Project Database of ICP Forests
PROJECT DESCRIPTION

PROJECT INFORMATION

Project title: Seed C 2 – Carbon allocation to fruits and seeds in European forests as a function of climate, atmospheric deposition and nutrient supply

Project ID: 91

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Introduction

Climate and atmospheric deposition are affecting tree growth and carbon allocations in forests. While tree stem growth is partially increasing in Europe, allocation to crown foliage seems to decrease. Mast and seed years seem to increase in frequency (Övergaard et al. 2007, Paar et al. 2011). The question of how global warming, increased nitrogen deposition and CO_2 concentrations are influencing the frequency and intensity of seed production is highly important for the estimation of forest development under global change. The proposed project intends first to estimate the reoccurring fruit and mast years of the main European tree species using the available large-scale ICP Forests data base (level I plots) and literature studies of the main European tree species, i.e. common beech, Norway spruce, Scots pine and oak species. In a second step the Swiss and the European ICP Forests level II plots with available litterfall, crown condition and tree growth data will be used to quantify the amount of carbon that is allocated in different years to stem wood growth, leaf/needle growth and seed and cone production. Out of a wide range of hypotheses for the occurrence of mast years three need to be mentioned: the resource allocation or economy of scale hypothesis, the pollination efficiency hypothesis and the predator satiation hypothesis (Kon et al. 2005, Kelly and Sork 2002). These are not exclusive and several of them may hold at the same time (Kon et al. 2005).

The objectives of the study are:

- To statistically analyse climate and deposition related interactions in relation to fruiting, stem growth and foliage estimates
- To develop simple carbon allocation models for the above mentioned factors for different species

Data

Studied species are European beech, Norway spruce, Scots pine and oak species.

Phase I

Data from the ICP Forests data base: fruiting occurrences derived from tree crown assessment, proportion of trees with observed fruiting. Modelled climatic data and deposition data from EMEP (see also Solberg et al. 2009).

Phase II

Data from the ICP Forests data base: litterfall data to obtain the total annual (March until March) fruit and flower compartment, leaves and needles per main species, 5 year tree growth data and annual tree stem circumference data, annual crown assessment data, nitrogen deposition data, mean monthly temperature and precipitation data (for detail the see the manual of ICP Forests 2010). Data may be optimised by adding data sets from countries not involved in the ICP Forests data base.

Phase III

Analysis of cause-effect relationships between climate, soil fertility and deposition, prior masting years and competing above-ground C allocation by application of mixed effect models accounting for temporal autocorrelation. Application of spatial analysis for the tree level I data following a method presented by Calana et al. 2011 using a method for zeroinflated observations such as no fruiting years. Application of statistical prediction models, developed for a subset of the data, and data set validation.

Expected results

Description of the relations between fruiting / seeding, litterfall, stem growth and foliage in the main tree species of European forests. Derivation of driving factors for mast year occurrence in the main tree species

Expected products

One scientific publication for each of the three evaluation phases is planned. Final results report as well as progress report after one year for the Cost Action.

References

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