

Lower Colorado River Multi-Species Conservation Program



Balancing Resource Use and Conservation

Cibola National Wildlife Refuge Unit 1 Conservation Area Restoration Development and Monitoring Plan: Phase 1



July 2009

Lower Colorado River Multi-Species Conservation Program

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Bureau of Land Management
Bureau of Indian Affairs
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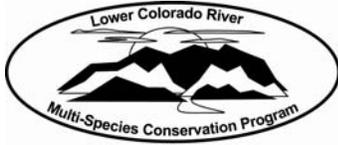
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**Lower Colorado River
Multi-Species Conservation Program Office
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Acronyms and Abbreviations

AMM	Area Management Measures
BACI	Before-After-Control-Impact
Cibola NWR	Cibola National Wildlife Refuge
CW	Cottonwood-willow land cover type, as defined in the LCR MSCP HCP
FWS	U. S. Fish & Wildlife Service
HCP	Habitat Conservation Plan
HM	Honey mesquite land cover type, as defined in the LCR MSCP HCP
LCR	Lower Colorado River
LCR MSCP	Lower Colorado River Multi-Species Conservation Program
MMRP	Mitigation Monitoring and Reporting Program
NWR	National Wildlife Refuge
Reclamation	Bureau of Reclamation
SWFL	Southwestern Willow Flycatcher
YBCU	Yellow-billed Cuckoo

Background

Cibola National Wildlife Refuge (Cibola NWR) consists of about 16,600 acres of land located along approximately twelve miles of the lower Colorado River in Arizona and California. It was established in 1964 as a refuge and breeding ground for migratory birds and other wildlife. The Refuge is divided into six management units known as Unit 1, Unit 2, Unit 3, Unit 4, Unit 5, and Unit 6 (Figure 1).

Unit 1 is located on the northern end of the refuge in Arizona and encompasses approximately 4,100 acres, with approximately 1,000 acres dedicated to agriculture and 3,100 acres currently undeveloped. The Bureau of Reclamation has previously partnered with the U.S. Fish and Wildlife Service (FWS) at Cibola NWR in a number of established projects at Unit 1. These include habitat creation projects as well as research and demonstration projects. In 1999, FWS and Reclamation planted the Cibola Corn Field/Nature Trail and established 34 acres of cottonwood-willow and mesquite land cover type within Unit 1. In 2002, FWS and Reclamation planted approximately 18 acres of cottonwood/willow in Unit 1 north of the Corn Field/Nature Trail.

Approximately six 20-acre fields in Unit 1 have been set aside for the Lower Colorado River Multi-Species Conservation Program (LCR MSCP) to conduct research and development projects. To date, four fields are occupied by three projects that have been fully or partially funded by the LCR MSCP. These include Work Task E6: Cottonwood Genetics Study, Work Task E7: Mass Transplanting Demonstration, and Work Task E8: Seed Feasibility Study. To the east of these projects are two additional agricultural fields which are still in agricultural production. The six fields combined are currently included in a five-year land use agreement under which FWS conducts research activities on Unit 1; the agreement expires this fiscal year (FY09).

Cibola NWR Unit 1 Conservation Area incorporates these existing projects and agricultural land as well as additional adjacent acreage into a single conservation area. Note that the Cibola NWR Unit 1 Conservation Area (~ 900 acres) only includes a portion of the total area designated as “Unit 1” by the Cibola NWR (~ 4100 acres).

1.0 Purpose

Cibola NWR Unit 1 Conservation Area is being developed in phases. The purpose of Phase 1 is to create approximately 102 acres of riparian habitat that shall be managed for the Southwestern willow flycatcher (*Empidonax traillii extimus*) (SWFL), Western yellow-billed cuckoo (*Coccyzus americanus occidentalis*) (YBCU), and other covered species listed in the LCR MSCP Habitat Conservation Plan (HCP). Phase 1, being implemented this fiscal year, is designed to convert approximately 102 acres of active agricultural fields to cottonwood-willow (CW) habitat (Table 1).

Table 1. Proposed Development Phasing Schedule

Fiscal Year/Area	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15+
Crane Roost (area #5)	cover crop planting	cover crop maintenance	Phase 1 plant 102 acres	maintenance	maintenance	maintenance	maintenance	maintenance	maintenance
Hippy Fire (area #2)	cover crop maintenance	cover crop maintenance	cover crop maintenance	cover crop maintenance	cover crop maintenance	Phase 2 plant 160 acres	Phase 3 plant 160 acres	maintenance	maintenance
North 160 (area #4)	weed control	weed control	cover crop planting	cover crop maintenance	cover crop maintenance	cover crop maintenance	cover crop maintenance	Phase 4 plant 150 acres	maintenance
Baseline 90 (area #3)	weed control	weed control	weed control	cover crop planting	cover crop maintenance	cover crop maintenance	cover crop maintenance	cover crop maintenance	Phase 5 plant 100 acres
Active 40 (area #1)	active farming	active farming	active farming	active farming	active farming	active farming	active farming	active farming	Phase 6 plant 40 acres

2.0 Design and Planting Plan

Phase 1 will be implemented in area #5 (the Crane Roost) of the Conservation Area. The managed acreage is approximately 154 acres; however, a portion of this acreage (approximately 38 acres) has already been planted with native riparian vegetation. Planting of Phase 1 is expected to convert active the agricultural fields to CW land cover type. The configuration of this riparian cover type establishment is designed to approximate a mosaic of native vegetation composition necessary to support species covered under the LCR MSCP. The fields in the Crane Roost will be planted with blocks of native plant species based on water requirements and field/soil conditions. This stratification of riparian tree and shrub species is what is typically observed in natural riparian communities. Future structure management will address mechanical seral-stage setbacks and the introduction of other species into the patches to achieve greater structural and biological diversity (Figure 2).

