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004 EPA STAR Graduate Fellowship Conference   Next Generation Scientists—Next Opportunities

The Effects of Urbanization on Nitrate Removal Capacity of Urban Wetlands

igure 1. Riverine wetland near Newark, NJ.

igure 2. Mineral flat wetland n East Hanover, NJ.

cknowledgements

dvisor: Dr. Joan Ehrenfeld

eld/Lab Assistance: Robert amilton IV, Manisha Patel, Mike artels, Seth Davis, Ryan Sklar, ave Berry, Ann Lang

ublication: Ehrenfeld, J.G., H.B. utway, R. Hamilton IV, and E.K. ander. 2003. Hydrology of rested wetlands in northeastern J, an urban/suburban region. etlands 24(3): 685-700.

Overview

Wetlands are known for their ability to remove nitrate due to their saturated soils. They are used as a management tool to remove nitrate before it becomes a pollution problem in streams. Are wetlands in urban landscapes (figure 1) still performing this service?

Urban hydrology causes wetlands to be dryer and more hydrologically erratic than wetlands in more pristine areas. This dryness is caused by:

1. Downcutting of streams due to erosion of stream banks during rain storms (figure 2).

2. Decreased infiltration of rainfall due to impervious surface (roads, roofs, etc.)

Dry conditions may prevent wetlands from removing nitrate from uplands and rainfall. This may lead to drinking water pollution and eutrophication of downstream water bodies which affects fisheries and marine ecosystems.

Research Plan

I will monitor hydrology and nitrogen fluxes in urban and less urban wetlands. I will compare the ability of urban intensity versus natural processes to explain and predict patterns in nitrogen (N) cycling. I will also measure N inputs (in rain) and outputs (loss to streams) in the same wetlands.

The graphs at the right show that patterns in N cycling are better explained by urbanization than natural processes. Urban hydrology does affect N cycling.

Project Description

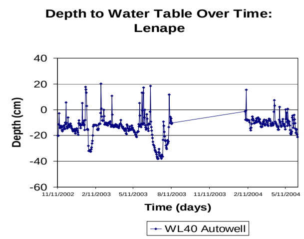
I am using 15 forested swamps in northeastern NJ – one of the most urban regions of the US. These wetlands fall into three hydrogeomorphic (HGM) classes (table 1). HGM setting is a description of hydrological inputs and dynamics and is thought to be a good predictor of N fluxes. HGM is therefore a natural predictor in my study.

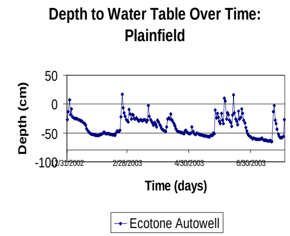
Riverine	Mineral Flat	Flat-Riverine
3 urban	3 urban	3 urban
2 less urban	2 less urban	2 less urban

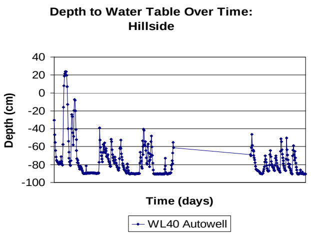
Table 1. The wetlands fall into one of three HGM classes: riverine, mineral flat, or flat-riverine. Each HGM class is represented by both urban and less urban sites.

Hydrology

Wells and piezometers in three sampling locations per site. Collecting depth to water table every six hours, discharge/recharge every 2-4 weeks.



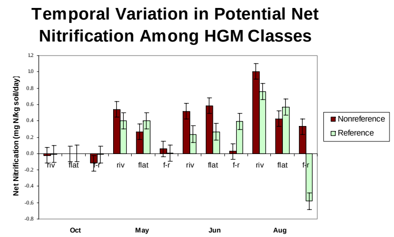


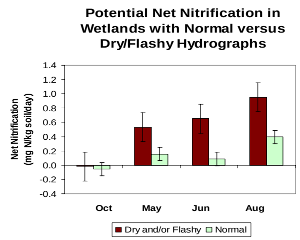


The first hydrograph shows a wetland that is functioning normally. The water table is usually between the soil surface and 30cm deep. The second hydrograph shows a wetland that is drier than normal, with water tables below 30cm much of the time. The third hydrograph shows a wetland with erratic hydrological patterns. Does this affect N cycling?

N Cycling

Two soil cores were taken at each of five sampling locations per site. One core is immediately analyzed for nitrate and ammonium; the other core incubates for one month before analysis so I can calculate rates of N cycling over the month-long incubation.





This fellow is sponsored by EPA's STAR or Greater Research Opportunities (GRO) Program.