Plant-Mycorrhizal-Decomposer Interactions and Their Impacts on Terrestrial Biogeochemistry

Nahuel Policelli[1]* (npol@bu.edu), Colin Averill[2], Edward R Brzöstek[3], Hui-Ling Liao[4], Haihua Wang[4], Ryan Tappero[5], Joseph E Carrara[3], Corinne Vietorisz[1], Jake Nash[6], Rytas Vilgalys[6], and **Jennifer M Bhatnagar**[1]

[1]Boston University, Boston, MA; [2]ETH Zürich, Zürich, Switzerland; [3]West Virginia University, Morgantown, WV; [4]University of Florida, Quincy, FL; [5]Brookhaven National Laboratory, Upton, NY; and [6]Duke University, Durham, NC.

Project Goals: We aim to determine the role of plant and soil resources in shaping interactions between coniferous plants, symbiotic ectomycorrhizal fungi, and free living saprotrophs, and the impact on plant and soil biogeochemistry.

Ectomycorrhizal fungi (EMF) are the main tree roots symbionts in temperate and boreal forests and can mine soil for nitrogen (N), increase trees carbon (C) allocation belowground, and interact with free-living saprotrophic microbes (SAPs) that decompose soil C. We hypothesized that plant-EMF-SAP interactions and their controls over ecosystem biogeochemistry are context-dependent but predictable, based on resource (C and N) availability to both SAPs and EMF. In a greenhouse-based synthetic ecosystem experiment, we grew *Pinus taeda* seedlings with and without a highly specific EMF symbiont (*Suillus cothurnatus*), under high and low levels of soil C, soil N, and plant C (ambient vs. elevated carbon dioxide -CO_2). To assess soil microbial activity, we measured soil CO_2 release under the different conditions. We also measured plant biomass and EMF root colonization. We found that when more plant C was available, EMF suppressed soil CO_2 release under low soil C but had no effect under high soil C. By contrast, when less plant C was available, EMF promoted CO_2 release under high soil C conditions. Elevated soil N had a tendency to suppress the EMF effect on soil C-derived CO_2 release, although the result was not significant. Biomass was higher for those plants growing with EMF, regardless of soil C. Plants inoculated with EMF doubled the biomass of non-inoculated plants under high CO_2 conditions. EMF root colonization of inoculated plants was similar between treatments. Together, our results show that the direction of EMF-SAP interactions depends on soil C availability, potentially reversing according to plant C allocation belowground.

Funding statement: The authors acknowledge DOE BER awards DE-SC0020403, AN_360581, and JGI/EMSL FICUS 51536.