Poster #UF-2

Microbial Stabilization and Destabilization of Soil Organic Carbon Across Scales

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EMSL provides researchers with a wide range experimental, computational, modeling and simulation approaches to investigate biogeochemical processes from molecular to ecosystem scale. In this poster we present selected approaches to study microbial stabilization and destabilization of soil organic carbon across scales.

Soil microorganisms affect the processes of soil organic carbon stabilization and destabilization at all scales of complexity, from nano- to micro- and macro-scale. At the micro-scale, we studied microbial-mineral associations in soils, where complex processes, including mineral aggregate formation, microbial mineral weathering, and soil organic matter stabilization occur. We placed in-growth mesh bags containing biotite in the ponderosa pine rhizosphere and after 9 months analyzed their contents by Fourier-transform ion cyclotron resonance mass spectrometry to obtain molecular-level identification of newly-formed organic compounds. We analyzed bacterial and fungal soil microbiomes by DNA sequencing. We used high- resolution electron microscopy to examine the nature of organo-mineral associations, aggregation, and mineral weathering processes. Weathering was validated by X-ray diffraction analysis. The results suggest that the mineral aggregation and weathering were driven by the newly formed organic matter produced by microbial activity.

At the macroscale, we used a meta-analytical approach to quantify the importance of soil microorganisms for prediction of soil organic carbon destabilization/mineralization under expected increase of temperature. We show that accounting for the size of microbial biomass in the soil improves the predictive ability of a given mathematical model by more than 500% (from 12 to 68% of explained variability in data).