Lower Colorado River Multi-Species Conservation Program

Balancing Resource Use and Conservation

CNWR Unit 1 Conservation Area 2009 Annual Report

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

August 2010

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National Park Service
Bureau of Land Management
Bureau of Indian Affairs
Western Area Power Administration

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Lower Colorado River
Multi-Species Conservation Program

CNWR Unit 1 Conservation Area
2009 Annual Report

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ACRONYMS AND ABBREVIATIONS

AFLP	amplified fragment length polymorphism
cm	centimeter(s)
CNU1	Cibola National Wildlife Refuge Unit 1 Conservation Area
CNWR	Cibola National Wildlife Refuge
DBH	diameter breast height
FY	fiscal year
GST	coefficient of gene differentiation, measures the proportion of gene diversity that is distributed among populations
HCP	Habitat Conservation Plan
HS	intrapopulation genetic diversity
HT	total genetic diversity or expected heterozygosity in the total population (HT = HS + DST, where DST = interpopulation diversity)
LCR	lower Colorado River
LCR MSCP	Lower Colorado River Multi-Species Conservation Program
m	meter(s)
Nature Trail	Cibola Corn Field/Nature Trail
NAU	Northern Arizona University
PLS	pure live seed
Reclamation	Bureau of Reclamation
USFWS	U.S. Fish and Wildlife Service

Symbols

%	percent
ΦRT	genetic diversity in terms of amongst regions
ΦPR	genetic diversity in terms of populations within regions
ΦPT	genetic diversity in terms of distribution of variation

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BACKGROUND

Cibola National Wildlife Refuge (CNWR) consists of about 16,600 acres of land located along approximately 12 miles of the lower Colorado River (LCR) 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.

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 (Reclamation) has previously partnered with CNWR and currently has a number of established projects at Unit 1, which include previous habitat creation projects as well as research and demonstrations projects. In 1999, the U.S. Fish and Wildlife Service (USFWS) and Reclamation planted the Cibola Corn Field/Nature Trail (Nature Trail) and established 34 acres of cottonwood-willow and mesquite land cover type within Unit 1. In 2002, USFWS and Reclamation planted approximately 18 acres of cottonwood/willow in Unit 1 north of the Corn Field/Nature Trail.

Six approximately 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 of the fields are occupied by three projects that have been fully or partially funded by the LCR MSCP: 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 an additional two agricultural fields that are still in agricultural production. The six fields combined are currently included in a 5-year Land Use Agreement, which expires in fiscal year (FY) 2009, with USFWS to continue research activities on Unit 1.

The CNWR Unit 1 Conservation Area (CNU1) incorporates the aforementioned existing projects and agricultural land as well as additional adjacent acreage into a single conservation area. The acreage in CNU1 has been categorized into five areas (figure 1). Area #1 includes active agricultural fields, existing (converted agriculture) cottonwood-willow land cover type, and ongoing LCR MSCP research and demonstration projects as described above. Area #2 (Hippy Fire) includes 338 acres that have been cleared as a result of the Hippy Fire. Areas #3 (Baseline 90) and #4 (North 160) were undeveloped land and fallowed agricultural land, respectively. Area #5 is Crane Roost. Figure 1 illustrates the current state of these lands as managed under the LCR MSCP. A Land Use Agreement, which supersedes the aforementioned agreement, was signed in 2007 that secured the lands within this conservation area for the term of the program. Note that CNU1 (~ 949 acres) only includes a portion of the total area designated as “Unit 1” by the CNWR (~ 4,100 acres).

