

## Soil and Environmental Microbial Ecology

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Microbes are essential for sustainable agricultural production and the bioremediation of contaminated ecosystems. Many microbial processes occur in and affect soil quality, which is considered to be an integrative indicator of environmental quality, food security and economic viability. Healthy soil supports extraordinary levels of biological diversity, nutrient cycling and resilience to disturbance. The use of microbial community structure and diversity as an indicator to monitor soil and groundwater quality is challenging due to insufficient understanding of the relationships that exist between microbial community structure, diversity and functionality.

We use biogeochemical methods to establish soil properties that serve as indicators of soil ecosystem health and functionality. We use metagenomics approaches to characterize the size and diversity of communities that are associated with the soil ecosystem under investigation. Our aims are to identify linkages between microbial species assemblages and their associations to soil ecosystem services. Basic understandings of the factors influencing microbial processes are critical to the comprehension of soil health and quality.

Our goals are to: (1) identify microbial community composition and diversity using culture and culture-independent techniques like DNA sequencing and Fatty Acid Methyl Ester (FAME) analyses, (2) assess several enzyme activities involved in C, N, P and S cycling to address soil biogeochemical and functional activities occurring, and (3) utilize the findings of goals 1 and 2 to determine linkages between the microbial assemblages and the functions they provide. The measurement of enzyme activities and phylogenetic characterizations of fungi and bacteria provide unique insights into the microorganisms contributing to biogeochemical cycling in soils, sediment and groundwater under pristine and contaminated conditions. Laboratory research will combine soil science, microbiology and metagenomics (including 16S and ITS rDNA sequencing and bioinformatics). Additional opportunities exist to collect samples from agricultural plots and local sites of interest.