Planting Plan

The planting design incorporates native riparian species along the lower Colorado River (LCR) into a mosaic of created habitats. Areas of CW and honey mesquite (HM) cover types are based on information in the LCR MSCP HCP for each species. Patch sizes of created habitats are designed and managed to provide habitat for more than one species. Based on site conditions, CW and HM will be planted in proximity to each other to re-create an integrated mosaic of habitats that approximate terrestrial communities historically present in the LCR floodplain.

The planting design establishes vegetation species with higher water needs closer to irrigation gates, and the species that require less water farther from the irrigation gates (Figure 3). Areas that target SWFL will have the ability to be irrigated more frequently from April through September (breeding season of the SWFL) so that multiple areas will have moist soils or standing water.

Figure 2. Planting Design for Phase 1, Cibola NWR Unit 1 Conservation Area
Number in parentheses represents number of plantings

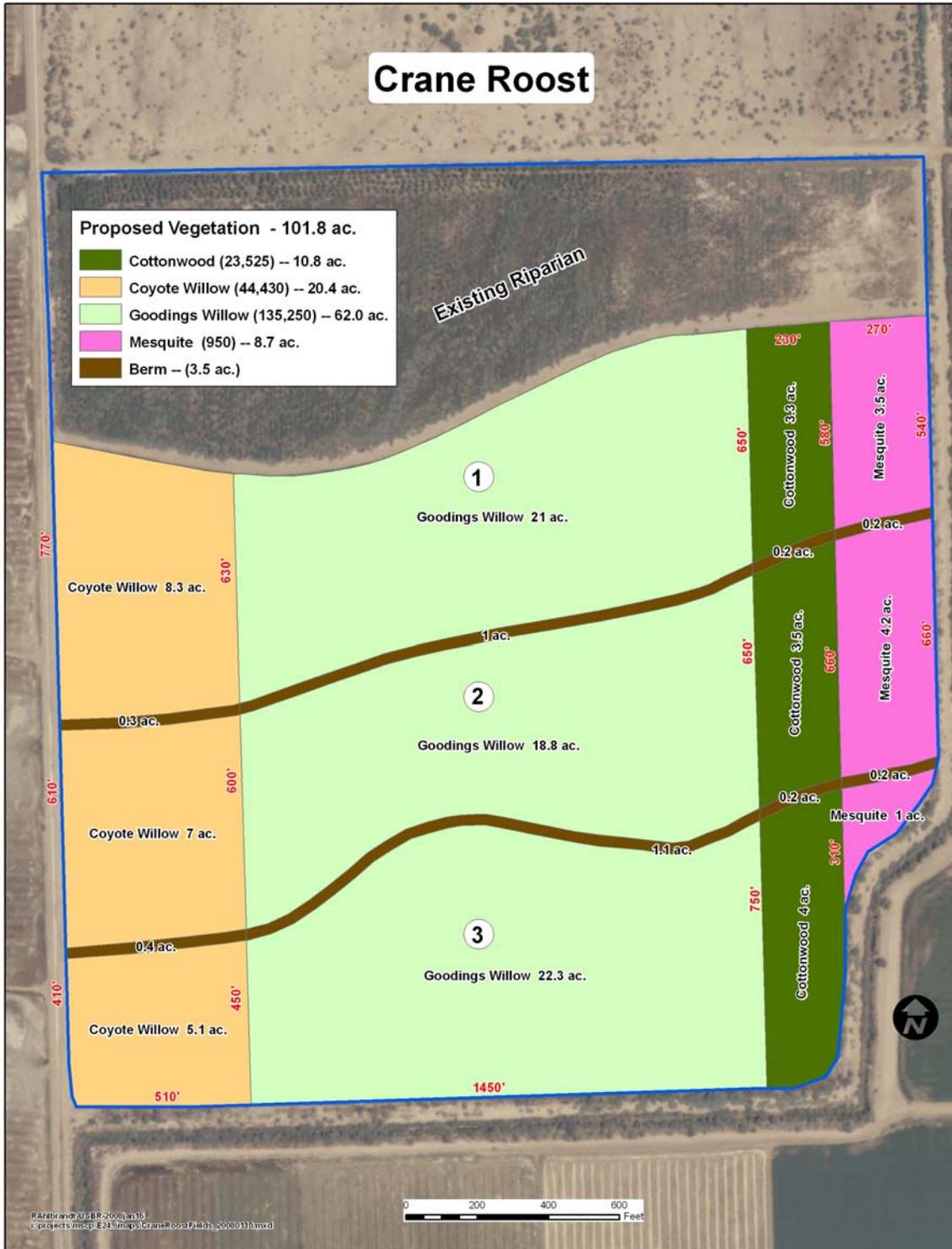
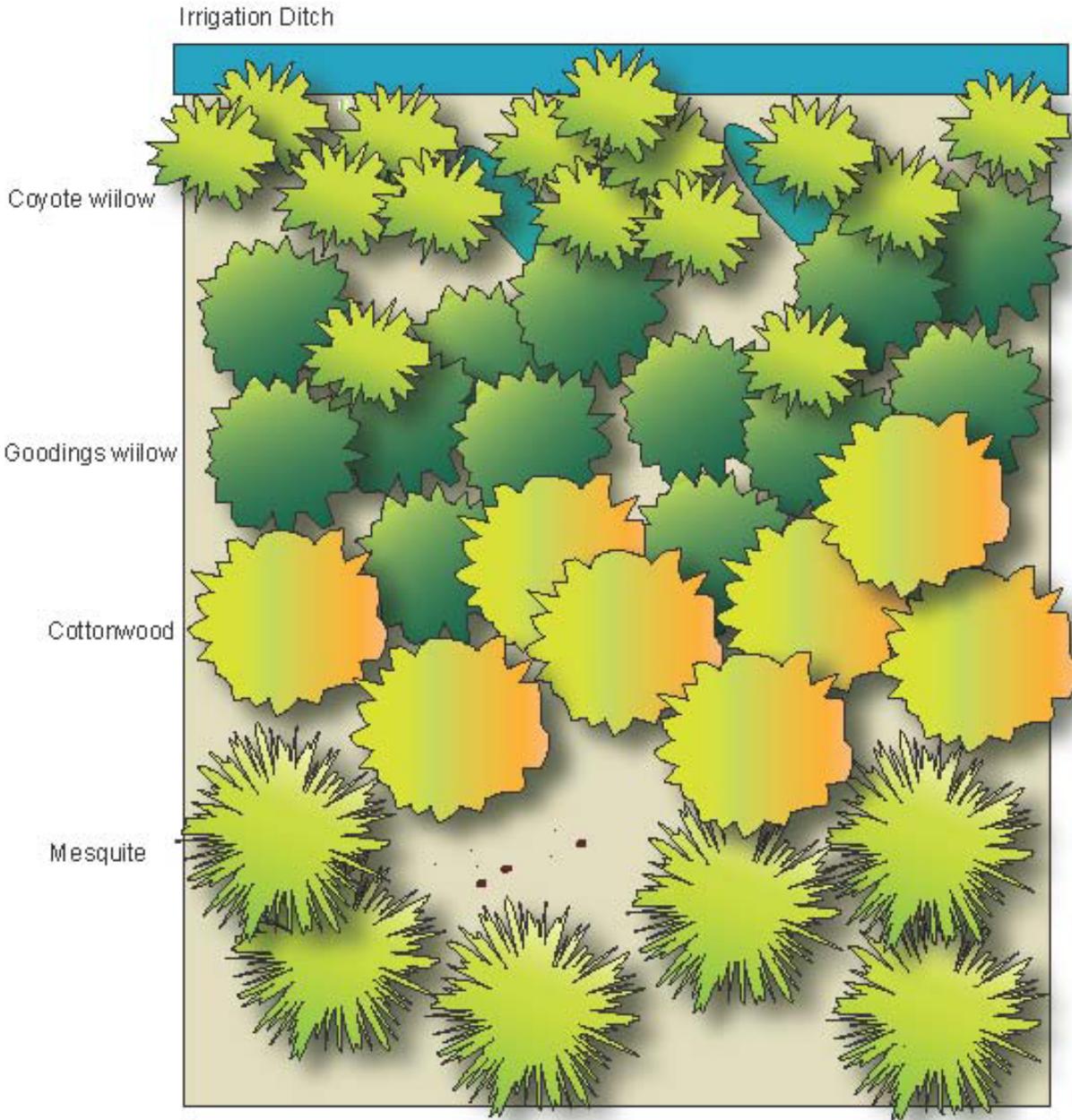


Figure 3. Typical Planting Plan to be used for Phase 1, Cibola NWR Unit 1 Conservation Area



Typical riparian planting plan

