

## Investigating the coupled effects of climate change and nitrogen on lake periphyton

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**Abstract:** Excessive green algal and cyanobacteria growth is beginning to be reported from oligotrophic lakes in the United States that do not had a history of algal blooms, such as Lake Tahoe and Sunapee Lake, New Hampshire. Several hypotheses that have been suggested for the unexpected growth include climate change, access to nutrients from atmospheric deposition or invasive species, or a combination of these factors. Locally, dense mats of the green alga *Zygnema* spp. have been observed in The Loch, a sub-alpine lake in the Loch Vale Watershed, Rocky Mountain National Park. By 2012, the algal mats grew as high as Sky Pond, an alpine lake in the same watershed that sits at the base of Taylor Glacier. These algal mats have not been observed prior to 2010 in this long-term monitoring and research site in spite of weekly observation and high lake concentrations of nitrate (NO<sub>3</sub><sup>-</sup>) from atmospheric nitrogen (N) deposition. We hypothesize that changing climatic factors and nitrogen are causing lake periphyton to proliferate. To disentangle the effects, we aim to 1) trace the existence and abundance of *Zygnema* using paleolimnological techniques, 2) test the biotic and abiotic drivers of periphyton primary productivity, 3) investigate the bottom-up effects on alpine food webs and the transfer of N and P through the food chain.