

## **LBNL TES SFA—Kinetic Properties and Temperature Sensitivity of Microbial Exoenzymes Through the Soil Profile.**

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**Project Abstract:** Current knowledge of the mechanisms and responses of soil organic matter (SOM) decomposition to warming remains incomplete, and is mostly limited to surface soils. However, over 50% of global soil carbon is contained in sub-soils, characterized by different physicochemical conditions, nutrient inputs, and SOM chemistry. Such factors select for microbiomes with distinct functional traits that may constrain SOM decomposition responses to warming. In the LBNL TES SFA, we are investigating microbial traits and feedbacks to warming through the soil profile using continuous field-based experiments and laboratory manipulations. Soil exoenzymes represent fundamental traits of microbes, and mediate the rate-limiting step in SOM decomposition by liberating the assimilable products required by microbes and plants. We hypothesized that microbial exoenzyme properties are optimized to the substrate availability and temperature regimes of their soil horizon, and integrate broader trait spaces that reflect the life strategies and ecophysiology of microbes at depth. Here, we determined the Michaelis-Menten kinetics and temperature sensitivity of three ubiquitous enzymes involved in carbon, nitrogen and phosphorus acquisition across a broad range of soil depths and temperatures, in soils from our field site in a mixed coniferous forest underlain by alfisols at Blodgett, CA. We observed that maximal reaction rates ( $V_{max}$ ) decreased with depth, whereas their affinities ( $K_m$ ) increased, indicating adaptation to lower substrate availability. Enzyme  $V_{max}$ , affinity and catalytic efficiency increased consistently with temperature, indicating higher SOM depolymerization potential with warming, although their temperature sensitivity ( $Q_{10}$ ) did not change substantially with depth. Also, the N-acquiring enzyme had much lower affinity and catalytic efficiency, suggesting that nitrogen is relatively less limiting to microbes than other nutrients. Moreover, we are investigating relationships and trade-offs between measured enzyme properties and genetic trait distribution/expression, and SOM chemistry, inferred from meta-omics data from the ongoing whole-soil profile warming experiment at Blodgett. This information will be used to test and validate the representation of depth-dependent microbial traits in biogeochemical models.