This mosaic of habitat includes the following elements: drought tolerant vegetation, riparian vegetation and moist/saturated soils. The design takes into consideration observed natural riparian vegetation configuration by stratifying each species into zones. Those species with the greatest affinity for water are appropriately located nearest to the irrigation water supply and therefore receive the greatest amount of water and longest periods of inundation. In this way, the maximum benefit can be obtained while incorporating the greatest amount of water conservation.

The following table lists the plant species that may be used in the development of habitat at Phase 1 of the Cibola NWR Unit 1 Conservation Area:

Table 2. Native Plant Species List for Phase 1

Scientific Name	Common Name	Number of Plants
<i>Populus fremontii</i>	Fremont Cottonwood	23,525
<i>Salix gooddingii</i>	Goodding's Willow	135,250
<i>Salix exigua</i>	Coyote Willow	44,430
<i>Prosopis glandulosa</i> var. <i>torreyana</i>	Honey Mesquite	950

Planting Material and Planting Techniques

Phase 1 will be planted using an automated mass planter, a technique successfully used in other LCR MSCP conservation areas, such as Palo Verde Ecological Reserve and Cibola Valley Conservation Area. The plants will be planted in rows spaced 40 inches apart with 6-foot inline spacing. This method will achieve dense, rapid growth plantings of native species and inhibit the establishment and growth of nonnative plant species. Plant material for the project will be collected from LCR MSCP nurseries along the LCR, and from areas that are ecologically similar.

