Understanding the biogeochemical role of soil microbial communities in Northern VT agricultural riparian zones connected to Lake Champlain waterways.

Colleen Yancey[1], Kunal Palawat[2], Carol Adair[2]

Department of Biology (College of Arts and Sciences)[1], Rubenstein School of Environment and Natural Resources[2]
University of Vermont, Burlington, VT

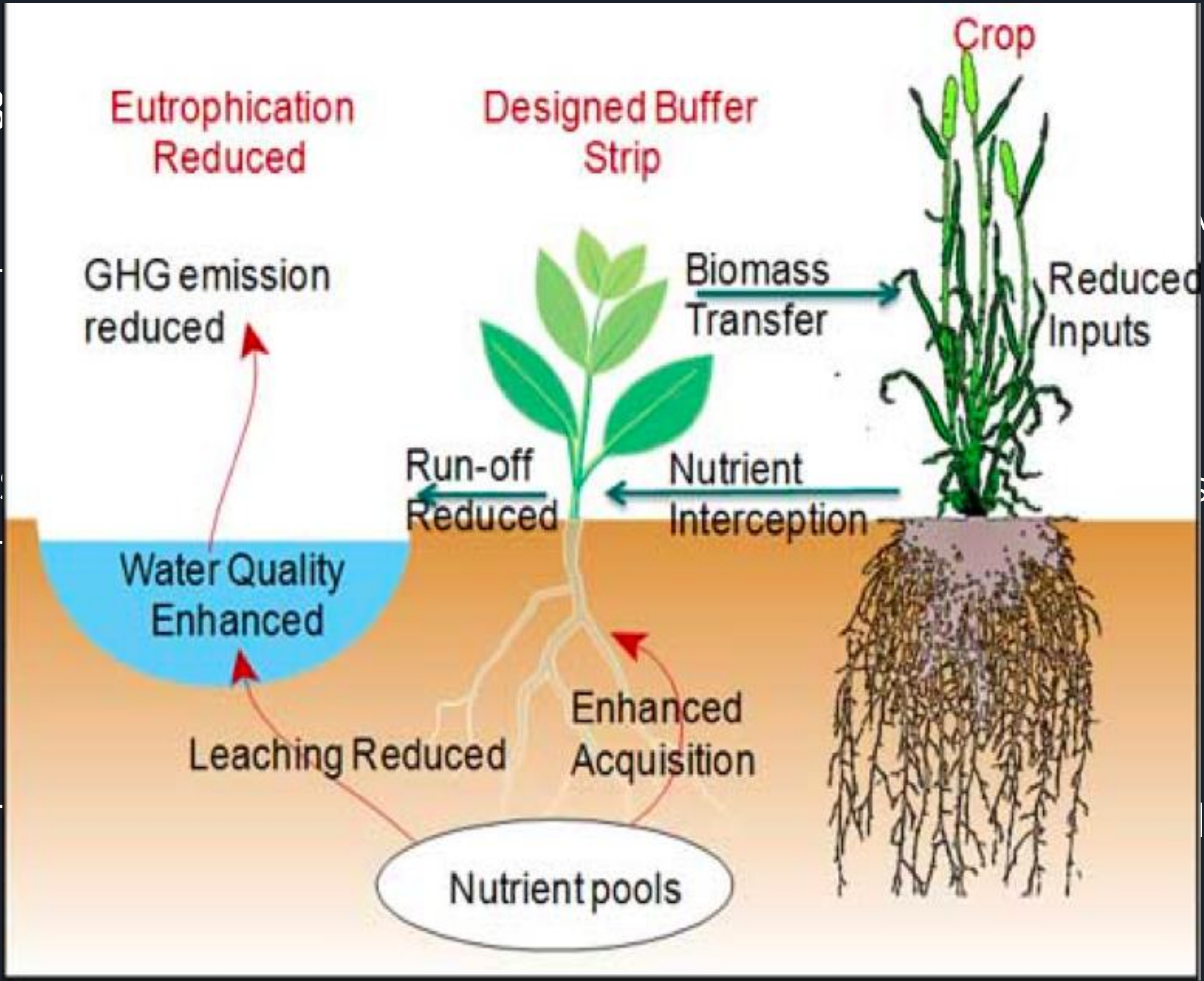
Background

B

- ws and

- s and
  events is

- ly



http://www.hutton.ac.uk/sites/default/files/images/research/ebs/Phosphorus-riparian-fig2.jpg

How does this fit into BREE?

