Dissolved organic carbon (DOC) abundance links to microbial and DOC composition in soil

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Project Goals: The project goals are to 1) determine if there are dominant compounds underlying patterns in DOC abundance, and 2) investigate the microbial taxa governing DOC composition.

Carbon flow from soil microbial decomposition processes significantly influences climate. Soil microbial decomposition of litter results in CO_2 released to the atmosphere contributing to global warming and dissolved organic carbon (DOC) potentially sequestered in soil. Therefore, manipulation of microbes during decomposition can help us increase C storage. However, controls on decomposition processes and C partitioning to each of these fluxes (CO_2 and DOC) are not completely understood. We know microbial composition alters DOC abundance and composition, yet we do not know 1) if there are dominant compounds underlying patterns in DOC abundance, and 2) the microbial taxa governing DOC composition. Here, we address both of these knowledge gaps. We extracted natural microbial communities from 206 soil samples from the Southwestern United States, inoculated them on plant litter in homogeneous laboratory microcosms, and compared cumulative carbon flow into two divergent pools (CO_2 and DOC) after 44 days. We sequenced the microbial communities using an Illumina MiSeq sequencer at the Los Alamos National Laboratory (LANL) and characterized DOC composition using Fourier transform ion cyclotron resonance mass spectrometry (FTICR MS) and nuclear magnetic resonance (NMR) spectroscopy at the Environmental Molecular Sciences Laboratory (EMSL). The combination of these state-of-the-art tools provides unprecedented detail into both microbial and DOC composition. By doing so, we reveal types of compounds driving DOC abundance and the types of microbes associated with these compounds.

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