Project: Improving Roadside Ditch Management to Reduce Greenhouse Gas Emissions Associated with Agricultural Runoff

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Need:
Nitrogen pollution, largely from agricultural fertilizers, is both a major source of pollution to aquatic ecosystems and a source of the potent greenhouse gas nitrous oxide (N_2O). Excess nitrogen in aquatic systems is a leading driver of algal blooms, dead zones, and fisheries decline. In the atmosphere, N_2O is estimated to have 300 times the impact of CO_2 and is third on the list of greenhouse gases responsible for climate change. Roadside ditch networks have been identified as conduits for other pollutants between agricultural fields and streams, yet uncertainty remains regarding how nitrogen is transported and transformed across landscapes.

Approach:
The project (NYC-147411) included field and lab experiments that were designed to uncover the role of roadside ditches in the transport and transformation of nitrogen runoff from farms. Dr. Rebecca Schneider and her team investigated temporal changes in the quantity and type of nitrogen flowing through ditches and how they are affected by seasonal changes in agricultural activities and weather. Additionally, researchers measured flux rates from ditches under different management practices and evaluated the efficacy of woodchip bioreactors as a mitigation technique to reduce N_2O emissions and flow of dissolved nitrogen. Extension activities were designed to communicate ditch management strategies to stakeholders.

Results and Impact:
The Cornell Roadside Ditch program has been underway for more than a decade and is a shining example of integrated research and extension. In the current project, field experiments confirmed that agricultural practices are a major source of dissolved nitrogen, which is efficiently transported to nearby streams via the ditch network. The research team also measured highly variable emission rates of N_2O gas, indicating that denitrification is occurring in ditch substrates under certain conditions, including both complete denitrification to N_2 as well production of the greenhouse gas N_2O. Given the high flow rates of dissolved nitrogen, researchers tested an in-ditch woodchip bioreactor as a strategy for removing significant quantities of nitrogen with the hope of improving water quality in connected streams. The pilot test was successful, with up to 80% nitrogen removal, and justifies more research to determine its potential use as part of a ditch-based, watershed-wide filtration system.

Related Information: 'Re-plumbing' our watersheds