

m-CAFÉs: Microbial Community Analysis and Functional Evaluation in Soils

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Project Goals: To derive mechanistic understandings of plant-microbe-soil interactions using reproducible, simplified ecosystems

The m-CAFÉs is a collaborative, coordinated and integrated, mission-driven program to interrogate the function of soil microbiomes with critical implications for carbon cycling and sequestration, nutrient availability and plant productivity in natural and managed ecosystems. The project targets molecular mechanisms governing carbon and nutrient transformation in soil, with a focus on microbial metabolic networks. We are developing precisely controlled ecosystem fabrications (EcoFABs) that reflect key functional attributes of plant-microbe interactions within soil, focusing on progressively increasing complexity that honor the physical, chemical and biological properties of soils. To interrogate microbial function in EcoFABs, we are pioneering CRISPR-Cas and environmental RNAi technologies to systematically determine functions of bacteria and fungi in the rhizosphere/soil. These approaches address the grand challenge determining the molecular basis of soil microbiome metabolism that governs the stabilization of carbon in soil. The m-CAFÉs team will test hypotheses about microbial functional roles within soil interaction networks in an iterative manner, by observing, recapitulating and manipulating rhizosphere/soil microbiomes to establish robust predictive models of microbial community function in soils. The results of these studies will be transformative for our understanding of soil metabolism and microbiome science, with applications to DOE missions in energy and environment.

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