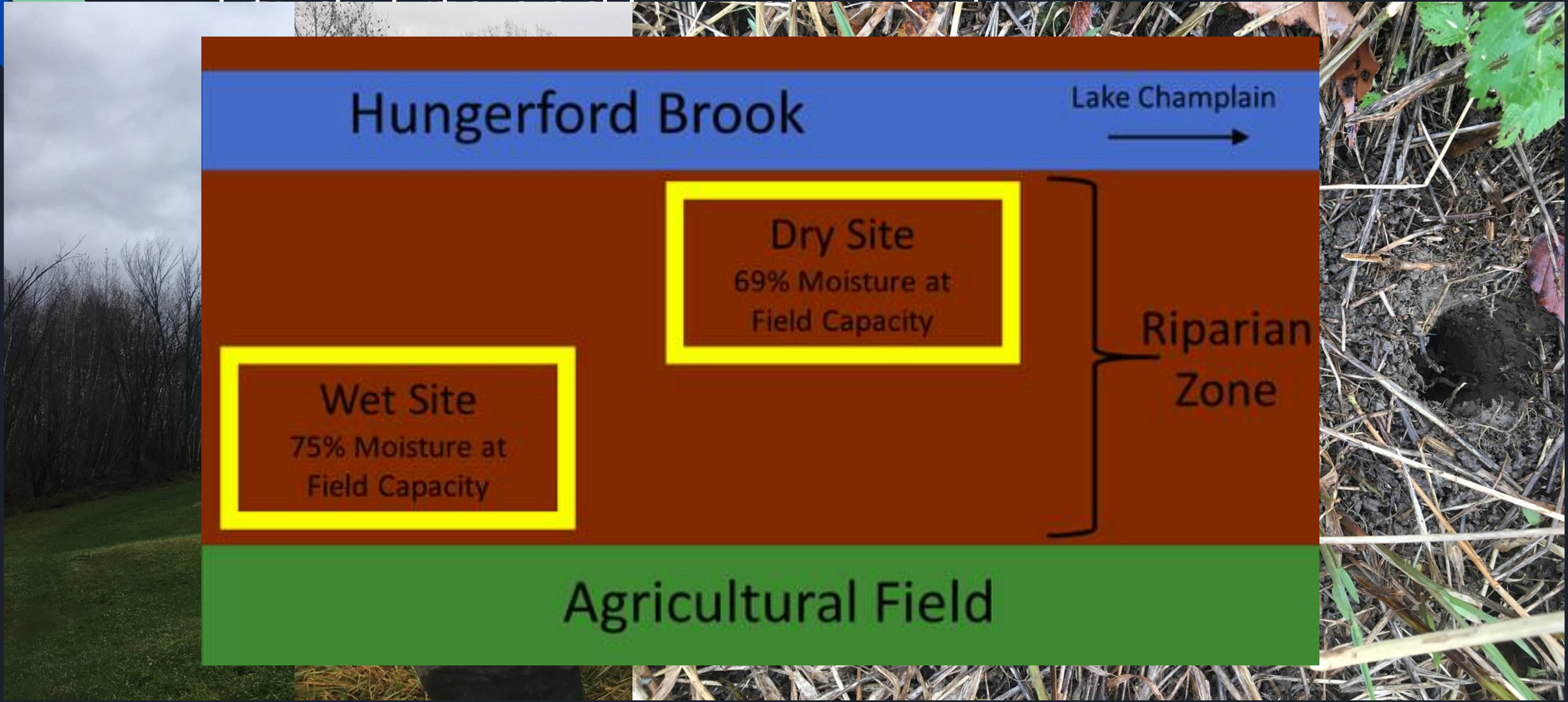
- One consequence of extreme events is increased eutrophication and algal blooms which have negatively affected the health of Lake Champlain in recent years (Zia, et al., 2016)

- This study will inform models that will be used to assess the structure and function of agricultural riparian zones

