Plant stability along a soil microbial diversity gradient

Background

Diversity at multiple biological levels plays an important role in shaping ecosystem stability, when undergoing environmental stressors such as drought. While both plant diversity and belowground microbial diversity are recognized as key drivers of plant productivity, their relative contributions to the stability of the ecosystem remain unclear. Microbial communities in particular may influence plant growth through nutrient cycling, resource availability, and stress alleviation. However, how variations in microbial richness as well as their functional strategies interact with plant richness to determine drought resistance, resilience and recovery remains unclear. This master project aims to examine the individual and combined effects of plant and microbial diversity on ecosystem responses to drought.

Key Questions

- How do plant diversity and microbial diversity contribute stability under drought?
- What are the respective roles of microbial species richness and functional growth strategies (fast, mixed, and slow) in influencing plant biomass during drought?
- Do interactions between plant diversity and microbial diversity have any additive of synergistic effects on ecosystem stability?

Methodology

This experiment aims to take place in parallel to the Hasli Outdoor Mesocosm Experiment (HOME), and to contribute to discovering part of the underlying mechanisms of the stability of plant communities in the context of global changes. As such, it will feature monocultures and 8-species communities of plants grown in a climate chamber, inoculated with varying levels of microbial species richness (monoculture, 4 species, and 8 species). Within the 4-species inoculation treatment, microbial communities will vary in functional growth strategies (fast, mixed, and slow-growing bacteria). This setup will be subjected to two treatments: a control, and a drought treatment. Plant shoot and root biomass will be measured as indicators of the stability of the community. By systematically varying microbial diversity and growth strategies, the study will disentangle the contributions of belowground diversity from aboveground diversity, focusing specifically on biomass responses under stress.

Key Readings

Ives, A. R., & Carpenter, S. R. (2007). Stability and diversity of ecosystems. science, 317(5834), 58-62.
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