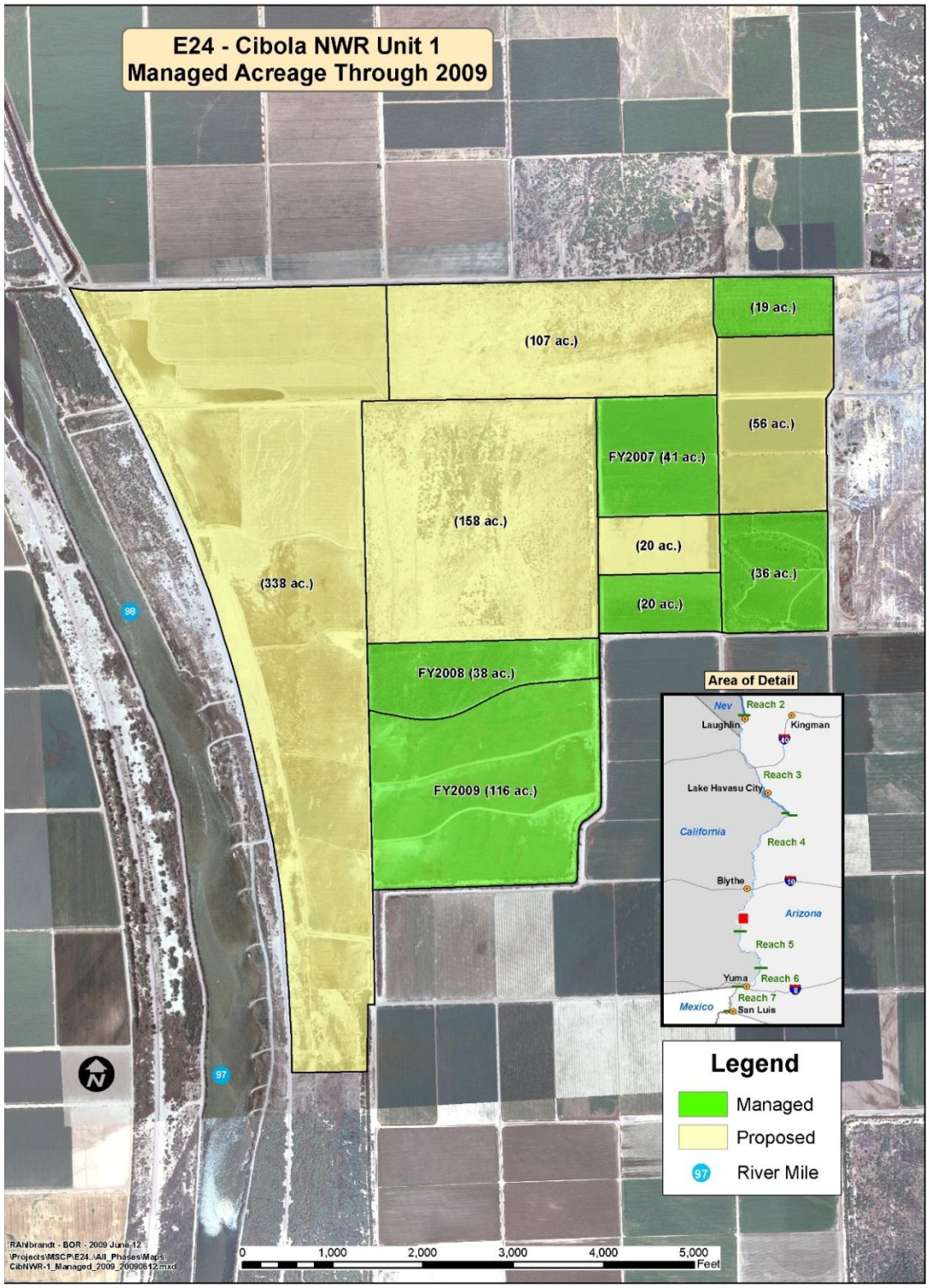

Figure 1.—The CNWR Unit 1 Conservation Area.

GENERAL SITE INFORMATION

Purpose

Cottonwood-willow land cover created within CNU1 will be managed for the southwestern willow flycatcher (*Empidonax traillii extimus)*, yellow-billed cuckoo (*Coccyzus americanus occidentalis*), and other species covered under the LCR MSCP. The creation of habitat includes both the establishment of native plants and the management of the vegetation and its structural type to meet performance standards for integrating seral stages of vegetation, moist soil, standing water, and open areas into mosaics of riparian vegetation.

Location

CNU1 consists of approximately 949 acres on CNWR, located in Arizona between River Miles 97 and 99 (figure 2). The initial partnership for CNU1 includes Reclamation and the USFWS The legal description of this area is as follows:

Township 1 South, Range 23 West, Gila and Salt River Base and Meridian, La Paz County, Arizona:

> Section 6, lots 4, 5, and 6

Township 1 South, Range 24 West:

> Section 1, lots 1 through 4, inclusive, S½NE¼, NW¼, SW¼, N½SE¼, and SW¼SE¼
>
> Section 2, lot 1, lots 2 and 3 those portions lying east of the levee road
>
> Section 12, N½NW¼NE¼, SW¼NW¼NE¼, SE¼NW¼NE¼ excluding that portion lying east of the irrigation drain, NE¼NW¼, W½NW¼ excluding that portion lying west of the levee road, NW¼NW¼SW¼ excluding that portion lying west of the levee road, and NE¼NW¼SW¼.

Land Ownership

CNU1 is located on the CNWR in Arizona, and it is owned and managed by USFWS: Cibola National Wildlife Refuge, 6660 Cibola Lake Road, Route 2, Box 1, Cibola, AZ 85328.

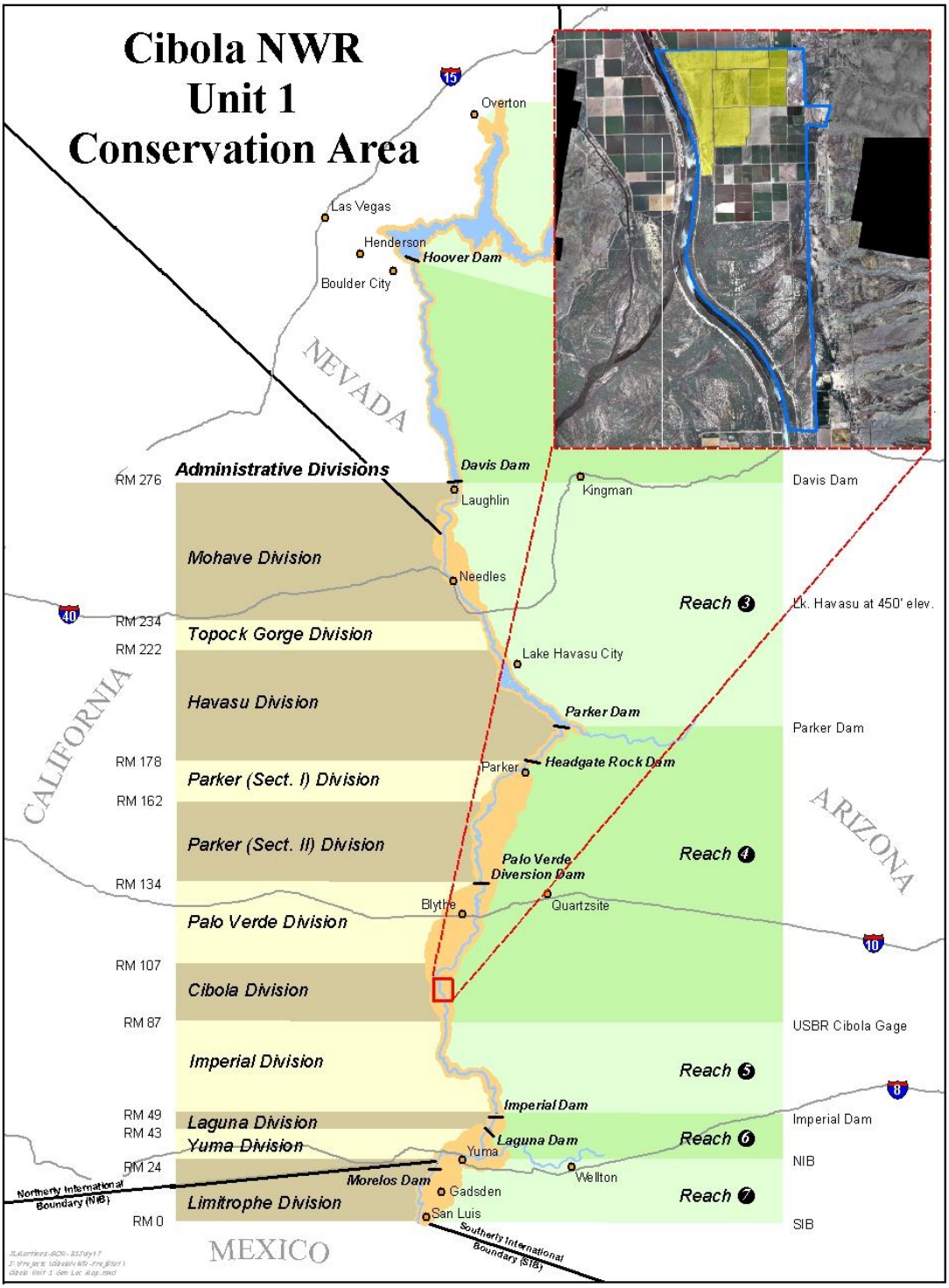

Figure 2.—Location of CNWR Unit 1 Conservation Area.

Water

CNWR has second priority water rights, which include a diversionary entitlement of 27,000 acre-feet per year and a consumptive use entitlement of (diversion minus return flow) of 16,793 acre-feet per year. In addition, the refuge has a circulatory (circulation water with minimum consumptive use) water right of 7,500 acre-feet per year. The 900-acre CNU1 will have a maximum of 5,400 acre-feet per year (6 acre-feet per acre of consumptive use per year) available when the conservation area has been fully developed.

Agreements

A Land Use Agreement for restoration activities has been finalized to secure the availability of land and water resources for CNU1 for the 50-year term of the program.

HABITAT DEVELOPMENT AND MANAGEMENT

Fiscal Year 2009 Planting

Planted

Crane Roost was planted in the spring of 2009. This establishment of riparian vegetation adds approximately 116 acres to the 38 already established acres within the Crane Roost area, making a total of 154 managed acres. Crane Roost was planted with over 200,000 trees, which included coyote willow, Gooding's willow, Fremont cottonwood, and honey mesquite species. The numbers of trees planted in Crane Roost are presented in the following table.

