Land Use Policy xxx (xxxx) xxx–xxx

Contents lists available at ScienceDirect

Land Use Policy

journal homepage: www.elsevier.com/locate/landusepol

Opportunity costs of alternative management options in a protected nature park: The case of Ramat Hanadiv, Israel

Itai Divinski[a], Nir Becker[b,*], Pua Bar (Kutiel)[c]

[a] Ben Gurion University, Department of Geography and Environmental Development, Ben-Gurion University, Beer-Sheva, Israel
[b] Department of Economics and Management, Tel-Hai College, Upper Galilee, Israel
[c] Department of Geography and Environmental Development, Ben-Gurion University, Beer-Sheva, Israel

ARTICLE INFO

Keywords:
Species richness
Non-market valuation
Ecosystem services
Efficiency frontier
Protected areas

ABSTRACT

In the last few decades, "natural" open space has been rapidly disappearing, replaced by various land uses, such as agriculture, pastureland and cities. This decline in open space, combined with other processes adversely affecting ecosystems and the environment, highlights the importance of natural open spaces protection. Protected areas enable ecosystems to maintain their ecological integrity, thereby safeguarding many important ecological assets and services provided by ecosystems.

The aim of this study is to assess the economic value of multiple ecosystem services (ESs) and the tradeoff between them and species richness across different management alternatives at the protected area of Ramat Hanadiv long term ecological research (LTER) Nature Park, in Israel. Ecological data were retrieved from previous research conducted at the nature park, and the valuation of landscape values was performed using the replacement cost method and a contingent valuation survey.

The relationship between ES value and species richness was found to be negative. Of all management alternatives studied, only the planted conifer forest alternative was found to be inefficient; moving to other alternatives would enhance ES provision levels and species richness. This research demonstrates a simple path for providing land managers with an ecological data-based tool for comparing management alternatives in monetary terms.

1. Introduction

Ecosystem service valuation (ESV) is a method of assessing the contribution of ecosystem services (ESs) to human well-being in accordance with social values and preferences (Costanza and Folke, 1997; Bateman et al., 2013; Ruckelshaus et al., 2015).

There is growing recognition that the environment in general and ESV in particular, must be viewed and studied as a social-ecological system (Collins et al., 2011; Muhar et al., 2017). This is true of many environmental media, one of which is landscape valuation (Pinto-Correia et al., 2011).

The ES valuation can be split into three major groups, differentiated by the ease in which they can be valued monetarily: first of all, services that are easy to quantify because they have a market value attached to them (e.g., food provisioning). ESs that do not have a market value but their value can be derived through methods developed in environmental economics (DEFRA, 2007; Fisher et al., 2011). Such ESs may include cultural (e.g., recreation) values, which are recognized as requiring a different set of tools and analysis even from a non-economic point of view (Katz-Gerro and Orenstein, 2015; Hølleland et al., 2017).

There is a third group of ESs which is almost impossible to value. This may include formation (or destruction) of habitats as an example of species richness. Oteros-Rozas et al. (2017) indicates that visualization in general and social media photographs in particular are becoming popular, but still cannot reveal ecological features of a landscape formation besides aesthetic ones. Studies aiming to value such services (e.g., Baral et al., 2014) are not using preferences as a means for valuation, but rather conservation effort costs. Nevertheless, Cervelli et al. (2017) state that the Mid-term Review of the EU Biodiversity Strategy (February 2, 2016) highlights the importance of biodiversity protection in Europe, not only in terms of ethical behavior, but also due to its intrinsic value in the face of biodiversity loss, estimated at 50 billion euros a year. Steinman et al. (2017) have also recognized the importance of mapping ESs in the Great Lakes Basin, including non-use values.

Since a basic requirement for cost-benefit analysis is to measure things in monetary terms, this clearly creates a problem of a significant missing linkage. One possible way to obtain a different perspective is by

* Corresponding author.
E-mail address: nbecker@telhai.ac.il (N. Becker).

https://doi.org/10.1016/j.landusepol.2017.11.015
Received 11 February 2017; Received in revised form 6 November 2017; Accepted 7 November 2017

creating an efficient frontier which bypasses this issue by simply contrasting the lost monetary value of the first two ES groups due to an increase in variables such as biodiversity (the third group). The classical use of such an analysis is to test the efficiency of different management schemes, which generates the maximum diversity for a given economic measure (and vice versa). The efficiency frontier illustrates what can be achieved in terms of biological/ecological and economic objectives by choosing one management policy over another (Guerry et al., 2012; Lester et al., 2010; Ma et al., 2016; Naidoo et al., 2006; Polasky et al., 2008).