Grading

Grading and contouring will consist of laser leveling the fields prior to planting. Borders will be added and maintained between field checks for efficient water delivery.

Irrigation

It is anticipated that all fields will be flood irrigated on a regular basis. Soil moisture and other microclimate monitoring and observation will provide the data necessary to determine an appropriate irrigation schedule.

Once the CW matures, irrigation will be increased during breeding and nesting season of the SWFL to ensure moist soil conditions. Differing watering regimes will be employed to hold irrigation water during SWFL season (March through September), creating conditions of moist soils, and standing or ponded water necessary for the species' habitat. Moist soils and areas of standing water encourage insect diversity and can also increase the relative humidity within the vegetation, which has been observed as a preferred component of habitat for SWFL.

Herbicide/Fertilizer/Pesticide Application

To maintain healthy stands of native riparian species, the application of herbicides, fertilizer, and pesticides may be required. All herbicide, fertilizer, or pesticide application will be applied by persons possessing valid applicators' licenses for the chemicals being applied and in compliance with the rules, regulations, and laws set by the State of Arizona, La Paz County and Cibola National Wildlife Refuge.

All records and associated chemical application documents will be stored by the land manager and will include:

- Training records of all employees handling pesticides and herbicides
- Material Safety Data Sheets for all pesticides, herbicides, and fertilizers
- Location map of herbicide and pesticide storage site
- Use of Arizona, La Paz County and Refuge approved herbicide, pesticide, and fertilizers
- Record of herbicide, pesticide, or fertilizer use

3.0 Monitoring

This section contains the overall strategy for monitoring the Cibola NWR Unit 1 Conservation Area restoration project. Subsequent documents (Restoration Phase Plans) will provide the specific monitoring requirements for each phase and will typically be created on an annual basis.

Monitoring is critical to the Adaptive Management Program. This process allows the LCR MSCP to analyze implementation activities, address the uncertainty inherent in a 50-year program, and respond appropriately. Scientifically designed monitoring studies will be conducted to evaluate whether: (1) the restoration parameters established for each covered species habitat are being achieved; (2) the restoration area develops as covered species habitat, and (3) the habitat is being utilized by the covered species. Results on how the created habitat develops, relative to the restoration and management techniques employed, will be used to refine techniques and develop the most cost-effective and efficient approaches for future phases at Cibola NWR Unit 1 Conservation Area and other restoration sites.

Initial conservation area monitoring plans are based on elements described in the HCP (LCR MSCP 2004). A document describing the science and adaptive management plan strategies for the LCR MSCP is found in the LCR MSCP Final Science Strategy (Bureau of Reclamation 2007).

Monitoring at Cibola NWR Unit 1 Conservation Area will be structured into four categories:

- Predevelopment Monitoring
- Implementation Monitoring
- Habitat/Species Monitoring
- Vegetation Classification

The goals for monitoring may be revised depending on the Adaptive Management Program results, covered species requirements, or other management decisions in the future. All monitoring will be designed specifically for each phase and habitat type within that phase. Covered species monitoring will be organized in the following guilds: marsh birds, neotropical birds, cavity nesting birds, small mammals, bats, and reptiles and amphibians. The SWFL, YBCU, and MacNeill's sootywing skipper will be monitored using species-specific protocols.

Purpose

The purpose of the Cibola NWR Unit 1 Conservation Area monitoring plan is to determine whether restoration parameters established for each covered species habitat are being achieved, when each phase of Conservation Area develops as covered species habitat, and if the habitat is being utilized by the covered species. The Avoidance and Minimization Measures, Conservation Area Management Measures (AMM), Monitoring and Research Measures (MRM), and General- and Species-Specific Conservation Measures from the LCR MSCP HCP document dictate the range of data collected, analyzed, and incorporated into the adaptive management plan.

Monitoring Design

Sampling design is based on quasi-experimental design using the Before-After Control-Impact (BACI) design (Stewart-Oaten and Osenberg 1992, Bernstein and Zalenski 1983, Green 1979). The BACI approach prescribes the collection of data prior to an activity and comparison to data collected after the activity (Smith 2002). The quasi-experimental design will use pre-restoration phases as controls. The designs will utilize randomization where possible. Subsamples of each phase will be taken at the same or similar randomized points both pre- and post-restoration. To the greatest extent practicable, pre-restoration monitoring will be conducted for a minimum of 1 year prior to the implementation of each phase.

Resources

Population and habitat resources are determined based on the appropriate AMM, MRM, and General- and Species-Specific Conservation Measures. Monitoring will be conducted both pre- and post-restoration. Select resources will only be monitored post-restoration if no potential exists prior to development for the existing agricultural fields to support populations of targeted covered species (e.g., SWFL has never been found to occupy cotton fields). In most cases, the resources monitoring will focus on guilds of species for efficiency. The pre- and post-restoration resources that will be monitored are summarized below in each appropriate monitoring category. Specific protocols that have been developed for each resource may be found in the document entitled *Draft 2006 Monitoring Protocols for the LCR MSCP*.

