Poster #1-41

Soil Radiocarbon Measurements Across Climatic, Edaphic, and Physiographic Gradients in Tropical Forests

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BER Program: TES
Project: Early Career Award (Karis McFarlane)

Tropical forests account for 29% of global soil carbon, but much of this belowground carbon is stored in pools with short (decadal) turnover times with a potential for rapid response to future change. Moisture may be more important than temperature in driving soil C storage and emissions in the tropics, yet the role of moisture on soil C dynamics is understudied and underrepresented in land surface models. We measured or attained data for soil carbon stocks and radiocarbon (^{14}C) values of profiles from the tropics including sites in Puerto Rico, Mexico, Costa Rica, Panama, Brazil, Peru, Cameroon, and Indonesia. Our sites represent a large range of moisture, spanning 710 to 4200 mm of mean annual precipitation (MAP), and include Alfisols, Andisols, Inceptisols, Oxisols, and Ultisols. We found a large range in soil ^{14}C profiles between sites, and in some locations, we also found a large spatial variation within a site. MAP explains some of the variation in soil ^{14}C profiles and carbon stocks, with smaller C stocks and younger soil carbon in drier forests. However, differences in soil type contribute substantially to observed variation across the dataset and with constrained gradients in moisture and parent materials in Panama. Collaborative site-specific studies to explore the influence of controlling factors in manipulation experiments and constrained gradients of precipitation, soil type, root inputs, geomorphology, and landuse on carbon storage and turnover soil characteristics, root inputs, topography and landuse on carbon storage and longevity through collaborative site-specific studies. For example, conversion of primary forests to pasture in the Ucayali region of Peru caused a loss of young soil carbon in 10-20-year-old pastures. Reforestation of agricultural lands to secondary forests restored young soil C stocks after 15 years, but young secondary forests retain a legacy of lost carbon. Site-level runs of ELM v.1 and integration with a reduced complexity model (SoilR) will be used to evaluate model representation of soil C processes, including vertically-resolved carbon transfer rates, root inputs, and decomposition.