EGU2020-16574
https://doi.org/10.5194/egusphere-egu2020-16574
EGU General Assembly 2020

Re-colonization of sterile soil samples during long term field exposure

Michael Herre[1], Bernd Marschner[1], and Sven Marhan[2]
[1]Ruhr-University Bochum, Institute of Geography, Chair for Soil Science and Soil Ecology, Bochum, Germany
[2]University of Hohenheim, Soil Biology Unit, Hohenheim, Germany

The distribution of soil organic matter and microbial biomass in subsoils is much more heterogeneous than in the topsoil due to a more localized input of fresh substrate and nutrients from rhizodeposition and preferential flow paths forming hotspots of microbial activity. However, the remaining bulk soil also contains substantial amounts of labile substrates that are readily mineralized during lab incubation experiments. We therefore hypothesized that one reason for this is that potential consumers are spatially separated from these substrates due to the low microbial densities in subsoils. Consequently, hotspots are not only formed through high substrate inputs but also through a higher abundance and diversity of microorganisms compared to the bulk soil due to inputs of cells and spores with the soil solution or through hyphal growth. However, little is known about the colonization potential or dynamics of microorganisms in the subsoil.

In November 2018, we started a field experiment to investigate the re-colonization potential of microorganisms by exposing 24-well microplates containing sterilized soil samples in the field at two different depths (topsoil: 10 cm, subsoil 60 cm) at a beech forest site in northern Germany. After 6 and 12 months, samples from each well and from the intact soil compartments above each well were analyzed for enzyme activities (hydrolytic enzymes using MUF and AMC substrates), microbial activity parameters (soil respiration and SIR using the MicroResp®) and the microbial community structure (quantitative PCR).

We expect (1) different temporal dynamics of re-colonization between top- and subsoil samples; (2) that the recolonization potential is related to the microbial activity in the soil compartments above the exposed samples and (3) that the heterogeneous re-colonization is maintained throughout the field exposure and thus indicates the relevance of preferential flow paths for microbial transport especially in subsoils.

First results of the SIR assays after 6 months of field exposure show that in the topsoil microbial activity has been re-established in all of the wells, but is still below the mean activity in the undisturbed soil above the sterilized samples. In all subsoil samples, the re-established microbial activity was much lower and even below detection limit in some of the wells. In both depths, the SIR assays show a very patchy distribution of wells with higher microbial activities indicating that the influx of organisms is limited to small areas from the soil above the exposed containers.