

Research shows declining levels of acidity in Sierra Nevada lakes

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Researcher Peter Homyak is seen here collecting a lake sediment core to study the impacts of air pollution and climate change on alpine lakes of the Sierra Nevada. Credit: Sickman Lab, UC Riverside.

California's water supply depends on a clean snow pack and healthy mountain lakes. The lakes receive a large amount of runoff in the spring



from the melting snowpack. If the snowpack is polluted, the lakes will be polluted.

James O. Sickman, an environmental scientist at the University of California, Riverside, has conducted research on lakes in the Sierra Nevada—the most sensitive lakes in the U.S. to acid rain, according to the Environmental Protection Agency—and described human impacts on them during the 20th century. The research was done by long-term measurements of <u>lake</u> chemistry beginning in the 1980s and the collection of long sediment cores from the lakes.

The conclusion is the overall news is good: Air quality regulation has benefited aquatic ecosystems in the Sierra Nevada, and controlling <u>air</u> <u>pollution</u> is benefiting nature in California.

Led by Sickman and his graduate students, the researchers have published a series of articles in peer-reviewed journals on their work, the <u>latest</u> of which appears in *Environmental Science and Technology*.

Carbonaceous particles, formed by burning oil and coal, are an indicator of <u>air</u> pollution and acid rain. They are transported, along with sulfuric and nitric acid, through the atmosphere and deposited in the lakes. Andrea M. Heard, a former graduate student of Sickman's, found that since 1970 there have been declining levels of carbonaceous particles in the Sierra Nevada lakes, indicating that <u>air quality</u> in California (and likely the western U.S.) has improved dramatically owing to the U.S. Clean Air Act.

"The Clean Air Act is arguably the most important and successful environmental law in the United States, both from a human health standpoint and the environment," said Sickman, a professor of hydrology and the chair of the <u>Department of Environmental Sciences</u>. "The residents of California should be especially grateful since we have a



geography that is conducive to bad air pollution. Without the Clean Air Act, air quality in Los Angeles and the Central Valley would be much, much worse increasing cases of asthma and other respiratory diseases. The Clean Air Act should be emulated by China and India where acid rain and air pollution are ruining the environment and making people sick."

Less acidity and lower nitrogen inputs have allowed sensitive aquatic species to be maintained in the Sierra Nevada lakes. For example the lakes still possess native clams, zooplankton, sponges and invertebrates that could have been eradicated by higher acidity. Another impact has been the preservation of water clarity and color. Greater <u>acid rain</u> and nutrient input would have encouraged algal growth, clouding the water and impairing the lakes' deep blue color. Less acidity in mountain lakes preserves these fragile ecosystems and maintains their visual beauty.

To do the research, Sickman and his colleagues collected sediment cores from about 50 lakes in the Sierra Nevada. The researchers hiked to the lakes and used rafts to access the deepest part of the lake. They lowered corers into the sediments. When retrieved, the <u>sediment cores</u> were cut into 1-centimeter-thick slices. The slices were then subjected to chemical analyses to determine the age of the individual slices. The researchers then counted the carbonaceous particles and diatoms (small phytoplankton with silicon bodies) under a microscope.

Provided by University of California - Riverside

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