Title: **Plant water sourcing in the neotropics—effects of topography and rainfall**

Cynthia Wright,[1*] Alex Pivovaroff,[2] Nate McDowell,[2] Brent Newman,[3] Jeff Warren,[1]

[1]Oak Ridge National Laboratory, Oak Ridge, TN; [*]presenting author; [2]Pacific Northwest National Laboratory, Richland, WA; [3]Los Alamos National Laboratory, Los Alamos, NM;

Contact: (wrightcl1@orng.gov)

Project Lead Principle Investigator (PI): Jeff Chambers, LBNL

BER Program: TES

Project: NGEE-Tropics

Project Website: http://ngee-tropics.lbl.gov/

Project Abstract: Plant water sourcing and rooting depth are critical in understanding and predicting tropical forest response to climate change scenarios—specifically how changes in the timing and availability of soil water influence net carbon exchange. Yet we know very little about tree rooting depths and how water extraction patterns vary by species, soil type, depth to water table, and degree of rainfall seasonality. To address this type of uncertainty, the E3SM-FATES land model was developed to represent the dynamics of tree cohorts of differing size and functional types, allowing for the representation of variable water extraction patterns. This modeling effort represents a major advancement in Earth systems models. Still, E3SM-FATES has not yet been parameterized and validated with field data. The objective of this research, therefore, is to quantify tree water sourcing and rooting depth as a function of species and across a topographic and hydrologic gradient. Preliminary results for a tropical rainforest near Manaus, Brazil show that fine roots distribution has strong correlation with rates of water uptake. Yet, a transition from wet to dry conditions indicates that water sources shift to deeper soil layers. Although fine root biomass declines with depth, during dry conditions, 30% or more of daily plant water use is extracted from the 1+ m depth. To quantify species-specific depth of water uptake during drying conditions, we are using vertical profiles of stable isotopes of water (δ^2H and $\delta^{18}O$) within the soils and plants as natural tracers. Data are coupled with soil water content, sap flux and transpiration patterns. First, we are testing plant water extraction patterns across a topographic and hydrologic gradient at the ZF2 site near Manaus, Brazil. Here we expect drought conditions to be more extreme on the plateau where depth to water table is greater than in the valley. Second, we are testing plant water extraction patterns across a rainfall gradient for three sites in Panama. Here, we are also targeting species with varying drought tolerance/resistance levels to see if root water uptake depth helps explain sensitivity to drought. Plant water sourcing and rooting depth data will therefore improve the E3SM-FATES model and enhance the ability of this model to predict tropical forest response to climate change scenarios.