Soil carbon storage and turnover in tropical forests along a precipitation gradient in Panama

KARI M. FINSTAD[1]*, DANIELA CUSACK[2], LEE DIETTERICH[2], BENJAMIN TURNER[3], KARIS MCFARLANE[1]

[1]Center for Accelerator Mass Spectrometry, Lawrence Livermore National Laboratory, Livermore, CA 94550, USA (*correspondence: finstad1@llnl.gov)

[2]Department of Geography, University of California, Los Angeles, Los Angeles, CA 90095, USA

[3]Smithsonian Tropical Research Institute, Balboa, Ancon, Panama

Tropical forests account for over 50% of the global terrestrial carbon sink and 29% of global soil carbon, but the stability of carbon in these ecosystems under a changing climate is unknown. Recent work suggests moisture may be more important than temperature in driving soil carbon storage and emissions in the tropics. Here, we explore the role of moisture and soil type in controlling soil carbon storage and turnover along a natural precipitation gradient in Panama where differences in parent material result in different fertility and other soil characteristics.

While the three sites included in this study maintain similar mean annual temperature (26°C), they range in mean annual precipitation from 1875 to 2850 mm/yr. At each precipitation level (low, medium, high), a high and a low fertility soil were also compared. Surface soils were incubated to determine the size of the “active” carbon pool and radiocarbon measurements made to determine the age of heterotrophic respiration. At each site, soil carbon age and stocks were also measured from soil pits sampled to at least 1.5 meters. Radiocarbon measurements of the surface soil indicate multi-decadal cycling and the age of heterotrophic respiration ranges from current photosynthate to decadal cycling. The size of the active pool increases with increasing precipitation, however the age of respired carbon does not appear to be dependent on the amount of precipitation or active pool size.

This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344. LLNL-ABS-746769.