Restoring wetlands near farms would dramatically reduce water pollution

December 17 2020, by Brian Flood

Researchers at UIC and the University of Waterloo examined detailed data on wetland locations and nitrogen loads from fertilizer on farm fields throughout the U.S. Credit: Dave Hoefler via Unsplash

Runoff from fertilizer and manure application in agricultural regions has

led to high levels of nitrate in groundwater, rivers, and coastal areas. These high nitrate levels can threaten drinking water safety and also lead to problems with algal blooms and degradation of aquatic ecosystems.

Previous research has shown that wetlands improve water quality, but how much of an impact are wetlands having on nitrate removal now, and what improvements could wetland restoration deliver in the future?

Researchers from the University of Illinois Chicago and the University of Waterloo sought to evaluate these details at the U.S. scale and publish their findings in a new paper featured in the journal *Nature*.

Their study examines the positive effects of wetlands on water quality and the potential for using wetland restoration as a key strategy for improving water quality, particularly in the Mississippi River Basin and Gulf of Mexico regions.

The wetland essentially has a purifying effect when nitrate-laden water enters its boundaries. Chemical reactions take place that removes the harmful nitrate from the water, allowing for harmless nitrogen gas to be released into the atmosphere and cleaner water to flow downstream.

"Unfortunately, most wetlands that originally existed in the U.S. have been drained or destroyed to make way for agriculture or urban development. Ironically, areas with the biggest nitrate problems, due to agriculture and intensive use of nitrogen fertilizers, are also usually areas with the fewest numbers of remaining wetlands," said Kimberly Van Meter, UIC assistant professor of earth and environmental sciences and co-lead author of the paper.

The researchers used maps of remaining wetlands across the U.S. to quantify the amount of nitrate that is currently being removed by wetlands. Despite the high levels of wetland loss, their results suggest

that nitrate loads in the Mississippi River might be approximately 50% higher than they are currently without the presence of wetlands.

The wetlands' significant contribution to current nitrate removal is important for two key reasons, according to UIC's Van Meter and her colleagues Frederick Cheng, Danyka Byrnes and Nandita Basu, all from the University of Waterloo.

"First, the Mississippi River is the largest source of nitrogen to the Gulf of Mexico and a major cause of the large dead zone that appears in the Gulf every summer. Second, protections for current wetlands have been eroded in recent years, especially with revisions of the Clean Water Rule under the Trump administration, which eliminated protections for approximately half of all U.S. wetlands," Van Meter said.

The researchers also carried out computer model simulations to better understand how wetland restoration might benefit water quality.

"We found that by targeting wetland restoration to areas in the U.S. with the highest levels of nitrate pollution, even a 10% increase in current wetland area could cut nitrate levels in rivers and streams by half," Van Meter said.

The cost of a wetlands initiative is estimated at $3.3 billion a year, an amount researchers described as feasible given current government spending levels. While that is twice the estimated cost of a non-targeted approach, the model showed it would remove 40 times more nitrogen.

"You get much more bang for your buck if wetland preservation and restoration are targeted," said Nandita Basu, professor of civil and environmental engineering, and earth and environmental sciences at the University of Waterloo and corresponding author of the paper. "From a policy perspective, it is dramatically more effective and efficient."

The authors also point out that various negative socio-economic outcomes stem from nitrate pollution in lakes and coastal areas. When algal blooms, which are generally considered to be unsightly and often release an unpleasant sulfur-like smell, take over a water body it usually limits recreational access for swimming, boating, and fishing and, thus, negatively affects tourism. Toxins associated with algal blooms also restrict fishing, resulting in financial problems for coastal fisheries. When cities rely on impacted water bodies for drinking water, the costs of water treatment also rise.

More information: F. Y. Cheng et al. Maximizing US nitrate removal through wetland protection and restoration, *Nature* (2020). DOI: 10.1038/s41586-020-03042-5

Provided by University of Illinois Chicago