Project Database of ICP Forests
PROJECT DESCRIPTION

PROJECT INFORMATION

Project title: Determinants of local diversity across spatial scales: the significance of absent species

Project ID: 3

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Our main objective is to discover the role of large- and local-scale processes on maintaining local-scale diversity in forested ecosystems in a European scale. Specifically, we hypothesize that understory species diversity in European forests is determined by different interlinked factors that act at contrasting spatial scales.

Species diversity is among the most important topics of conservation and restoration ecology. Nowadays, it is recognized that species diversity in a local community is dependent on both, regional (i.e. large-scale) and local (i.e. small-scale) processes related with evolutionary history, environmental heterogeneity, human influence and species interactions. However, there are few studies testing the relative influence of these contrasting factors at continental or world spatial scales. One of the main problems for the lack of these studies is the difficulty to found consistent local-scale species diversity data according to factors such as sampling design, grain (i.e. plot size) and methods. Therefore, the ICP-Forest database of "biodiversity and ground vegetation" supposes an invaluable tool to test important hypotheses of biodiversity maintenance an European scale, providing useful results for biodiversity conservation and management at this spatial scale.

There are multiplicities of factors that can influence forest understory species diversity at continental scales. Firstly, past events determine the evolution of species in different regions due to the different climatic and topographic conditions across Europe, determining the regional species pool. Secondly, the large-scale environmental heterogeneity (mainly topography) and the human interaction determine the distribution of suitable habitats (i.e. forests) for these species. Finally, the local environmental conditions and the interaction among species (mainly facilitation and competition) can potentially determine the presence or absence of the different species in each specific location. Therefore, three scale levels, biogeography (**level A**), landscape (**level B**) and local conditions (**level C**), shall be considered to understand diversity maintenance in a given locality.

We aim to model the simultaneous, and interlinked, influence of these factors acting at contrasting spatial scales to understand its influence on local species diversity. The climatic conditions, mainly temperature and precipitation (Haylock et al. 2008; van den Besselaar et al. 2011), and the classification of biogeographical regions in Europe according to the European Environmental Agency (http://www.eea.europa.eu/data-and-maps/data/biogeographical-regions-europe-2005) can be used to obtain large-scale data (**Level A**). The Digital Elevation Models of Europe (http://www.eea.europa.eu/data-and-maps/data/digital-elevation-model-of-europe) and the Corine type Habitat distribution map of the European Environmental Agency (http://www.eea.europa.eu/data-and-maps/figures/dominant-landscape-types-of-europe-based-on-corine-land-cover-2000-1), as well as forest distribution maps from the Joint Research Centre of the European Commission (http://forest.jrc.ec.europa.eu/forestmap-download) and a map of the human footprint (Sanderson et al. 2002) can be used to obtain the regional-scale data (**Level B**). The databases of crown conditions, soil data and ground vegetation of the ICP-Forest project (http://www.icp-forests.org/) will be used as the local-scale (**level C**) and species diversity data. Specifically, we are interested in the data of the 776 ICP-Forest level II plots where soil and ground vegetation data is available (Fischer et al. 2010). Since the crown condition, forest type and tree dominant species can be also important factors driving diversity we are also interested in the crown condition database for the above mentioned 776 plots. We will use the data in accordance with the "intellectual property and publication policy" of the ICP-Forest (Lorenz 2010).

We will develop different explanatory variables to reflect the influence of the above mentioned factors and relate them with the local scale species diversity. However, instead of using the classical value of species richness or diversity indexes as response variable we will use the recently developed concept of local:dark diversity ratio (Pärtel et al. 2011). The advantage of this concept is that we account for local species richness but also for the influence of absent species, an important concept in conservation biology since it can reflect extinction processes. Since we expect that the different factors will be interlinked, we will use Structural Equation Modelling to account for the simultaneous influence of the different contrasting factors. Moreover, we can also account for direct and indirect (i.e. through the modification of a third factor) influences on local diversity values.

Species diversity is a fundamental characteristic of ecological communities, and thus understanding the mechanisms involved in its maintenance is of primer importance for conservation biology. A global or continental-scale strategy to conserve and maintain diversity needs global or continental approaches to understand the factors that influence it. Analyses of local-scale data in a continental perspective are thus of great utility, and the use of consistent local datasets a warranty to obtain reliable results. Therefore, we think that the applicability of the ICP-Forest dataset to test our hypothesis supposes a great opportunity to understand diversity patterns and develop conservation and management plans in a continental scale.