FunDivEUROPE

Functional significance of forest biodiversity in Europe

Project number: 265171

Quantifying species richness and abundance of exotic plants, and monitoring growth and survival of exotic seedlings

FunDivEUROPE (FP7) field protocol

V1.0

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Content

1 Introduction

It is often hypothesized that diversity begets resistance against invasions owing to niche pre-emption and competition. However, observational studies usually reveal a positive relationship between diversity of native and exotic species. This may be caused by co-varying extrinsic factors, e.g. habitat heterogeneity or resource availability, that influence diversity of both native and exotic species and mask any effect of diversity on invasibility. Based on diversity experiments conducted on a local scale, effects of these confounding factors can be avoided, and experiments replicated in different regions will allow generalizations about the diversity-invasibility relationship. Furthermore, comparisons of observational and experimental data obtained across the same study sites will reveal the relative importance of diversity versus co-varying environmental factors for the invasibility of ecosystems.

2 Scope and application

This sampling protocol will provide a simple, consistent and robust methodology to quantify invasibility of forest ecosystems using (A) observational data on spontaneously occurring exotic species, and (B) experimental data on the establishment rate of planted individuals of exotic species. Since the same subplots will be used for the assessment of understorey vegetation (page **Fehler! Textmarke nicht definiert.**), invasion success of exotic species in terms of cover, abundance or establishment rate can also be related to diversity and productivity of the herb layer.

3 Objectives

The main objective of the study is to test the hypothesis that resistance of forest stands to invasions by exotic species is causally related to the diversity of resident tree species.

In particular, we will investigate:

1) Whether susceptibility to invasions (in terms of number and abundance of invasive species) decreases with increasing taxonomic or functional diversity of forest stands;

2) Whether plantations of, or invasions by exotic tree species facilitate further invasions by other exotic species (invasional meltdown);

3) Whether the importance of biological invasions in forests correlates with climatic conditions, and increases from the boreal to the Mediterranean zone.

4 Location of measurements and sampling

4.1 Field sampling design and replicates

A. Cover of exotic herbaceous species and number of seedlings and juveniles of exotic woody species

Estimation of cover of exotic herbs and of abundance of exotic woody seedlings will be done on exactly the same subplots that are used for the description of understorey vegetation (page **Fehler! Textmarke nicht definiert.**):

Exploratory sites: Each core plot will be divided in four quadrants and in each quadrant, a subplot of 2 m x 2 m will be marked resulting in four replicates per plot. This results in a total of 6 sites x 40-50 plots x 4 replicates = 960-1200 subplots. Within each subplot, we will determine the cover of exotic herb species, and count the number of seedlings and sapling (< 1.3 m) of exotic woody species.

Experimental sites: We will apply the same sampling design at each plot of the Satakunta tree diversity experiment (163 x 4 subplots), the BIOTREE experiment (117 x 4 subplots) and the FORBIO experiment (84 x 4 subplots).

B. Growth and survival of exotic tree seedlings

Exploratory sites: To determine how resident tree diversity affects establishment of exotic tree seedlings, we will establish additional 2 m x 2 m subplots on c. 30 plots in each of the six Exploratory sites. Within each subplot, we will plant pre-grown seedlings of exotic tree species. For each subplot, we will supply a planting scheme where the ID of each planted individual is indicated.

The particular species will be previously discussed with site managers, and carefully selected according to the following criteria: we will avoid any aggressive invaders, select species typical for the particular region, and the plants should be easy to remove. Survival and growth (in terms of shoot length and number) will be monitored each subsequent year, and the surviving seedlings will be harvested at the end of the funding period to determine their dry mass and remove them completely.

4.2 Sampling equipment

Rulers will be used to measure height of planted seedlings. For the final harvest, we use shears to clip planted seedlings, and paper bags to store and to dry them. Shovels are needed to remove main roots of these individuals.

4.3 Frequency of sampling

A. Cover of exotic herbaceous species and number of seedlings and juveniles of exotic woody species

Sampling will be done together with the quantification of understorey vegetation (page **Fehler! Textmarke nicht definiert.**) in early summer 2011 for the three Experimental Platforms, and in spring/summer 2012 for the six Exploratory sites.

B. Growth and survival of exotic tree seedlings

Seedlings will be planted in fall 2011. Once in spring and once in summer of each subsequent year (2012, 2013, 2014), survival of seedlings will be monitored and their size will be measured. In summer 2014, the seedlings will be harvested and their dry mass will be determined.

5 Measurements

- Cover of each exotic herbaceous species in each subplot (in percent of the sampling area);
- Number of seedlings and juveniles of each exotic woody species in each subplot;
- Height and number of shoots of planted seedlings;
- Above-ground dry mass of planted seedlings.

6 Data sheet templates

A. Cover of exotic herbaceous species and number of seedlings and juveniles of exotic woody species

Site:

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

Species code	Cover (%)	Number of new seedlings (in case of woody species)	Number of juveniles <1.3 m (in case of woody species)	Comment

B. Growth and survival of exotic tree seedlings

Site:

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

Species code	Seedling ID	Height (mm)	Number of shoots	Comment