Source: **Institute Of Ecosystem Studies**

Print this page

Date: 2004-10-07

URL: http://www.sciencedaily.com/releases/2004/10/041007090321.htm

A Treatment, Not A Cure: Calcium Silicate Neutralizes An Acidic Stream

As a result of fossil fuel emissions, many freshwater bodies in eastern North America have become acidified. When combusted, fossil fuels release sulfur dioxide and nitrogen oxide, the precursors to acid precipitation, into the atmosphere. Persistent exposure to these pollutants, which return to Earth in rain, snow, sleet, hail and fog, can compromise the health of aquatic ecosystems.

In a recent Restoration Ecology paper, Institute of Ecosystem Studies President and Director Dr. Gene E. Likens, with colleagues, explores a new approach to restoring acidified streams, the addition of calcium silicate. The paper is the first to document the neutralizing effects of Wollastonite, a calcium silicate, on an acidic stream.

The research was performed at the Hubbard Brook Experimental Forest, located in the White Mountains of New Hampshire. Likens, who discovered acid rain at Hubbard Brook in the 1960s, has been investigating human-accelerated environmental change there for over four decades. A network of researchers and agencies, including over 70 scientists, has made the 3,160-hectare forest one of the most intensively studied watersheds in the world.

"Years of monitoring have documented that Hubbard Brook receives high levels of acid precipitation from emissions largely originating at Midwestern utility plants, as a result many streams on the site are acidic." Likens comments. Adding that, "The only way to successfully combat stream acidity is through improved air quality. Until that happens, we are exploring short-term methods of restoring water quality to sensitive sites."

Symptoms of acidified streams include a drop in pH, calcium, and dissolved inorganic carbon and an increase in metals like aluminum. When pH-levels decline, a stream is said to have lost its acid neutralizing capacity (ANC). Aquatic and semi-aquatic animals, such as fish and salamanders, are more prone to stress and disease when exposed to acidity and heavy metals.

As a remedy for acid stomach, people reach for Tums, or a similar calcium-based acid reducer. When attempting to increase pH-levels in acidic streams, scientists have historically used various forms of limestone, a natural source of calcium carbonate. Its neutralizing effects are short-lived, however, and can generate extreme fluctuations in water chemistry. Recognizing the limitations of limestone, Likens and colleagues looked to another material to neutralize an acidified stream at Hubbard Brook--Wollastonite.

Over one hundred and thirty pounds (61kg) of this naturally occurring calcium silicate mineral, mined from the Adirondacks and manufactured into a pellet form, was manually applied to the study stream. Pellets were added to 50-meters of the 910-meter stream, including the stream channel and adjacent stream bank. Researchers took extensive measurements of water attributes, such as pH and acid neutralizing capacity, before, during and after the application.

Despite the small treatment area, the buffering effects of the Wollastonite were long lasting. By adding the pellets to 5.5% of the stream, acidity was suppressed for over four months. It is likely that a larger addition would have resulted in a longer neutralizing effect. Wollastonite degraded slowly in the system; as a result water chemistry fluctuations were smaller than seen during limestone additions.

While the study's findings are useful to land managers looking for new methods of temporarily neutralizing acid streams, Likens is quick to comment that, "Manually adding buffering agents to acidic streams will never solve the acid rain problem. At most, it is a way to buy time until the real solution emerges-- a reduction in air pollution."

He goes on to warn that, "Viewing calcium applications as a prescriptive cure for acid rain is like a runner viewing steroids as a cure for a bad knee. At the end of the race, when the steroids have worn off, the runner is left limping. Calcium additions, which are cost and labor-intensive, temporarily mask symptoms. They don't alleviate underlying causes, they are not feasible on a landscape scale and they will not protect our nation's freshwater resources."

The Wollastonite stream application was part of a larger watershed-level addition. To learn more about how calcium silicate impacted forests and wetlands, visit an overview on the Hubbard Brook website: http://www.hubbardbrook.org/yale/watersheds/w1/

The following coauthors were integral in conducting the Wollastonite addition research and preparing the Restoration Ecology paper. Several were IES graduate students when they participated in the project (*).

Don Buso, Institute of Ecosystem Studies

*Brian K. Dresser

*Emily S. Bernhardt, University of Maryland

Robert O. Hall, Jr., University ot Wyoming

*Kate H. Macneale, Northwest Fisheries Science Center

Scott W. Bailey, USDA Forest Service

Editor's Note: The original news release can be found here.

This story has been adapted from a news release issued by Institute Of Ecosystem Studies.