Title: **Tropical Rain Forests, Drought, Hurricanes and Heat: Results from the TRACE Experiment to Date**

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Project Website: https://www.forestwarming.org/

Project Abstract:

Global climate change has led to rising temperatures and more frequent and intense climatic events, such as storms and droughts. These changes may have non-additive effects on ecosystem processes, resulting in complicated legacies we have yet to understand. We will present recent results from the Tropical Responses to Altered Climate Experiment (TRACE) in Puerto Rico, which was exposed to a severe drought, two years of experimental warming, and two major hurricanes, to assess the resilience of tropical forests to multiple disturbances. Plant community composition has been resistant to change (drought, warming, hurricane) over the timescale of this study. With warming, seedling survival increased with increasing density of the same species. These positive density-dependent feedbacks may lead to declined diversity with continued warming. Photosynthesis at optimal temperatures decreased in the experimental warming plots for understory shrubs, and there was no apparent thermal acclimation of optimum temperatures. One of the species did acclimate to warmer temperatures by expanding the thermal photosynthetic niche. Relative survival of both understory shrubs correlated with their ability to physiologically acclimate to warmer temperatures. Root production and standing stock was reduced in response to warming. This response was exacerbated following hurricane disturbance, such that prior warming led to significantly reduced root recovery. Root specific respiration was not influenced by warming or hurricane disturbance, yet root respiration rates were positively correlated with root nitrogen. We have seen relatively little physiological acclimation of the understory vegetation to warmer temperatures for root processes, whereas aboveground physiological acclimation was species-dependent. While the community composition was resistant to change, should warmer temperatures continue, it is likely that a shift in community composition could occur. Total soil respiration rates were significantly higher in warmed plots, which appeared to be driven by microbial and not root responses. The temperature sensitivity (i.e., Q_{10}), however, was ~50% lower in warmed plots, suggesting a mechanistic shift. Even with reduced Q_{10}, if observed soil respiration rates persist in a warmer world, the feedback to future climate could be considerably greater than previously believed.