klimaat voor ruimte
climate changes spatial planning

A2: Strategies for optimising the nature conservation potential of the Dutch National Ecological Network and the surrounding multifunctional farm landscape under predicted climate change scenarios

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Climate change and habitat fragmentation

Since climate is a key driving force for ecological processes, climate change is likely to exert considerable effects on current biodiversity conservation goals. Indications for impacts were found in many species over a wide range of taxa (Parmesan and Yohe 2003, Thomas et al 2004). One of the major concerns (e.g. IPCC 2001a) is that nature can not adapt adequately, because the rate of climate change is unprecedented and because the effects of climate change are expected to be aggravated by habitat deterioration and **fragmentation** and by spatial barriers (Opdam & Wascher 2004). The Dutch National Ecological Network (EHS) is a strategy to conserve biodiversity in a highly fragmented landscape, which is under heavy pressure of increasing economy and growth of human population. The EHS with it's core areas, nature restoration areas and robust corridors, still under construction – 2018 is the targeted completion year - is the backbone of Dutch nature policy. This creates opportunities for adaptation: **We cannot stop climate change, but we can adapt the landscape to enhance biodiversity.**

The **general aim of the project** is to identify ecological risks of climate change for targeted species in the EHS, as well as effective options to adapt the EHS and the surrounding landscape to minimize these risks. Specific aims:

1. to explore and quantify the potential risks and opportunities of climate change for populations of a selection of targeted **plant** (project A2.2) **and animal species** (project A2.3) in the EHS, as a firm empirical basis to build the risk management strategies on.
2. to explore the potential risks and opportunities of climate change for the **genetic adaptability** of targeted plant and animal species in fragmented populations to changing climate (project A2.4)
3. adapting existing methodology by **integration and generalization** of these results to ecosystems and target species (eco-environmental profiles) (project A2.5)
4. to explore how and where **multifunctional agricultural landscapes** can be adapted to minimise the risks of climate change to nature values in the EHS (project A2.1).
5. to identify where in the EHS loss of nature quality is at risk or is likely to increase, and **design effective spatial strategies** to solve these problems or profit from these opportunities (project A2.6). These strategies will be input for project IC3 'Designing natural land use adaptation and mitigation strategies under changing climate conditions'.

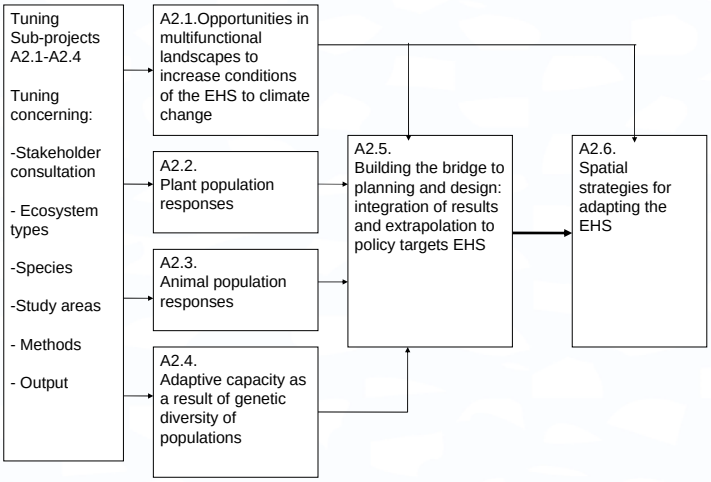

Figure 1: Structure of the project

Aims of the subprojects

A2.1 OPPORTUNITIES IN MULTIFUNCTIONAL LANDSCAPES: To explore the contribution of multifunctional agricultural landscapes to nature values in the light of climate change and agricultural policy.

A2.2 PLANT POPULATION RESPONSES: To assess the effects of land use and climatic changes on the distribution range and occurrence of plant species in the Netherlands, to assess factors that limit adaptation in plants, and to determine and evaluate the consequences of such changes for nature policy targets.

