

Molly Cavaleri

Tropical Response to Altered Climate Experiment (TRACE): adventures in warming a wet tropical forest in Puerto Rico

Although tropical forests account for only a fraction of the planet's terrestrial surface, they exchange more carbon dioxide with the atmosphere than any other biome on Earth, and thus play a disproportionate role in the global climate. In the next 20 years, the tropics will experience unprecedented warming. With a Coupled Model Intercomparison Project Phase 5 analysis, we found that model variability in projected net ecosystem production was nearly 3 times greater in the tropics than for any other latitude, thus showing exceedingly high uncertainty in projected tropical responses to this imminent climatic shift. Through a review of the most current literature, we concluded that manipulative warming experiments are vital to accurately predicting future tropical forest carbon balance. Our preliminary data from a wet tropical forest canopy in Puerto Rico shows that photosynthetic optima already exceed maximum leaf temperatures, indicating a decline in carbon assimilation at mid-day temperatures which may be exacerbated by further warming. Yet, it is unknown to what extent tropical species will be able to acclimate, thus mitigating this trend of decreasing the carbon sink behavior of tropical forests. To address these critical research needs, we have initiated the Tropical Response to Altered Climate Experiment (TRACE) in a wet tropical forest in Puerto Rico (El Yunque National Forest). Our primary objectives are: 1) to investigate thermal acclimation potential of mature tropical tree canopy foliage physiology using canopy access towers, branch warming techniques, and chamber gas exchange measurements, and 2) to assess the effects of warming on carbon and nutrient cycling and storage in tropical forest soils with a field warming experiment: the first of its kind in any tropical forest. Here, we present pre-treatment data and report on progress of experimental infrastructure. Results of this research will ultimately represent a significant step forward in our understanding and ability to effectively model tropical forest responses to a warmer world.