

Beavers take a chunk out of nitrogen in Northeast rivers

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A beaver dam on Pond A along the Chipuxet River in Washington County, RI.
Credit: Julia G. Lazar

Beavers, once valued for their fur, may soon have more appreciation in the Northeastern United States. There they are helping prevent harmful levels of nitrogen from reaching the area's vulnerable estuaries. By creating ponds that slow down the movement of water, they aid in removing nitrogen from the water.

Nitrogen levels have been increasing in Northeast waters for years. The use of [nitrogen](#) fertilizers has risen and urbanization has brought in influences such as septic systems. This nitrogen is released into small streams and ponds and eventually travels to estuaries, where rivers meet

the sea.

High levels of nitrogen in these areas stimulate [algal blooms](#). As these organisms die and decompose, oxygen is consumed from bottom waters, creating low oxygen levels that can generate fish kills. While many know of these dead zones in the Gulf of Mexico, they are also becoming a problem for the plentiful estuaries that comprise the coastline of the Northeast U.S.

Arthur Gold at the University of Rhode Island, along with his colleagues, studies how the presence of beavers affects nitrogen levels in these waters.

"What motivated us initially to study this process was that we were aware of the fact that beaver ponds were increasing across the Northeast," he said. "We observed in our other studies on nitrogen movement that when a beaver pond was upstream, it would confound our results."



Lazar holding a recently collected subaqueous soil core on Pond C, along Roaring Brook in Washington County, RI, USA. Cores were extracted with the metal soil corer from the canoe, wrapped and transported back to the University

of Rhode Island for experiments. Credit: Richard A. McKinney.

The researchers realized the water retention time and organic matter build up within beavers' ponds lead to the creation of ideal conditions for nitrogen removal. They then wanted to see how effectively they can do this.

The researchers tested the transformative power of the soil by taking sample cores and adding nitrogen to them. These samples, about the size of a large soda bottle, were large enough to incorporate the factors that generate chemical and biological processes that take place in the much larger pond. They were also small enough to be replicated, manageable and measured for numerous changes. Researchers then added a special type of nitrogen to the samples that allowed them to be able to tell if the nitrogen was transformed and how.

Bacteria in the organic matter and soil were able to transform nitrogen, specifically a form called nitrate, into [nitrogen gas](#), removing it from the system. This is denitrification. Thanks to the conditions brought about by the beaver ponds, this process can remove approximately 5-45% of the nitrogen in the water, depending on the pond and amount of nitrogen present.

"I think what was impressive to us was that the rates were so high," Gold explained. "They were high enough and beavers are becoming common enough, so that when we started to scale up we realized that the ponds can make a notable difference in the amount of nitrate that flows from our streams to our estuaries."

The study also found 12% of the nitrogen gases created in the samples were nitrous oxide, a potent greenhouse gas. However, the scientists

pointed out that the high amount was likely a result of some unique experimental conditions and these ponds are not likely to release that much of the gas in nature.

The research has some interesting implications. Julia Lazar, who conducted the work as part of her doctoral dissertation and is now working as an environmental consultant, said it might change the way people think about beavers and their ponds.

"Most of these beavers are in areas with smaller streams, not big rivers," Lazar said. "These smaller streams are usually the first to be developed, causing a decrease in beaver populations. So, it may be important to keep these areas from being developed so they can have effects on nitrogen levels downstream."

Gold hopes to study the ponds over a longer period and to study abandoned ponds to see if the nitrogen retaining qualities remain after the beavers are gone.

"It's noteworthy that the beavers have such an impact on improving nitrogen downstream," Gold said. "We have a species whose population crashed from wide-spread trapping 150 years ago. With their return they help solve one of the major problems of the 21st century. I don't want to minimize that. We have to remember that those [ponds](#) wouldn't be there without the beavers."

More information: Julia G. Lazar et al. Beaver Ponds: Resurgent Nitrogen Sinks for Rural Watersheds in the Northeastern United States, *Journal of Environment Quality* (2015). [DOI: 10.2134/jeq2014.12.0540](https://doi.org/10.2134/jeq2014.12.0540)

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