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The EcoChange Project

Aim and Focus

The aim of EcoChange is to assess and forecast changes in terrestrial biodiversity and ecosystems. The project will assess the ability of biodiversity and ecosystems to supply humans with required goods and services and to buffer against climate and land use change.

The project concentrates on the one hand on the improvement of models and the generation of new data. On the other hand it will integrate the findings with socio-economic analysis. The work is organised within six activities.

Project information

EcoChange - "Challenges in assessing and forecasting biodiversity and ecosystem changes in Europe" is an Integrated Project with 22 Partners from all across Europe. It is supported by the 6th Framework Programme of the European Union.

Contract number: FP6-036866

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The consortium of EcoChange is led by the National Centre for Scientific Research (CNRS), Grenoble, France. Project Co-ordinator: Pierre Taberlet, pierre.taberlet@ujf-grenoble.fr



Investigating the Stability of Plant Niches and Communities

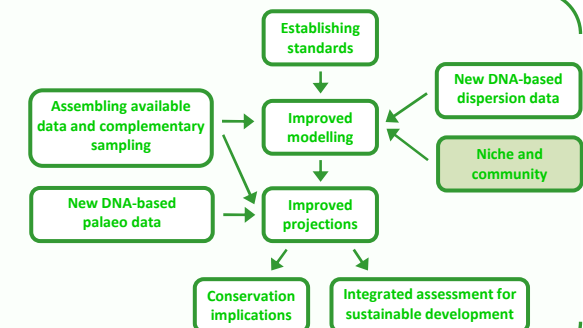
Work Description of EcoChange Activity 4

Activity 4 addresses changes in biodiversity and plant species distribution in time and space. Is current species distribution along environmental gradients (like temperature) comparable with the distribution several thousand years ago? Is species distribution along environmental gradients similar in different regions of Europe? Information about particular species will enable us to understand how whole plant communities change over time and space. This information will serve us as a basis to forecast more precisely possible effects of climate change on biodiversity.

EcoChange Briefing Sheet

Activity 4 Establishing Standards

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Overview

A debate has been going on whether the ecological requirements of species (so-called ecological niches) are rather stable in time, or whether a niche is labile and constantly adjusting. The same question might be asked with spatial aspects in mind: Is the ecological niche of a species similar across its whole distribution area, or do ecological requirements differ, say, in the southern and northern limits of its distribution area?

Niches can be labile in time and/or space due to two reasons:

1. Niches may differ due to the so-called local community context – i.e., the lack or presence of particular plant neighbours may result in different ecological requirements of a particular species.
2. Niche lability may be due to evolutionary changes – i.e., species adapt to environmental shifts resulting in a gradual change of the particular niches in the course of time.

Having information about the stability or lability of ecological niches in time and space, one may make guesses about the way how ecological communities are organised and how they change in a changing environment. As a result, we may be able to understand how biodiversity varies in changing environments. This in turn enables us to better forecast biodiversity changes under a changing climate.

Objectives

Activity 4 aims at answering three main questions:

1. We would like to check whether ecological niches of plant species are *stable in time*. The main question in this context is: Has the distribution of particular plant species along environmental gradients been the same over thousands of years?
2. We would then like to study whether ecological niches are *stable in space*. Here we aim at answering the following question: Is the distribution of plant species the same in different regions of Europe, given that environmental conditions (e.g. temperature) are the same?
3. Our conclusions from the first two questions will help us to assess whether plant communities have been assembled similarly throughout recent history and across different regions of Europe.

Approaches

In order to study niche stability *in time* we shall address ancient plant distribution with the help of pollen analysis, as well as with ancient DNA analysis from the soil. The work will build on the results of the Activities 2 and 3 (please refer to the according briefing sheets).

During the past 20,000 years, the Earth has undergone a major glacial event followed by a major global warming. Some species failed to adapt to these global climate changes in terms of cooling/warming and/or changes in water availability. Others have survived and spread throughout the continent. For assessing niche conservatism, we will focus on species that survived the glacial time. We will quantify the past climate changes since the last glacial maximum period (around 18,000 years ago) and depict if their past distribution reflects their current niches, and vice versa. This task is expected to evaluate the relationship between the past climatic changes and the occurrence (or not) of the species in their present-day distribution areas.

The stability of niches *in space* will be studied by comparing the distribution of the same plant species along the same environmental gradients (like temperature) in different regions of Europe. In our work we will focus on the Alps and the Arctic region. We shall also analyse the similarities or differences between contemporary and ancient plant communities, as well as between communities across Europe.

Expected results

Based on the results of this EcoChange Activity we expect to receive confirmation of how stable plant communities are in time and space. This knowledge is essential when trying to build models that aim at predicting future changes in biodiversity under possible future climate change.

Publications

- Pearman, Peter B. et al., 2007. Niche dynamics in space and time. *Trends in Ecology and Evolution* 23/3, p. 149-158
- Pearman, Peter B., et al., 2008. Prediction of plant species distributions across six millennia. *Ecology Letters*, 11, p. 357–369