Title: A Nutrient Enabled Demographic Ecosystem Model - FATES-ELM-CNP - Evaluation and Parametric Sensitivity at a Tropical Testbed

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Project Abstract:
Nitrogen and phosphorus play an important role in modulating global vegetation dynamics. Earth system models have shown that nutrient availability impacts projections of the global carbon sink. It has also been shown that terrestrial biosphere models that represent vegetation size, function and age structure, capture key processes that drive accurate and representative projections of forest demographics that traditional big-leaf models cannot. The Functionally Assembled Terrestrial Ecosystem Simulator (FATES) is a terrestrial vegetation model that is coupled with the Energy Exascale Earth System's Land Model (ELM). It can resolve plant growth, competition, mortality, recruitment and disturbance through a size, type and age structured scaling approximation. Until recently, these processes had been mediated solely through an evaluation of the plant's carbon balance. Here we present an updated version of the FATES-ELM model that accounts for the cycling of nitrogen and phosphorus between the vegetation and the soil microbiome, as well as the limitations that nutrient availability imparts on plant growth and dynamics. We evaluate the model at a tropical testbed site at Barro Colorado Island in Panama, using observations to constrain model parameters. We evaluate model hypotheses with a focus on the plant acquisition of mineralized nutrients, as well as their modulation of construction costs under nutrient limitations.