



MAGIC

The rescue of beech by well-adapted mycorrhizal fungal partners – Do symbiotic interactions confer adaptive capacity to drought conditions?

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Summary —

Recent extreme climatic events, such as extended drought periods, impose serious threats to the functioning of forest ecosystems. **To date, the role of symbiotic plant–fungus interactions in response to drought is poorly understood** and its assessment requires an integrative framework linking genotypic, phenotypic, and environmental data from natural populations and experimental validation of in situ observations.

Our aim is to enlarge the knowledge gained from recent studies on natural beech populations to belowground adaptation processes. In particular, we need to know **whether the key mutualistic partners of forest trees are adapted to their local habitat and whether the trees and fungi form a co-adaptation complex that could confer nutrient and water supply benefits under adverse environmental conditions.**

First, we aim to identify gene networks responsible for beech adaptation to low water availability and high temperatures and to determine the role that associated ectomycorrhizal (ECM) fungal communities play in these adaptive processes by studying drought-affected beech at dry study sites. Second, we intend to infer patterns of local adaptation in the main ECM symbiont of beech, *Cenococcum geophilum*, by sequencing 280 strains from beech forests situated on a water availability gradient across Switzerland. And third, we want to develop simplified mycorrhization systems with beech seedlings and *C. geophilum* in the laboratory to be able to understand the effects of drought-adapted strains on the interaction with beech under diverse conditions.

MAGIC will provide knowledge on the adaptation of tree-fungal symbiotic partners to drought. In particular, **the role that well-adapted symbiotic partners play in the drought resistance and resilience of beech, a foundation species of European lowland forests.** The results will be of interest to evolutionary biologists, ecologists, plant breeders and foresters in the context of assisted migration strategies. **Predicting vulnerable tree populations in future climates is critical to help establish tomorrow’s forests.**