# Streams Play a Vital Role in Filtering Nitrogen Pollution

## UNH Scientists Part of First-Ever North American Study

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DURHAM, N.H. -- Small streams play a vital role in removing pollutants before they get to larger waterways, filtering as much as half the excess nitrogen from fertilizer runoff, auto emissions and human and animal waste disposal.

Scientists, including three with ties to the University of New Hampshire, report in a recent edition of the journal "Science" that nitrogen in streams is rapidly removed by algae, bacteria, and fungi, and by gaseous emissions to the atmosphere. In fact, low to moderate inorganic nitrogen inputs into headwater streams are removed or transformed within minutes to hours and within a few hundreds of meters.

"Small-size streams may be the most important factor in regulating water chemistry in large drainages. They comprise 85 percent of the drainage network, and collect most of the water and dissolved nutrients from adjacent land," says William McDowell, UNH professor of natural resources and one of the study's authors.

Yet small streams are endangered because they are the most vulnerable to human disturbance. "Restoration and preservation of small stream ecosystems should be a central focus of management strategies to ensure maximum nitrogen processing in watersheds," says McDowell. "This in turn will improve the quality of water delivered to downstream lakes, estuaries and oceans."

McDowell, former UNH Professor Breck Bowden, and current earth sciences graduate student Wil Wolheim were part of the National Science Foundation-funded study that examined 12 streams in Alaska, Arizona, Kansas, Minnesota, Michigan, New Hampshire, New Mexico, North Carolina, Ohio, Oregon, Puerto Rico and Tennessee. The New Hampshire stream was in the Hubbard Brook Experimental Forest.

Previously, experts studying pollution assumed that streams acted more like pipes that simply carried nitrogen to lakes, rivers and oceans. Excess nitrogen can cause ecologically damaging effects in large waterways, including algae blooms, which kill fish and other marine life.

The study is significant because it is the first large-scale study to compare these sorts of processes under natural conditions in small streams, instead of in a laboratory or in field experiments with artificially high concentrations.

By pumping a stable isotope tracer of ammonium -- a form of nitrogen -- into the streams, the scientists were able to measure how much of it was absorbed by plants and animals, and how much was washed downstream. The isotope has a different weight, and allows the scientists to trace it, and look at the resulting biochemical processes without actually changing the nitrogen concentration of the streams.

McDowell says the study provides scientists new insight into how streams mitigate excess nitrogen.

"The next step is to apply what we've learned to larger systems that are polluted with high nitrogen loads," he says. "We'll be interested to see if the capacity of these systems to effectively transform nitrogen is similar.

Back to UNH News Bureau