

Work Task E8: Seed Feasibility Study

FY07 Estimates	FY07 Actual	Cumulative Accomplishment Through FY07	FY08 Approved Estimate	FY09 Proposed Estimate	FY10 Proposed Estimate	FY11 Proposed Estimate
\$160,000	\$71,382	\$563,992	\$65,000	\$210,000	\$0	\$0

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Start Date: FY05

Expected Duration: FY10

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 NWR, one-half mile east of River Mile 97, AZ.

Purpose: This research project documents the feasibility of establishing native riparian habitat (cottonwood, willow, and other native groundcovers and shrubs) from seed to potentially increase the cost effectiveness and quality of future habitat creation projects.

Connections with Other Work Tasks (past and future): Beginning in FY11, operation and maintenance costs for this work task will be included in Cibola NWR Unit #1 (E24).

Project Description: Through a series of laboratory and field experiments, this study will document the necessary steps involved in using seed to create dense mosaics of native riparian land covers. Steps in the process include 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 nonnative to native vegetation resulting from using seed for restoration will also be an important factor in determining the feasibility of this method. Reclamation has entered into a 50-year land use agreement with the USFWS to conduct restoration research and manage created land covers in Unit #1 at Cibola NWR.

Previous Activities: Through FY06, which was the first year of the three year contract, seed collection and testing was completed and is discussed in the FY07 accomplishment section.

FY07 Accomplishments:

Laboratory and Greenhouse Results: Viability of seed from cottonwood and both species of willow that had been frozen since May 2006 remained greater than 80% during 2007, and

monthly testing will continue until 2-year viability results are final. Although cleaning seed did not affect seed viability, germination on soils continues to be higher for frozen, cleaned seed than for frozen uncleaned seed.

Tests comparing the effect of long-term storage of cottonwood and willow seed on germination and growth were completed. No significant differences were observed between seeds collected in 2006 and kept frozen and seeds collected in 2007. Seed collection year did not result in decreased plant growth, crown cover, species count, dry plant mass, or plant height.

In greenhouse tests of honey and screwbean mesquite, although counts of both species were comparable, honey mesquite dominated crown cover and biomass, indicating the seeds of these species should not be planted together. Mesquite stem counts were unaffected by soil type; however, biomass, height, and total root mass decreased progressively from loose soil to compacted soil to sand. Mesquite height decreased from low to high seeding rate, indicating a lower seed rate is best for maximal growth of trees.

In greenhouse tests of Emory's *Baccharis*, counts were higher and biomass was larger for seeds planted in loose soils rather than in compacted soils or sand. Further results for greenhouse tests can be found in the 2007 Annual Report.

Small-Scale Field Studies at CNWR: Variables tested in the field in 2007 included presence or absence of early sprinkler irrigation, seed cleaning (yes or no), seeding method (broadcast, hydroseeded), surface irrigation method (furrow or border strip), plot placement, and seeding rate. Target species indicators measured included crown cover, canopy cover, stems/m², average height, maximum height, biomass/m², and biomass/stem.

Goodding's and coyote willow had low establishment and results were not conclusive. Tests will be repeated in 2008 using only willow seed. Willow appears to be unable to compete when planted with cottonwood or when saltcedar and grasses are present within the plots. In 2008, extensive weed control and removal of cottonwood from the experiments will determine if this is the case.

Crown cover, average height, maximum height and biomass were greater for cottonwoods in plots that did not receive early-time sprinkler irrigation than ones that did. Un-cleaned hydroseeding resulted in the highest canopy cover, stem density and biomass for all three seeded species. Furrow irrigation had better results than border strip irrigation on all target species indicators except cottonwood cover, which did not differ. Seeding rate was directly correlated with cottonwood plant establishment and biomass, but other relationships did not show significant differences.

Cottonwood stem counts ranged from 0 to 59 per m², with an average stem density of 18 per m². Maximum cottonwood, Goodding's willow, and coyote willow biomass was 220.3 g, 5.6 g, and 1.9 g per m², respectively. Goodding's willow was observed in only 12 of the 36 plots and coyote willow in only 6 plots. Saltcedar stem counts ranged from 2 to 70 per m², with an average of 21.5 per m², and maximum biomass was 93.5g per m², with an average of 21.5 per m².

Average crown cover and tree height was greater for cottonwood than for saltcedar in most treatments and saltcedar generally decreased in number or vigor where cottonwood establishment was dense. Results of the seed treatments indicates that hydroseeding may have the same effect as cleaning the seeds prior to planting. Further results can be found in the Fiscal Year 2007 Accomplishment Report (Annual Report).

FY08 Activities: Based on results from the 2007 annual report, a contract modification will be required to maximize the benefit of these data and make a more informed decision before proceeding to the large-plot phase of this research. Dominance of cottonwood and poor establishment of willows in the small-plot studies suggest that this species may not compete well against cottonwood and other plants. To determine the feasibility of willow establishment using seed, an additional small plot study will be conducted using only Goodding's willow seed and using more timely applications of weed herbicides. These small plot studies will be conducted in the same field, adjacent to the 2007 small-plot study. The 2007 small-plot studies where cottonwood dominated the vegetation structure will continue to be irrigated and monitored through 2008 to determine second year survivorship and overall vegetative composition of the plots (i.e., whether cottonwood will continue to dominate and shade out saltcedar (particularly) and other weeds).

Additional tasks for FY08 include greenhouse pot studies to determine best protocols for *Baccharis* establishment and the continuation of seed storage viability testing up to the 2-year-frozen mark.

Proposed FY09 Activities: Fiscal Year 2009 activities will be dependant upon results from FY08 research. If willow small plot studies indicate that willow establishment is poor using seed, or if the monitoring of the 2007 small plot studies indicate that saltcedar is persistent in high percentages compared to cottonwood, the large-plot studies will not be undertaken and the contract and work task will be closed. If willow establishment appears successful and the 2007 small plots have promising competitive advantages over nonnative weeds, particularly saltcedar, then testing of the most successful treatments on the large scale with standard irrigation infrastructure will be pursued in 2009.

Pertinent Reports: *Year 1 Research Plan, Feasibility Study using Native Seeds in Restoration, July 17, 2006; Technical Proposal, Feasibility Study using Native Seeds in Restoration;* and the 2006 Annual Report, *Feasibility Study using Native Seeds in Restoration*, will be posted to the LCR MSCP Web site.