

Research Project

Common mycorrhizal networks: Impact on biodiversity, ecosystem functioning and sustainable land use.

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Project title Common mycorrhizal networks: Impact on biodiversity, ecosystem functioning and sustainable land use.

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The main topic in the current phase of our project concerns the mycorrhiza (Greek for "fungus-root"), arguably the most common but still largely enigmatic mutualistic symbiosis on land fulfilling a key role in terrestrial ecosystems: it is responsible for establishing the basic linkage of the plants as the primary producers of the biosphere to the soil and bedrock of the pedo- and lithosphere. In this symbiosis, the mycorrhizal fungi spread out in the soil with an intricate mycelial network, foraging for nutrients that are delivered to their plant partners in exchange for products of photosynthesis. These extended networks belowground exert also many other key functions for maintaining natural soil fertility such as preventing losses in the process of nutrient cycling, stabilization of soil structure counteracting erosion and sequestration of carbon in the soil. The mycorrhizal networks are known also to form linkages between roots of different plants. Currently our main interest is to explore interactions between such interconnected plants. Using isotope tracer techniques, we measure the investments of co-existing plants for the build-up and maintenance of common mycorrhizal networks and conversely, the return of these investments by the gain of mineral nutrients *via* these networks. We found that the returns of investments in shared networks are not necessarily balanced, with plants contributing much but profiting little and *vice versa*. We are particularly interested in the functioning of mycorrhizal networks shared between plants belonging to different functional groups (e.g. grasses, legumes etc.) where mutual facilitation has been observed. Moreover we want to assess the capability of plants to integrate in preformed mycorrhizal networks (e.g. seedlings, invasive plants, annual crops in agro-forestry and mixed-cropping systems) and to select the fungal species most rewarding for them as symbiotic partner when exposed to diverse fungal communities. To tackle such questions, we developed new molecular tools allowing a specific tracing of individual fungal strains in colonized roots. These techniques are of relevance also in the current endeavor to develop more sustainable agricultural systems demanding less input of mineral fertilizers by the use of mycorrhizal fungi as "bio-fertilizers".

