Geophysical Research Abstracts
Vol. 19, EGU2017-10537, 2017
EGU General Assembly 2017
© Author(s) 2017. CC Attribution 3.0 License.

Multiscale Framework for Assessing Critical Loads of Atmospheric Nitrogen Deposition for Aquatic Ecosystems in Wilderness Areas of the Western United States

Leora Nanus (1), David Clow (2), Jasmine Saros (3), Jill McMurray (4), Tamara Blett (5), and James Sickman (6)

(1) San Francisco State University, San Francisco, California, United States, (2) United States Geological Survey, Denver, Colorado, United States, (3) University of Maine, Orono, Maine, United States, (4) United States Forest Service, Bozeman, Montana, United States, (5) National Park Service, Denver, Colorado, United States, (6) University of California Riverside, Riverside, California, United States

High-elevation aquatic ecosystems in Wilderness areas of the western United States are impacted by current and historic atmospheric nitrogen (N) deposition associated with local and regional air pollution. Documented effects include elevated surface water nitrate concentrations, increased algal productivity, and changes in diatom species assemblages. A predictive framework was developed for sensitive high-elevation basins across the western United States at multiple spatial scales including the Rocky Mountain Region (Rockies), the Greater Yellowstone Area (GYA), and Yosemite (YOSE) and Sequoia & Kings Canyon (SEKI) National Parks. Spatial trends in critical loads of N deposition for nutrient enrichment of aquatic ecosystems were quantified and mapped using a geostatistical approach, with modeled N deposition, topography, vegetation, geology, and climate as potential explanatory variables. Multiple predictive models were created using various combinations of explanatory variables; this approach allowed for better quantification of uncertainty and identification of areas most sensitive to high atmospheric N deposition ($>$ 3 kg N ha^{-1} yr^{-1}). For multiple spatial scales, the lowest critical loads estimates ($<$1.5 $\pm$ 1 kg N ha^{-1} yr^{-1}) occurred in high-elevation basins with steep slopes, sparse vegetation, and exposed bedrock and talus. Based on a nitrate threshold of 1 μmol L^{-1}, estimated critical load exceedances ($>$1.5 $\pm$ 1 kg N ha^{-1} yr^{-1}) correspond with areas of high N deposition and vary spatially ranging from less than 20% to over 40% of the study area for the Rockies, GYA, YOSE, and SEKI. These predictive models and maps identify sensitive aquatic ecosystems that may be impacted by excess atmospheric N deposition and can be used to help protect against future anthropogenic disturbance. The approach presented here may be transferable to other remote and protected high-elevation ecosystems at multiple spatial scales that are sensitive to adverse effects of pollutant loading in the US and around the world.