FunDivEUROPE

Functional significance of forest biodiversity in Europe

Project number: 265171

Litter decomposition and nutrient cycling

FunDivEUROPE (FP7) field protocol

V1.0

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By Stephan Hättenschwiler, Centre National De La Recherche Scientifique

Content

1 Introduction

The aboveground plant litter input constitutes a main resource of energy and matter for an extraordinary diverse community of soil organisms connected by highly complex interactions. Recycling of carbon and nutrients during decomposition is a fundamentally important ecosystem process having a major control over the carbon cycle and over nutrient availability, and consequently plant growth and community structure.

Tree species composition significantly affects decomposition and ecosystem nutrient cycling directly through the production of litter of species-specific quality, and indirectly through plant root activity and microenvironmental conditions. Distinguishing these different controls of tree species diversity on decomposition is essential for a mechanistic understanding of biodiversity effects on decomposition and nutrient recycling.

2 Scope and application

By using plot-specific litter mixtures of different qualities and a standard substrate in the form of wood sticks and cellulose paper in all plots, tree diversity related litter quality control and microenvironmental control of decomposition are separated.

3 Objectives

The main objective is the quantification of carbon turnover and nutrient release during litter decomposition and how these processes are influenced by changing tree diversity. Doing these measurements across the broad range of sites included in FunDivEUROPE will also allow assessing the role of climatic variables and soil types and their interactions with tree diversity on litter decomposition.

This information will help to understand the relative impact of tree diversity and environmental conditions on litter turnover, C sequestration in soils and nutrient mineralization.

Combining litter decomposition assessed here with litter production aboveground stand-level productivity and root biomass production, this task will help to achieve an integrated view on how tree diversity affects elemental cycling and productivity.

4 Location of measurements and sampling

4.1 Number of replicates

Experimental Platform: Decomposition will only be assessed at the sites in Finland (Satakunta, one site) and in Germany (BIOTREE – Kaltenborn). Number of replicates depends on planting design:

Finland, Satakunta: Three litterbags per plot x 38 plots = 114 litterbags
Three wood sticks per plot x 3 time series x 38 plots = 342 woodsticks
Three cellulose papers per plot x 3 time series x 38 plots = 342 cellulose papers

Germany, BIOTREE Kaltenborn: Three litterbags per plot x 16 plots = 48 litterbags
Three wood sticks per plot x 3 time series x 16 plots = 144 woodsticks
Three cellulose papers per plot x 3 time series x 16 plots = 144 cellulose papers

Exploratory Platform, all sites: Three litterbags per plot x 40 plots x 6 sites = 720 litterbags
Three wood sticks per plot x 3 time series x 40 plots x 6 sites = 2160 woodsticks
Three cellulose papers per plot x 3 time series x 40 plots x 6 sites = 2160 cellulose papers

Estimated samples per campaign:
For each harvest time, 120 litterbags (one harvest), and 120 wood sticks and 120 cellulose papers (three harvests) will be sampled per site of the Exploratory Platform. For the Experimental Platforms it will be 114 litterbags, wood sticks and cellulose papers in Finland and 48 litterbags, wood sticks and cellulose papers in Germany.

4.2 Placement of litterbags, wood sticks and cellulose papers

Litterbags, wood sticks and cellulose papers will be placed randomly in three blocks (corresponding to the three replicates) close to the centre of each plot assuring equal influence of natural litterfall from the different species constituting the specific plot.

4.3 Sampling equipment

Litterbags, wood sticks, and cellulose papers will be prepared in Montpellier and dispatched with a clear manual for field installation to each site.

4.4 Frequency of sampling

According to the site-specific harvest protocol send along with litterbags, wood sticks and cellulose papers to each site.

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

Litterbags, wood sticks and cellulose papers will be collected for each replicate separately, stored in plastic bags for transportation from the field site to the storage room/lab. Once in the lab litterbags, wood sticks and cellulose papers will be gently rinsed and cleaned with tap water to remove adhering soil particles, invertebrates, plant roots and other debris. After washing litterbags, wood sticks and cellulose papers will be put individually in carefully labelled paper bags (each replicate in an individual paper bag) and dried at 65°C. Once dry, paper bags should be stored dry and shipped to Montpellier.

4.6 Measurements

Except of grinding the samples, all further activities and measurements will be done in Montpellier on dried samples shipped to Montpellier. Because grinding of this huge amount of samples is a very time consuming activity, it may eventually be shared among different laboratories.

In the laboratory, remaining dry mass of litterbags, wood sticks and cellulose papers will be determined by weighing. In the following, all litter samples are ground in order to establish a NIRS database allowing the determination of some key litter chemistry traits of decomposed material.

According to initial litter quality measurements, these traits include C, N, carbon quality (van Soest profile), and eventually P.

5 Template for a data sheet

Exploratory / Experimental site	Sampling date	Collector	Plot No.	Diversity level (no. tree species)	Block No.	Litter type	Dry weight (g)
FIN	31.10.2013	Adam & Eva	32	5	3	Wood stick	0.456