A2.3 ANIMAL POPULATION RESPONSES: To analyze changes in population distribution and densities of selected species in relation to climate change, including increased weather variability, and habitat fragmentation. Interpret the results in terms of vulnerability to climate change in different ecosystems and under different degrees of habitat fragmentation.

A2.4 ADAPTIVE CAPACITY AS A RESULT OF GENETIC DIVERSITY OF POPULATIONS: To explore how changes in the spatial structure of the EHS can contribute to maintaining the genetic diversity under scenario's of climate change.

A2.5 INTEGRATION OF RESULTS AND EXTRAPOLATION TO NATURE POLICY TARGETS EHS: Integration and generalization of the project results as generated in 2.1-2.4 into a tool box for application. In the projects 2.2 to 2.4 a detailed analysis is performed, for plants, birds and butterflies, to get insight into the characteristics of species and landscapes, including genetics. As a result, data are produced about species where problems are to be expected due to either temperature rise or increased weather variability. In this project, these results, in close cooperation with the other sub-projects, are extrapolated to other species, including target species for the EHS. Rules of thumb and standards for application in landscape planning are derived. Weak spots in the national ecological network are identified with the tool kit thus obtained.

A2.6 SPATIAL STRATEGIES FOR ADAPTING THE EHS: To develop generic adaptation strategies for the EHS, focussing on ecosystem types most affected by climate change, to determine relative benefits and costs of potential alternatives, and indicate regions of the EHS where application is effective and profitable. This outcome is input in the integrated project IC3.

Description of the project

The project has six sub-projects, which interact in the following way (see figure 1). Project A2.2, A2.3 and A2.4 are focussed on knowledge development, and aim at finding an empirical basis for risk assessment of climate change for biodiversity. We focus on plants, birds and butterfly species as these groups represent a broad spectrum of life history traits in relation to habitat fragmentation and climate change pressures. Within these groups a further selection of species and study areas was made during plenary sessions at the start of the project, as an important prerequisite for cooperation between the project parts. Together the projects carry out an extensive literature survey and empirical analysis of factors that determine the relative vulnerability of species and species groups and they explore future risks using climate change scenarios (developed under Theme 1 of the Climate for Space Programme) and population models.A2.5.

In Project A2.5 the results derived from species population (including genetic) responses to climate change are integrated and extrapolated to risks for nature policy targets. Eco-environmental profiles incorporate species characteristics of climate change susceptibility and fragmentation susceptibility. Simulation models generate guidelines for 'climate change proof' ecological networks, possible weak points in the EHS and adaptive strategies.

Project A2.1 studies the effects of climate change on land-use, focussing on how changes in multifunctional land-use might generate opportunities to contribute to nature policy targets. The results of this study form input for Project A2.5 and A2.6. In project A2.6 an analysis is made to determine which spatial adaptation strategies of the EHS and the adjacent agricultural landscape can be followed successfully to solve potential problems due to climate change.

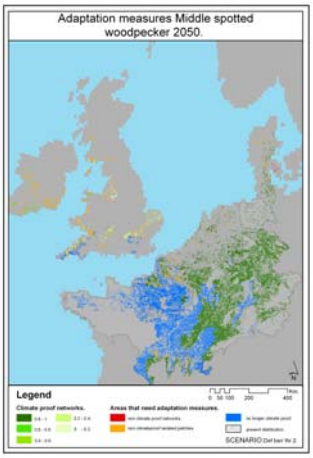

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Figure 2: Example of project A2.5 output; identifying weak spots in ecological networks. In this related project funded by INTERREG IIIB North West Europe of a.o. Alterra and Environmental Change Institute, climate envelope model results (SPECIES model) that predict suitable distribution ranges as a function of climatic factors for 2000 and 2050 were compared and combined with habitat maps based upon Corine land cover data. Dispersal models and ecological network assessment methods were then used to identify networks that need adaptation measures. See for details www.branchproject.org

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