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YEAR: 1 of **3**

PROJECT TITLE: Resilience of soil organic matter to harvesting: A global study of long-term soil productivity experiments

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PROJECT DESCRIPTION:

Soil organic carbon (SOC) quantity and quality are linked to important soil functions including nutrient mineralization, aggregate stability, trafficability, and water retention and hydrologic processes. In turn, these soil functions are correlated with a wide range of ecosystem properties that are relevant to forest managers. For example, high SOC is associated with high plant productivity. Harvesting can remove substantial portions of a forest's aboveground C stores; however, in most cases these disturbances have little impact on mineral associated soil carbon. Very few studies have been conducted to examine the mechanisms that SOC has to resist change or be resilient against change (i.e. recover C at rates similar to those lost). The overall objective of this proposal is to elucidate the mechanisms that impart resilience to forest soil carbon after harvesting. Our central hypothesis is that organo-mineral complexes are resistant to disturbance-induced degradation and that soil carbon vulnerable to disturbance is readily replaced by decaying roots left after harvest. We will utilize three decades of archived and new data and samples from North American and New Zealand forest biomass harvesting studies in conjunction with detailed characterization of the mineralogy, soil carbon stabilization mechanisms, radiocarbon age, and biomarkers to elucidate mechanisms in soil carbon dynamics in disturbed and recovering systems. By meeting our objectives, we will be able to understand which soils are most vulnerable to losses and degradation and develop management strategies that maintain or enhance forest SOC in managed settings. This research is currently funded by the USDA-AFRI.

HYPOTHESES or OBJECTIVES:

1) Characterize soil carbon dynamics after forest harvesting using treatments designed by the long-term soil productivity experiments (LTSP).
2) Determine the mechanisms of resilience, resistance, or vulnerability of soil carbon to forest harvesting.

METHODS:

We will examine the dynamics of soil carbon stabilization across archives of soils collected from a the widely applied LTSP treatments (Currently – CA, ID, OR, NC, and New Zealand). This study encompasses a broad spectrum of soils, forests, and climates and will allow us to determine if the mechanisms of stabilization and resistance to change are different by soil or forest type. We will use density fractionation, mineralogical characterization, radiocarbon, stable isotopes, and biomarkers to characterize soils and soil carbon. Using these methods, we will be able to pinpoint the resistance of mineral and aggregate stabilized pools as well as the organic constituents' (e.g. charcoal/biochar, lignin) resistance to biomass loss. We hypothesize that those forests that initially have a higher proportion of mineral and aggregate stabilized soil carbon will resist changes associated with loss of aboveground biomass but that the molecular structure of soil carbon will have no effect on resistance

to loss. We further hypothesize that root abundance helps soil carbon be resilient against forest harvesting.

MAJOR FINDINGS:

- Preliminary results suggest that younger labile carbon is mineralized.
- Retaining surface residues maintains labile carbon pools in the mineral soil.

DELIVERABLES:

None to date.

We expect to identify soil characteristics that lead to resilience or resistance to harvesting and disturbance. Further chemical interrogation of soil samples is needed to achieve this deliverable.

MEMBER COMPANY BENEFITS:

Understand which sites need special care to preserve soil carbon pools.