on survey protocols and habitat requirements for elf owls and gilded flickers have been initiated. Numerous non-covered species have also been observed using conservation areas.

## Marsh Birds

Three secretive marsh birds are covered by the LCR MSCP and include the Yuma clapper rail (recently renamed Yuma Ridgway's rail), which was listed as endangered in 1967, the California black rail, and western least bittern. Several LCR MSCP conservation areas have marsh habitat being managed for these species and include Yuma East Wetlands, Laguna Division Conservation Area, Imperial Ponds Conservation Area, and Hart Mine Marsh. Yuma clapper rails were detected in three conservation areas, and California black rails were detected in two. Least bitterns were common in most created marsh habitat. At Hart Mine Marsh, Yuma clapper rails and least bitterns moved into the conservation area within 1 year of construction; black rails were detected by year 4.

## Bats

Four native bat species listed as covered or evaluation species in the HCP use riparian habitat as forage areas. Red bats may also roost in large cottonwoods found within conservation areas. Acoustic monitoring has detected red bats, yellow bats, California leaf-nosed bats, and Townsend's big-eared bats at LCR MSCP conservation areas. Acoustic monitoring provides a cost-effective method of documenting their presence without handling stress. Mist nets are also used to capture bats and provide additional information on the health and reproductive status of these species along the LCR. Other bats not targeted specifically by the program have also benefited from this new habitat.



California leaf-nosed bat

## Rodents

Two cotton rat species are covered by the LCR MSCP. The Colorado River cotton rat has been found in several conservation areas, including the Big Bend Conservation Area in southern Nevada, and it is the first record of this species in Nevada since the 1950s. The Yuma hispid cotton rat has been recorded at Yuma East Wetlands. Research and monitoring data will be used to manage habitat for these species.



Yuma hispid cotton rat

## Amphibians and Reptiles

Research and monitoring for the lowland leopard frog and Colorado River toad, both evaluation species in the HCP, has focused on documenting distribution and habitat requirements for these rare species. To date, no populations have been found along the LCR; however, both species are present along the Bill Williams River within the LCR MSCP planning area. Continued research will help determine the feasibility of establishing populations in unoccupied habitat. The relict leopard frog, a covered species under the HCP, is found primarily within the Lake Mead National Recreation Area and adjacent public lands. The LCR MSCP provided funding to support conservation efforts for this species, including population monitoring, rearing young, and establishing new populations in unoccupied areas.

The flat-tailed horned lizard and desert tortoise are two reptile species covered under the LCR MSCP. Habitat occupied by each species was acquired in order to protect these important areas in southern California. The Bureau of Land Management will manage these areas to permanently protect this habitat.

## Insects

The MacNeill's sootywing skipper is a small butterfly that requires quail bush and nectaring



**Sticky buckwheat**

plants to complete its life cycle. The LCR MSCP is providing skipper habitat by developing patches of quail bush and flowering plants within honey mesquite habitat in newly developed conservation areas. Monitoring data show that skippers are present in these habitats within a number of conservation areas, including Palo Verde Ecological Reserve, Cibola Valley Conservation Area, and Hart Mine Marsh. The Pretty Water Conservation Area should also provide skipper habitat after its completion in 2015.

## Plants

Sticky buckwheat and threecorner milkvetch are two endemic plants found within the Lake Mead National Recreation Area and adjacent public lands. The LCR MSCP provides funding to support conservation efforts for these species, which includes conducting surveys to monitor populations and removing invasive plant species to ensure these populations continue to thrive.

## Future Challenges

Research and monitoring data have been used to successfully create and manage habitat in LCR MSCP conservation areas. Many species have

responded positively to this new habitat. However, additional information is still required to be able to effectively and efficiently manage these sites and continue to provide conservation benefits for native species into the future. Some data gaps have already been identified and are being addressed with new, directed research projects (e.g., research focusing on how the LCR MSCP manages water to benefit species, such as moist soils for southwestern willow flycatchers, within the conservation areas where soil water retention and water availability are limited). Other management needs will be identified in the future as conservation areas and species response to these new habitats change over time. A flexible adaptive management program will allow the LCR MSCP to use newly acquired monitoring and research data to manage these sites over the next 40 years.



**Research and monitoring data have been used to successfully create and manage habitat in LCR MSCP conservation areas.**



# Adaptive Management

## Overview

**T**he LCR MSCP is a habitat-based conservation program in which uncertainty is an expected component of creating and managing habitat for the benefit of native species. A flexible adaptive management program allows the LCR MSCP to have confidence that goals will be met and that effective conservation for native species and their habitats will occur. It is also an important factor in evaluating the most effective approaches needed to increase native fish populations by increasing survivorship under the fish augmentation program.

