Integrative Molecular Biogeochemistry of Soil Organic Matter with Long-term Litter Manipulation in Temperate Forests

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Global environmental change is altering the rate and direction of the biogeochemical cycling of carbon which in turn alters the stabilization and destabilization of soil organic matter and global carbon soil storage. Soil organic matter composition is complex and unravelling its biogeochemistry requires the development and use of sophisticated analytical approaches. An integrative molecular biogeochemistry approach was used to study how above- and below-ground inputs and removals altered soil organic matter composition after 20 years in three temperate forests (Bousson, PA; Harvard, MA; and HJ Andrews; OR). This approach isolates and quantifies plant- and microbial-derived compounds using mass spectrometry and nuclear magnetic resonance approaches. This molecular-level information will also be compared to soil carbon and radiocarbon results. A comparative analysis of all three experimental data sets will identify the underlying mechanisms responsible for elucidating shifts in biogeochemical cycling with changes in above- and below-ground litter. This synthesis will compare ecosystem properties to identify the long-term controls on soil organic matter biogeochemistry in temperate forests.