

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

FY12 Estimate	FY12 Actual Obligations	Cumulative Expenditures Through FY12	FY13 Approved Estimate	FY14 Proposed Estimate	FY15 Proposed Estimate	FY16 Proposed Estimate
\$90,000	\$86,835.87	\$501,917.22	\$95,000	\$0	\$0	\$0

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**Start Date:** FY06

**Expected Duration:** FY13

**Long-term Goal:** Species Research.

**Conservation Measures:** WIFL1, WIFL2, YBCU1, YBCU2, GIFL1, GIWO1, VEFL1, BEVI1, YWAR1, SUTA1, WRBA2, WYBA3, CLNB2, PTBB2.

**Location:** Beal Lake Conservation Area (Havasu NWR), Palo Verde Ecological Reserve, Cibola Valley Conservation Area.

**Purpose:** The purpose of this work task is to determine the effect of two abiotic factors, water and nutrient contents, on abundances of insects and insectivorous birds and bats covered by the LCR MSCP. Establishing vegetation at restoration sites will not by itself provide habitat for birds and other wildlife. Proper amounts of plant water and other nutrients in plants and insects are needed to support wildlife.

**Connections with Other Work Tasks (past and future):** Work task C5 developed from the Southwestern Willow Flycatcher Prey Base Study (C20). Information obtained in these studies will be used in the design and implementation of future habitat creation projects detailed in Section E.

**Project Description:** 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.

Plant-feeding insects respond to water and nutrient concentrations of their plant hosts. Plants with higher water concentrations produce more insects. This increase in phytophagous insects also increases densities of predaceous insects and spiders. Plant nitrogen concentrations similarly affect insect populations. Nutrient concentrations in spiders and insects also may affect foraging by insectivorous birds. Nutrients that vary

among spiders and insects include nitrogen, sulfur, and phosphorous. This project will examine the following at LCR MSCP restoration sites:

1. the influence of increased plant-nitrogen content on spider and insect densities
2. variation in nitrogen, sulfur, and phosphorus among spiders and insects
3. the influence of plant water-content on spider and insect densities

**Previous Activities:** Effects of plant water and nitrogen contents on arthropod abundance and mass was examined at the Palo Verde Ecological Reserve. Fertilizing trees with nitrogen had a small but significant effect on insect abundance and mass. Nitrogen concentrations were measured in collected arthropods. Overall, arthropod herbivores and predators contained similar nitrogen concentrations. A follow-up study was performed in 2010 examining the occurrence of resilin in insects. Resilin was abundant in grasshoppers, dragonflies, and true bugs, and rare in flies and beetles.

Amounts of sulfur in spiders and insects collected at the Beal Riparian Restoration Site were examined during 2011. Insectivorous birds require these compounds for growth and reproduction. Concentrations of sulfur were measured in 4 families of spiders and 22 families of insects. Spiders contained higher sulfur-concentrations than insects, and concentrations of sulfur were lower in beetles than in other insects.

**FY12 Accomplishments:** The element phosphorus in arthropods at the Beal Riparian Restoration Site was examined during 2012. Phosphorus is found in DNA and RNA, in AMP, ADP, and ATP, and in phospholipids. Phosphorus concentrations were higher in spiders than in insects, in insect predators than in herbivores, and in strong-flying insects compared with weak-flying or non-flying insects.

**FY13 Activities:** The effects of irrigation frequency on densities of arthropods on different plant species at Beal Riparian Restoration Site will be examined during 2013. Three adjacent plots at Beal will be irrigated on different schedules during 2013. All three plots contain planted coyote willow, Goodding's willow, and cottonwood. Arrowweed may also be examined. Numbers and biomasses of arthropods will be measured on each species at each plot monthly during April to September. The effects of irrigation frequency on spider and insect abundance on each plant species will be determined. Plant water contents also will be measured.

**Proposed FY14 Activities:** Closed in FY13.

**Pertinent Reports:** Annual reports for C5 are available on the LCR MSCP website.