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Biodiversity and Landscapes: Where is the missing link?

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Summary

Around 15 years ago, the term ´Anthropocene´ was popularized by Nobel Prize-winning meteorologist Paul J. Crutzen, who described a new era of human induced global environmental change that put an end to the Holocene epoch with beginning of the industrial revolution in the late 18th century. Hence, the adverse consequences of this development regarding global biodiversity pools are manifold either being caused by direct actions such as urbanization, land transformation and associated land use change among others or insidiously affecting our biosphere by ever-increasing CO2 emissions. Accordingly, my dissertation (Kuttner 2015) conflates a series of scientific articles that are dealing with various human-induced impacts that affect both ecosystem functioning and biodiversity patterns on different spatial scales. At this, I refer to the ´Pattern and Process paradigm´ which basically states that landscape structure is always reflecting its underlying processes. As the inherent geometrical attributes of basic spatial units that constitute a landscape, i.e. landscape elements can be quantified by certain indices, they may in turn being used as a toolset to assess certain ecological key functions a landscape is able to provide for local biodiversity as well as human society.

There is a broad consensus that habitat loss and landscape fragmentation are critically contributing to local extinctions, as habitat loss reduces the carrying capacity and associated fragmentation additionally aggravates dispersal and gene flow within landscapes of interest. Additionally, underlying feedback mechanisms that have been triggered by human induced global change processes which in turn affect biodiversity along with ecosystem service provision, are thus indirectly falling back to society as well (Chapin et al. 2000). Although ecosystem services are usually emphasizing on human well-being, they may also act as indirect measure of biodiversity as Cardinale et al. (2012) revealed a strong interconnectedness between the magnitude of 'provision' and 'regulation' services and biodiversity. In this concern, landscape connectivity appears to be a key point interlinking these aspects, as for many ecosystem services the degree of connectivity across the landscape of interest is directly or at least indirectly affecting the magnitude of service provision, e.g. the effectiveness of pollination and pest regulation as well as water regulation and the flow of nutrients amongst others (Mitchell et al. 2013).

In this context, various case studies have been conducted in the Neusiedler See – Seewinkel region and adjacent Hungarian areas. In particular, they are addressing the development of a rule set to quantify ecological key functions based on landscape structural parameters (Kuttner et al. 2013); a new and fine-scaled assessment on major ecosystem services landscapes are able to provide for human well-being (Hermann et al. 2014); a comparison if landscape structure is able to recapitulate ecosystem service provision throughout protected and unprotected areas (Kuttner et al., 2014) and a spatially explicit assessment to estimate ecosystem service potential among the region (Hainz-Renetzeder et al. 2015).

In the scientific fields of landscape ecology and nature conservation, one major restraining factor that limits spatially explicit research assessments on broader scales is the availability of comprehensive and recent base datasets. Although advances in remote sensing, data processing and storage capacities have facilitated the emergence of new environmental raw data, the issues of data validation and subsequent post-processing still remain. As part of my dissertation I present the results of a combined approach including spatial data aggregation and harmonization from various sources complemented by additional modelling steps to establish a new habitat distribution map which covers the eastern alps and adjacent regions (Kuttner et al. 2015). This spatially and thematically fine scaled map facilitates application within a broad range of research fields such as ecological modelling or network planning and allows, for example, comparative analysis on composition and configuration of certain key land cover classes among different conservation areas or between areas inside and outside of nature reserves. The map may also be used in various planning and feasibility studies to e.g. optimize trans-regional conservation measures such as ecological corridor planning between major protected areas.

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