Total plants for Crane Roost, within CNU1, 2009

Common name	Scientific name	Number
Coyote willow	*Salix exigua*	44,496
Fremont cottonwood	*Populus fremontii*	22,224
Goodding's willow	*Salix gooddingii*	133,056
Honey mesquite	*Prosopis glandulosa*	950
Total		200,726

The tree species were planted in a stratified arrangement in an attempt to mimic the natural stratification that occurs with these species in a native riparian setting. In addition, this arrangement would also take advantage of both the species

differential water requirements as well as the irrigation infrastructure. The more water-intensive species such as like coyote willow were located closer to the irrigation turnouts where they would receive more water per irrigation cycle, while more drought-tolerant species such as honey mesquite were planted farthest away from the turnouts at the ends of the fields.

Based on preliminary observations, tree establishment in Crane Roost appears to be variable in some locations, suggesting areas of heavy and persistently saline soils. In most cases, these are small areas, and this effect will likely result in providing a more diverse mosaic across the Crane Roost fields; however, in a few areas, these variable soil conditions are more pronounced and have resulted in reduced establishment of native trees and dominance of weedy species. Depending on the results of the next growing season, these discreet areas may be cleared and replanted with appropriate native vegetation. To minimize similar situations in future planting phases at the CNU1, cover crops will be maintained for longer periods to better condition soils. In addition, less salt-tolerant cover crops have been established in these future phases in order to indicate potential soil problem areas.

Irrigation

Flood irrigation was used to water the cover crop and saturate the soils at the appropriate seasons to leach the salts through the soil column and provide favorable conditions for future land cover establishment. The cottonwood-willow land cover type, when planted, will be irrigated in accordance with the schedule prepared by Reclamation. A crop consultant will be used to monitor the site and recommend slight irrigation regime changes.

Site Maintenance

Regular water delivery, invasive plant mitigation, cover crop establishment, and site maintenance continued through FY09 in CNU1. Approximately 158 acres were cleared in the North 160 fields within the conservation area. In addition, irrigation turnouts were installed in North 160 in preparation for leveling and cover crop establishment in FY10. The majority of these activities were provided through contracted services; however, Reclamation and CNWR supplied additional personnel and equipment to assist during the clearing and disposal of debris on North 160.

Site Management

Flood irrigation was also used on other previously established fields within the conservation area for regular watering to maintain healthy stands of trees and to promote growth. Additional measures were taken as necessary to maintain field borders, and herbicide use and/or fertilizer were appropriately used where and when necessary.

In FY09, according to the prescription from the crop consultant, fertilizer was applied to all of the planted areas in CNU1. A grass-specific herbicide was applied to the fields where the seed feasibility study was being conducted to reduce weed competition.

Crop Consultants

A local crop consultant was used to provide irrigation scheduling as well as soil and plant analyses. Field observations were made for soil moisture depletion, water holding capacity, plant available water, and general appearance of plant growth and vigor. Additionally, soil and plant samples were taken from each field to be tested for complete analysis of nutrient content.

Fire Management

USFWS (the cooperating land management agency) will provide an appropriate management response on all wildfires that occur within CNWR. The full range of suppression strategies is available to managers provided that selected options do not compromise firefighter and public safety or cost effectiveness. USFWS is developing a fire management plan for all the refuges located on the LCR. The plan is expected to be released in 2009. The plan will contain more detailed information about all elements of wildland fire management within each refuge.

Federal and State agencies in Arizona have entered into a Wildland Fire Management Joint Powers Master Agreement whereby they agreed to work cooperatively to improve efficiency by facilitating the coordination and exchange of personnel, equipment, supplies, services, and funds among the agencies for management of wildland fires, presidential declared emergencies and disasters, or other emergencies under the Federal Emergency Management Agency's authority.

Law Enforcement

Law enforcement regulations are administered on CNWR through USFWS. USFWS special agents and refuge officers have existing authority to enforce Federal and State regulations on refuge lands. USFWS Refuge Officers have proprietary jurisdiction on refuges in Arizona. In addition, local law enforcement agreements are in place with the Bureau of Land Management, National Park Service, and Reclamation.

Public Use

Public use on CNU1 will be administered by CNWR, but will be compatible with the goals of the LCR MSCP as defined in the Land Use Agreement. For 2009, low-impact public use, such as wildlife watching and education/outreach, is expected at CNU1. However, these activities are limited to the Nature Trail and Goose Loop Drive.

Restoration Research and Demonstration

A number of previously established long-term research and demonstration projects are ongoing on CNU1 in "Area 1" as depicted on figure 1. The projects are described in greater detail in their respective work plans. If available, research updates will be periodically presented in the annual reports for projects in CNU1; however, for more detailed information on these projects, please refer to the specific research reports for these projects.

