

Estimating the climatic adaptation capacity of habitats and the adequacy of the Hungarian National Ecological Network to support the adaptation



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Introduction

According to most climatic projections (e.g. IPCC 2007), future climate of the Pannonian biogeographic region will tend to be more arid and warm, with an increase in the frequency of extreme climate events. The extent of changes in temperature and precipitation will demand rapid adaptation capacities from plant and animal communities. Among the several forms of adaptation to changing environmental conditions, one is migrating to more suitable sites. A precondition to migration is the existence of corridors or stepping stones between originally occupied sites, and sites to be colonized. Due to human activity there has been a redoubtable decrease in the natural connectedness of most habitat types, which, however, has never been quantified for the Pannonian region.

Questions

1. How well are various habitat types connected with adjacent habitats of similar species pool, i.e. what is the rate of isolation of the occurrences. Is it likely that the species of the habitats will be able to adapt to climate change by migrating from one location to the other?
2. Does the National Ecological Network provide adequate spatial protection of the corridors of migration for species of the various habitat types?

We sought answer to our questions with the following presumptions:

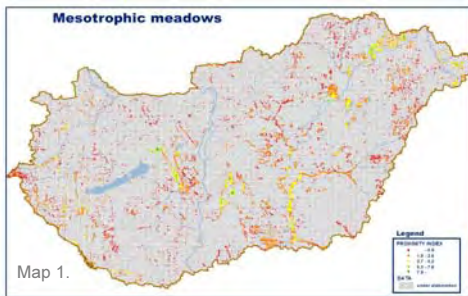
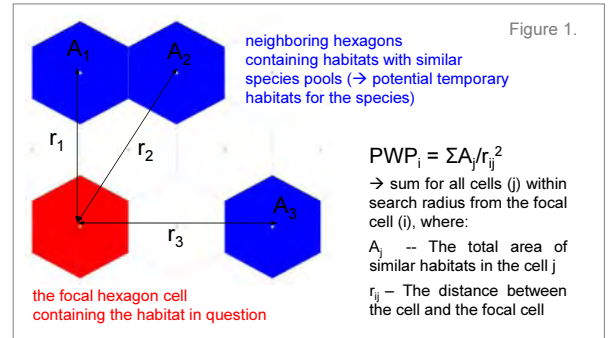
1. We observed the landscape from the perspective of intermediately vagile species (capable to disperse over 5-20 km's)
2. We assess connectivity for the starting phase of the projected climate changes (when the actual network of habitats is still close to its initial state).

Materials and Methods

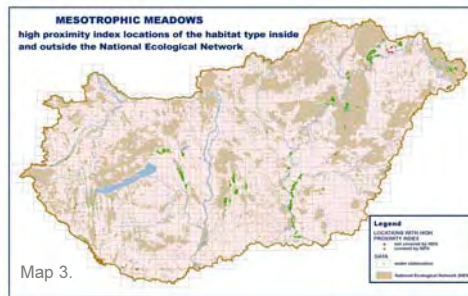
The project „Landscape Ecological Habitat Mapping of Hungary” has been launched in 2002 to survey all remaining semi-natural habitats in Hungary. The resulting MÉTA database, 90% complete to date, classifies Pannonian habitats into 86 habitat types and contains spatially referenced data on a 35 hectare hexagon grid. In this study we selected two typical and widespread Pannonian grassland habitat types, *Mesotrophic meadows* (MÉTA code: D34, Natura 2000 code 6440: and *Artemisia salt steppes* (MÉTA code: F1A, Natura 2000 code: 1530).

A pixel-wise proximity index (PWP) was calculated for the cells containing the studied habitat types (Figure 1.). Search radius was limited to 20 kms to decrease calculation costs. This limitation does not affect PWP values significantly, as the effect of relevant habitat occurrences decreases with the square of the distance. Analyses were run separately for the two habitat types in ArcGIS 9.1 (ESRI). Individual habitat occurrences were classified according to their PWP value as *isolated*, *poorly connected*, *moderately connected*, *well connected* or *completely embedded* (classification boundary values were determined on a series of theoretical model landscapes). To assess the degree of coherence between the efforts of official nature conservation and the inherent landscape dynamics suggested by our results, we compared the distribution of studied habitat types to the National Ecological Network (NEN) of Hungary.

