Theme 5: Forests, Soil and Water Interactions

123 - Roots and Ecosystem Services

KG I - 1015 (Uni Freiburg)

IUFRO17-3691 **Adaptive root foraging strategies along a boreal-temperate forest gradient**

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Abstract: Tree root-mycorhizosphere plays a key role in resource uptake, but also in adaptation of forest to changing environments. We evaluated adaptive foraging mechanisms of ectomycorrhizal (EcM) and fine roots of Picea abies, Pinus sylvestris and Betula sp along a temperate to subarctic boreal forest gradient (38 sites between latitudes 48 ° N and 69° N) in Europe. We estimated the response of absorptive fine root biomass (EcM-FRB), root tissue density and %N, mycelia biomass in soil per root length unit (sEMM), changes in community structure of root-associated EcM fungi and rhizosphere bacteria in relation to climate, soil and stand characteristics.
We observed a significant increase of EcM-FRB per stand basal area towards boreal forests for all studied tree species, coinciding with longer and thinner root tips with higher root tissue density and decrease in sEMM. These changes were associated with a shift in community structure of dominating EcM fungi in coniferous forests as well as with lower number of bacterial phylotypes in the rhizosphere of fine roots in birch stands. Soil C:N ratio was a factor characterizing most of the variability in functional root traits and rhizosphere bacterial community structure. We suggest a conceptual multidimensional framework for adaptive foraging mechanisms of fine root involving both qualitative and quantitative changes in root-mycorhizosphere along climate and soil C:N gradients.

forests, root foraging, root-mycorhizosphere

KG I - 1015 (Uni Freiburg)

IUFRO17-2045 **Functional specialization of Eucalyptus grandis fine roots: contrasting potential uptake rates for nutrients in function of depth and soil fertility**

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Abstract: Little is still known about the role of deep roots in the nutrition of forest. We then studied the potential uptake of N, K and Ca by Eucalyptus grandis trees (2 years of age), in Brazil, as a function of soil depth and fertilization. Our hypotheses were: i) deep roots are more efficient than the shallow roots in potassium and calcium uptake compared to nitrogen ii) the specialization of the eucalyptus roots in nutrient absorption decreases when soil fertility is improved by fertilization. We injected NO3 -15N, Rb+ (analog of K+) and Sr 2+ (analog of Ca 2+) tracers simultaneously in a solution at 10, 50, 150 and 300 cm in depth. A complete randomized design was set up with three replicates of paired trees per injection depth and soil fertility. Recently expanded leaves were sampled at 70 days after tracer injection. Determination of foliar Rb, Sr concentrations and 15N atom% makes it possible to estimate the relative uptake potential (RUP) from the 4 soil depths and the Specific RUP, defined as RUP, per unit of fine root length density in the corresponding soil layer. The results being analysed will give insights into the functional specialization of roots in forests.

deep root, nutrient uptake potential,Eucalyptus

KG I - 1015 (Uni Freiburg)

IUFRO17-1430 **Root branching is a leading root trait of the plant economics spectrum in temperate trees**

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Abstract: Global vegetation models use conceived relationships between functional traits to simulate ecosystem responses to environmental change. Coordinated leaf trait variation is suggested by the leaf economics spectrum (LES), which separates species which invest into short-lived leaves with fast energy return from species with longer-lived leaves and slower return. While it has been assumed that being fast or slow is a general feature for all organs, the translation of the LES into a root economics spectrum (RES) for trees has been hitherto inconclusive. This may be partly due to the assumption that the bulk of tree fine roots have similar uptake functions as leaves, despite the heterogeneity of their environments and resources. In this study we investigated well-established functional leaf and stature traits as well as fine root traits (for different root orders) of 13 major temperate tree species of Central Europe, representing two phylogenetic groups (gymnosperms and angiosperms) and two mycorrhizal associations (arbuscular and ectomycorrhizal). We found reflected variation in leaf and lower-order root traits in some (surface areas and C:N) but not all (N content and longevity) traits central to the LES. Accordingly, the LES was not mirrored below-ground. We identified significant phylogenetic signal in morphological lower-order root traits. By contrast, root architecture was strongly influenced by the mycorrhizal association which developed independent from phylogeny of the host tree. In SEMs we show that root branching significantly influences both below-ground and above-ground traits which relate to resource investment and lifespan. We conclude that branching of lower order roots can be considered a leading root trait that relates to the mycorrhizal association type and below-ground resource acquisition; while the dominance of the phylogenetic signal makes morphological root traits less suitable for describing economics spectra among temperate tree species.

functional traits, mycorrhiza, root order

BOOK OF ABSTRACTS

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