Predevelopment Monitoring

Predevelopment monitoring is designed to establish what types of restoration activities may be conducted, establish baseline data for evaluating post-development, and identify whether covered species currently inhabit Cibola NWR Unit 1 Conservation Area. To establish baseline conditions, an understanding of the current and historical conditions at the Conservation Area is necessary.

Predevelopment monitoring is divided into abiotic (soil features) and biotic (vegetation and covered species) factors:

- Abiotic Monitoring
 - Soils
 - Samples are taken from each phase after removal of the agricultural crop and before the planting of the trees.
 - Samples in each phase are analyzed for moisture, salinity, textural classification, depth to ground water, and nutrients, including nitrate, ortho-phosphate, and ammonia.
 - Microclimate
 - If any covered species are found during pre-restoration surveys, microclimate monitoring will be conducted to measure temperature and relative humidity, and data will be compared with post-restoration data.
- Biotic Monitoring
 - Vegetation Monitoring
 - Currently, Cibola NWR Unit 1 Conservation Area consists of farm fields, partially developed and undeveloped land, and no riparian or marsh habitats are present; therefore, only *Atriplex* spp. will be surveyed and mapped.
 - Avian Monitoring:
 - Neotropical birds will be monitored utilizing a standardized point-count protocol (GBBO 2003). Because Cibola NWR Unit 1 Conservation Area is currently in agricultural crops, only three point-count transects will be established along the existing roads.
 - Marshbirds will not be monitored, as marsh habitat is not present.
 - Cavity nesting birds will not be monitored, as riparian or mesquite habitats are not present. However, point-count surveys will record any avian species present during the predevelopment monitoring phase.
 - Species-specific SWFL and YBCU surveys will not be conducted, as riparian habitat is not present. However, point-count surveys will record any avian species present during the predevelopment monitoring phase.
 - Small mammal presence/absence surveys will be conducted utilizing a standardized protocol. Trapping will occur prior to the implementation of each phase between late September-November and late February-May. Trapping will be conducted overnight. Trapping will be conducted for a minimum of 500 trap nights.
 - Bat presence/absence surveys will be conducted utilizing active/passive Anabat surveys at least two days per season (spring, summer, winter, and fall), prior to the implementation of each phase. All Anabat system locations will be chosen based on suitable habitat for the covered bat species and ability to maximize data collected.
 - Amphibian and reptile monitoring will not be conducted because Cibola NWR Unit 1 Conservation Area is outside of the known range of the covered amphibian species and does not currently meet covered reptile species habitat requirements.
 - MacNeill's sootywing skipper presence/absence surveys will be conducted if *Atriplex* spp. is located at the Conservation Area. Visual surveys will be conducted when the skipper flies between April and October (Pollard 1977). A minimum of three surveys will be conducted.

Implementation Monitoring

Implementation monitoring will be conducted to assess whether land cover type creation and management actions have been implemented as designed for each phase. This type of monitoring quantifies changes immediately after treatments and evaluates whether actions were implemented as prescribed (Block et al. 2001). For example, this type of monitoring would be used to determine whether the planting techniques employed were effective and vegetation was planted according to the phase design specifications. This monitoring is focused on the habitat (biotic) and conditions therein (abiotic):

- Abiotic Monitoring
 - Soil
 - Samples in each phase will be analyzed for moisture, salinity, textural classification, depth to ground water, and nutrients, including nitrate, ortho-phosphate, and ammonia.
 - Samples will be collected annually until the nutrient and salinity measurements are stable.
 - Water
 - Deliveries will be recorded.
- Biotic Monitoring
 - Vegetation
 - Four to six weeks after planting (or after dormancy break), a sample of the trees will be counted and an index of condition (Table 3) will be recorded to determine initial survivorship. These data will be used to guide initial management activities, such as water use and re-planting.
 - After the first two growing seasons, growth and survivorship will be determined, utilizing transects through each phase during the dormancy period (October-January). Sample transects would be randomly determined on an annual basis. The number of sample transects would be determined for each phase and will be based on several factors including patch size, restoration technique, vegetation species, and variation within each stand. Within each sample transect, every tree will be counted and recorded by species. Diameter at breast-height and tree condition (Table 3) will be recorded for every hundredth tree sampled. Percent cover will be measured at random 1-meter square plots in each transect to evaluate herbaceous and shrub plant component.

Table 3. Tree Index of Condition

Condition	Definition
Live	Trees appear in apparently good condition; leaves green, no symptoms of wilting, die-back, or chlorotic appearance of leaves.
Stressed	Trees appear to be in generally poor condition; chlorotic leaves and leaf drop.
Tip die-back	The main stem is in good condition; the most apical portions are in very poor condition exhibiting wilting and die-back symptoms.
Basal sprouts	Main stem dead; new growth is initiated from stem base or root stock.
Not found	Seedling not found during particular sampling period. If seedling not found in two consecutive periods, it is considered dead.
Apparently dead	General appearance of stem is dry and brittle; no live wood observed and no observable green foliage growth; re-sprouting still possible.
Dead	Previously listed as apparently dead; tree in such poor condition that survival by re-sprouting is unlikely.

