Poster #117

A Little Help From Your Friends: Heterogeneity in Forest Diversity Explains Observed Variation in Carbon Respiration in a Lowland Tropical Forest

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Plant roots, their associated mycorrhizal community, and the free--living microbial community interact to regulate the movement of carbon from soil to the atmosphere. Although the inclusion of plant and microbial activity in to global carbon models has generally improved model predictions, model uncertainty is still high in areas with high plant diversity and habitat heterogeneity, such as tropical forests. Heterogeneity in plant species diversity and density may create carbon decomposition hot-- and cold--spots around a focal individual, leading to high measurement variation within a site. To understand how tree diversity and habitat heterogeneity influenced variation in ^{13}C--labelled substrate respiration and microbial activity in a lowland tropical forest (La Selva Biological Station, Costa Rica), we first measured variation in carbon respiration rates under functionally disparate, dominant tree species, *Pentaclethra macroloba* (a nitrogen fixer), and *Goethalsia maiantha*. Additionally, to understand how free--living microbes, root--associated fungi, and plant roots shape carbon respiration, we manipulated the access of roots and mycorrhizal fungi to bulk soils *in situ*. Next, we tested how surrounding community alpha and functional diversity, shape the presence of roots, mycorrhizal fungi, free--living microbial community, and soil carbon decomposition underneath our focal individuals. We predicted that as tree community functional diversity increases around a focal individual, we would observe higher total root growth, root associated fungi, free--living microbial communities and higher variation in carbon respiration. Additionally, we predicted that carbon respiration would be suppressed around trees surrounded by a high number of con--specific neighbors.

The overwhelming variability in carbon fluxes in a lowland tropical forest was resolved when we considered a tree's neighbors. Soil respiration was highly variable throughout our study site. Despite low nutrient availability in tropical soils, we found no effect of a nitrogen--fixing tree species on organic matter decomposition. Without accounting for neighbor diversity, we detected no differences in carbon respiration among root and mycorrhizal hyphal exclusion treatments or between tree types. However, a significant amount of respiration variation was explained by variability in tree neighbor identity and diversity. Additionally, the abundance of root fungi in a focal tree was explained by tree neighbor density. Our study demonstrates that predicting carbon fluxes across diverse tropical ecosystems requires an understanding and incorporation of the diversity and functioning of the supporting plant community.