

Project Summary
Rocky Mountains Cooperative Ecosystem Studies Unit

Project Title: Climate Change Impacts Assessment of Boreal Toads (*Anaxyrus boreas boreas*)

Discipline: Natural
Type of Project: Research
Funding Agency: National Park Service
Other Partners/Cooperators: Colorado State University
Student Participation: Yes Youth Participant
Effective Dates: 7/1/2016 to 10/31/2017
Funding Amount: \$7,100

Investigators and Agency Representative:

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Project Abstract: The objective of this study is to explore the suitability of climate data to predict pond dry-up in ponds used by Boreal Toads (*Anaxyrus boreas boreas*) for breeding and to gain insight into the impacts of future climate change these breeding habitats.

Climate change results in changes in the spatial distribution of suitable climatic conditions for multiple species. Amphibians, in particular, are expected to show direct and rapid response to climate change due to their ectothermic physiologies and need for sustained shallow water or wet surfaces to successfully reproduce. Freshwater habitats such as shallow alpine lakes are considered some of the most imperiled habitats worldwide. As a result, the species residing in them are particularly vulnerable to climate change effects. Thus, strategic conservation planning efforts that anticipate where in the landscape future locations may become suitable or unsuitable are essential.

Predictive modelling techniques are commonly used to relate climatic variables to response variables of interest. Climate change is expected to bring warmer temperatures, seasonality shifts, more extreme events, and changes to precipitation. Using future climate projections from Global Climate Models (GCMs), the response of a system or organism to these changes can be projected into the future.

Boreal toads lay eggs in shallow water habitats that are susceptible to drying. Years and locations where ponds dry-up early can result in the complete loss of metamorphs. While the predictive modelling approach is limited by data quality, resolution, and future uncertainty of climate this approach remains valuable to anticipate the potential impacts of climate change for conservation planning efforts.

Hydrological covariates will be explored in models for their ability to predict pond dry-up. Precipitation minus evapotranspiration controls the ponded duration for many small wetlands. In the Rocky Mountains, snow pack and summer precipitation are the primary inputs to small wetlands and the intensity (i.e. high temperatures) and duration of the summer evaporative period drive water loss from wetlands. Multi-year data on pond drying from Rocky Mountain National Park will be predicted in an exploratory fashion using climate covariates that represent potentially important drivers. Given sufficient predictive power, models will be used to compare current conditions to future conditions for Rocky Mountain National Park.

Downscaled climate datasets, as well as edaphic and topographic variables, would be used as candidate predictor variables. We will consult with climate scientists to select climate datasets and associated variables based on accuracy and relevance to southern Rocky Mountain ecosystems. Variability in future climate will be taken into account by using a representative selection of GCMs.

Keywords: Boreal toads, climate change, assessment, Rocky Mountain National Park, Colorado State University