Habitat/Species Monitoring

Habitat/species monitoring is designed to determine whether each phase is providing the habitat requirements needed for the targeted covered species; if any covered species is utilizing the habitat; and if there are differences in wildlife use of the habitat depending on planting design, composition, and watering regimes. All monitoring will be designed specifically for each phase and habitat type within that phase. The monitoring is divided into habitat and covered species and will be analyzed incorporating both categories:

- Habitat Monitoring
 - Abiotic Conditions
 - Soil
 - Samples will continue to be analyzed for moisture, salinity, textural classification, depth to ground water, and nutrients (including nitrate, ortho-phosphate, and ammonia) until the conditions are stable. When conditions reach the reference points, samples will be analyzed every 3 to 5 years. If conditions change, samples will be analyzed annually until conditions reach the reference point again.
 - Soil moisture probes will be utilized 10 times during the breeding season for SWFL, in SWFL habitat, beginning the year SWFL surveys are conducted.
 - Samples will be conducted minimally at the same site as the predevelopment monitoring.

- Water
 - Deliveries to each phase will be recorded and analyzed to determine if the necessary amounts were delivered to grow the requisite habitat.
 - Microclimate
 - Random and strategically located data loggers will be placed within the habitat. Data loggers record temperature and relative humidity. The number of data loggers for each phase will be based on acreage of restored habitat. Data will be downloaded approximately every 4 months. If a SWFL or YBCU nest is located, a data logger will be placed within 2 meters of the nest.
 - Biotic Conditions
 - Vegetation
 - Beginning at the end of the third growing season, habitat condition will be monitored using a standardized protocol based on a nested sample plot design. Initially, habitat monitoring will occur on an annual basis (years 3 through 6). Monitoring will occur every other year between year 6 and year 10. After year 10, each site will be sampled every 5 years to monitor successional changes through the LCR MSCP term. If a catastrophic disturbance (fire, flood, etc.) occurs to the stand, post-disturbance monitoring will mimic the post-restoration monitoring regime.
 - Vegetation monitored will include: overstory trees, sapling, shrub, understory, herbaceous layer, vertical foliage density, and crown closure.
- Covered Species Monitoring
 - Marshbirds
 - Monitoring will not be conducted because no marshbird habitat will be restored.
 - Neotropical Birds
 - A standardized area search protocol (GBBO 2003) will be used. Area searches will be conducted annually during the breeding season (May-July), each month beginning the first May after the planting of each phase. Separate transects for each phase will be conducted based on habitat type and acreage.
 - Standardized breeding and winter season banding/mistnetting (DeSante 2005) may be conducted if conditions warrant.
 - If covered species are observed, targeted species-specific surveys, nest searches, and banding/mistnetting may be conducted.
 - Cavity Nesting Birds
 - Elf owl surveys may be conducted after 4 to 6 years, depending on when the land cover type structure and density indicate the habitat has achieved the reference conditions. Installed nest boxes would be monitored during the breeding season (April-July) for elf owls. If an elf owl is detected

- during the breeding season, nest searches or targeted banding/mistnetting may be conducted for long-term use of site and refinement of habitat use.
- Gilded flickers and Gila woodpeckers will be surveyed as part of the neotropical bird monitoring mentioned above. Installed snags will be monitored during the breeding season (May-July). If gilded flickers or Gila woodpeckers are detected during the breeding season, nest searches or targeted banding/mistnetting may be conducted for long-term use of site and refinement of habitat use.
- Southwestern Willow Flycatcher
 - Standardized presence/absence surveys (Sogge et al. 1997, USFWS 2000) will be conducted after three growing seasons, depending on when the land cover type structure and density indicate the habitat has achieved the reference conditions. A minimum of five surveys will be conducted beginning in May and ending in July. If a SWFL is detected after June 15 or positive breeding evidence is identified, nest searches will be conducted to determine breeding status and use of habitat. Targeted banding/mistnetting may be conducted for long-term use of site and refinement of habitat use.
 - Yellow-billed Cuckoo
 - Standardized presence/absence surveys (Halterman and Johnson 2005 Draft) will be conducted after three growing seasons, depending on when the land cover type structure and density indicate the habitat has achieved the reference conditions. A minimum of five surveys will be conducted beginning in June and ending in September. If a YBCU is detected during the breeding season, nest searches will be conducted and targeted banding/mistnetting may be conducted for long-term use of site and refinement of habitat use.
 - Small Mammals
 - Standardized presence/absence surveys will be conducted at least once annually between September-November and late February-May. Trapping will be conducted overnight. Traps will be placed in parallel, linear transects of approximately 150 meters in length. A trap station will be located at 10-meter intervals along each transect. Transects will be located 10 to 15 meters apart, with the actual distance apart determined by the size of the area being surveyed. Trapping will be conducted for a minimum of 500 trap nights.
 - Bats
 - Presence/absence surveys will be conducted utilizing active/passive Anabat surveys at least 2 days per season (spring, summer, winter, and fall) annually. When the vegetation is at sufficient height to hide the equipment, data may be collected daily utilizing two stationary Anabat/Sonabat systems. One system will be installed in a riparian phase and one system in a riparian/mesquite phase to be determined later. The stationary systems will be established for at least 5 years. Data will be examined after the 5-year period, and future monitoring decisions for bat species will be made. All system locations will be chosen based on

suitable habitat for the covered bat species and ability to maximize data collected.