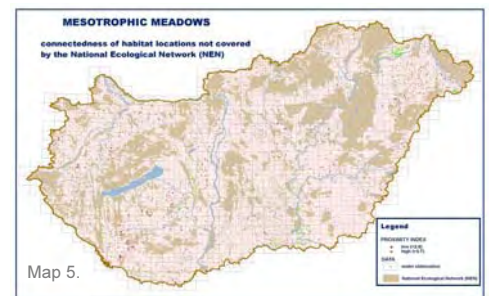
This particular study focuses on solely two habitat types out of the 86 that are differentiated in the MÉTA database. Our future aim is to perform a similar analysis on the remaining habitat types.



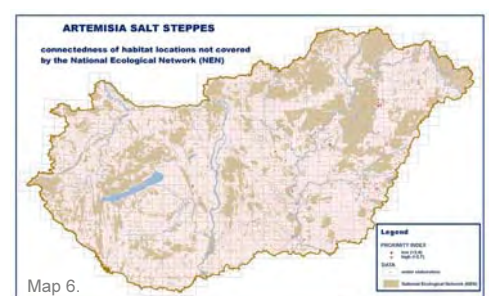
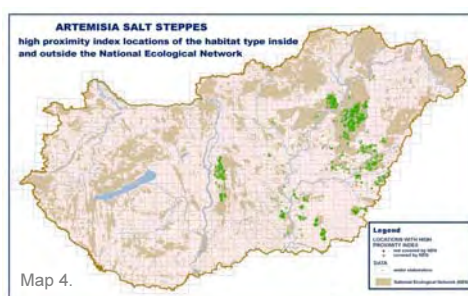
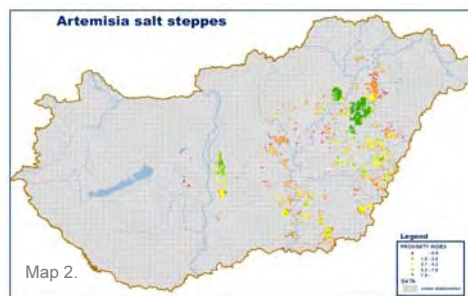
Maps 1. and 2. The connectedness of *Mesotrophic meadow* and *Artemisia salt steppe* habitats in Hungary, based on pixel-wise proximity index (PWP). Higher PWP values reflect better connectedness.



Maps 3. and 4. At least moderately connected (PWP > 2.6) *Mesotrophic meadow* and *Artemisia salt steppe* occurrences, inside (green) and outside (red) the National Ecological Network of Hungary.



Maps 5. and 6. The connectedness of *Mesotrophic meadow* and *Artemisia salt steppe* occurrences lying outside the National Ecological Network of Hungary.



Discussion

Mesotrophic meadows are dispersed and isolated with the exception of few locations, and thus - according to this analysis - species dependent on this habitat type face a high risk of disability of adapting to changing environmental conditions, including climate change, via migration to more suitable location

Artemisia salt steppes are less isolated than *Mesotrophic meadows* in general, but appear to be well connected only in locations where several thousand hectares form a larger cluster

The Hungarian National Ecological Network apparently covers the majority of those locations where the connectedness is still relatively good, and hence helps to conserve landscape's potential to support the migration of species. On the other hand, isolated occurrences outside the Ecological Network exhibit low connectedness, and are therefore unlikely to act as important network elements.

Nevertheless, low connectedness (in terms of PWP) does not necessarily imply low migrational response of the affected species. The actual migrational response is also dependent on the inherent vagility of the species

Currently the NEN represents the lowest form of spatial protection in Hungary. Since our result show that NEN supports the connectivity of the habitats to a considerable degree (thus fulfilling its intended goal), we argue that the protection level of NEN should be strengthened.

Acknowledgements

The authors wish to thank the more than 200 surveyors that contributed to the setting up of the Habitat Database of Hungary. The research project received funding from the State Secretariat for Nature Conservation of the Hungarian Ministry of Environment and Water.