FunDivEUROPE

Functional significance of forest biodiversity in Europe

Project number: 265171

Fine root production

FunDivEUROPE (FP7) field protocol

V1.0

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Content

1 Introduction

A large proportion of all sugars produced by plants are sent belowground to build root systems and fuel microbial processes. Hence, belowground organs are an important contribution to primary productivity, they are a significant source for soil organic matter, and thus, for the regulation of soil food webs and carbon sequestration. Despite the difficulties in sampling and quantifying root systems, it is therefore essential to include them in assessments of diversity effects on ecosystem functioning.

2 Scope and application

Both the fine root (diameter ≤ 2 mm) biomass and biomass production will be studied. This protocol explains the work related to the fine root production. There we test the hypothesis that total fine root production is greater in diverse forests because niche differentiation in space and time among co-existing species leads to more efficient exploitation of available soil resources in monocultures.

3 Objectives

The aim is to show whether fine root biomass production increases with tree species diversity and whether more carbon is allocated to fine roots in diverse compared to single tree species forests.

4 Location of measurements and sampling

4.1 Field sampling design

Fine root biomass production will be determined with the ingrowth bag method on the Satakunta and Kaltenborn Experimental plots and the HIPs (Highly Instrumented Plots) per focus region within the Exploratory Platform. The bags filled with root-free soil from the sites were installed on the experimental plots in Kaltenborn and Satakunta in August/September 2011 and the bags will be retrieved from the soil in August September 2013. The installation of the bags will be co-ordinated with the soil sampling for C/N stocks and fine root biomass. The installation of the bags in the HIPs of the exploratory plots was done concurrently with the soil sampling (see “Fine root biomass”), and the retrieval will be done one year after installation.

4.2 Number of replicates

Nine ingrowth bags per plot were installed. Each bag is 50 cm long (diameter 42 mm, mesh size 6 mm) and was installed as deep as possible with a maximum depth of 40 cm in mineral soil starting from the forest floor. The bags were filled with the root-free soil removed from the place where the bags are installed and consist of organic layer and mineral soil (0-40 cm or respective layer).

4.3 Sampling scheme

The bags were installed systematically on a grid established on the plots, dividing the 30 x 30 m core plot into nine 10 x 10 m subplots in which one ingrowth bag was installed at a distance of approx. 0.5 m from the soil sample. First a core sample was taken from the soil (inner diameter of the corer 36 mm, and outer diameter 42 mm, length 50 cm). The core sample was taken until 40 cm in the mineral soil if possible (if this was not feasible, then as deep as possible). The organic layer and mineral soil were kept separate and roots were removed from the mineral soil sample (by sieving and sorting out by hand). The ingrowth bag was put on a plastic tube (length 50 cm or longer and diameter 40 mm) and both were installed into the same hole where the core sample was taken from. The soil material was filled into the plastic tube which, at the same time, was lifted up, step by step. Thus the bag, filled with the root-free soil, remained in the hole. Then the organic layer was put back on the top of the hole. The bags are removed from the soil by digging out with a spade. The soil piece to be dug out has to include the ingrowth bag, and after digging out, the soil around the bag is carefully removed with a knife and scissors. Care is taken not to lose the roots grown inside the bags. Then the ingrowth bag is tightly wrapped into plastic wrap, and secured with adhesive tape, and then put into a box. The processing of the samples will be done on site. The soil cores are divided into horizons of 10cm intervals and living fine roots (diam. ≤ 2mm) will be extracted from the soil cores. The roots will be airdried before packing and sending to Metla Joensuu/Finland, and subsequent analyses.

4.4 Sampling equipment

Installing: ingrowth bags, soil corer, plastic tube for helping the installation into the soil, bucket, sieve, funnel, knife, ruler, table spoon, small shovel, hammer, field sampling protocol and template, pens. **Retrieving:** spade, bucket, scissors, knife, plastic bags, plastic wrap, tape, field protocol and template, pens, boxes for transportation.

4.5 Sample collection, transport and storage – quality control in the field and between plots and sites

The ingrowth bags taken from the soil have to be transported in a box (i.e. no plastic bags or sacks) for minimal disturbance or the soil cores. Processing of the samples will be done on site, where fine roots (diam. ≤ 2mm) will be extracted from the soil cores.

5 Measurements

The fine roots will be separated from the ingrowth bags on site. Subsequent analyses in Metla Joensuu/Finland include weighing and NIRS analyses, if the material is enough for the latter one.

6 References

Helmisaari, H.-S. & Makkonen, Kirsi 2006. Root biomass and necromass. Root ingrowth core method. In: Luster, J. & Finlay, R. (eds.) Handbook of methods used in rhizosphere research. Swiss Federal Research Institute WSL, Birmensdorf (online available at http://www.rhizo.at/download.asp?id=919)