- Reptiles and Amphibians
 - No monitoring will be conducted because no habitat for reptiles and amphibians will be restored or removed.
- MacNeill’s Sootywing Skipper
 - Pollard Walks (Pollard 1977) visual surveys will be conducted in the *Atriplex* spp. habitat when the skipper flies between April and October to determine presence/absence. Surveys will be conducted when *Atriplex* crown coverage is approximately 10’x 10’. A minimum of three surveys will be conducted.

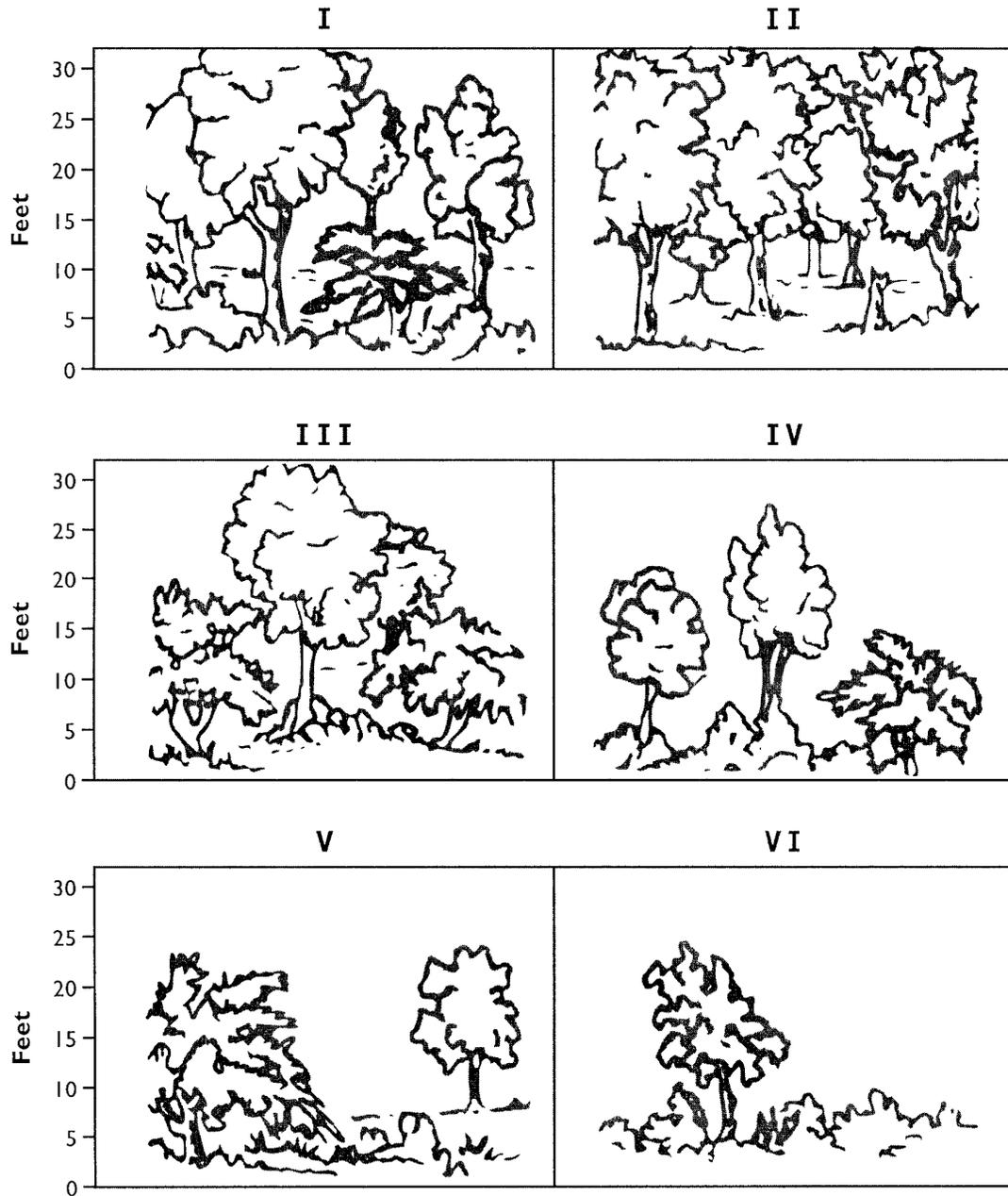
Vegetation Classification

The HCP (LCR MSCP 2004) outlines the specific habitat acreage to be created and classified utilizing the Anderson and Ohmart (1976, 1984) classification system (Table 4 and Figure 5). Using aerial imagery of the site obtained annually, each phase of the project will be mapped, classified, and ground-truthed.

Table 4. Vegetation Communities, Criteria, and Types

Community Type	Criteria	Vegetation Type
Cottonwood-willow (CW)	<i>P. fremontii</i> and <i>S. gooddingii</i> constituting at least 10% of total trees	I, II, III, IV, V, VI
Salt cedar (SC)	<i>Tamarix</i> spp. constituting 80-100% of total trees	I, II, III, IV, V, VI
Salt cedar-Honey mesquite (SH)	<i>P. glandulosa</i> constituting at least 10% of total trees	I, II, III, IV, V, VI
Salt cedar-Screwbean mesquite (SM)	<i>P. pubescens</i> constituting at least 20% of total trees	I, II, III, IV, V, VI
Honey mesquite (HM)	<i>P. glandulosa</i> constituting at least 90% of total trees	I, II, III, IV, V, VI
Arrowweed (AW)	<i>Tessaria sericea</i> constituting at least 90-100% of total vegetation area	I, II, III, IV, V, VI
<i>Atriplex</i> spp. (ATX)	<i>A. lentiformis</i> , <i>A. canescens</i> , or <i>A. polycarpa</i> constituting 90-100% of total vegetation in area	I, II, III, IV, V, VI

Figure 3. Vegetation Classification



Adapted from Anderson and Ohmart (1984).