Cottonwood Genetics

This research project is designed by Northern Arizona University (NAU) to determine the relative levels of genetic diversity in remaining stands of Fremont cottonwood across the Southwest and investigate the influence of this genetic diversity and local genetic adaptations on community diversity in the context of habitat restoration. The expression of these genetic adaptations may manifest in trees possessing superior traits with respect to growth, reproduction, survival, and the habitat quality they influence. NAU was awarded a Cooperative Agreement and contributed matching funds from a National Science Foundation grant to undertake these investigations. The project includes genetically screening remaining stocks of Fremont cottonwood trees in stands throughout the Southwest and selecting genetically distinct trees, representative of these locations, to be planted in an experimental garden with a replicated design. The experimental garden will be monitored to observe how these genetic differences may be expressed in terms of growth, reproduction, and survival in a typical restoration site and genetic traits that influence superior habitat quality (including those that

may support LCR MSCP covered species). These genetic traits will likely be important for long-term survival and for maintaining habitat quality and health throughout the life of the program. Recent results shed light on a number of research questions posed by this study:

1. Large-scale riparian restoration: (How) do home site factors affect restoration success?

   Survivorship studies on a 6,400-tree restoration common garden at CNWR in southern Arizona reveal that some genotypes survived at higher rates than others. However, when investigating the collection site climate (temperature and precipitation) characteristics of each genotype in comparison to the climate of the common garden site, no specific patterns emerged. These results challenge the local climate adaptation model for choosing "local" genotypes in riparian restoration. Preliminary results also suggest that additional investigation is needed to determine the importance of genetic mixing for preserving riparian species, especially those that are under strong selection through human influences and global climate change.

2. What is the importance of genetic diversity and structure of a foundation riparian forest tree, Fremont cottonwood (*Populus fremontii*)?

   Riparian habitats, centers of biodiversity in the Southwest, are in steady decline from ongoing climate change and human impact. Preserving foundation riparian species is critical for the maintenance of streamside communities and their numerous ecosystem services. Recent studies of *Populus* indicate that genetic diversity drives biodiversity in southwestern riparian ecosystems. However, no studies have investigated genetic diversity and structure of any single *Populus* species throughout its range. Using 243 loci derived from amplified fragment length polymorphisms (AFLPs), we investigated population genetic diversity and structure in *Populus fremontii*. At the species level, we found relatively high levels of total genetic variation (HT = 0.301) and structure (GST = 0.48). Within the population level, we found highly variable levels of genetic diversity (HS ranged from 0.060–0.209). Hierarchical analysis of genetic variation showed structuring at the regional level and among population levels ($\Phi RT = 0.350$, $\Phi PR = 0.273$), but most variation was harbored within populations ($\Phi PT = 0.527$, $P < 0.001$). At a landscape scale, *P. fremontii* shows high levels of genetic variation and structure, which may be important for the maintenance and preservation of riparian ecosystems and associated communities. Results indicate that populations of *P. fremontii* are highly structured across the Southwest, suggesting that genetic variation may be an important consideration when choosing trees for maximum fitness and adaptability, and therefore restoration success.

Seed Feasibility

Through a series of laboratory and field experiments, this study documented the necessary steps involved in using seed to create dense mosaics of native riparian land covers. The steps in the process included seed collection, storage, treatment, planting, germination, and seedling growth and survival. Using seeds in lieu of, or in conjunction with, cuttings may be feasible if it involves less labor, is more cost effective, or preserves the genetic diversity of the riparian habitat created under the LCR MSCP. The amount of non-native to native vegetation resulting from using seed for restoration will also be an important factor in determining the feasibility of this method.

Germination Trials

During 2008, three additional germination trials were completed on frozen Fremont cottonwood, Goodding's willow, and coyote willow seed collected on the LCR during April 2006. Results indicate viability of over 80 percent (%) for at least 27 months after collection. Therefore, it appears that long-term seed viability under freezer storage conditions should not be considered a limitation for the use of native seed for direct seeding and revegetation on the LCR.

Monitoring of 2007 Cottonwood-Willow Test Plots

Vegetation and water content monitoring continued for cottonwood-willow study plots seeded at CNWR in May 2007. Additionally, two distinct irrigation regimes were implemented. One-half of the study plots received approximately 7 centimeters (cm) of water once per week, whereas the other plots received approximately 21 cm of water once per 3 weeks. In addition to large-scale monitoring of plant cover and establishment, individual cottonwood, willow, and saltcedar trees were tagged and monitored for the 2008 growing season, allowing survival and growth rate calculations for these species. Finally, trenches were excavated in the plots during October 2008 to monitor root growth through the soil profile.