Objectives

- Understand the effectiveness of riparian buffers as nutrient buffers between land and water
- Quantify and model nutrient leaching through riparian soils as a result of varying storm severity
- Understand the microbial communities in these buffer zones and their impacts on dynamic nutrient cycling

Methods


Hungerford Brook
Lake Champlain
Dry Site
69% Moisture at
Field Capacity
Wet Site
75% Moisture at
Field Capacity
Riparian
Zone
Agricultural Field

Core Set-Up

PAS Gas Sampling

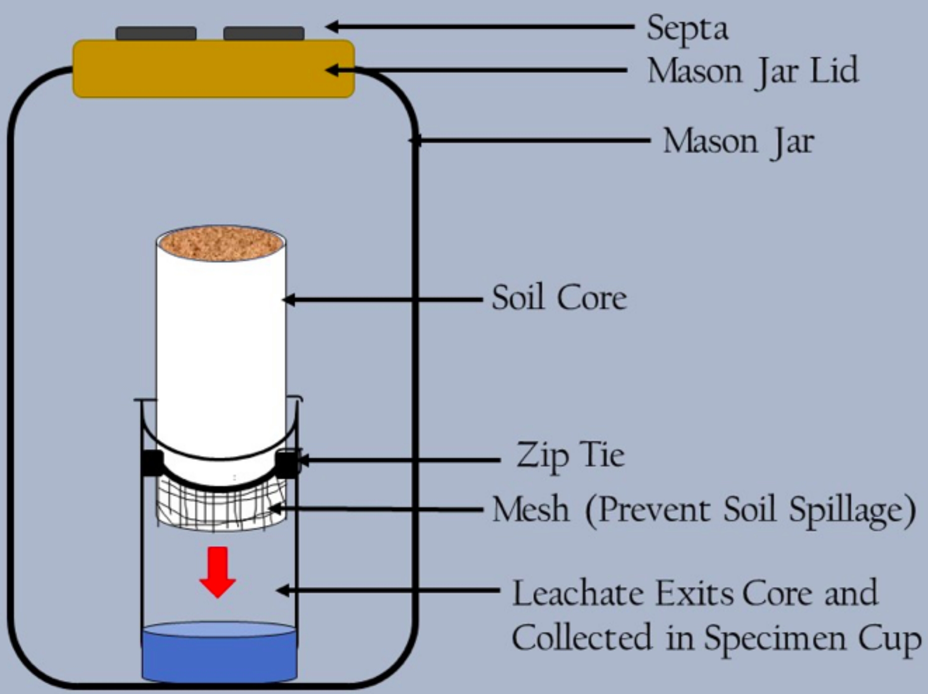
- N_2O

Destructively Sample Soil

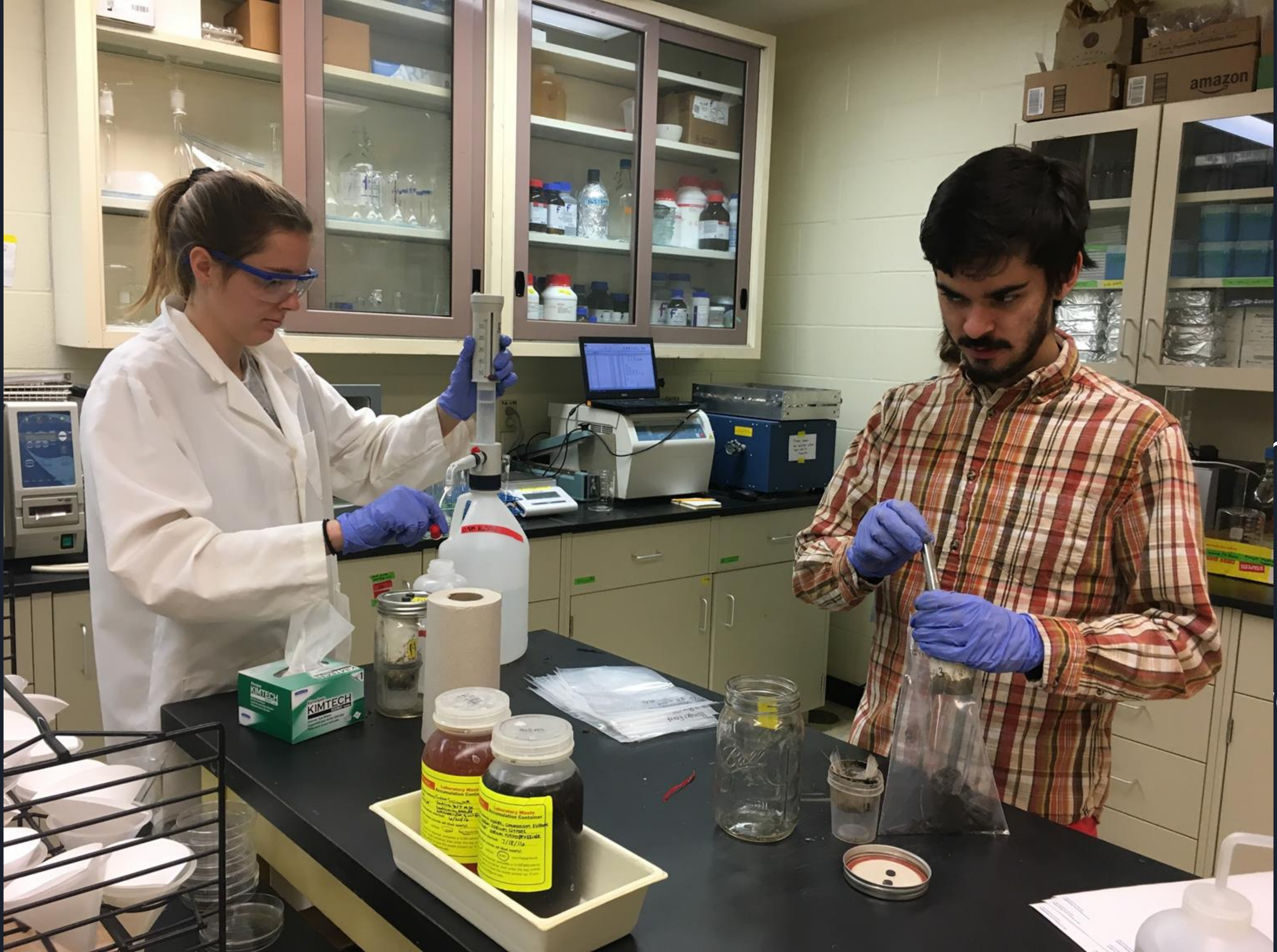
- For future enzyme analysis

Leachate Collection

- NH_4
- NO_3



e c
h s
orn
ac
cor

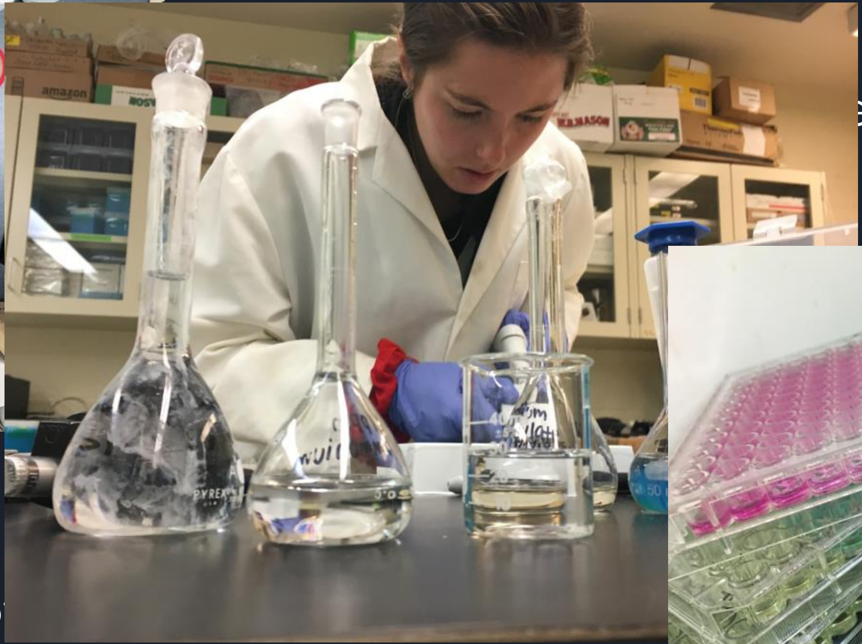


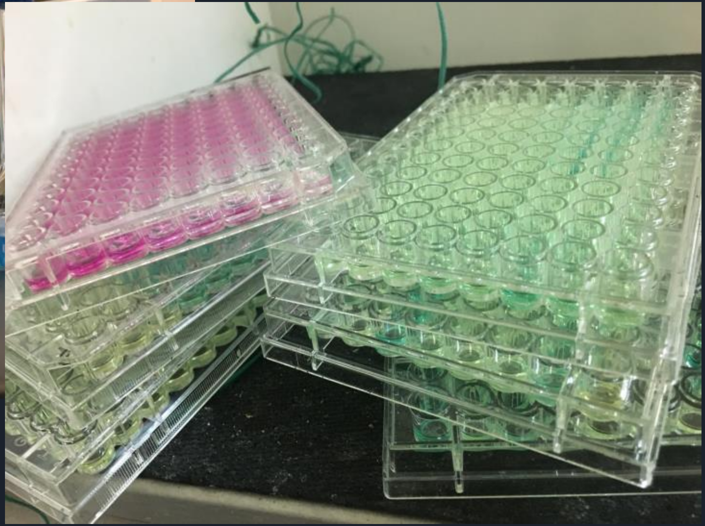
re

e

tion

etc.)





