

HCP Section 6.3.4.2 Applied Research Projects to Prioritize for 2015

Below are the yet to be completed Applied Research projects required by Section 6.3.4.2 of the EAHCP.

Following this section are five additional recommendations from the contractors that completed the 2013 Applied Research. These projects are not identified in the EAHCP but may provide useful information about the species.

The Science Committee is requested to review these studies in order to provide a comprehensive list of prioritized projects to be conducted in 2015.

Tier A: Comal Springs Riffle Beetle Habitat Associations and Movement

1. Effects of flow levels on Comal Springs riffle beetle (CSRB) movement
 - Will require two study approaches.
 - Lab component study will be conducted as a 2014 Applied Research CSRB movement study.
 - Field component study cannot be done without completion of the Lab Component.
2. Test spring run connectivity on Comal Springs riffle beetle habitat
 - Studies the importance of the surface habitat and riparian detritus and the subsurface habitat.
 - Cannot be done without an established population in an experimental habitat (which is part of the 2014 Applied Research CSRB habitat study).

Tier B: Direct Impacts to Covered Species

1. When does fountain darter compensatory reproduction get triggered, and if so, when and what causes it?
 - Compensatory reproduction may occur when reproduction limiting conditions are no longer a factor.
 - Low flow conditions in the San Marcos and Comal springs aquatic ecosystems could cause factors that may affect fountain darter reproduction.
 - Knowledge of compensatory fountain darter reproduction could be beneficial to recovery in the wild, or for breeding in a refugia setting.
2. What are the behavioral responses of the fountain darter under different turbidity levels in relation to feeding success?
 - The fountain darter is a visual predator.
 - Storm water runoff and recreation affect in-stream turbidity.
 - Does the change in turbidity affect fountain darter behavior?

Tier C: Testing Repeat Occurrences of Low-Flow or Combination of Effects

1. System memory.

- Components or parameters of earlier studies that showed impacts from varying flows will be studied for potential additive effects of repeat occurrences.
2. Ecological model evaluation.
- Toward the end of Phase 1, specific studies will be designed and conducted to test the validity of the eco-model results.

Applied Research Recommendations made by Contractors for 2015 (Studies not specified in HCP)

Based on HCP applied research findings from the Vegetation Tolerance studies and Food Source studies (BIO-WEST), the following five Applied Research projects have been recommended:

1) *Ludwigia* growth field study

- The apparent suitability of *Ludwigia* to substitute for *Hygrophila* with regard to providing fountain darter habitat is encouraging.
- Further investigation of *Ludwigia* growth under varying environmental conditions in the Comal River (Landa Lake, Old Channel, and New Channel) and in the San Marcos River (upstream and lower sections) is warranted.
- While the 2013 greenhouse and pond studies strongly support the use of *Ludwigia*, the results of the laboratory vs. field experiment cautions against too much extrapolation.

2) Plant competition study

- An *in situ* plant competition study using *Ludwigia* and two nonnative species (*Hygrophila* and *Hydrilla verticillata*) is recommended.
- Previous research has shown that under relatively stagnant flow conditions, *Hygrophila* strongly outcompeted *Ludwigia*.
- It would be useful to have data under more reasonable field conditions.
- Studying the competitive ability of both of these species vs. *Hydrilla verticillata* is warranted for understanding the San Marcos River plant dynamics.

3) Algae dynamics study

- Based on the laboratory and field experiments, in conjunction with the annual build-up of algae in portions of the San Marcos and Comal rivers.
- Directed at understanding the effect of water quality on algal growth and the effect of algal growth on the survival of aquatic vegetation.

4) Food source temperature refinement study

- The objective of this study would be to evaluate the temperature range between 28 °C and 34 °C to more accurately determine a threshold temperature for amphipods.
- At 28 °C, fountain darters live and reproduce (to a limited degree), but near 34 °C their reproduction shuts off and survival becomes tenuous.

- If food becomes limiting at 29 °C rather than 33.5 °C, there is the potential for this parameter to be extremely important.
- If the threshold is closer to 34 °C, then direct temperature impacts to fountain darters would likely trump any food source response in the ecological model.

5) Food source response to plant species

- The objective of this investigation is to evaluate whether *Vallisneria* and *Ludwigia* provide similar benefits to amphipod survival to what was experienced with *Riccia*.
- The reason for this investigation is that *Riccia* is likely the first plant species to be eliminated from the system during low flows while *Vallisneria* and *Ludwigia* should persist.