Poster #1-5

Warming Effects on Litter Decomposition and Soil Respiration in a Tropical Forest

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Litter decomposition and soil respiration are important ecosystem process in tropical forests, and their responses to ongoing changes in climate will have important consequences for the global carbon cycle. The Tropical Responses to Altered Climate Experiment (TRACE) in Puerto Rico investigates how tropical forest ecosystems will respond to increased temperatures. The TRACE field site has six plots, three controls at ambient temperature and three warmed at 4°C above ambient temperatures. Working with TRACE, we evaluated the effects of sustained warming on 1) in-situ litter decomposition and 2) *ex-situ* soil respiration. For the in-situ litter decomposition, we measured rates of decomposition across four substrates (native litter, green tea, black tea and wood) over a three-month period. Contrary to our hypothesis that increased temperatures would increase litter decomposition rates, we found that warming reduced mass loss by an average of ~10% across the four substrates. Warming decreased soil and litter moisture by an average of ~35%, which limited microbial activity and decomposition. However, the effect of warming on reduced mass loss varied among the different substrates (green tea: not significant, native litter: 3% p=0.05, black tea: 8% p = 0.04, wood: 17% p=0.02), with a stronger response in lower quality substrates. To test the effects of temperature on the ex-situ soil respiration, we conducted two laboratory soil incubation experiments. In the first experiment, we derived microbial temperature response curves and calculated the Q_{10} in short-term incubations with temperatures ranging from 20°C to 60°C. In the second experiment, we fertilized soils incubated at 24°C and 28°C with six nutrient treatments to test if they constrained microbial respiration in warmed soils. Similar to previous studies, we found that sustained higher temperatures decreased the temperature sensitivity (Q_{10}) of the soils. We also found that microbial respiration in the warmed soils had the highest response to the C + Fertilizer treatment (respiration rate increased ~30% compared to the control treatment), showing that warmed soils were not just limited by labile carbon as expected, but also by other micro nutrients. These results suggest that warmer temperatures could: 1) with concomitant drying, slow carbon and nutrient turnover from lower quality litter to soil, and 2) drive increased soil microbial respiration until they are limited by labile carbon and micro nutrients, or until they eventually acclimate.