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Landscape, facilities and visitors: An integrated model of recreational ecosystem services

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ABSTRACT

Recreation is a complex and important ecosystem service. Therefore, there is a need for approaches that can account for this complexity, and integrate both environmental and socio-economical perspectives. The Recreational Ecosystem Services (RES) model proposed in this paper responds to this need. RES are understood as the delivery of services, conditioned by recreational use. Demand is, however, shaped by supply, in the form of natural potential, and recreational infrastructure. New mapping methods are proposed and tested using the example of water-based recreation in the Great Masurian Lakes, Poland. A combination of three levels of landscape potential, recreational infrastructure and use made it possible to identify and map 27 types of RES and calculate their monetary value. Although the study was carried out in a relatively natural area, the findings showed that it was not landscape potential, but recreational facilities that was correlated with recreational use. This suggests that the responsible management of an area can significantly influence recreational use and develop various RES patterns.

1. Introduction

Contact with the natural environment is essential for human health and well-being (Ulrich et al., 1991; Kaplan, 1995; Abraham et al., 2010). As the number of people living in urban areas is growing, and fewer jobs involve outdoor work, most interactions with nature take place in individuals' free time (Bell et al., 2007). Consequently, recreation and tourism can be seen as *cultural ecosystem services* (ES). They are, however, defined in diverse ways. While the Millennium Ecosystem Assessment (MEA) merged the two categories, and limited "tourism" to something closer to "ecotourism", the later studies moved towards more detailed distinctions. The Economics of Ecosystems and Biodiversity (TEEB) classification distinguishes between recreation and tourism; the latter involves a trip outside the usual environment. Common International Classification of Ecosystem Services (CICES) identify various types of physical and intellectual interactions with ecosystems which may include different recreational or tourism activities. Still, the distinction between recreational, tourism and other cultural ES remains blurred (Kulczyk et al., 2014; Smith and Ram, 2017). The aesthetic experience is often an integral part of recreational ES, merged with factors related to the physical use of the natural environment (Peña et al., 2015; Vigl et al., 2017). To avoid double counting or misleading interpretations, in this paper we follow the Common International Classification of Ecosystem Services (CICES), and refer only to the physical use of natural settings for recreational purposes, taking into account both day-trippers and tourists.

Recreational ecosystem services (RES) are the most often assessed cultural ecosystem services (Hernández-Morcillo et al., 2013; Milcu et al., 2013). Boerema et al. (2017) find that most studies of RES focus on its monetary value. However, there is a clear need to expand this narrow approach to include multiple, interdisciplinary aspects of ES (i.e. supply, delivery, demand and consumption), and biophysical and social dimensions (Wei et al., 2017). Another challenge is to develop spatially-explicit methods that incorporate the elements listed above (Anton et al., 2010; Palomo et al., 2013), as RES relates to the movements of users (Costanza, 2008; Yahdjian et al., 2015). This means that areas where a service is produced and used must overlap, as there is no recreation unless there is a person (unlike e.g. global climate regulation or, in many cases, food production). As areas of high natural quality are often regarded as areas of high recreational value (Paracchini et al., 2014), they must be responsibly managed. Although meeting visitors' expectations can bring significant benefits to local communities, it can also create many environmental threats (Petrosillo et al.,

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2006). Therefore, careful spatial planning and management is key to a destination's sustainable development.

The ES cascade model, first proposed by Haines-Young and Potschin (2010), is widely used to order, understand and assess the links between the natural and socio-economic ES contexts (van Oudenhoven et al., 2012; Spangenberg et al., 2014; Saarikoski et al., 2015; Small et al., 2017). Most RES studies only address a few, selected steps in the cascade. To the best of our knowledge, there are no studies that focus specifically on RES, and encompass the entire ES cascade. Studies that compare biophysical supply with social demand (the core of the concept) in the context of recreation are surprisingly scarce. Research by Villamagna et al. (2014) and Peña et al. (2015) attempts to respond to this problem, but does not recognize the complexity of recreation phenomena. The first focuses on only one activity (recreational fishing), while the second understands recreation as a homogenous system, and does not address the specificities of different outdoor activities. The limitations of RES research seem to be due to a general lack of ecological and sociological knowledge about the relations between ecosystems and recreation, methodological difficulties related to interdisciplinary research, and problems with data access.

