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Soil-Earthworm-Litter System Controls on the Soil Aggregates and Soil Organic Matter Dynamics in Eastern Deciduous Forests

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Many soils from forests in northern North America are undergoing a recent invasion of European Lumbricid earthworms with important implications for soil organic carbon (SOC) dynamics. Our work seeks to identify how native and invasive earthworm (EW) activity alters the relative importance of physical, chemical, and biochemical protection mechanisms controlling SOM stabilization in deciduous forests by changing the dynamics of soil particulate organic matter (POM) and aggregates. Within forests of the Smithsonian Environmental Research Center (SERC) in coastal Maryland, USA, wood and litter amendment plots were established in high, low and no EW activity areas within forests of different stand age and land use history to study EW impacts to litter-soil systems. Older, mature successional forests have relatively fewer or no earthworms while forests with agricultural disturbance less than 75 years exhibit the greatest number of individuals. Our previous work demonstrated that the plant biopolymer chemistry of both decayed litter and soil (0-5 cm) POM is driven by differences in EW activity and is responsible for the differences observed in lignin and root aliphatic matter accumulation in this system. In the present study we compare soils to a depth of 15 cm among plots with 5 years of wood and litter amendment to track the control of EW activity on the vertical transport and microaggregation of litter. Elemental C&N, 13C, 15N abundances, and diffuse reflectance Fourier transform infrared spectra (DR-FTIR) data will be presented for bulk soil and size-density separated soil fractions. These plots have variable land use histories over the last 250 yrs which is mostly reflected in their stable 15N and 13C values of mineral bound SOC with depth but earthworm activity seems to have a control on the degree of isotope change with depth. Our results from analysis of stable isotopes and lignin phenols in soil indicate the invasive EW feeding habits and activity are a major control on the degree of mixing of surface litter and deep soil in all of research plots and that ground wood amendments exhibit the greatest degree of change with depth. This work will have important implications for understanding how invasive EW will influence soil-atmosphere carbon budget in northern North America in the future.