

# National Park Service Project Completion Report

## Rocky Mountains Cooperative Ecosystem Studies Unit (RM-CESU)

**Project Title:** Evaluating the Influence of Nitrogen Deposition Gradients on Plant Diversity: Filling in the Gaps

**Project Code (such as UMT-72 and/or the "P" number):** P13AC00407

**Type of Project (Research, Technical Assistance or Education):** Research

**Funding Agency:** National Park Service

**Partner University:** The University of Colorado Boulder, Institute of Arctic and Alpine Research

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**Start Date of Project:** 06/27/2013

**End Date of Project:** 03/15/2015

**Funding Amount:** \$64,848

### Project Summary,

This project evaluated the influences of nitrogen deposition on plant diversity by conducting field surveys of plants along nitrogen deposition gradients near national park units. This project supplements an effort funded by the Environmental Protection Agency, and the U.S. Geological Survey that evaluated existing vegetation data set along deposition gradients across the U.S. The study found that over a nitrogen deposition range of 1 to 19 kgN/ha/yr, species richness increased at low deposition levels and decreased above 8.7 and 13.4 kgN/ha/yr in open and closed canopy vegetation, respectively. Nitrogen deposition exceeded critical loads for loss of plant species richness in 24% of 15,136 sites examined nationwide. There were negative relationships between species richness and N deposition in 36% of 44 community gradients.

The project resulted in a publication which also serves as the final report for the project: *Sam Simkin, Allen, E. B., Bill Bowman, Clark, C. M., Belnap, J., Brooks, M. L., Cade, B. S., Collins, S. L., Geiser, L. H., Gilliam, F. S., Jovan, S. E., Pardo, L. H., Schulz, B. K., Stevens, C. J., Katharine Suding, Throop, H. L., Waller, D. M., 2016: Conditional vulnerability of plant diversity to atmospheric nitrogen deposition across the United States. Proceedings of the National Academy of Sciences, 113(15): 4086-4091. DOI: 10.1073/pnas.1515241113*

Two additional manuscripts, one addressing invasive species, and the other the traits of species that confer sensitivity to N deposition, are near completion.

**Number of students participating in this project: undergraduates, graduate students, degrees conferred.**

Three undergraduate students served as field assistants, and two graduate students contributed assistance and benefited from the modeling exercise estimating rates of N deposition at regional scales. Most notably Amy Churchill was able to use this information to evaluate the potential impact of N deposition in alpine moist meadows using a gradient approach, the first time this has been attempted in the alpine of the southern Rockies.

**Lessons Learned from this project:**

The project confirmed that widespread loss of herbaceous plant diversity is occurring across numerous communities in the Continental U.S. The influence of N deposition on plant diversity is influenced by soil pH, with greater sensitivity in more acid soils.

**Other RM-CESU agencies or research partners who participated in this project:**

**Environmental Protection Agency, U.S. Geological Survey**