Effects of tree dissimilarity on microbial biomass and respiration

Background:

Soil microbial communities drive important ecosystem functions and services such as decomposition of organic matter or nutrient mineralization (Bardgett and van der Putten 2014; Wall et al. 2015, Delgado-Baquerizo et al. 2016). Soil organisms and the processes they drive are closely related to the plant community composition (Eisenhauer et al. 2012; Kulmatiski et al. 2012). Previous work has shown that tree community composition and diversity drive microbial biomass and activity, and therefore, ecosystem functioning (Pei et al. 2016, Liang et al. 2016). However, studies on the underlying mechanisms are rare but are suggested to be often subjected to microenvironmental variations (e.g. temperature, humidity, or soil quality like nutrient limitations). These environmental conditions have been shown to be major drivers of the microbial community composition and functions. This present project aims to address this knowledge gap by linking tree diversity effects on soil microbial biomass and ecosystems functions in a controlled greenhouse experiment. By providing a controlled environment, we aim to highlight diversity effects on soil microbial biomass without been disturbed by variations due to the environment. In addition, a fertilization treatment with addition of phosphorus (i.e. the main limiting nutrient in the studied soil (BEF China)) will allow us to understand the effects of tree diversity on soil microbial biomass and respiration when the nutrient conditions are optimal. Finally, all soils have been sterilized before the experiment, by adding a microbial inoculum from BEF China we aim to investigate the interactions between the local microbial community and the tree diversity treatment on soil microbial biomass and respiration.

Method

A greenhouse experiment was set up within the framework of the BEF-China experiment. Twenty different pairs of tree species (i.e. 8 mono-specific pairs and 12 hetero-specific pairs) have been planted in two different soils (i.e. sterilized soil and a soil inoculum containing the microorganisms from the monocultures of the BEF-China experiment) and with (+phosphorus) and without fertilization. Overall, 240 tubes have been planted with 3 replicates for each treatment. Trees grew for 12 months in the greenhouse in controlled conditions.

Hypotheses

1- We expect tree diversity to increase microbial biomass and respiration
2- We expect tree diversity effects on microbial biomass and respiration to be enforced by nutrient limitation
3- We expect tree diversity effects on microbial biomass and respiration to be enforced by local microbial community inoculation

Master's student profile

We are looking for a master student in ecology with great interest in experimental ecological research. This project is a great opportunity to work on exciting ecological questions at the German Centre for Integrative Biodiversity Research (iDiv). The student will develop skills in lab techniques relevant to soil and microbial ecology.

We are looking for dedicated students with good organizational skills and an interest in soil and in the interaction between plants and soil microbial communities. Skills in the statistical software R or the motivation to acquire them are also required.

Tasks: (1) experimental sampling; (2) measure soil microbial biomass and basal respiration (SIR method); (3) measure soil substrate induced respiration (Microresp™ method); (4) run statistical analyses

Timing: From August 2020 to spring 2021 (to be discussed)

Fig. 1: Insight to the greenhouse with 1 m long tubes each planted with two trees from a sub-tropical forest in China (BEF-China).

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