The Dutch flora in a changing environment

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Introduction

Natural areas in The Netherlands have become highly fragmented. Nature reserves often lack spatial cohesion and connection, which severely limits the dispersal abilities of many plant and animal species.

The main strategy to conserve biodiversity in the highly fragmented Dutch landscape is the national ecological network (NEN) (fig. 1). This ecological network, however, has been designed before climate change became an important issue. To counteract negative effects of fragmentation and climate change on biodiversity, spatial cohesion of nature areas has become even more crucial. The general aim of this project, therefore, is to identify the ecological risks of climate change for the distribution and dispersal of target plant species within the NEN, as well to identify effective options to configure the NEN and the surrounding landscape to minimize these risks. We will use metapopulation theory to study the colonization-extinction dynamics of plant species and determine their potential dispersal capacities in a changing environment.

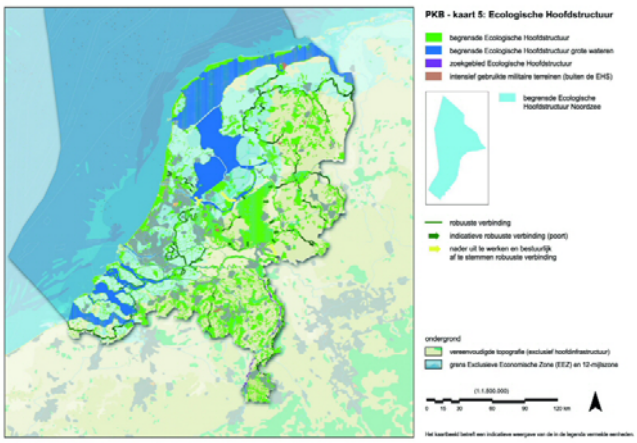

Figure 1: The design of the Dutch Ecological network

Two case studies

Since colonization and extinction processes are key parameters of the metapopulation theory, we will first perform studies on colonization-extinction dynamics in different ecosystems. One of the case studies focuses on the colonization of Dutch IJsselmeer polder forests by forest understory plants. These polders have recently been reclaimed from the sea and thus provide an unique opportunity to study plant colonization processes. The forests can be considered as distinct patches occurring scattered in the landscape, separated by largely unsuitable habitats (fig. 2). We have performed field surveys in 2006/07 and will compare these to field surveys from 1993. As these forests differ in age and distance to the main land, these data should allow us to gain insight in the colonization process, i.e. the dispersal rate of plant species in a fragmented landscape and the importance of plant traits, soil characteristics and other factors that may affect the colonization process.

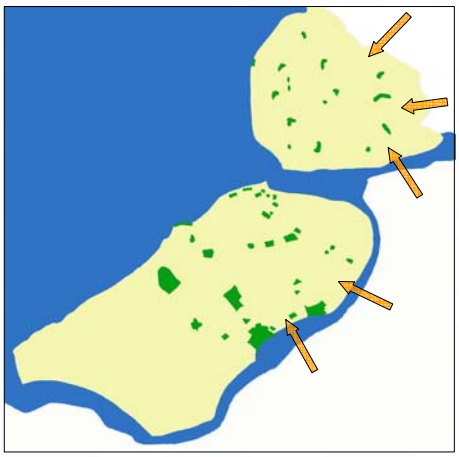

Figure 2: Surveyed forests (green) on land recently reclaimed from the sea (yellowish). The arrows show potential colonization routes from the main land (white) to the new polders.

Another case study focuses on the relationship between colonization-extinction dynamics and climate change. Tamis et al. (2005) showed an increased occurrence of thermophilic plant species in the Netherlands during the last 20 years (fig. 3). We aim to study the potential expansion of thermophilic plant species in more detail by differentiating between different types of ecosystems and study the abundance of the new species within the vegetation. We will use the Dutch Vegetation database, which comprises over 400000 descriptions of the species composition of small permanent plots. We aim to determine if ecosystems differ in their susceptibility to invasion and if the invading thermophilic species show an increase of abundance at the expense of native species.

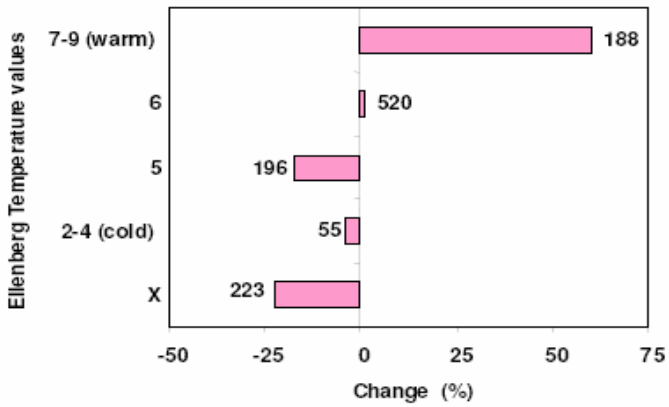

Figure 3: Mean relative change (%) in measured frequency of plant species in relation to Ellenberg temperature classes from 1980-2000. Bars are labelled with number of species used for calculation.

Objectives

Studying colonization-extinction dynamics and dispersal rates in natural plant populations should provide a better understanding of the applicability of the metapopulation theory as a tool for the conservation of plant populations. Due to the direct link between the NEN and metapopulation theory, our work will also provide insight into the functioning of the NEN for plant species, now and under future climate change scenarios.

References

Tamis W.L.M., van 't Zelfde M., et al. (2005). "Changes in vascular plant biodiversity in The Netherlands in the 20th century explained by their climatic and other environmental characteristics." Climatic Change 72: 37-56.