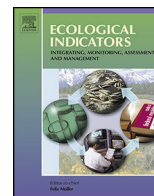




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Assessment framework for landscape services in European cultural landscapes: An Austrian Hungarian case study

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ARTICLE INFO

Article history:

Received 21 May 2012

Received in revised form

13 November 2012

Accepted 18 January 2013

Keywords:

Landscape services

Ecosystem services

Assessment framework

Mapping

Capacity Matrix

Spatial reference framework

ABSTRACT

European cultural landscapes are characterised by a high level of anthropogenic fragmentation which is known as a major reason for the loss of biodiversity in industrialised countries. To receive support for adequate choices in sustainable landscape planning, information on the spatial distributions of landscape functions and services is needed. Therefore, the objective of this study was to develop an integrative assessment framework to evaluate a wide range of landscape services at different spatial scales. The proposed methodology was applied within the cross-border region of Austria and Hungary. Embedded in a spatial reference framework we assessed and visualised five main landscape services within the investigation area: *regulation, habitat, provision, information and carrier*. Considering location and spatial extent three different levels of service assessment were distinguished: (1) the Landform Approach was based on seven different Landform Types within the study area. All services were directly observable either by the use of Corine land cover or by clearly identifiable spatial indicators. (2) The Broader Habitat Approach focused on the assessment of services at the landscape element scale within randomly selected landscape sample sites. It was based on the use of an expert driven capacity matrix, which values were revised by semi-quantitative data gained from field work. (3) The *information* services occurring at a broader scale were assessed at the Landscape Character Type scale within the Socio-cultural Approach. Additional indicators mainly based on geo-data were defined. Finally, all services were extrapolated to the Landform Types revealing the actual landscape service provision within the study area. The results presented hot and cold spots of service provision at different spatial scales as well as the trade-offs between the different services. The landscape service maps might provide regional stakeholders with valuable information on service supply and can therefore be used as knowledge basis in cross-border landscape planning decision processes. Making landscape services spatially explicit and combining empirical data with spatial information presents an innovative approach to landscape research in the field of assessing and visualising landscape services. This would enable the development of a decision support tool, which can be used for the systematic evaluation of goal attainments and conflict detection.

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1. Introduction

European cultural landscapes are known to provide a wide range of functions and services that are useful for humans. However, the supply of ecosystem services and biodiversity is threatened, mainly caused by a high level of habitat loss and fragmentation (MEA,

2005). One reason for the loss of ecosystems in cultural landscapes is the lack of integrating ecosystem service values in regional spatial planning projects. The ecosystem service concept is therefore aiming at supporting the development of policies and instruments by integrating ecological, socio-cultural and economical perspectives to provide insights into human impacts on ecosystems and the welfare effects of management policies (TEEB, 2010). This scientific concept has experienced increasing attention in the last decades as it provides the means of documenting the importance and benefits of ecosystems and landscape for human society. One of the most relevant publications is the *Millennium Ecosystem Assessment* (MEA, 2005) which provides the basic framework for assessing the interactions between ecosystems and humans and

Abbreviations: LFT, Landform Type; LCT, Landscape Character Type; BHT, Broader Habitat Type; BHS, Broader Habitat(type) value; LESV, Landscape Element Service value.

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how these can be measured, evaluated and strengthened for future human well-being. After the release of the Millennium Assessment (MEA, 2005), which focused on the benefits people derive directly and indirectly from ecosystems, the literature concerning ecosystem services has increased exponentially all over the world (Fisher et al., 2009). Several authors have been dealing with classifying, quantifying, mapping and valuing of ecosystem services in order to integrate the concept into decision making processes (e.g. Costanza et al., 1997; Daily, 1997; de Groot et al., 2010; Fisher et al., 2009; Hermann et al., 2011). However, despite the enhancing interest in ecosystem service research, still many open questions remain to fully integrate the ecosystem service concept in landscape research and decision making.