Results for continued monitoring indicate an expansion of Fremont cottonwood crown and canopy cover as well as saltcedar crown and canopy cover. Monitoring of tagged trees has allowed documentation of superior growth rates of Fremont cottonwood over saltcedar under both irrigation regimes. Mortality was observed for both cottonwood and saltcedar at 6.4% and 4.2%, respectively. However, the average cottonwood growth rate was significantly greater than that of saltcedar. Finally, root systems were observed at depths greater than 1.5 meters below ground surface, indicating that seeded cottonwood likely used groundwater for at least a portion of the 2008 growing season (approximate depth to groundwater was 2 meters). A detailed report with these findings is located on the LCR MSCP Web site: http://www.lcrmscp.gov/reports/2007/e8_rep_07.pdf.

2008 Goodding's Willow Test Plots

Sixteen additional small-scale study plots were established at CNWR to analyze the effectiveness of direct seeding of Goodding's willow under reduced competition. Fremont cottonwood seed was not applied, and grass-specific herbicide was applied four times between May and July to control weed competition. Additionally, seeding rates of Goodding's willow were increased to approximately 140 pure live seed (PLS) per square foot (approximately 1,400 PLS per square meter). Finally, hydroseeding of uncleaned seed was compared with broadcast seeding of cleaned seed.

Goodding's willow establishment in the 2008 plots averaged 0.13% for broadcast seed and 0.95% for hydroseed. The relative Goodding's willow establishment compared to the 2007 cottonwood-willow study plots increased approximately 300% and 450% for broadcast and hydroseed methods, respectively. These data indicate that reduced competition increased plant establishment. However, the plant density was still low enough that the ratio of saltcedar to Goodding's willow was approximately 1.5:1. This is approximately equal to the ratio of saltcedar to cottonwood in the 2007 plots after the first growing season. A detailed report with these findings is located on the LCR MSCP Web site: http://www.lcrmscp.gov/reports/2008/e8_rep_08.pdf.

2009 Gooding's Willow Test Plots

In FY09, an additional set of willow plots were set up to determine if the best treatments (most successful in terms of establishment, survival, and density) would have repeatable results and were not simply a result of random variability. The interim results indicate a higher degree of promise than for previous small-plot willow trials. Establishment success was high, with less establishment of saltcedar. The researchers suggest that a reduction in saltcedar seed source next to the main canal and plots may have contributed to this lower observed saltcedar establishment. Grasses and other weedy species are also abundant in these plots, but do not seem to be out-competing the willows at this stage. Growth rates for the willows in these plots are still lower than what we have observed in other mass transplanted areas; however, this may be a site-specific (local) effect.

Results to date indicate continued monitoring is warranted to evaluate future competitive effects between saltcedar and Fremont cottonwood (2007 plots) and Goodding's willow (2008 and 2009 plots).

Mass Transplanting

This project evaluates mass transplanting techniques for cottonwood and willow using commercially available mechanized transplanting equipment. To meet the requirement to create 5,940 acres of cottonwood-willow land cover type habitat, a significant number of native trees will need to be established each year. Mass

transplanting is an approach used successfully by commercial growers. If mass transplanting of native species proves effective, it is expected to provide a useful cost-effective tool in the creation of future habitat.

Effectiveness of this technique has been established and is currently being used as a primary means for large-scale establishment of cottonwood-willow land cover-type for the LCR MSCP. For greater detail on this project, refer to the specific report for this technique demonstration. We are continuing to monitor the fields where these demonstrations took place to determine the long-term survival and growth of trees planted using this technique and at these high densities. A detailed report with these findings is located on the LCR MSCP Web site: http://www.lcrmscp.gov/reports/2006/e7_massplanting_06.pdf.

MONITORING

Vegetation

Vegetation plots were established at five habitat creation sites as part of the Lower Colorado Multi-Species Conservation Program (LCR MSCP). The LCR MSCP was designed to create habitat to support the conservation of target fish and wildlife species important to the LCR ecosystem. A long-term monitoring strategy was designed to follow the progression of each LCR MSCP habitat creation goal over time and ensure that the long-term goals were reached.

Data were collected to capture vegetation composition and structure within each habitat creation site (BioWest 2010). Data gathered across multiple years will be used to guide the adaptive management process for each habitat creation site.

Vegetation monitoring data were collected within several parameters to capture vegetation composition and structure from the ground layer to the canopy layer. Detailed methods used to gather vegetation data can be found in BioWest's Vegetation Monitoring Report (BioWest 2010). The following data were summarized across each site. Table 1 lists the percent of total vegetation per meter layer. The high percentage of vegetation at meter 1 and 2 is reflective of the ground cover at the foliage height diversity sampling points. Table 2 lists percent of ground cover by species. Table 3 shows ranges and means of height and diameter breast height (DBH) for plants within the overstory tree and intermediate tree and shrub categories. Ground cover data were gathered on herbaceous plants and small shrubs only. Table 4 shows average total abundance of target tree species per plot and per acre at each site/phase. Abundance was calculated from plots containing trees within each respective category (overstory, intermediate and shrub, DBH classes 1-4) and then added together to get the values shown in table 4.

