Airborne nitrogen shifts aquatic nutrient limitation in pristine lakes

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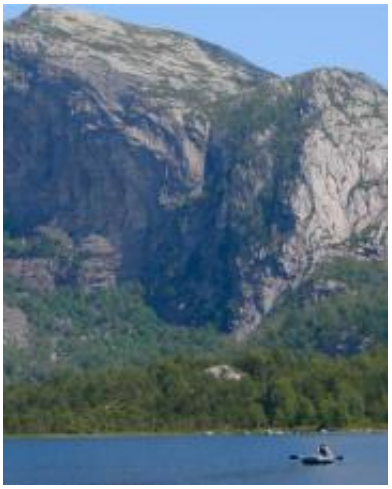


Scientist Laura Steger (University of Colorado) is sampling Sandvotni Lake in southwestern Norway. This lake receives elevated inputs of atmospheric N deposition due to transport of polluted air masses from northern Europe. Credit: Photo credit: James Elser/ASU

The impact of airborne nitrogen released from the burning of fossil fuels and wide-spread use of fertilizers in agriculture is much greater that previously recognized and even extends to remote alpine lakes, according to a study published Nov. 6 in the journal *Science*.

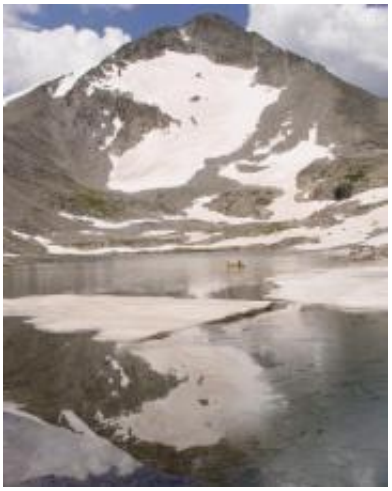
Examining nitrogen deposition in alpine and subalpine lakes in Colorado, Sweden and Norway, James Elser, a limnologist in the School of Life Sciences at Arizona State University, and his colleagues found that, on

average, nitrogen levels in lakes were elevated, even those isolated from urban and agricultural centers.

The article "Shifts in lake N:P stoichiometry and nutrient limitation driven by atmospheric nitrogen deposition" presents experimental data from more than 90 lakes. The researchers' collaboration also revealed that nitrogen-rich air pollution has already altered the lakes' fundamental ecology.

"This is because plant plankton or phytoplankton, like all plants, need nitrogen and phosphorus for growth," Elser says. "Inputs from pollution in the atmosphere appear to shift the supplies of nitrogen relative to other elements, like phosphorus."

The increase in the availability of nitrogen means that growing phytoplankton in lakes receiving elevated nitrogen deposition are now limited by how much phosphorus they can acquire. Elser says that this is important because "we know that phosphorus-limited phytoplankton are poor food - basically 'junk food' for animal plankton, which in turn are food for fish."



Scientist Jim Elser (Arizona State University) is sampling Green Lake 5, located

at the Niwot Ridge Long-term Ecological Research (LTER) site in the Front Range of the Colorado Rocky Mountains. Like other lakes in the Front Range, this lake receives elevated inputs of atmospheric N deposition due to transport of polluted air from urbanized areas and from high intensity agricultural operations. Credit: Photo credit: James Elser/ASU

"Such a shift could potentially affect biodiversity," he adds. "However, we don't really know, because, unlike in terrestrial systems, the impacts of nitrogen deposition on aquatic systems have not been widely studied."

Elser's collaborators include researchers Tom Andersen and Dag Hessen from the University of Oslo; Jill Baron of the United States Geological Survey and Natural Resource Ecology Laboratory at Colorado State University; Ann-Kristin Bergström and Mats Jansson with Umeľ University, Sweden; and Koren Nydick of the Mountain Studies Institute in Colorado, in addition to members of his own group in ASU's College of Liberal Arts and Sciences, Marcia Kyle and Laura Steger.

Hessen, a well-known limnologist, and Elser have had a long-standing collaborative relationship, looking not only at nitrogen deposition, as in this study, but also zooplankton nutrition and a broad range of stoichiometric studies. Elser met Bergström at a conference at Umeľ University and discovered that she had performed similar experiments in Sweden.

"By combining these studies we were able to achieve a more global picture of how nitrogen was impacting a broad range of lakes and come to firmer conclusions about effects of deposition," Elser notes.

Elser and Hessen hope to expand on these findings and have a pending grant proposal with the Norwegian government. In addition, Elser says

he hopes to perform similar studies in China "where atmospheric nitrogen pollution is extremely high," but, as yet, unstudied.

Source: Arizona State University (news : web)