

## **Project Summary**

### **Rocky Mountains Cooperative Ecosystem Studies Unit**

**Project Title: Post-Doctoral Researcher in Landscape Ecology and Amphibian Malformations**

**Discipline:** Natural  
**Type of Project:** Research  
**Funding Agency:** US Fish and Wildlife Service  
**Other Partners/Cooperators:** University of Colorado Boulder  
**Effective Dates:** 5/1/2012 - 4/30/2014  
**Funding Amount:** \$159,573

**Investigators and Agency Representative:**

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**Project Abstract:** The FWS began researching amphibian abnormalities in 2000, when several highly publicized findings of abnormal frogs prompted congressional funding for a nationwide investigation of the problem. A portion of this funding went to the FWS, and is being used to investigate the presence and prevalence of abnormal amphibians in National Wildlife Refuges across the United States. The goal of this collaborative program is to gain an understanding of the geographic distribution and severity of amphibian abnormalities on our nation's refuges. The objectives are to: 1) determine the prevalence of abnormalities in frogs and toads on refuges; 2) evaluate how abnormality frequencies vary among sites, refuges, and years; and 3) investigate possible causes of the abnormalities through targeted follow-up studies. As of early 2011, a 10 year descriptive report that primarily addresses the first objective is nearly complete.

During these 10 years of amphibian abnormality research, the FWS has surveyed almost 70,000 frogs and toads from over 40 species in 675 individual wetland sites on 150 National Wildlife Refuges, spanning 45 of the 50 States. This Service-owned database is globally unparalleled in terms of spatial extent and consistent methodological implementation in addressing the abnormal amphibian problem.

Because of land management concerns within the FWS, the refuge monitoring sites were chosen to explicitly explore the effects of different management regimes and types of landscape disturbance. Standard protocols used by field biologists specified intentional selection of sites both close to human disturbance (agriculture, roads, oil and gas development, range management, invasive species management) as well as more pristine locations, when possible. Biologists in the field then collected basic information about land use, site hydrology, and possible contaminants of concern, according to standard protocols while they were conducting abnormality assessments. This field information now requires validation by comparison to more objective sources to accomplish the rigorous analysis needed for publication.

This database affords a unique opportunity to definitively analyze patterns of abnormalities in amphibians and how they vary at spatial scales ranging from local (e.g., among ponds within a refuge or among refuges within a Landscape Conservation Cooperative) to regional (e.g., among LCCs). However, the spatially nested nature of the data also creates significant analytical challenges, including (but not limited to) identifying and properly incorporating spatial autocorrelation as well as joining existing amphibian data with the appropriate GIS layers for land usage, water chemistry, LCCs, etc. For a database of this magnitude and scope, ignoring autocorrelation will almost certainly lead to spurious results that obscure the project's important findings.

The FWS will work with the University of Colorado to find a postdoctoral researcher skilled in landscape ecology and spatial statistics to analyze the abnormal amphibian data for telling environmental trends and assist with publication of results in a scientific journal(s).

The selected candidate will be able to develop and pursue their own research questions using this database, which includes information on amphibian communities, the types and frequencies of morphological abnormalities, the identity and intensity of more than 30 endo- and ectoparasites, and additional data (e.g., local land use, basic hydrology information, etc.) for selected refuges. Any additional reports or publications on results from these additional research questions will be coordinated and reviewed by a FWS representative prior to final completion or submission to a scientific journal.

Results of the landscape and spatial analysis will be used to guide the future direction of the program as we move into more targeted studies to identify stressors responsible for the abnormalities, and consider manipulative and experimental research to conclusively determine the causes of abnormalities.

**Outcomes with completions dates:**

Interim performance reports	May 1, 2012 - December 31, 2012	January 20, 2013
Interim performance reports	January 1, 2013 - June 30, 2013	July 30, 2013
Interim performance reports	July 1, 2013 - December 31, 2013	January 20, 2013
Final performance reports	January 1, 2014 - April 30, 2014	July 29, 2014

**Keywords:** modeling, amphibian abnormalities, database, post-doctoral researcher, landscape ecology, spatial statistics US Fish and Wildlife Service, University of Colorado Boulder