Table 1.—Foliage height diversity at CNWR Unit 1 (Percent total vegetation and standard deviation per meter layer are shown.)

Site/phase	Meter	% (SD)[1]
CNU1	1	18.03 (0.01)
CNU1	2	6.38 (0.04)
CNU1	3	10.26 (0.05)
CNU1	4	9.73 (0.02)
CNU1	5	8.21 (0.01)
CNU1	6	8.16 (0.02)
CNU1	7	10.97 (0.06)
CNU1	8	5.67 (0.00)
CNU1	9	5.47 (0.01)
CNU1	10	3.37 (0.00)
CNU1	11	3.26 (0.01)
CNU1	12	3.10 (0.01)
CNU1	13	2.94 (0.01)
CNU1	14	2.30 (0.02)
CNU1	15	1.03 (0.00)
CNU1	16	0.80 (n/a)
CNU1	17	1.13 (0.01)
CNU1	18	0.94 (0.01)
CNU1	19	1.39 (n/a)
CNU1	20	0.40 (n/a)

[1] Standard deviation.

Table 2.—Average percent ground cover by species a CNU1

Site/phase	Species	% (SD)[1]
CNU1	*Cynodon dactylon*	33.41 (3.67)
CNU1	*Medicago sativa*	2.00 (n/a)
CNU1	*Sorghum halepense*	53.39 (3.93)

[1] Standard deviation.

Table 3.—CNU1 overstory tree, intermediate tree and shrub height, and diameter breast height (Means plus standard deviations are shown)

Site/phase	Overstory				Intermediate			
	Height (range in m[1])	Mean (SD)[2]	DBH (range in cm)	Mean (SD)	Height (range in m)	Mean (SD)	DBH (range in cm)	Mean (SD)
CNU1	0.00–13.94	5.41 (5.87)	0–33.13	11.76 (11.62)	2.90–11.20	8.22 (2.53)	8.00–12.50	9.99 (1.09)

[1] m = meters.
[2] Standard deviation.

Table 4.—Average total abundance of target tree species per plot and per acre

Abundance – number of trees										
	Populus fremontii		***Salix gooddingii***		***Salix exigua***		***Prosopis glandulosa***		***Prosopis pubescens***	
Site	**Plot**	**Acre**	**Plot**	**Acre**	**Plot**	**Acre**	**Plot**	**Acre**	**Plot**	**Acre**
CNU1	36.03	1750.20	13.50	715.50	12.00	636.00	4.00	179.00	1.00	53.00

Table 5 shows mean percent crown closure at each site/phase. The number of observations for each site refers to the number of readings at all plots across each site/phase.

Table 5.—Mean percent crown closure

Site	Number of observations[1]	Mean % crown closure (SD)[2]
CNU1	126	78.74 (34.69)

[1] Number of observations for each site refers to the number of readings at each plot across the site.
[2] Standard deviation.

Avian Surveys

Table 6.—LCR MSCP avian species detected at CNU1, 2009

LCR MSCP covered species detected	Number of confirmed breeding pairs
Bell's vireo	0
Sonoran yellow warbler	2
Willow flycatcher	0
Yellow-billed cuckoo	0

Yellow-billed cuckoo surveys were conducted following Halterman et al. (2008). Four or five complete surveys of each site were performed during the field season (mid-June to early September). Sequential surveys were spaced 12 to 20 days apart and took place between sunrise and 12:00, or until temperatures reached 40 degrees Celsius (104 degrees Fahrenheit). Call playback, described by Johnson et al. (1981) and Gaines and Laymon (1984), was used to increase the probability of detection. Data were also collected on nesting, microhabitat, vegetation, and arthropods (McNeil et al. 2009).

As many as two yellow-billed cuckoos were detected during these visits. One bird, a female, was captured on July 21, banded with USFWS color bands, and fitted with a telemetry receiver. This bird was followed until August 6, after which, signals were no longer detected at the site. Breeding was not confirmed at this site.

All flycatcher surveys were conducted according to methods described in Sogge et al. (1997), following a 5-survey protocol, as recommended by USFWS. At least one survey was conducted between May 15 and 31, at least one survey between June 1 and 15, and three additional surveys between June 16 and July 25.

To elicit responses from nearby willow flycatchers, conspecific vocalizations previously recorded throughout the Southwest from 1996 to 1998 were broadcast within appropriate habitat. Detailed methods are described in McLeod and Koronkiewicz (2010).