The goal of this paper is to present a spatially-explicit model of RES. This is crucial for their proper management (Schulp et al., 2012). The model aims to order relations between different aspects of RES, and proposes a method for their detailed mapping. The approach responds to the increasing need to develop applied and integrated socio-ecological solutions using interdisciplinary approaches (McDonough et al., 2017), and the model proposed in this paper addresses the issue in the following ways:

- it includes a wide range of natural features;
- it recognizes recreation as a complex phenomenon, taking into account a number of outdoor activities;
- it is multi-dimensional: natural, social and economic aspects are included; and
- it is spatial: every step is the subject of a mapping procedure.

The model is tested on the example of water-based activities at the Great Masurian Lakes in northern Poland. Similarly to other cultural ES, recreation can be considered as directly used service, where service is produced, delivered and used in the same place (Antognelli and Vizzari, 2017). Therefore, we focused on the region which is well known for its recreational values. This area is particularly suitable to conduct such a study due to its landscape diversity that permits to undertake a wide range of recreational activities. At the same time there are no barriers that would significantly influence recreational patterns (such as, for example, protected areas). Moreover, water is the most important driver for tourism development in the region (Derek et al., 2017), and as water bodies have been identified as a crucial recreational resource (Chhetri and Arrowsmith, 2008), we focus on water-based activities.

2. Model

The context for the RES model (Fig. 1) is the supply and demand framework that is widely used in tourism and ES research (Hall and Page, 2006; Palomo et al., 2013). The supply side includes environmental base, widely considered as crucial for recreation and tourism (Hall and Page, 2006), and supporting elements that determine its use for recreational purposes (Fredman and Tyrväinen, 2010). The demand side includes recreationists and their willingness to undertake nature-based activities. As we focus on the destination, we do not include accessibility to the region. Although it is perceived as a driver for the development of tourism and recreation (Paracchini et al., 2014; Uysal, 1998), in this study we assume that people have already reached their destination and we focus on intraregional scale.

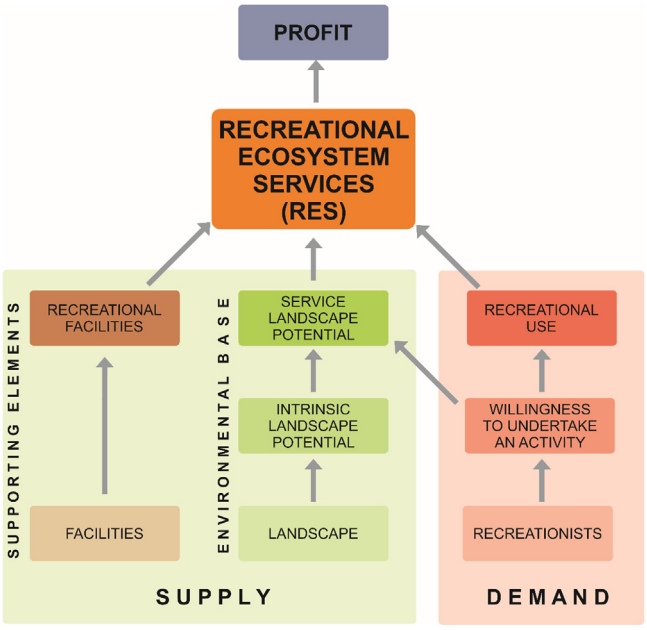

Fig. 1. The RES model.

RES are at the core of the model, and are understood as the flow between supply and demand. As Costanza (2008) points out, recreation is a user movement related service, which means that a service is delivered when and where recreationists actually undertake their nature-based activities. This delivery brings profit to the user.

2.1. Supply

2.1.1. Environmental base

Landscape. ES models describe natural resources as an ecosystem (van Oudenhoven et al., 2012), biophysical structure or process (Haines-Young and Potschin, 2010), or landscape (Van Zanten et al., 2014). In this model we refer to 'landscape' for several reasons:

- it includes both biotic and abiotic natural elements (Syrbe and Walz, 2012);
- it describes a spatial approach (Wu, 2013); and
- it provides a complex, integrated view that focuses on the interplay between humans and their environment (Bastian et al., 2014).

We follow Termorshuizen and Opdam (2009) and Bastian et al. (2014), and adopt the landscape approach as a specific application, rather than an alternative to the ecosystem approach.

Intrinsic landscape potential. Several properties define the capacity of a landscape to provide goods and services that meet human needs—this is termed landscape potential (Bastian et al., 2012) or function (de Groot et al., 2002). Although landscape potential for recreation is frequently assessed, it is understood in two ways: as the potential to satisfy hypothetical human needs (van Oudenhoven et al., 2012), or the capacity to respond to defined user preferences (van Berkel and Verburg, 2014). Here, intrinsic landscape potential is entirely based on natural properties that permit to perform an activity. These properties have a specific spatial distribution. It can be assessed and mapped for any, even

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