- Lots o

Results

Nitrous Oxide Fluxes Compared between Wet and Dry Sites

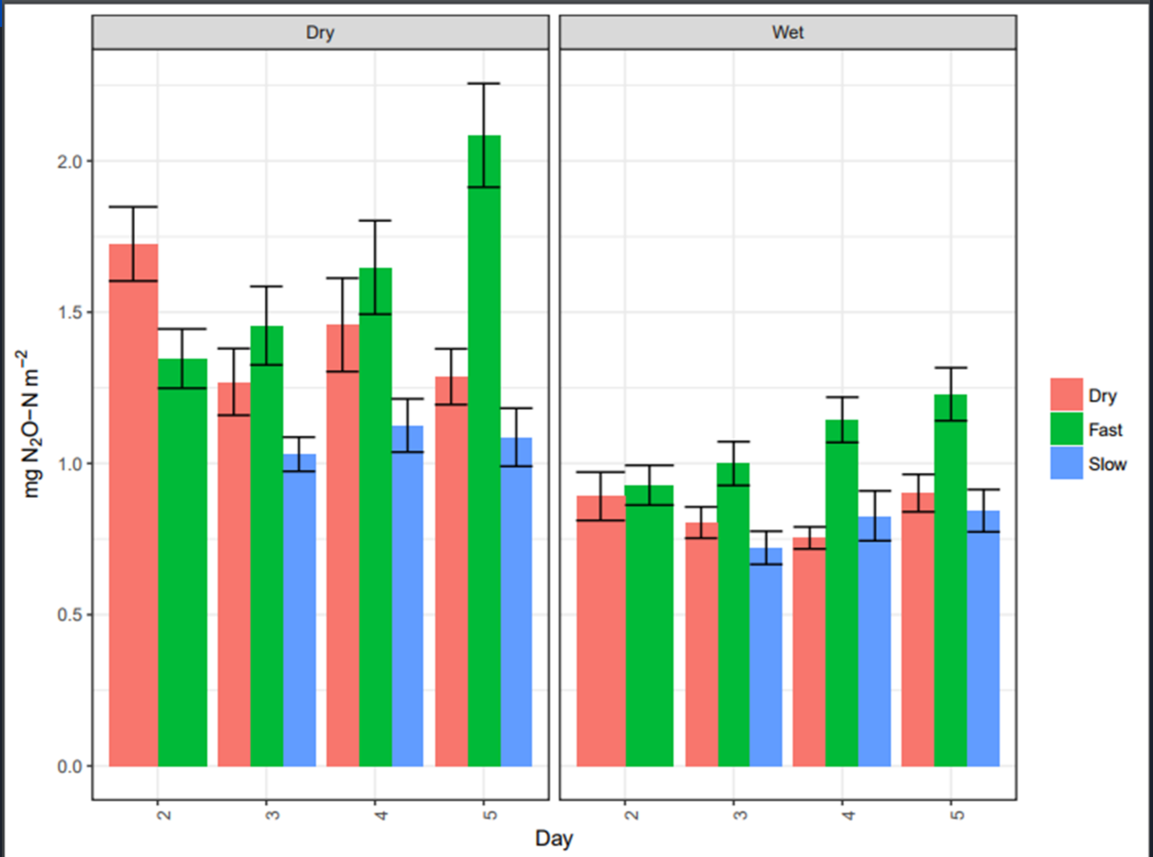


Figure 1: This figure demonstrates nitrous oxide flux data for the duration of the study, separated by site, day and treatment. Red bars indicate no storm event; green indicate fast wetting, blue indicate slow wetting. In general, the dry site had higher nitrous oxide fluxes and the fast treatments had higher nitrous oxide fluxes.

Average Ammonium Concentrations of Leachate Collected

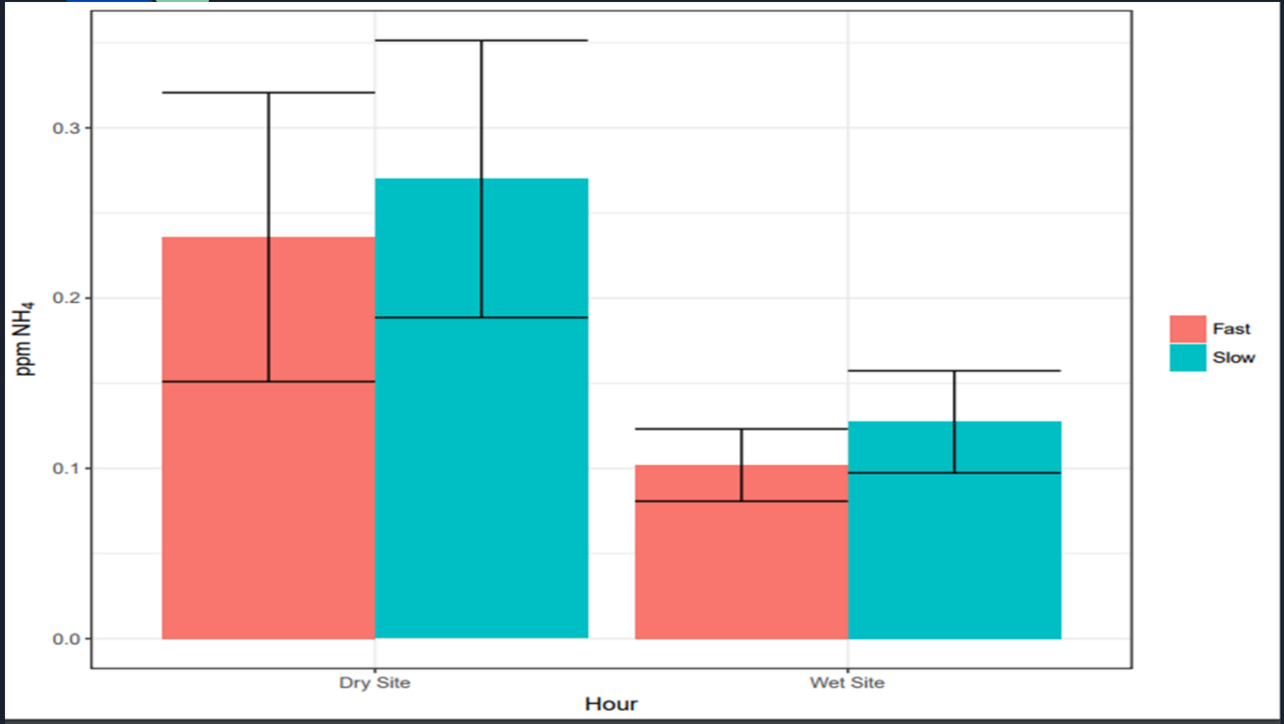


Figure 2: This figure visualizes the variation in leachate ammonium concentration, separated by site, day and treatment. Red bars indicate Hurricane Irene like simulations, and blue bars represent slow wetting. Generally, there was a significantly higher observed amount of ammonium found in samples collected from the dry site than the wet site.

Average Nitrate Concentrations of Leachate Collected

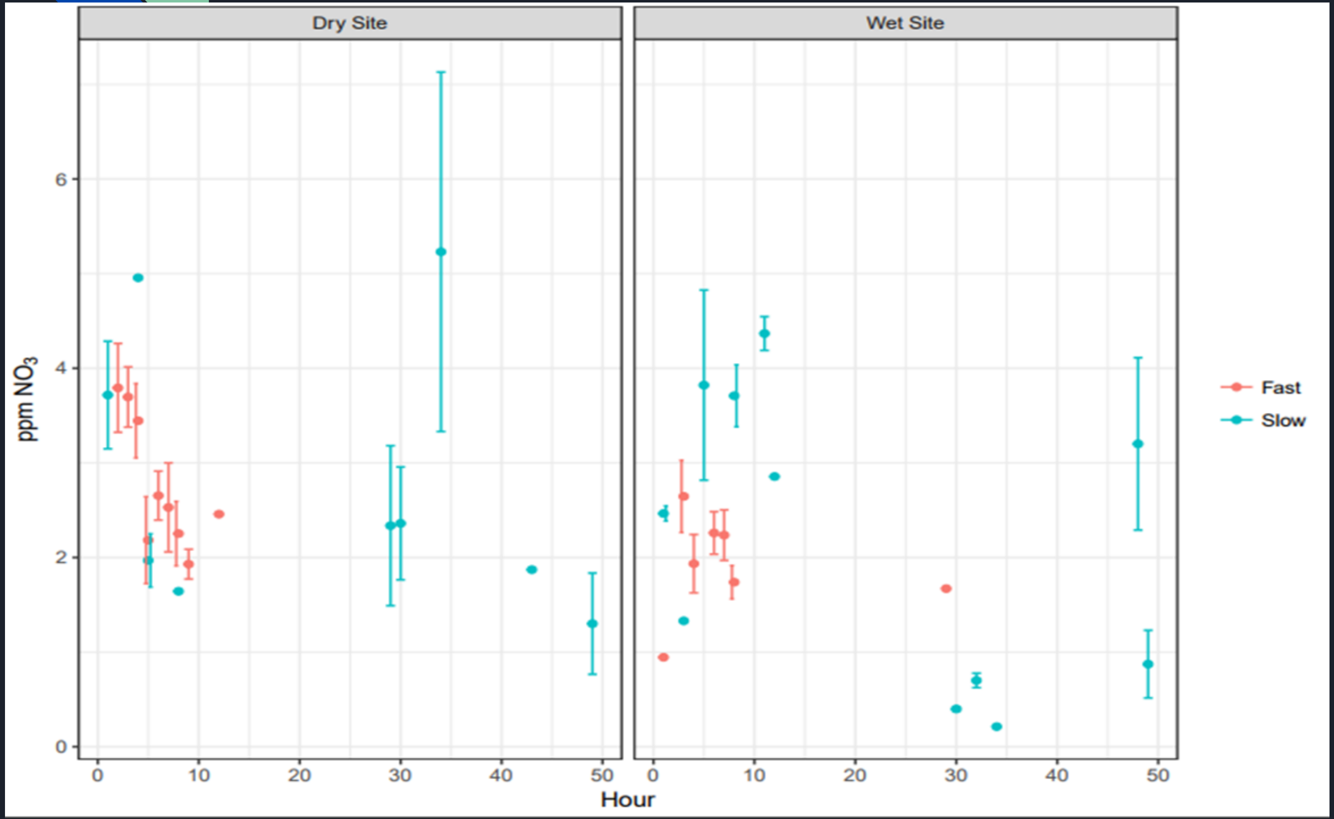


Figure 3: This figure shows differences in leachate nitrate concentration, separated by site, day and treatment. Red lines indicate fast wetting, and blue bars represent slow wetting. There is an observed significant site treatment hourly interaction. It appears that in the wet site, the slow treatment tends to lose more nitrate than the fast wetting treatment.

