FunDivEUROPE

Functional significance of forest biodiversity in Europe

Project number: 265171

Description of the understorey vegetation composition and quantification of the understorey biomass

FunDivEUROPE (FP7) field protocol

V1.0

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1 Introduction

Most of the plant diversity in European forests is found in the understorey, and despite its relatively low biomass compared to the forest overstorey, its functional importance is high. The understorey vegetation, for instance, is a potential nectar source for pollinators, provides habitat for small mammals, affects tree regeneration, invasion resistance and influences decomposition and nutrient cycling (Gilliam 2007). Relationships between overstorey and understorey diversity and composition, regeneration and invasion resistance will be tackled in collaboration with T.II.1 and T.IV.7, respectively. Furthermore, we will focus on the understorey impact on nutrient cycling along gradients of overstorey diversity. Here, the understorey vegetation is defined as all vascular species (woody and non-woody) smaller than 1.3 m (thus no mosses).

2 Scope and application

This sampling protocol aims at providing a consistent methodology to collect high quality, harmonized and comparable forest understorey vegetation data at the exploratory and experimental platforms of FunDivEUROPE. Harmonization of procedures is essential to enhance comparability of forest understorey vegetation data between the different sites of FunDivEUROPE. Protocols of ICP Forests (Canullo et al., 2010) and Futmon (http://www.futmon.org/index.htm) were used for the writing of this protocol to further enhance comparability between FunDivEUROPE and other research initiatives. All partners and site managers of FunDivEUROPE should follow the methods described here to minimise any potential bias caused by the sampling procedure.

Sampling of the understorey vegetation will be done in the experimental sites Satakunta, BIOTREE and FORBIO, and all of the exploratory sites of FunDivEUROPE. It includes identification and cover estimates of the species, quantification of the total biomass and chemical analyses (K, Ca, Mg, P, N and C).

3 Objectives

The main objective of the understorey vegetation assessment is to estimate the status and differences in diversity, biomass and nutrient stocks and status of plant communities between the plots at the exploratory and experimental platforms. Specific hypotheses to be tested are:

- Diversity and abundance of the understorey vegetation increases with increasing overstorey diversity in the canopy;

- Overstorey diversity effects on herb layer diversity and abundance are caused by a direct effect of canopy complexity and an indirect effect of the overstorey diversity on the humus layer dynamics;
- In turn, a more diverse and abundant understorey has a positive feedback on litter decomposition and nutrient cycling.

4 Location of measurements and sampling

4.1 Field sampling design and number of replicates

Exploratory sites: for each of the plots per focal region, the core plot will be divided in nine quadrants. In three quadrants, a subplot of 5 m x 5 m will be marked for identification and estimation of cover of understorey vascular plant species. Within this subplot, understorey vegetation will be clipped in a zone of 0.5 m x 0.5 m, where understorey vegetation is relatively abundant and where vegetation composition is representative for the whole subplot. This results in a total of 215 (plots) x 3 (subplots) = 645 subplots for identification of understorey vegetation, biomass sampling and chemical analyses.

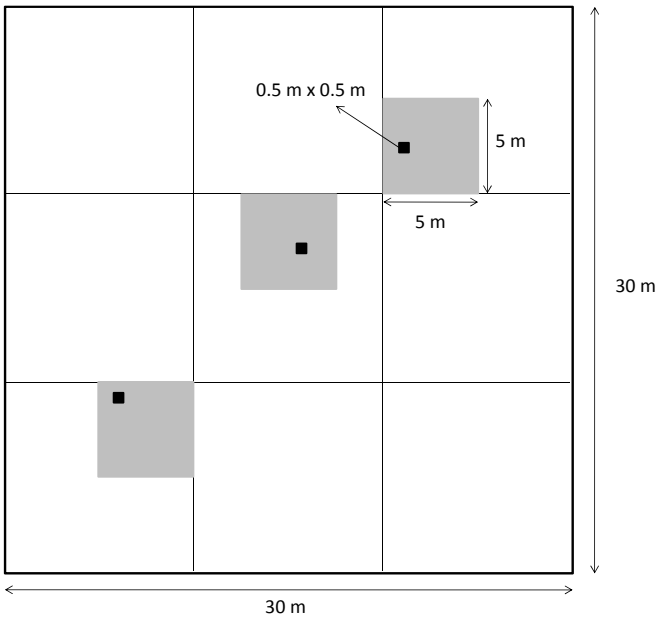

Figure 1: Each core plot (30 m x 30 m) will be divided into nine quadrants. In three quadrants, a subplot (5 m x 5 m, grey zones) will be marked. In each subplot, vegetation will be clipped in a representative zone of 0.5 m x 0.5 m (black zones).

Experimental sites: a similar sampling design will be used at the experimental sites Satakunta, BIOTREE and FORBIO, taking into account the design of former vegetation surveys at these sites.