A science strategy was developed in 2006 that outlines the LCR MSCP adaptive management process. The strategy describes both project-specific and programmatic adaptive management approaches. Project-specific adaptive management allows Reclamation to make management decisions based on the best scientific data available at the time and also allows for the incorporation of new information when it becomes available and the modification of management approaches when necessary. Programmatic adaptive management uses information obtained through research and monitoring to track program accomplishment and provide the information necessary to change conservation measures in the HCP to ensure effective conservation occurs within the confines of the program.

The LCR MSCP used an adaptive management approach to evaluate existing information on species life history requirements, limiting factors, and habitat requirements needed for conservation area development and management. Data gaps were identified, and research was conducted to fill these gaps. Additional data needs were identified and helped define future research projects and monitoring protocols. Monitoring was conducted to evaluate the effectiveness of conservation actions and to track progress toward program goals. Throughout the process, data management was extremely important, as data provide the basis to make management decisions that will ensure conservation goals are met.

## Determining Research and Monitoring Priorities

The LCR MSCP requires that management decisions be based on sound scientific principles. Evaluating existing knowledge acquired from research and monitoring projects conducted by the LCR MSCP and other conservation programs is a mandatory step in determining future information needs necessary to make management decisions. Conceptual Ecological Models (CEMs) are being developed for each LCR MSCP species to identify current scientific knowledge, the degree of



Biologist record survey data with GPS units

certainty in that knowledge, and the relationships among known life history requirements. These CEMs will help direct future research and monitoring projects by identifying the priority data needs required to implement sound scientific management decisions.

Once knowledge gaps have been identified through the CEM process, research and monitoring priorities are established. A 5-year planning cycle is used to determine priorities. Annual accomplishment reports are written to document completion of these priorities.

## Data Management

Management decisions required for effective and efficient implementation of the LCR MSCP are based on the best scientific information available. Research and monitoring projects provide the information necessary to make these decisions. A robust, interdisciplinary, modular data management system is being developed to store the data acquired by the LCR MSCP. This customized data management system will enable the LCR MSCP to manage and analyze data, integrate Geographic Information System capabilities, and efficiently store information for use by this and other conservation programs. Information is disseminated through the LCR MSCP



**A flexible adaptive management program allows the LCR MSCP to have confidence that goals will be met and that effective conservation for native species and their habitats will occur.**

Web site developed and managed by Reclamation specifically for this program.

The LCR MSCP continually looks for new technology and approaches to acquire and manage data. Currently, new data collection techniques, such as collecting data digitally in the field, are being analyzed to determine if data collection and management can be accomplished more efficiently. Automated data collection techniques are also being evaluated where appropriate.

## Future Challenges

The adaptive management program allows the LCR MSCP the flexibility to accomplish the



**Biologists scan a razorback sucker for implanted microchip**

conservation measures described in the HCP in a biologically effective and cost-efficient manner. In order to accomplish this task, data collected from research and monitoring programs must be analyzed at a species, conservation area, and landscape level. Informed management decisions must take into account multiple, sometimes conflicting, species habitat requirements. The development of site-specific management guidelines is required to manage each conservation area, provide the maximum benefit for covered species, and to ensure all conservation measure requirements are completed. Data management is a key component to this process. Data management challenges, such as assessing and managing capacity, developing analysis tools, and integrating new technologies, will be a vital task over the life of the program.

# Program Accomplishment

The HCP lists species-specific and general conservation measures required under the ESA incidental take authorization to provide conservation for native species and their habitats. The LCR MSCP tracks the accomplishment of these conservation measures to ensure that they are completed by the required deadlines and to inform the program partners and regulatory agencies if the desired conservation goals are being met. Completed conservation measures during the first 10 years of implementation include:

- Acquire and protect 230 acres of occupied desert tortoise habitat
- Acquire and protect 230 acres of occupied flat-tailed horned lizard habitat
- Support existing relict leopard frog conservation programs
- Support existing flannelmouth sucker conservation programs
- Avoid impacts of flow-related actions on covered species habitats at Topock Marsh by improving the water delivery system

The LCR MSCP is responsible for creating and managing covered species habitat; therefore, a process for tracking habitat creation was developed. The managed acres within a conservation area that meet the conservation measures described in the HCP are called creditable acres. Habitat mosaics have been established targeting 20 covered species, and by 2015, creditable acres will be tallied for 19 covered species. The amount of creditable acres established for red bat, yellow bat, Colorado River cotton rat, summer tanager, MacNeill's sootywing skipper, Yuma hispid cotton rat, elf owl, and Gila woodpecker will exceed the habitat creation requirements. Habitat requirements are still being defined for the southwestern willow flycatcher, and creditable acres will not be tallied for this species until these requirements are better understood.

New information is being gathered every day, which will not only be used to help effectively and efficiently accomplish the goals of the LCR MSCP, but will also further the understanding of the Colorado River ecosystem. The success of this program will inform and inspire large landscape conservation programs in other ecosystems. Many challenges remain over the next 40 years, and we look forward to meeting those challenges.

# **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 Local Governments Authority  
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  
Chemehuevi Indian Tribe

## **Conservation Participant Group**

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

