Jena School for Microbial Communication
Graduate School of Excellence

PhD project title: The Mycoremediation Potential of Ectomycorrhiza

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Abstract:
Fungal hyphae of ectomycorrhizal fungi grow three-dimensionally into the soil and by forming the mycelial network they create an enormous surface area for interaction with everything they encounter. Understanding hyphal interactions with soil particles, soil pollutants, microorganisms and the host tree are crucial for developing remediation strategies of contaminated field sites. Ectomycorrhizal fungi not only help trees to establish in toxic environments but also contribute to their role as soil stabilizers. This PhD project focuses on understanding ectomycorrhizosphere processes at the test fields Beerwalde and Gessenwiese on former uranium mining sites near Ronneburg, Thuringia. Soil from the test field is inoculated with mycorrhizal fungi to study the effects on soil erosion and soil aggregation. In column experiments the hyphal effect on soil aggregation and water retention will be analyzed. In soil, the hyphal network constructs a perfect habitat for bacteria, which in turn can contribute pollutant degradation capacities, support hyphal growth and the establishment of mycorrhizal symbiosis. In cocultures with rhizosphere bacteria, mycorrhizal fungi and host trees growing on soil, microbial interactions are studied. The reactions of the tested microorganisms to different environmental conditions are to be analyzed by means of qPCR and transcriptome analysis in laboratory experiments. Furthermore, soil from the field sites is used for metagenome and metatranscriptome analysis to depict a more realistic picture of microbial processes in the field.
By comparing and combining results from the field and laboratory experiments, strategies for a potential application of mycorrhizal interactions for mycoremediation of former uranium mining sites can be developed.