

Work Task E6: Cottonwood Genetics Study

FY07 Estimates	FY07 Actual	Cumulative Accomplishment Through FY07	FY08 Approved Estimate*	FY09 Proposed Estimate	FY10 Proposed Estimate	FY11 Proposed Estimate
\$15,000	\$16,036	\$259,405	\$15,000	\$0	\$0	\$0

*Costs for operation and maintenance are now captured under Work Task E24.

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Start Date: FY04

Expected Duration: Closed in FY07

Long-term Goal: Restoration research.

Conservation Measures: WIFL1, WRBA2, WYBA3, CRCR2, YHCR2, YBCU1, ELOW1, GIFL1, GIWO1, VEFL1, BEVI1, YWAR1, and SUTA1.

Location: Reach 4, Cibola National Wildlife Refuge, one-half mile east of River Mile 97, AZ.

Purpose: 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. Previous research indicates that diversity in cottonwoods can have a direct effect on associated trophic communities and can lead to increases in wildlife diversity. A benefit of genetically diverse stands of trees in dominant riparian communities is increased plasticity to varying environmental perturbation including disease, insect outbreaks, and climate change. Reclamation will use the information gained from this study to increase knowledge and success in creating functional wildlife habitat, and to insure that adequate genetic diversity of dominant riparian plants are included in habitat creation projects.

Connections with Other Work Tasks (past and future): All work tasks in Section E that target cottonwood-willow habitat. Starting in FY08, operation and maintenance costs for E6 will be included in Cibola NWR Unit 1 (E24).

Project Description: Information is lacking regarding the relative levels of genetic diversity within the remaining cottonwoods along the LCR and the impact of this genetic diversity as it pertains to community structures and ultimately, wildlife diversity within restoration sites. In an effort to increase knowledge and success in creating functional wildlife habitat, Reclamation solicited the scientific community for proposals to investigate these relationships. The 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. Sampling will be conducted to indicate species diversity and richness at multiple trophic levels with respect to soil microbes, invertebrates, and vertebrate communities associated with specific cottonwood genotypes. The experimental garden will be located at Cibola NWR on agricultural land with water and irrigation infrastructure.

Previous Activities: The cottonwood genetics garden was established and monitored in FY06, but due to high mortality was selected for replanting in FY07.

FY07 Accomplishments: The cottonwood genetics experimental garden was replanted in spring of FY07. The design and composition of the garden planted was identical to the original garden as detailed in the study plan. Reclamation assisted with field preparation and personnel for planting; however, the majority of the replanting and labor costs (recollection, propagation, transportation, and planting) were assumed by NAU.

Over the first growing season, establishment was initially high; however, tremendous competition from weeds (particularly sunflowers and Johnson grass) and inconsistent delivery of water to all parts of the fields resulted in relatively high location-specific mortality. Total survival was recorded at around 50%; however, NAU may replant a number of the critical blocks for this experiment in future years.

Due to the difficulties in establishment experienced in these fields, research results are limited at this time. However, a number of interesting patterns of survival have begun to emerge with respect to genotype and field location. A few of the genotypes exhibited poor propagation success in the greenhouse, specifically, poor rooting success, which translated to poor survival in the fields. In addition, patterns of mortality were attributed to the way water was distributed across the fields. In many places, irrigation water was not able to reach trees, due to soil textures or field topography resulting in areas of higher mortality. Monitoring of vegetation and arthropod communities in the experimental garden continued throughout FY07.

FY08 Activities: Operation and maintenance of the site will be included under E24, thereby closing Work Task E6.

Proposed FY09 Activities: N/A

Pertinent Reports: *Nature Reviews*, July 2006; *Science Daily*, July 2006; U.S. Dept of State *Washington File*, August 2006; and Ecological Society of America *Frontiers in Ecology and the Environment*, October 2006, are posted on the LCR MSCP Web site.