The subplots should be placed as close as possible to the central quadrant. Location of subplots should exclude major heterogeneities at any scale of sampling (tree trunks, tracks and paths, streams and ponds, peaty pools, boulders and cliffs…). Thus, terricolous plants growing on mineral and organic soil of the undisturbed forest floor will be represented.

4.2 Sampling equipment

Clipping shears to clip understorey vegetation

Paper bags to store biomass

Labels

Small herbarium press for species that could not be identified in the field

4.3 Frequency and time of sampling

The frequency and time of sampling should take in consideration: 1) the occurrence of vernal species, such as Crocus, Scilla and Galanthus; 2) maximum biomass values. This may imply more than one sampling, for example spring for communities dominated by vernal ground flora but later in summer for grasses, sedges and rushes. Also evergreen vegetation shedding leaves in mid-summer will need to be sampled later, when new canopy is fully developed. However, for logistical reasons only one sampling period per exploratory region is scheduled. We will, however, try to optimize as much as possible criteria 1) and 2).

One hour per plot per person is needed for cover estimations and clipping of the vegetation.

Early summer 2011:

- Experimental Platform Satakunta, BIOTREE, and FORBIO;
- Sampling will probably take seven to ten days in each platform.

Spring and summer 2012:

- Exploratory Platform;
- One single campaign in an Exploratory Platform will probably take two weeks.

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

A squared subplot of 5 m x 5 m is marked out on the ground and all understorey vegetation within the subplot is identified and % cover of each occurring species is estimated. For species that cannot be identified in the field, a voucher specimen is collected and dried in a herbarium press for later identification. Next, a small frame of 0.5 m x 0.5 m is placed within

this subplot at a location where vegetation is relatively abundant and composition is representative for the subplot. All above ground parts of the vegetation passing through this small frame are cut at ground level using a pair of shears. A 'projectional' approach should be adopted: plant parts (of plants rooted inside the frame) which grow outside of the frame are omitted from the study. Likewise, plant parts (of plants rooted outside the frame area) which grow into the frame are included. The samples of each subplot are stored separately in durable paper bags to be transported for further treatment.

Sites should be provided with drying ovens to dry clipped biomass. Afterwards, oven-dried biomass samples have to be stored in a dry place before shipping. For the biomass storage of the circa 100 samples of one exploratory site about 1 m^3 will be needed. For the experimental sites Satakunta, BIOTREE, and FORBIO, about 4 m^3, 3 m^3, and 2 m^3 is needed, respectively.

No trees have to be tagged. At least, the corners (and the central point) of each plot should be registered in order to be able to retrace the subplots in the future.

5 Measurements

Vegetation subplot

- *General (per subplot):*
  - Total cover of shrub (> 1.3 m and stem < 7.5 cm diameter) and tree layer (stems > 7.5 cm diameter (% of sampling area)
  - Total cover of the understorey vegetation (% of sampling area)
  - Total cover of mosses (% of sampling area)
  - Total cover of bare soil (% of sampling area)
  - Total cover of litter (% of sampling area)

- *Specific for each species (per subplot):*
  - Species name
  - Cover of each species in the vegetation subplot (% of sampling area)
  - Maximum height of the species in the subplot (cm)
  - Phenological phase present in the subplot (vegetative/flowering/fruiting)

Biomass subplot (within vegetation subplot)

- Species name
- Cover of each species in the biomass subplot (% of sampling area)

6 References

Canullo R, Starlinger F, Granke O, Fischer R, Aamlid D (2010) Assessment of ground vegetation. Manual Part VII, 18 pp. In: Manual on methods and criteria for harmonized sampling, assessment, monitoring and analyses of the effects of air pollution on forests. UNECE, ICP Forests Programme Co-ordinating Centre, Hamburg [http://www.icp-forests.org/Manual.htm]

Gilliam, F.S. (2007) The Ecological Significance of the Herbaceous Layer in Temperate Forest Ecosystems. BioScience, 57, 845-858.

http://www.futmon.org/Fieldprot.htm

Data sheet template

Site:

Site name:
Plot ID:
Subplot ID:
Sampling date:
Person responsible for sampling:

Vegetation subplot (5m x 5m):

Total cover of the tree layer (% of sampling area):	
Total cover of the shrub layer (% of sampling area):	
Total cover of the understorey vegetation (% of sampling area) (projectional approach):	
Total cover of mosses (% of sampling area) (on forest soil, not on rocks nor stem feet):	
Total cover of litter (% of sampling area):	
Total cover of bare soil (% of sampling area):	

Species name	Cover (%)	Max. height (cm)	Vegetative/flowering/fruiting?	Comment

Biomass subplot (0.5 x 0.5m):

Species name	Cover (%)	Comment