

The Promise and Pitfalls of Extracellular Enzymes as the “Bio” in Biogeochemistry

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Extracellular enzymes are ubiquitous across global terrestrial biomes and catalyze transformations of nutrient elements of C, N, P and S. In soils, extracellular enzymes reflect abiotic and biotic processes, notably microbial community dynamics, that are proposed to underpin soil health. Though measurements of enzyme activities stand to help functionalize the role of the soil microbiome in soil health, the study of soil enzymes has yet to fully deliver on their potential. Both methodological and conceptual improvements are needed to sharpen the accuracy of soil enzyme measurements and to make sense of measured activities. In particular, links among microbes, enzymes, and nutrient availability-limitation are theoretically promising but difficult to articulate. Challenges and opportunities toward capitalizing on the potential of soil enzymes to mechanistically ground microbial dynamics in soil health will be identified and discussed.