

## Project Summary

### Rocky Mountains Cooperative Ecosystem Studies Unit

**Project Title:** Atmospheric deposition of nitrogen in Grand Teton NP: determining biological effects on algal communities in alpine lakes

**Discipline:** Natural  
**Type of Project:** Research  
**Funding Agency:** National Park Service  
**Other Partners/Cooperators:** University of Colorado, Boulder  
**Effective Dates:** 4/1/2011 - 12/31/2012  
**Funding Amount:** \$24,800

**Investigators and Agency Representative:**

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**Project Abstract:** The objective of this research is to utilize lake sediments to reconstruct N deposition and diatom species composition to determine the effects of atmospheric nitrate and ammonium concentrations and the timing of potential anthropogenic impacts on GRTE lakes. In order to accomplish the objective, the PI will:

- 1) Determine the effects of atmospheric deposition of nitrogen on primary producing organisms (diatoms). We will examine the abundance and composition of diatoms in sensitive lakes in GRTE by reconstructing the paleolimnological history of diatom species composition in sediments of five lakes.
- 2) Strive to determine the sources of N within the study basins based on interpretation of sediment  $\delta^{15}\text{N}$ , recognizing that it is problematic to determine the role of emissions sources, changing algal uptake dynamics, or relative isotopic fractionation by different species (Enders et al. 2008).
- 3) Evaluate the shifts in species composition of diatoms over time across the five lakes. We expect that if recent biotic impacts have occurred, the changes have favored taxa that are:
  - a) Considered indicators of mesotrophic to eutrophic waters
  - b) Associated with disturbance on a regional and national scale
  - c) Related to widespread loss of endemic diatoms in the western US
  - d) Species that are considered acidophilic
  - e) Shifting together as a group (whole community shifts in composition).
- 4) Determine if N impacts to lakes in GRTE are synchronous with those in Rocky Mountain NP or with those in the Beartooth Mountains, and if impacts are part of the wider regional trends in the deposition of atmospheric N.
- 5) Address the interaction of atmospheric deposition of N and climate change impacts by evaluating the sediment records in light of lake physical parameters (depth, surface inflows), watershed features (snowfields, vegetation, soils), synchronicity of change in sediment proxies, and research results in the region.
- 6) Use atmospheric monitoring data to hindcast an ecological threshold, or critical load, of nitrogen species at which primary producer organisms (diatoms) undergo change in community composition or total biomass.

**Outcomes with Completion Dates:** December 31, 2012

- a. Annual Accomplishment Reports will be submitted no later than October 30, 2010 and 2011 to WASO (Project Coordinator). The accomplishment report shall contain an abstract not to exceed 300 words in length as a stand-alone document. - *Spaulding*
- b. Final Accomplishment Report will be submitted, consisting of a one paragraph (300-word) abstract of the work completed during the entire project. The report will include details (including interpretive component) on any portion of the implementation plan that has not been completed. Due into PMIS by October 30 2012. - *Spaulding*

- c. Completion and posting of at least ten taxon pages for the Western Diatom Taxonomic and Ecological Resource, a publicly accessible taxonomic database of diatoms in the western US by March 2011. Each taxon page will include taxon description, images, and key features. - *Spaulding, and post-doctoral fellow*
- d. Development of USGS fact sheet by October 30, 2012.
- e. Submission of manuscript for publication in peer-reviewed journal by October 30, 2012 - *Spaulding, Baron, Wolfe, and post-doctoral fellow*

**Keywords:** nitrogen deposition, diatom composition, alpine lakes, Grand Teton National Park, University of Colorado at Boulder