Poster #9-25

The Panama Tropical Forest Model Testbed: Comprehensive, Integrated Datasets on Abiotic Drivers, Plant Functional Traits, Tree Demography, and Stand-Level Carbon and Water Pools and Fluxes

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BER Program: TES
Project: NGEE-Tropics
Project Website: https://ngee-tropics.lbl.gov/

The improvement of the representation of tropical forests in global vegetation models – a task widely recognized as critical to by DOE and the modelling community – depends crucially on the availability of appropriate datasets for parameterization and evaluation. Panama offers a comprehensive and integrated set of datasets that provide an unmatched model testbed for tropical forests, a testbed that has been further developed in recent years by NGEE-Tropics. Here, we present an overview of these datasets, and key results for relationships of interest for evaluating models at a variety of spatial and temporal scales and levels of organization. The study area spans natural rainfall gradients from <1500 mm to >6000 mm of rainfall per year, as well as extensive variation in soils, elevation, and land use history. High-quality, detailed microclimate data subject have been collected for decades at multiple locations. Local geology and soils are well-characterized. Leaf functional traits, wood density, seed mass, and height and crown allometries have been measured on hundreds of woody plant species. Over 150 long-term forest monitoring plots encompassing > 150 ha provide data on aboveground biomass, woody productivity, tree mortality, functional composition, and tree size distributions, and their relationship with climate, soils, and forest age. Seed traps and seedling censuses within these plots provide additional species-specific data on tree reproduction and recruitment and its interannual variation with climate. Eddy covariance quantifies high-resolution stand-level carbon and water fluxes to the atmosphere for > 5 years at 2 sites, and complementary measurements quantify soil CO_2 efflux, stem CO_2 flux, sap flux, runoff, and leaf phenology. Additional datasets quantify carbon fluxes in litterfall at weekly resolution for >30 years and annual tree growth from dendrometers for the last decade. Large-scale, long-term soil fertilization experiments and detailed measurements within them in old-growth and secondary forests provide an excellent platform for evaluating the ability of models to capture effects of soil nutrients. Additional large-scale, long-term experiments involve litter manipulation, soil warming, and the removal of lianas (woody vines). Censuses of liana stems and liana infestation status of trees, as well as liana removal experiments, enable analyses of how forest carbon budgets are affected by lianas – and demonstrates

that these effects are substantial, even though they are not yet captured in vegetation models. Altogether, central Panama offers a powerful model testbed to evaluate and improve model representation of tropical forests.