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Research Paper

From intrinsic to service potential: An approach to assess tourism landscape potential

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ABSTRACT

Tourism contributes to human well-being and is recognized as a cultural ecosystem service. However, assessments of landscape potential for tourism tend to be very general. Therefore, this study proposes a method that takes into account both the complexity of landscape and the behavior of tourists. We introduce a new approach that encompasses both human and ecological aspects. The latter is broken down into biotic and abiotic elements, characterized by a variety of features. Tourism is assessed as a set of outdoor activities that are analyzed individually. Natural landscape potential is divided into intrinsic and service potential. Intrinsic potential describes the capacity of the landscape to be used for tourism purposes. Service potential adds tourists' willingness to undertake an activity. This is an important extension, as landscape service potential should be assessed as a function of the use tourists make of it; whether very often (e.g. walking) or very rarely (e.g. windsurfing). The Analytic Hierarchy Process was used to evaluate landscape properties, and a questionnaire evaluated tourist behavior. A case study was carried out in the Great Masurian Lakes (northeast Poland), which revealed substantial differences in the spatial diversity of intrinsic and service potentials. Furthermore, it showed that there are neither universally positive, nor negative landscape features as different activities have different, and sometimes opposing requirements. We believe that the proposed approach improves the accuracy of landscape potential assessment for tourism, thereby improving landscape planning and management.

1. Introduction

Estimates of the character and amount of natural goods that can be supplied to people are fundamental for policymaking, management, and planning. The issues are encapsulated by the concept of *ecosystem services* (ES), which has not only gained in popularity in the research community, but is also acknowledged by policymakers and practitioners (Crossman et al., 2013; Ruckelshaus et al., 2015). The model of the *ES cascade*, first proposed by Haines-Young and Potschin (2010) is frequently used in research (Maes, Crossman & Burkhardt, 2016). It conceptualizes how ES are generated, and how they are delivered. There are three main components, namely: the biophysical supply side (*potential*); the human demand side (*values*); and flows (*actual ES*) that link ecological and social systems.

The majority of ES potential mapping concerns global or regional scales (Pagella & Sinclair, 2014), while landscape planning needs a local-scale perspective. Although ES supply has been frequently studied (Balvanera et al., 2006; Egoh, Drakou, Dunbar, Maes & Willemen, 2012) there is little diversity in the current literature, and most work assumes that land cover data is an adequate proxy (Burkhard, Kroll, Müller & Windhorst, 2009; Frank, Fürst, Koschke, & Makeschin, 2012). This approach is limited because the relations between land cover variables and ES supply are not yet fully understood (Müller, de Groot, & Willemen, 2010). Although such data are helpful, they remain simplistic (Schägner, Brander, Maes, & Hartje, 2013) and should be supplemented with other environmental data (Martínez-Harms, Quijas, Merenlender & Balvanera, 2016). We aim to fill this gap by mapping ES supply using a variety of biotic and abiotic features.

As noted above, this study addresses the supply side of ES, as its evaluation remains underdeveloped compared to demand and use aspects (Adamowicz, Naidoo, Nelson, Polasky, & Zhang, 2011). Specifically, we focus on the supply of *tourism ES*. Tourism is an important contributor to human well-being in industrial societies (Harrison et al., 2010) and is widely recognized as one of cultural ES. The point deserves special attention, as meeting the expectations of tourists can bring significant benefits to the areas they visit. However, it should be borne in mind that tourism can also influence the state of ecosystems in a negative way (Leung & Marion, 2000). Therefore, careful spatial

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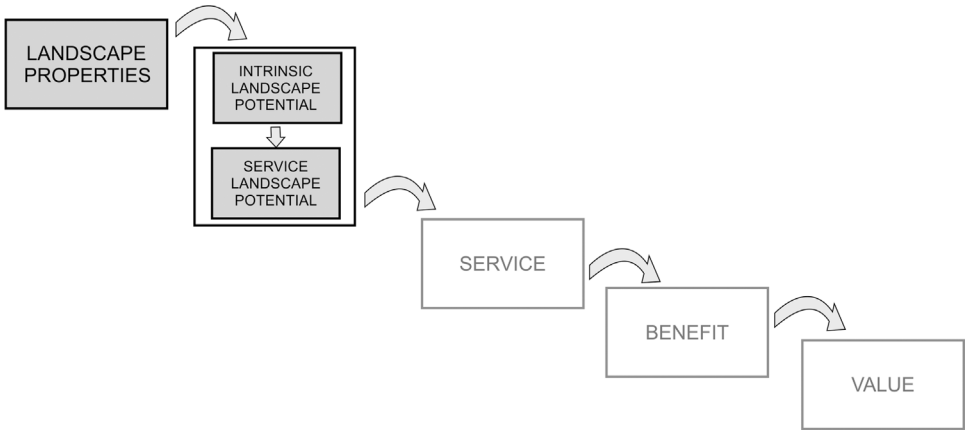

Fig. 1. Intrinsic and service landscape potential in the ES cascade (adapted from Potchin & Haines Young, 2010). The aspects covered in this paper are shown in grey.

planning and management is essential for sustainable tourism development.

Current methods to assess tourism ES have two main shortcomings: they fail to acknowledge the internal diversity of tourism phenomenon, and they lack precise assessment techniques. Studies tend to assume either that tourism is a homogeneous activity (Willemen, Verburg, Hein, & van Mensvoort, 2008), or they only address a few, selected forms (Potschin, Haines-Young, Palomo, Martín-López, & Montes, 2013). Our approach considers tourism as a heterogenous phenomenon, consisting of a number of different activities. The second problem is assessment techniques. Current landscape assessments are usually based on scores awarded by experts, which may be either subjective judgements (Burkhard et al., 2009), or indicators linked to tourism facilities (Weyland & Laterra, 2014). Although scoring can be efficient, there are limitations that include subjectivity, vagueness, oversimplification and a lack of transparency (Boerema, Rebelo, Bodi, Esler, & Meire, 2016).

This study, therefore, develops an approach for the assessment of tourism ES potential that takes into account both landscape complexity and the diversity of tourism activities. We propose a two-step analysis that distinguishes between *intrinsic landscape potential* and *service landscape potential* (Fig. 1). Intrinsic landscape potential is evaluated based on the set of relevant landscape features and a wide range of outdoor activities. The Analytical Hierarchy Process (AHP) is applied to structure and weight landscape properties. The method includes an assessment of the coherency of experts' judgments, which improves objectivity. Service landscape potential is the intrinsic one enriched with tourists' interest in participating in each of the activities. The analysis seeks to identify specific spatial niches, and multi-potential hubs for tourism activities, thus it helps to predict users' behaviours and eventual environmental threats caused by tourist activity. In this way, the study contributes to more efficient landscape planning and protection.

The paper is structured as follows. First, the theoretical foundations of the proposed approach are discussed, and an ES assessment method is proposed. Then, the method is tested using a case study based on the Great Masurian Lakes in Poland. The results of the analysis are described and, finally, maps obtained at different stages of the analysis are compared.

2. Theoretical framework

Understanding the sequence of elements that link ecosystems to human well-being is an essential element of a reliable analysis. The original ES cascade (Haines-Young & Potschin, 2010) has been modified by many other authors (Boerema et al., 2016; Van Oudenhoven, Petz, Alkemade, Hein, & Groot, 2012; Saarikoski et al., 2015; Spangenberg, von Haaren, & Settele, 2014), although all versions follow the general division into ecologically-conditioned supply, human-based demand, and flows between them. Despite these broad similarities, specific implementations differ significantly. Some differences relate to terminology, as authors use different names for similar, or the same things. Other ambiguities concern the term *ecosystem services* itself, as a similar term, *landscape services*, has increasingly been adopted.

First introduced by Termorshuizen and Opdam (2009) landscape services refers to:

- the inclusion of both biotic and abiotic natural elements (Syrbe & Walz, 2012);
- a spatial approach (Wu, 2013);
- a more complex and integrative view that emphasizes the interplay between humans and their environment (Bastian, Grunewald, Syrbe, Walz, & Wende, 2014); and
- relevance for local practitioners (Termorshuizen & Opdam, 2009).

Wu (2013) underlines two specificities of the landscape approach. First, different types of landscapes provide different types and amounts of services, and should be managed differently. Secondly, it is the landscape pattern that creates, mediates, and disrupts ES. For Termorshuizen and Opdam (2009), landscape services are a specification of, rather than an alternative to, ES. We adopt the approach of Bastian et al. (2014), who find no reason to replace or exclude any of these two terms and suggest using them depending on the context. Therefore, here we adopt the term landscape services, given that our approach is spatial, and considers both biotic and abiotic elements.

Natural potential characterizes all opportunities for a society to use and benefit from the environment (Bastian, Krönert, & Lipský, 2006). Although some authors use a term *function* in the same context (De Groot, Wilson & Boumans, 2002), we apply a term *potential*, because function can also be understood as ecosystem processes (Harrington et al., 2010). Although natural potential always encompasses both ecological and anthropogenic aspects, their ratios can vary. It can be understood as the ecosystem potential to satisfy hypothetical human needs (Burkhard et al., 2012; Van Oudenhoven et al., 2012), or the capacity to respond to the preferences of a specific group of users (van Berkel & Verburg, 2014). With this in mind, our analysis of ES potential encompasses:

- the identification of *landscape properties*;
- the assessment of *intrinsic landscape potential*; and
- the assessment of *service landscape potential*

These elements are shown in Fig. 2.

Most ES assessments of landscape properties focus on easily-available data, namely land cover. However, the results may not accurately reflect reality (Martínez-Harms et al., 2016), especially when simple typologies and coarse-grained data are used. In practice, landscape properties include both abiotic and biotic elements. Abiotic elements,