

## **Project Summary**

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

**Project Title:** Critical Loads for Nitrogen Deposition in Rocky Mountain National Park:  
Temporal Changes in Vegetation and Soil Chemistry

**Discipline:** Natural Resources  
**Type of Project:** Research  
**Funding Agency:** National Park Service  
**Other Partners/Cooperators:** University of Colorado at Boulder  
**Effective Dates:** 9/1/2009- 12/31/2012  
**Funding Amount:** \$55,303

**Investigators and Agency Representative:**

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**Project Abstract:**

Atmospheric nitrogen (N) deposition has increased significantly in several western National Parks, which are protected under the Clean Air Act Amendments of 1977 as Class 1 areas. Changes in aquatic ecosystems have been documented in Rocky Mountain NP (ROMO), and recent findings from ROMO and nearby Niwot Ridge indicate thresholds of N inputs causing changes in vegetation abundances have been reached (ca. 4 Kg N/ha /yr). These changes generally precede changes in soil chemistry which include losses of nutrient cations, decreases in pH, and increases in soluble aluminum (Al). Soil chemical changes have the potential to detrimentally affect abundance and diversity of microorganisms, plants, and animals. Decreased pH occurred after 10 years in soils receiving 20 Kg N / ha / yr and increases in soluble Al occurred in soils receiving 40 Kg /ha /yr. The timing of these changes, and N deposition thresholds at which they occur, are, however, not known. Experiments using a range of N fertilization levels (ambient (ca. 2), +5, +10, and +30 kg N/ ha /yr) have been applied to plots for 3 years. Initial vegetation responses are very similar to published responses on Niwot Ridge. The proposed research will extend an existing project in ROMO at Chapin Pass, to fine-tune N critical loads for vegetation changes, and to follow the time course of soil chemical changes. Results will assist in detecting early- and mid-stage ecosystem responses to anthropogenic N deposition and acidification.

**Outcomes with Completion Dates:**

- a) Annual accomplishments report (interim due December 31, 2010)- Project Manager (Bowman)
- b) Final accomplishments report (due December 31, 2011) - Project Manager (Bowman)
- c) Final completion report (due February 29, 2012) - Project Manager (Bowman)

**Keywords:** nitrogen, atmospheric deposition, alpine, plant, soil chemistry, Rocky Mountain National Park, University of Colorado at Boulder