Spatial and temporal variability of nitrogen cycling in riparian wetlands

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Committee members:
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Percent of nitrogen removed by stream:
- 100%
- 80%
- 60%
- 40%
- 20%
- 0%

Distance upstream of river mouth (km)

Grab Sample (8/26/01)
- Model results with dilution only
- Model results with dilution and reactivity

Dissolved Inorganic Nitrogen (mg/L)

Image adapted from Stewart et al. 2011
Research Question:

• Is nitrate uptake higher in wetlands compared to forested channels?
Sawmill Brook

Flow Direction

100 meters

North

Forested Channel

Wetland Pond

Wetland Channel

100 meters
Circulation Pump

D.O., pH, °C, NTU

[NO₃⁻] & [Br⁻]

0.15 m

0.28 m

Sediment Surface

Sediment Cores
Concentration of nitrate in chamber

\[ [\text{NO}_3^-/\text{Br}^-] \]

Time (hrs)

\[ y = 0.03e^{-0.05x} \]

\[ R^2 = 0.74 \]
Concentration of nitrate in chamber

\[ \ln\left( \frac{[\text{NO}_3^-/\text{Br}^-]}{[\text{NO}_3^-/\text{Br}^-] \text{ initial}} \right) \]

against Time (hrs)

\[ y = -0.05x - 0.04 \]

\[ R^2 = 0.74 \]
Concentration of nitrate in chamber

\[ \ln\left(\frac{[\text{NO}_3^-]/[\text{Br}^-]}{[\text{NO}_3^-]/[\text{Br}^-] \text{ initial}}\right) \]

\[ y = -0.05x - 0.04 \]

\[ R^2 = 0.74 \]

NO₃⁻ Uptake Rate Constant

Time (hrs)
Nitrate Uptake Rate Constant (1/hr)

- Forested Channel
- Wetland Pond
- Wetland Channel
Nitrate Uptake Rate Constant (1/hr at 20 °C)

- Forested Channel
- Wetland Pond
- Wetland Channel

[Bar chart showing nitrate uptake rates for different ecosystems with error bars for each category.]
Research Question:
• Is nitrate uptake higher in wetlands compared to forested channels?

Implications for coastal New England rivers:
• Need watershed management efforts to protect wetlands
• Watershed nutrient models should incorporate wetlands
Future Work:

Measure temporal variability

Additional measurements in Spring

Estimate whole wetland uptake rates

- Combine with whole wetland tracer studies to estimate influence of different areas on wetland scale uptake
- Compare with previously observed and modeled ambient nitrate uptake rates
Thanks!

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Questions?

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Much more information on this research can be found in David’s thesis: