

Annual Report for Period:07/2010 - 06/2011**Submitted on:** 04/08/2011**Principal Investigator:** Fisk, Melany C.**Award ID:** 0949317**Organization:** Miami Univ**Submitted By:**

Fisk, Melany - Principal Investigator

Title:

Collaborative Research: Nutrient co-limitation in young and mature northern hardwood forests

Project Participants**Senior Personnel****Name:** Fisk, Melany**Worked for more than 160 Hours:** Yes**Contribution to Project:****Post-doc****Graduate Student****Undergraduate Student****Name:** Geysler, Zach**Worked for more than 160 Hours:** Yes**Contribution to Project:****Name:** Mikolaj, Zack**Worked for more than 160 Hours:** Yes**Contribution to Project:****Name:** Dair, Ben**Worked for more than 160 Hours:** Yes**Contribution to Project:****Name:** Reidy, Matt**Worked for more than 160 Hours:** No**Contribution to Project:****Name:** Ulm, Ashley**Worked for more than 160 Hours:** No**Contribution to Project:****Technician, Programmer****Name:** Ratliff, Tera**Worked for more than 160 Hours:** Yes**Contribution to Project:****Other Participant**

Research Experience for Undergraduates**Organizational Partners**

Cornell University

State University of New York - ESF

University of Michigan

Marine Biological Laboratory

Other Collaborators or Contacts**Activities and Findings****Research and Education Activities:**

We established plots in 13 forest stands and collected pre-treatment data in preparation for nitrogen (N), phosphorus (P), and NXP fertilization that will begin in May, 2011. We have analyzed patterns of net N mineralization, resin-available P, soil P fractions, soil microbial respiration and microbial N:P ratios across all stands in organic and mineral soil horizons. We tested whether N and P availabilities vary in relation to one another or independently across our 9 replicated forest stands within the Bartlett Experimental Forest. We found a clear positive relationship between N mineralization and resin-P availability that was somewhat surprising given the variation in forest age, species composition, and site characteristics that were encompassed by our study sites. Stoichiometry of the decomposer microbial community might be expected to mediate this process, but we found no relationships between microbial N:P and nutrient availability. However, we did find a strong positive relationship between N mineralization and acid phosphatase activity, suggesting a mechanism by which organisms are using available N to maintain balance with P availability. A relative abundance of organic P in these forests suggests that this resource is potentially available in response to further N enrichment, and we are in the process of analyzing soil P fractions to test whether slowly recycling fractions are depleted in stands with higher N availability.

We have begun pre-treatment analysis of soil fungal communities in our forest stands in order to identify potential functional groups of interest for future studies of hyphal foraging for different nutrient resources. Soils were collected in stands of different ages and varying availabilities of N and P and we are now processing those in the lab.

Findings:

Our pre-treatment work in the Bartlett Experimental Forest has shown that plant roots forage primarily for P or Ca in forest stands where N availability is high. We have also found that allocation to phosphatase tends to increase P availability where N availability is high. These results suggest important mechanisms by which plants and soil organisms allocate effort to balance nutrient acquisition. The lack of correspondence with microbial N:P ratios emphasizes the need to consider turnover through the microbial pool, which may vary in relation to plant allocation belowground. Our results help us to understand spatial variation in biotic processes at the forest-stand level and raise intriguing questions about the sources of that variation. They also provide an important background for testing responses by these processes to changes over time in nutrient availability, as we begin our treatments.

Training and Development:

Tera Ratliff (technician, now beginning graduate program) has gained extensive lab experience by overseeing all analyses and training undergraduates to assist with and carry out analyses. She has been responsible for all soil chemical and biological analyses and is presenting work on patterns of nutrient availability and enzyme activity at the Ecological Society of America meetings in summer 2011. Zach Geysler, Zack Mikolaj, Matt Reidy, and Ashley Ulm (undergraduates) have learned soil and fungal community analyses. Ben Dair (undergraduate, REU) designed and carried out an independent project testing the influence of available C resources on the effects of N vs P on microbial activity and will present his work at ESA in summer 2011.

Outreach Activities:

Journal Publications

Naples, BK; Fisk, MC, "Belowground insights into nutrient limitation in northern hardwood forests", BIOGEOCHEMISTRY, p. 109, vol. 97, (2010). Published, 10.1007/s10533-009-9354-

Books or Other One-time Publications

Web/Internet Site

Other Specific Products

Contributions

Contributions within Discipline:

Contributions to Other Disciplines:

Contributions to Human Resource Development:

Contributions to Resources for Research and Education:

Contributions Beyond Science and Engineering:

Conference Proceedings

Special Requirements

Special reporting requirements: None

Change in Objectives or Scope: None

Animal, Human Subjects, Biohazards: None

Categories for which nothing is reported:

Activities and Findings: Any Outreach Activities

Any Book

Any Web/Internet Site

Any Product

Contributions: To Any within Discipline

Contributions: To Any Other Disciplines

Contributions: To Any Human Resource Development

Contributions: To Any Resources for Research and Education

Contributions: To Any Beyond Science and Engineering

Any Conference