

## Work Task C5: Effects of Abiotic Factors on Insect Populations in Riparian Restoration Sites

FY06 Estimates	FY06 Actual	Cumulative Accomplishment Through FY06	FY07 Approved Estimate	FY08 Proposed Estimate	FY09 Proposed Estimate	FY10 Proposed Estimate
\$90,000	\$8,584	\$8,584	\$90,000	\$90,000	\$90,000	\$0

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**Start Date:** FY06

**Expected Duration:** FY09

**Long-term Goal:** Species Research

**Conservation Measures:** WIFL1, WIFL2, YBCU1, YBCU2, GIFL1, GIWO1, VEFL1, BEV11, YWAR1, SUTA1, WRBA2, WYBA3, CLNB2, PTBB2

**Location:** Mass Transplanting Demonstration Site (E7) (Reach 4, Cibola NWR, AZ, 1/2 mile east of River Mile 97) and Cibola Valley Conservation Area (E5) (Reach 4, Reclamation, Hopi Tribe, and Mohave County, AZ, south of River Mile 103). Beal Riparian and Marsh (E1) (Reach 3, Havasu NWR, AZ, 0.5 miles east of river miles 238-239).

**Purpose:** Eight species of birds and four species of bats included in the LCR MSCP eat insects. Creating and maintaining habitat for these species requires providing an adequate supply of insects for food. This is especially difficult at the LCR MSCP habitat creation sites being developed, because riparian vegetation is being planted in non-riparian farmland. Growing plants will not by itself guarantee insect abundances large enough to feed and support bird and bat populations. Two abiotic factors, plant water content and plant nitrogen content, greatly influence abundances of plant-feeding insects. Both of these factors can be manipulated, depending on soil conditions, by controlling plant irrigation and fertilization.

**Connections with Other Work Tasks (past and future):** Work task C5 developed from Southwestern Willow Flycatcher Prey Base Study (C20). Work task C20, completed in 2006, identified insects and spiders eaten by the southwestern willow flycatcher. Work task C5 parallels Insect Population Biology in Riparian Restoration Sites (C6). Work task C6 currently is examining sources (riparian, upland, or aquatic) of insects eaten by riparian bird species covered under the LCR MSCP, and developing a method for monitoring populations of these bird species. Plant water and nitrogen contents also likely affect populations of MacNeill's Sootywing, being investigated in Survey and Habitat Characterization of MacNeill's Sootywing (C7). The same laboratory procedure will be used to measure plant nitrogen in C5 and C7. Information obtained in these studies will be used in the design and implementation of future habitat creation projects detailed in Section E.

**Project Description:** Insect densities will be estimated on different species of restored plants grown under different irrigation and fertilizer treatments. Water and nitrogen contents will be measured in tissue samples taken from insect-sampled plants. Relationships between plant water and nitrogen contents, plant species, and insect density will be determined. Field work will be performed at LCR MSCP habitat creation sites listed above.

**Previous Activities:** This work task is a new start in FY06.

**FY06 Accomplishments:** A technique for measuring amounts of nitrogen in plant tissue was developed based on a published method of measuring Total Kjeldahl Nitrogen in plant tissue; the technique was adapted to existing laboratory instrumentation for measuring nitrogen in water samples. Leaf samples were taken from 32 *Atriplex lentiformis* plants at Cibola NWR collected during work conducted under C7. Percent water of each plant was measured. Percent nitrogen (% of dry weight), measured in two samples from each plant, averaged 2.2%. Differences among plants accounted for 62% of variation in percent nitrogen, differences between subsamples accounted for 17% of variation, and interaction between subsamples and plants accounted for 21% of variation. Plant water and nitrogen contents were positively correlated. The procedure developed will enable comparison of plant nitrogen contents with insect abundances in created riparian habitats.

Once the technique for measuring plant nitrogen was developed, field trials were to be performed at Cibola Valley Conservation Area; however, these trials have been postponed due to delays in Phase 1 habitat creation efforts.

**FY07 Activities:** Two activities will be performed during FY07:

1. Effects of plant water nitrogen fertilizer on insect diversity and abundance will be examined in E7. Nitrogen fertilizer will be applied to 1-2 rows of riparian trees (coyote willow, Goodding's willow) monthly in May, June, and July. Insects will be collected on trees, sorted to order, and counted. Plant samples will be taken from trees in treated and non-treated areas and analyzed for percent water and nitrogen. Insect abundances and plant-nitrogen contents will be compared.
2. Effects of ponded water on insect diversity and abundance. This work will be performed at the Beal Lake Riparian Marsh (E1), where artificial liners are installed to create pools of water. Three insect (Malaise) traps will be placed in plots of mixed riparian trees: one trap above a water retention pool, one trap between two pools, and one trap away from the pools. The trap above the pool will collect insects attracted to, or emerging from, the moist soil within the pool. The trap between features will collect insects responding to increased relative humidity. The trap away from the pools will serve as a control. Insects trapped during May-August 2007 will be sorted by suborder (e.g., aquatic flies, terrestrial flies, wasps, bees), and counted. Insect abundance and diversity will be compared between traps within the channel and with pools and traps outside of the channel.

**Proposed FY08 Activities:** Effects of plant water and nitrogen content on insect abundance and diversity will be studied at LCR MSCP restoration sites as plants develop and opportunities for controlling irrigation and fertilizer-application arise.

**Pertinent Reports:** The study design is available upon request from the LCR MSCP.