Discussion/Conclusion

Soooo... What does it mean?

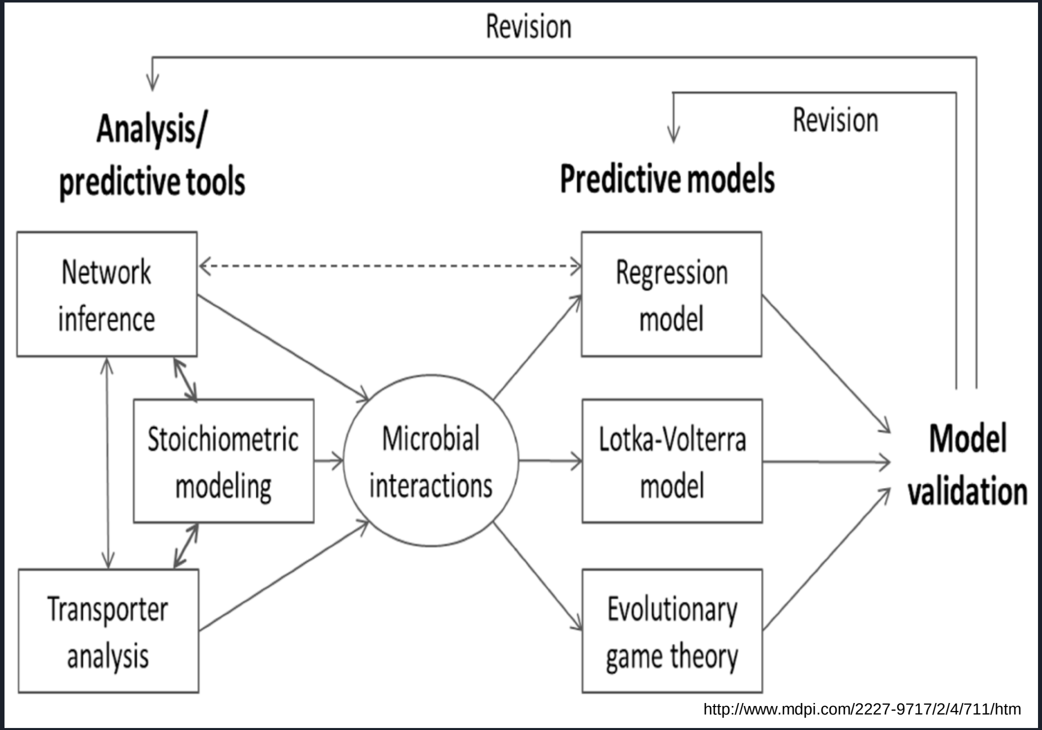
•Fast wetting events resulted in less efficient denitrification than slow wetting events due to the intensity of the storm.

•Denitrification in the dry site appears less efficient than in the wet site because of the likely differences in dynamics and species compositions in microbial populations

https://www.piccorn.com/tag/epscor

Future Directions

- Future Analysis: Dissolved organic carbon and total Nitrogen concentrations on leachate, and extracellular enzymatic assays
- Goals: to better inform us of the microbial dynamics and populations
- Ultimately: Build a basic model to understand how denitrification works in riparian zones



References and Thanks

References:

Zia, A., Bomblies, A., Schroth, A. W., Koliba, C., Isles, P. D., Tsai, Y., . . . Houten, J. V. (2016). Coupled impacts of climate and land use change across a river–lake continuum: insights from an integrated assessment model of Lake Champlain's Missisquoi Basin, 2000–2040. Environmental Research Letters, 11(11), 114026. doi:10.1088/1748-9326/11/11/114026

Vidon, P., Allan, C., Burns, D., Duval, T. P., Gurwick, N., Inamdar, S., . . . Sebestyen, S. (2010). Hot Spots and Hot Moments in Riparian Zones: Potential for Improved Water Quality Management1. JAWRA Journal of the American Water Resources Association, 46(2), 278-298. doi:10.1111/j.1752-1688.2010.00420.x

Special thanks to:

Funding provided by NSF Grant OIA-1556770

First Year Helpers: Vivian Karins, Carl Betz