Because landscape sciences focus on spatial pattern and scale, they can provide useful insights into how the spatial distribution of human activities influences important landscape processes and structures from which services are derived (Jones et al., 2008). The central notion in landscape development has always been that people are part of the landscape and that landscapes are changed for their benefit (Antrop, 2001; Linehan and Gross, 1998). Especially, in Central and Eastern Europe both the analysis of landscape pattern and processes and the assessment of landscape functionality as a basis for land use planning have a long tradition (Bastian and Schreiber, 1994; Buchwald and Engelhardt, 1968; Lee et al., 1999). In recent years, the terms 'landscape function and service' have become more important in literature (Bastian and Schreiber, 1999; de Groot et al., 2010; Willemen et al., 2010). To receive support for adequate choices in landscape planning, information on the spatial distributions of landscape functions and services is needed. Although in the last years considerable progress has been made in assessing, quantifying and mapping a multitude of landscape services, implementing the concept into sustainable landscape planning and management still remains a challenge (Hermann et al., 2011; Norgaard, 2010). Regarding

the state-of-the-art, better insight into interactions between land cover, use and function and methods to assess and map land use and landscape function is still needed (e.g. Verburg et al., 2009). Visualisation should illustrate the spatial heterogeneity in quality and quantity of services provision, which is due to differences in biophysical and socioeconomic conditions at different scale levels (Meyer and Grabaum, 2008; Wiggering et al., 2006). Therefore, landscape services are to be addressed and assessed on various scales (Hein et al., 2006). Assessing and mapping the multitude of services provided by different landscapes at different scales is seen as prerequisite for sustainable landscape management (Verburg et al., 2009). This would enable the development of a decision support tool, which can be used for the systematic evaluation of goal attainments and conflict detection. As assessing and mapping of services is mainly dependent on data availability and finding the appropriate indicator, most publications focused either on selected landscape services and/or emphasised only on one assessment scale (e.g. Burkhard et al., 2009; Troy and Wilson, 2006; Willemen et al., 2008). An integrative framework that takes a wide range of ecosystem/landscape services into account is still under development. Such a framework should be comprehensible, feasible and able to be applied at wide range of scales to different ecosystems or landscapes (Hein et al., 2006). We want to meet these challenges by the development of a framework which will link the processes in the landscapes with the services provided at different scales.

The aim of this paper is therefore to present a spatially explicit methodology evaluating a broad set of landscape services by meeting the following research objectives: (i) mapping the hot and cold spots of service provision within different landscape types (ii) visualising the trade-offs between the services within the investigation area (iii) testing the concept of landscape services as an operational tool to evaluate ecologically sensitive regions.

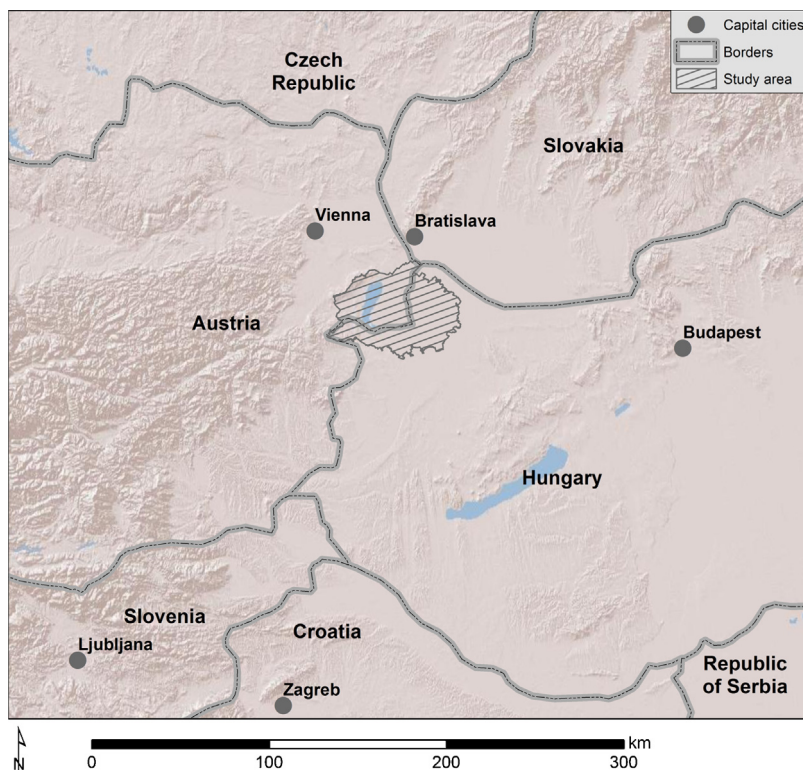


Fig. 1. Location of the study area in the transboundary region of Austria and Hungary in Central Europe. Topographical map is made with Natural Earth and www.ArcGIS.com.

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