One willow flycatcher was detected on May 16, two on May 27, and one on June 10. All willow flycatchers were considered migrants.

Surveys of habitat creation sites with more than 2 years' growth to determine their use for breeding by other LCR MSCP avian species were conducted using an intensive area search method. In 2009, the Nature Trail site was split into two intensive area search plots, and the Mass Transplanting site was covered with one intensive area search plot. The Sonoran yellow warbler (*Dendroica petechia sonorana*) was confirmed breeding (see table 6). The Arizona bell's vireo (*Vireo bellii arizonae*) was detected and classified as a non-breeder. Yellow warblers (*Dendroica petechia*) that were classified as non-breeders were also detected at the site. Details of the intensive area search method and further results are found in Great Basin Bird Observatory (2009).

A bird banding station has been in operation at the Nature Trail since 2002. Winter banding runs from October – March, and summer banding runs from May – August. Twenty-nine species were captured during the winter surveys, including one Bell's vireo. Thirty-three species were captured at the site during the summer surveys, including six yellow warblers. A more detailed description of banding results can be found in Dodge and Kahl (in press).

Small Mammals

Presence/absence surveys were used in previous years to determine the presence of the Colorado River cotton rat (*Sigmodon arizonae plenus*) at the Nature Trail. Cotton rats have also been observed by researchers in the cottonwood genetics field, though no trapping occurred due to the ongoing research within this area. Because a stable population was found at the Nature Trail, a habitat characterization and population demographic study began in the fall of 2009. The only trapping that occurred in FY09 was to practice pit tagging cotton rats for the upcoming habitat study. Approximately 15 traps were set, and 2 cotton rats were captured in the spring, indicating that a population still exists within CNU1.

Bat Monitoring

Anabat bat detectors were deployed across the site quarterly to determine bat activity across habitat types. Fifty-six detector nights were completed for seven monitoring sites in 2009. Bat activity is expressed in call minutes, which indicate

that a given species is present if it is recorded at least once within a 1-minute period. Table 7 lists the total number of call minutes of LCR MSCP species for each year sampled combined across 3 years of sampling. Acoustic surveys will continue in 2010. For more details of how these data are collected and analyzed, see the report entitled Post-Development Bat Monitoring of Habitat Creation Areas along the Lower Colorado River – 2009 Acoustic Surveys (Broderick, in press).

Table 7.—Total number of call minutes recorded for FY07 through FY09[1]

Species	FY07	FY08	FY09	All years
California leaf-nosed bat	12	67	11	90
Townsend's big-eared bat	0	0	7	7
Western red bat	0	0	2	2
Western yellow bat	0	0	4	4
All other species	433	2,067	5,702	8,202
Total call minutes	445	2,134	5,726	8,305

[1] Note that there were two restoration sample sites in 2007; 2008 was a transition year, with five new restoration site samples added in April and July; and 2009 had a total of six restoration samples.

This was the third year of bat capture surveys at the Nature Trail. A combination of mist nets and harp traps were deployed 1 night each month from May –September. Table 8 shows the captures of LCR MSCP species compared to all other species across all 3 years of surveys. California leaf-nosed bats (*Macrotus californicus*) are the only LCR MSCP species captured every year. Bat capture surveys will continue in 2010. See the report entitled Post-Development Bat Monitoring of Habitat Creation Areas along the Lower Colorado River – 2009 Capture Surveys (Calvert 2010) for a more detailed account of the bat capture surveys and methods.

Table 8.—All captures for all years at CNU1

Species	2007 N = 2[1]	2008 N = 5[1]	2009 N = 5[1]	Total N = 12[1]
California leaf-nosed bat	14	4	4	22
Townsend's big-eared bat	0	0	0	0
Western red bat	0	0	0	0
Western yellow bat	0	2	0	2
All other species	5	31	162	198
Total	19	37	166	222

[1] N = number of survey sessions.

HABITAT CREATION CONSERVATION MEASURE ACCOMPLISHMENT

The process for habitat creation conservation measure accomplishment has not been finalized. Once the process is finalized, information in this section will be used to establish credit.

ADAPTIVE MANAGEMENT

Adaptive management relies on the initial receipt of new information, the analysis of that information, and the incorporation of new information into the design and/or direction of future project work (LCR MSCP 2007). The Adaptive Management Program's role is to ensure habitat creation sites are biologically effective and fulfill the conservation measures outlined in the Habitat Conservation Plan for 26 covered species and potentially benefit 5 evaluation species. Post-development monitoring and species research results will be used to adaptively manage habitat creation sites after initial implementation. Once monitoring data are collected over a few years, and then analyzed for CNU1, recommendations may be made through the adaptive management process for site improvements in the future.

There are no adaptive management recommendations for CNU1.

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