

Tree species richness affecting fine root biomass in European forests

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Fine roots are an important factor in the forest carbon cycle, contributing significantly to below-ground biomass and soil carbon storage. Therefore it is essential to understand the role of the forest structure, indicated by tree species diversity in controlling below-ground biomass and managing the carbon pools of forest soils. We studied how tree species richness would affect fine root biomass and its distribution in the soil profile and biomass above- and below-ground allocation patterns of different tree species. Our main hypothesis was that increasing tree species richness would lead to below-ground niche differentiation and more efficient soil exploitation by the roots, resulting in a higher fine root biomass in the soil. We sampled fine roots of trees and understorey vegetation in six European forest types in Finland, Poland, Germany, Romania, Italy and Spain, representing boreal, temperate and Mediterranean forests, established within the FunDivEUROPE project for studying the effects of tree species diversity on forest functioning. After determining fine root biomasses, we identified the percentages of different tree species in the fine root samples using the near infrared reflectance spectroscopy (NIRS) method. Opposite to our hypothesis we did not find any general positive relationship between tree species richness and fine root biomass. A weak positive response found in Italy and Spain seemed to be related to dry environmental conditions during Mediterranean summers. At the Polish site where we could sample deeper soil layers (down to 40 cm), we found more tree fine roots in the deeper layers under species-rich forests, as compared to the monocultures, indicating the ability of trees to explore more resources and to increase soil carbon stocks. Tree species richness did not affect biomass allocation patterns between above- and below-ground parts of the trees.