Project Summary
Rocky Mountains Cooperative Ecosystem Studies Unit

Project Title: Modeling the Timeline for Acidification from Excess Nitrogen Deposition in Rocky Mountain National Park, Phase III

Type of Project: Research

Funding Agency: National Park Service

Other Partners/Cooperators: Colorado State University, USGS-BRD

Effective Dates: June 1, 2002 – March 31, 2006

Funding Amount: $14,300

Investigators and Agency Representative:

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Project Abstract:

Nitrogen deposition can lead to nitrogen saturation. Eventually excess N deposition will lead to lake and stream acidification, causing deformities or death in trout populations and loss of invertebrate species diversity. Previous research has shown the occurrence of nitrogen saturation at high elevations of the Colorado Front Range. The question that remains is when acidification will occur under current and potential future rates of nitrogen deposition. Evaluation of long-term records and models will be used to ask how much N deposition must occur for soil buffering to fail, causing ROMO lakes to acidify under current and increasing N deposition rates. Nitrogen is biologically-mediated, therefore simulation of N-induced acidification must include ecosystem nutrient cycling.

The CENTURY-PHREEQc model has been developed and paramaterized for Loch Vale Watershed, a data-rich environment with which to test scenarios of N deposition. The model has performed well for simulations of alpine and subalpine parts of the watershed. Results have been presented at the Rocky Mountain National Park All-Scientists meeting and at a federal land managers meeting on critical loads. A third presentation will take place in August 2004 at the Ecological Society of America annual meeting in Portland OR.

The research objective is to project, both in time, and in deposition amounts, the rate of change in soil buffering capacity until it is depleted to the point of causing episodic or chronic lake acidification for the Loch Vale Watershed.

Outcomes with completion dates:

List of Products:

1. Progress reports, in the form of electronic mail and/or oral presentations.
2. One hard copy and one electronic copy of an annual report describing progress, due March 31, 2005, to be delivered to the ROMO key contact.
3. One hard copy and one electronic copy of the final report, due December 31, 2005, to be delivered to the ROMO key contact, and one electronic copy is to be provided to Tamara Blett, ARD, and Kathy Tonnessen, RMCESU.
4. Annual and final reports will include analysis of model results describing conditions under which Rocky Mountain high elevations will acidify with N deposition.
5. A least one oral presentation will be provided to the ROMO staff describing the research findings and the resulting management implications of this work.
6. Two manuscripts (minimum) will be produced: a detailed model description and application paper that describes model tuning, results for all types of watershed characteristics, and a shorter paper that describes consequences of N deposition to alpine lakes in terms of N load and times to episodic and chronic acidification.
7. Users manual and user-friendly version of CENTURY-PHREEQc model.

Keywords: acidification, nitrogen deposition, modeling, Loch Vale watershed, Rocky Mountain National Park, Colorado State University

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Date Annual Report Received:
Date Final Report Received:
Publications, etc. on file: