BIOGEOMON 2024: Session 3 (Soil carbon stabilization and C sequestration)

Evaluation of soil carbon dynamics and microbial proxies under different climate-smart agriculture practices

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Regenerative and climate-smart agriculture practices can play a pivotal role in transforming the global agricultural system in the face of climate change and food security challenges. The primary focus of regenerative agriculture is to improve soil health by promoting soil microbial activities and ultimately increasing the potential of soil carbon (C) sequestration. Understanding the mechanisms of soil C sequestration is essential for strengthening natural C sinks and mitigating climate change. While changes in long-term soil C storage occur over extended timescales, biologically-mediated movement of soil C between pools can be more readily measured to provide precursory evaluations of management strategies. We are evaluating soil C dynamics and associated microbial proxies under different climate-smart agriculture practices (e.g., cover crop, agroforestry/silvopasture, conservation/reduced tillage, and soil amendments such as biochar and compost) within the Southeast USA. Soil samples collected from our on-the ground field studies are being measured for total C and N, potential C mineralization, soil C fractions (particulate and mineral-associated organic C), microbial biomass C and N, microbial necromass, potential extracellular enzyme activities, and microbial community structure. Evaluation of these parameters will provide information about the function and identify of the biological components of soil organic matter (SOM), and the extent to which soil C is being stabilized. Our findings will provide insights into how the boost of organic material provided by cover crops, amendments, conservation tillage, and agroforestry impacts the ability of soil microbes to sequester C. Our study combining functional and structural biological parameters may permit early evaluations of soil response to climate-smart agricultural practices to be made within a holistic context of soil C breakdown. Early-on, informative, and consistent indicators of changes in soil C cycling will help in decision making and adoption of climate-smart agriculture practices.