Monitoring Analysis and Evaluation

After the data collected during implementation, habitat/species monitoring, and vegetation classification are analyzed, the results will be evaluated based on thresholds and trigger points identified by the reference conditions.

Reference Conditions

The Cibola NWR Unit 1 Conservation Area reference conditions will be modeled on conditions found during the SWFL long-term life history site studies along the LCR (McLeod et al. 2005, Koronkiewicz et al. 2005). These variables (Table 5) may change depending on future analysis of the long-term life history studies currently being conducted. Variables that will be referenced include canopy height, canopy closure, vertical foliage density, mean soil moisture (percent volume), mean diurnal temperature, mean maximum diurnal temperature, and mean diurnal relative humidity. These variables were chosen as there were statistically significant differences in use sites versus non-use sites at the SWFL life history study sites (McLeod et al. 2005, Koronkiewicz et al. 2005).

Table 5. Reference Variables

Canopy Height (M)	Average greater than 4.0 m
Canopy Closure (percent total)	Greater than 70%
Vertical Foliage Density	Density greatest between 1 and 4 m above ground; this may change as additional analysis is completed
Mean Soil Moisture (percent volume)	Minimum of 17% Average of 23%
Mean Diurnal Temperature (Celsius)	Between 26° C and 33° C
Mean Maximum Diurnal Temperature (Celsius)	Maximum of 45° C Average between 32° C and 45° C
Mean Diurnal Relative Humidity (percent)	Greater than 33% Average between 33% and 63%

Thresholds

Thresholds signal that conditions are appropriate to continue current management practices. The thresholds are:

- Microclimate and vegetation reference conditions are achieved.
- One or more covered species are utilizing Cibola NWR Unit 1 Conservation Area during non-breeding season.
- One or more covered species are utilizing Cibola NWR Unit 1 Conservation Area during breeding season.

- SWFL and/or YBCU are utilizing Cibola NWR Unit 1 Conservation Area during non-breeding season.
- SWFL and/or YBCU are utilizing Cibola NWR Unit 1 Conservation Area during breeding season.

In addition, if any monitoring activities documented that SWFL or YBCU were occupying the site before reference conditions were achieved, management and maintenance activities would be adjusted, as appropriate.

Trigger Points

Trigger points signal the need to alter current management activities to achieve Cibola NWR Unit 1 Conservation Area goals for the restoration site or change the goals for the Conservation Area. The trigger points are:

- Microclimate and vegetation reference conditions have not been achieved.
- Previously suitable land cover type structures are no longer suitable for any of the targeted covered species.
- Targeted covered species habitat needs exceed water availability.

Adaptive Management

Data will be evaluated annually to determine if the thresholds and/or trigger points were reached. If results indicate that the restoration activities meet or exceed thresholds, recommendations will be made in the annual report for future management activities at Cibola NWR Unit 1 Conservation Area and for other restoration activities. If results indicate that restoration activities were deleterious to covered species or habitats, recommendations on prescriptions and modifications will be identified, and other methods tested.

Plant community and structural type are components necessary for obtaining performance criteria for woody riparian cover types. Criteria used to define woody riparian land cover types are determined by the Anderson and Ohmart Vegetation Classification System (1984). Annual reports will summarize the performance criteria of newly created habitat acreage and the specific habitat type acreage that will be credited as restored habitat. Through the adaptive management process, any structural management determined from vegetation classification will be defined in the annual report.

4.0 Reports

Annual Report

An annual report will be prepared by Reclamation and made available each calendar year summarizing the following:

- General description of the project status and the effects on the covered species
- A table from the Mitigation Monitoring and Reporting Program (MMRP) indicating current implementation status of each mitigation measure
- A description of all restoration activities and monitoring actions conducted over the past year
- A summary of monitoring and research activities over the past year
- Results and analyses of monitoring and research data
- An assessment of the effectiveness of each mitigation measure in minimizing and compensating for project impacts
- The total number of acres planted
- The total number of acreage that meets or exceeds the performance standards
- Any other applicable information

Through the adaptive management process, a Restoration Development and Monitoring Plan for each phase will be prepared as necessary. This plan will incorporate the monitoring results from previous years. The plan will include the planting design, planting techniques grading plan, and demonstration or research plan for the acreage that will be converted. The monitoring results will indicate the amount of structural management that will be accomplished in the next year and any modifications to previously restored habitats.

Final Report

A final report will be prepared by Reclamation and submitted no later than 180 days after the completion of all mitigation measures. The final report is anticipated in 2055 and will include the following information:

- A copy of the table in the MMRP with notes showing when each mitigation measure was implemented
- Recommendations on how mitigation measures might be changed to more effectively minimize and mitigate the impacts of future projects on the species
- Any other pertinent information

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