145. Interactions between Ascomycete fungi and Actinomycete bacteria during litter decomposition under an N gradient

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Project Goals: Studies of ecosystem response to N deposition have reported declines in plant litter decomposition rates and declines in the relative abundance of Basidiomycota fungi, which are root-associated plant symbionts and plant biomass decomposers with key roles in cycling N in surface soils and acquiring N for plant growth. When Basidiomycota relative abundance declines, the relative abundance of Ascomycota fungi often increases. Thus, other fungi and bacteria can become more important in plant litter decomposition. Our work aims to determine how N gradients influence the activity and interactions of two broad decomposer groups---the Ascomycete fungi and Actinobacteria-that are known to harbor lignocellulosic decomposition traits and are potential key players in litter decomposition.

Atmospheric N deposition has increased N availability in natural ecosystems by 2-fold, on average, but as much as 100-fold in specific locations. Increased N availability has been widely reported to reduce decomposition of plant litter, at least on short time-scales. In conventional models, increased N availability alters plant-Basidiomycota interactions such that hyphal networks decline and Basidiomycota relative abundance declines. In theory, other decomposer groups can fill the available niche space. Ascomycota fungi and Actinobacteria in particular are expected to play larger roles in litter decomposition when Basidiomycota fungi decline. While increases in relative abundance of these two groups have been documented in some studies, other studies suggest that increased N availability might inhibit Ascomycete activity.

We are monitoring the collective activities of mixed communities of Ascomycota and Actinobacteria in time course experiments, where defined mixtures of five fungal and five bacterial genera, decompose plant litter (arid-land grasses) in sand microcosms under five nitrogen treatments. Given the difficulty of manipulating natural communities, defined mixtures provide the best approach to decipher functional responses, interactions, inherent biological barriers, and relevant mechanistic phenomena. To identify general patterns, instead of the eccentric response of one or two specific mixtures, we are documenting trends across many independent mixtures. Fungal and bacterial isolates for the mixtures were obtained from arid grassland sites and a pine forest field experiment where N application was an experimental variable. Measurements of the defined mixtures include initial biomass, CO_2 evolution over a 30- 50 day time-course, initial and final community composition (rRNA surveys of fungal and bacterial composition), and metatranscriptome analyses.

Preliminary results show evidence of composition-dependent behavior. Nonetheless, strong patterns are emerging across fungal-bacterial mixtures that document the general interaction between fungi and bacteria in these communities and the general contribution of N availability to Ascomycete-dominated decomposition of arid-land grass litter.

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