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Published results

- 487772, Hildermann, Isabell; Messmer, Monika; Dubois, David; Boller, Thomas; Wiemken, Andres; Mäder, Paul, Nutrient use efficiency and arbuscular mycorrhizal root colonisation of winter wheat cultivars in different farming systems of the DOK long-term trial, 1097-0010, Journal of the Science of Food and Agriculture, Publication: JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)
- 487819, Krauss, M.; Berner, A.; Burger, D.; Wiemken, A.; Niggli, U.; Maeder, P., Reduced tillage in temperate organic farming: implications for crop management and forage production, 0038-0717, Soil Use and Management, Publication: JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)
- 487820, Tchabi, Atti; Coyne, Danny; Hountondji, Fabien; Lawouin, Louis; Wiemken, Andres; Oehl, Fritz, Efficacy of indigenous arbuscular mycorrhizal fungi for promoting white yam (*Dioscorea rotundata*) growth in West Africa, 0929-1393, Applied soil ecology, Publication: JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)
- 489051, Hildermann, Isabell, Performance of winter wheat cultivars in organic and conventional farming systems, Publication: Thesis (Dissertationen, Habilitationen)
- 489060, Börstler, Boris, Diversity of cultured isolates and field populations of the arbuscular mycorrhizal fungus *Glomus intraradices*: Development and application of molecular detection methods for mitochondrial haplotypes, Publication: Thesis (Dissertationen, Habilitationen)
- 489063, Thiéry, Odile, Molecular markers from the mitochondrial genome of arbuscular mycorrhizal fungi (Glomeromycota): evolutionary dynamics and application, Publication: Thesis (Dissertationen, Habilitationen)
- 489681, Börstler, Boris; Thiéry, Odile; Sýkorová, Zuzana; Berner, Alfred; Redecker, Dirk, Diversity of mitochondrial large subunit rDNA haplotypes of *Glomus intraradices* in two agricultural field experiments and two semi-natural grasslands, 0962-1083, Molecular ecology, Publication: JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)
- 489683, Thiéry, Odile; Börstler, Boris; Ineichen, Kurt; Redecker, Dirk, Evolutionary dynamics of introns and homing endonuclease ORFs in a region of the large subunit of the mitochondrial rRNA in *Glomus* species (arbuscular mycorrhizal fungi, Glomeromycota), 1055-7903, Molecular Phylogenetics and Evolution, Publication: JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)
- 1006532, Al-Yahya'ei, M.; Oehl, F.; Vallino, M.; Lumini, E.; Redecker, D.; Wiemken, A.; Bonfante, P., Unique arbuscular mycorrhizal fungal communities uncovered in date palm plantations and surrounding desert habitats of Southern Arabia, 0940-6360 ; 1432-1890, Mycorrhiza, Publication: JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)
- 1006540, Courty, Pierre-Emmanuel; Labbe, J.; Kohler, A.; Marcais, B.; Bastien, C.; Churin, J. L.; Garbaye, J.; Le Tacon, F., Effect of poplar genotypes on mycorrhizal infection and secreted enzyme activities in mycorrhizal and non-mycorrhizal roots, 0022-0957 ; 1460-2431, Journal of Experimental Botany, Publication: JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)
- 1006550, Mäder, P.; Kaiser, F.; Adholeya, A.; Singh, R.; Uppal, H. S.; Sharma, A. K.; Srivastava, R.; Sahai, V.; Aragno, M.; Wiemken, A.; Johri, B. N.; Fried, P. M., Inoculation of root microorganisms for sustainable wheat-rice and wheat-black gram rotations in India, 0038-0717 ; 1879-3428, Soil Biology and Biochemistry, Publication: JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)
- 1006553, Oehl, F.; Schneider, D.; Sieverding, E.; Burga, C. A., Succession of arbuscular mycorrhizal communities in the foreland of the retreating Morteratsch glacier in the Central Alps, 0031-4056 ; 1873-1511, Pedobiologia, Publication: JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)
- 1006554, Pritsch, K.; Courty, Pierre-Emmanuel; Churin, J. L.; Cloutier-Hurteau, B.; Ali, M. A.; Damon, C.; Duchemin, M.; Egli, S.; Ernst, J.; Fraissinet-Tachet, L.; Kuhar, F.; Legname, E.; Marmeisse, R.; Muller,

A.; Nikolova, P.; Peter, M.; Plassard, C.; Richard, F.; Schloter, M.; Selosse, M. A.; Franc, A.; Garbaye, J., Optimized assay and storage conditions for enzyme activity profiling of ectomycorrhizae, 0940-6360 ; 1432-1890, Mycorrhiza, Publication: JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)

1006561, Weiss, M.; Sykorova, Z.; Garnica, S.; Riess, K.; Martos, F.; Krause, C.; Oberwinkler, F.; Bauer, R.; Redecker, D., Sebacinales everywhere: Previously overlooked ubiquitous fungal endophytes, 1932-6203, PLoS ONE, Publication: JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)

1530011, Blum, Mathias; Gamper, Hannes A; Waldner, Maya; Sierotzki, Helge; Gisi, Ulrich, The cel-lulose synthase 3 (CesA3) gene of oomycetes : structure, phylogeny and influence on sensitivity to carboxylic acid amide (CAA) fungicides, 1878-6146, Fungal biology, Publication: JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)

1530013, Oehl, Fritz; Sieverding, Ewald; Palenzuela, Javier; Ineichen, Kurt; Alves da Silva, Gladstone, Advances in Glomeromycota taxonomy and classification, IMA fungus, Publication: JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)

1536969, Walder, Florian, Common arbuscular mycorrhizal networks: trade of carbon and soil nutrients between different plant species and their shared fungal symbiont, Publication: Thesis (Dissertationen, Habilitationen)

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