Stay informed – get involved!

Briefing Sheets inform every six months on the progress within the activities and can be downloaded from our website. If you are interested in receiving the *EcoChange newsletter* on a six month basis, please subscribe to ecochange@seri.at or register on our website. You will then also get an invitation to the stakeholder workshop in summer 2011, where EcoChange results will be discussed with the public.

Find more information at www.ecochange-project.eu!

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

Project duration: January, 2007 - December, 2011

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

CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE

Imprint: SERI Nachhaltigkeitsforschungs und -kommunikations GmbH, www.seri.at

EcoChange

Briefing Sheet Series
July 2008

New DNA-based Palaeo Data

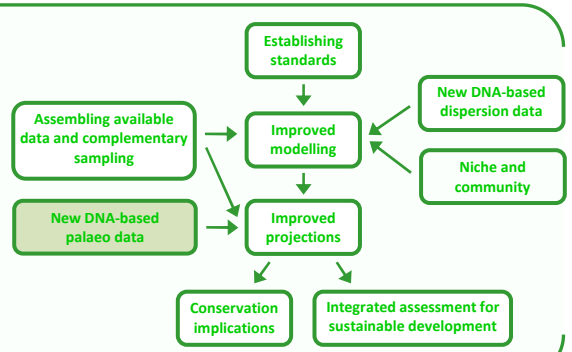
Work Description of EcoChange Activity 2

In order to learn how climate change might impact upon plant communities, models are required that can simulate future changes. Validation of these models can be done by comparing model simulations with independent data (i.e., data not used to inform the model experiment). One approach is to simulate past conditions and compare model predictions with radiocarbon-dated palaeobiological data. Activity 2 uses new DNA-based approaches to collect data on past Arctic plant communities, which will form the basis for such validations. A second focus of Activity 2 lies in assessing age and importance of clonal plants in a range of ecosystems, particularly in relation to the role of niche stability in structuring ecological communities.

EcoChange Briefing Sheet

Activity 2
New DNA-based Palaeo Data

Activity Leader
Mary Edwards
University of Southampton, GB
m.e.edwards@soton.ac.uk



Overview

Models and future scenarios are used to simulate possible future changes in natural systems, e.g. the impacts of climate change on plant communities' growth and species composition. To make these models useful for decision and policy makers their performance needs to be tested and the uncertainties in their predictions clarified. Until now, the validation of models has often been insufficient, as it has been performed internally on a pseudo-independent data set sampled from the same study area, or by re-sampling the training data set. Thus currently it may be unwise to base risk assessments on such models.

A powerful approach that can to some extent overcome the above shortcomings is to validate models by projecting them into the past and comparing them with independent indicators of past conditions. Previously this has been applied to climate models – here we use the approach with models that describe ecological processes. The approach must avoid reliance on using the same dataset (for example fossil pollen values) to represent past plant communities and also to derive or validate palaeoclimatic datasets. In cold-climate regions, a new type of palaeobiological archive is now available: ancient DNA (aDNA) in cold or frozen sediments and soils, which reflects the plants growing at a location in the past. The DNA-based record of plant community composition, dated using radiocarbon techniques, promises a method of verification of ecological model predictions that removes the potential circularity described above.

In addition, it is important to evaluate temporal niche stability and the likelihood that plants can persist through time, even in adverse conditions, without migrating to more favourable habitats. Some of the uncertainty in future predictions relates to the fact that models are typically constructed on the assumption of no change in the niche over time and that there is an immediate response to climate change (no resilience). Clonal plants may be highly resilient to environmental change. For example, individuals of the high-alpine sedge Carex curvula are over 2000 years old and persisted in situ through the changes of the Little Ice Age and Medieval Optimum. DNA fingerprinting of clonal plants can be used to determine clone age, which may reach to centuries or millennia.

Objectives

The main objectives of this activity are to:

- produce a DNA database containing 80% of current Arctic vascular plant species
- obtain ancient plant DNA from permafrost sediment samples in order to reconstruct past plant communities
- assess age and importance of clonal plants in various ecosystems and explore the effects of clonality on community structure
- design research protocols and systems for rapid DNA analysis

Approaches

EcoChange Activity 2 is developing a DNA-based approach to palaeoecology; the technique has been tested successfully in northern Norway on modern soils and vegetation. Samples of aDNA are being assessed using novel molecular marker techniques, which are species-specific and rapid to deploy. The work will represent the first large-scale DNA-based reconstruction of past plant communities. Samples range up to 500,000 years old and come from several geographic regions.

Activity 2 will use DNA fingerprinting techniques to study at least four clonal plants in one or more key ecosystems. This will allow us to estimate the persistence of various clonal species under the cooling and warming trends of the last millennium and assess the effect of clonality on ecosystem functioning.

Expected results

- a DNA database of 800 Arctic plant species has been created and is described in a publication submitted to *Systematic Biology*
- protocols for aDNA extraction and high-throughput analysis
- a collection of sediment samples from the Arctic analyzed for age and past plant community composition
- data on clonal plant persistence and its role in ecosystem functioning