Geophysical Research Abstracts
Vol. 12, EGU2010-12783, 2010
EGU General Assembly 2010

Role of Native and Exotic Earthworms in Plant Biopolymer Dynamics in Forest Soil

Timothy Filley

Many forests within northern North America are experiencing the introduction of earthworms for the first time, presumably since before the last major glaciation. Forest dynamics are undergoing substantial changes because of the activity of the mainly European lumbricid species. Documented losses in litter layers, expansion of A-horizons, loss of the organic horizon, changes in fine root density, and shifts in microbial populations have all been documented in invaded zones. Two free air CO2 enrichment (FACE) forest experiments (aspen FACE at Rhinelander, Wisconsin and sweet gum FACE at Oak Ridge National Lab, Tennessee) lie within the zones of invasion and exhibit differences in amounts of exotic and native species as well as endogeic (predominantly mineral soil dwelling) and epigeic (litter and organic matter horizon dwelling) types. Considerations of carbon accrual dynamics and relative input of above vs. below ground plant input in these young successional systems do not consider the potential impact of these ecosystem engineers. We investigated the impact of earthworm activity by tracking the relative abundance and stable carbon isotope compositions of lignin and substituted fatty acids extracted from isolated earthworms and their fecal pellets and from host soils. Indications of root vs leaf input to earthworm casts and fecal matter were derived from differences in the chemical composition of cutin, suberin, and lignin. The isotopically depleted CO2 used in FACE and the resulting isotopically depleted plant organic matter afford an excellent opportunity to assess biopolymer-specific turnover dynamics. We find that endogeic species are proportionately more responsible for fine root cycling while some epigeic species are responsible for microaggregation of foliar cutin. CSIA of fecal pellet lignin and SFA indicates how these biopolymer pools can be derived from variable sources, roots, background soil, foliar tissue within one earthworm. Additionally, CSIA indicates the distinct roles that different earthworm types have in “aging” surface soil biopolymer pools through encapsulation and upward transport of deeper soil carbon, and “freshening” deeper soil biopolymer pools through downward transport of surface carbon to deeper layers,. As earthworm species abundance and activity are not is steady state in many forests, the role of these important invertebrates should be more considered when assessing the changing soil state.