While assessing values derived from the first group of ESs is a relatively easy task, the other two groups pose issues that need to be related to: How can we monetize landscape visualization such as scenery or aesthetics, and which kind of indicators can we use to assess habitat formation or destruction?

For the second group of ESs, the value derived from the beauty of open spaces is likely to be an important factor when assessing the total economic value (TEV), especially in the case of open protected areas (WCPA 1998), but also for other open spaces, including agricultural landscape (Schirpke et al., 2013). Moreover, Hettinger (2008) suggests that the beauty of the environment is a significant motive for environmental protection. Therefore, it is not surprising that a significant number of studies assessing the willingness to pay (WTP) for conservation of open protected areas indicated that tranquility and aesthetic beauty were the most popular reasons for desiring to preserve them. The other ESs stated as reasons for WTP, in different descending order, were: flora and fauna; option value (getaway for future generations); historical and educational value and the uniqueness of the open space (Hadker et al., 1997; Bar (Kutiel) et al., 2016; Divinsky et al., 2017). Beauty is the quality that gives pleasure to the senses and is studied as part of “aesthetics”; a philosophical idea that changes over time according to the evolution of civilization. In our time, sustainability is a major issue, thus as people begin to understand the dynamic nature of landscapes, they will change the way they see the landscape as a static scene (Buijs, 2009a; Panagopoulos, 2009). Therefore, the perception of the public is sometimes strong enough to justify conservation and management decisions, even though they are not professional ecologists (Bar (Kutiel) et al., 2016; Dronova, 2017; Graves et al., 2017). However, we realize that public perception may also reveal conflicts among different sociodemographic groups within the community, such as age as an explanatory variable for aesthetic- versus ecosystem-based management (e.g., Tyrväinen et al., 2003). This brings us to the third group (The one which contains services that are almost impossible to assess monetarily).

The main question regarding this group is how to assess the impact certain ecological changes will have on ES delivery. In order to do this, the link between ESs and the ecosystem properties and the processes for providing them must be understood (Norberg, 1999; Palmer et al., 2004; US EPA, 2009; Bateman et al., 2011). One way of understanding this link is to study the relationship between ecological indicators and ESs (Balmford et al., 2003; Niemi and McDonald, 2004). Species richness is a widely used indicator (e.g., Engelhardt and Ritchie, 2004; Costanza et al., 2007; Polasky et al., 2008) because it is generally more available than other proxies for biodiversity (Costanza et al., 2007).

Relatively little attention has been given to the ES delivery scale in the current literature (Hein et al., 2006). The majority of ESV studies have been conducted on a small scale (a specific ecosystem), aimed at providing TEV (e.g., Ninan and Inoue, 2013). TEV may not be sufficiently useful for land managers facing decisions involving tradeoffs between ES delivery and biodiversity conservation, as it does not provide marginal value enabling comparison between different scenarios (Turner et al., 2003; Nelson et al., 2009). Studies providing marginal values (using an efficiency frontier) are usually conducted on a large scale, such as a county, state or country (e.g., Viglizzo and Frank, 2006; Polasky et al., 2008). These studies are useful for government agencies when preparing statutory land use plans, but provide little insight into smaller scales for land managers (Turner et al., 2003).

The aims of this study are: (a) to value the major market and non-market benefits derived from the Ramat Hanadiv LTER Nature Park, situated in the Mediterranean region of Israel. The benefits of aesthetic value, food provisioning services and pollination services were valued under four vegetation formations resulting from different management schemes and contrasted with species richness; (b) to create an efficiency frontier for Ramat Hanadiv (and not just calculate the TEV for the park).

The comparison between vegetation formations of ES delivery is important because, while all Mediterranean vegetation contributes to ES delivery, each formation maximizes different ESs (Levin et al., 2013). This valuation allows for more informed decision-making when facing tradeoffs between ecosystem maintenance and economic benefits under different management schemes.

In contrast with TEV, which only allows comparing the existence of the park with its non-existence, the efficiency frontier enables comparing different management schemes considering a certain set of management goals. This difference could prove important for decision makers in their efforts to maximize conservation with limited resources.

The data used for this study were based on LTER conducted in the park over 25 years. This paper outlines a highly applicable method of valuating ESs using on-site ecological data.

2. Materials and methods

2.1. Research area

The study was conducted between March and December 2015, at Ramat Hanadiv LTER Nature Park, a privately-owned nature park in northwest Israel, operated for the benefit of the general public by the family foundation “Yad Hanadiv” (Fig. 1). The park is one of the most

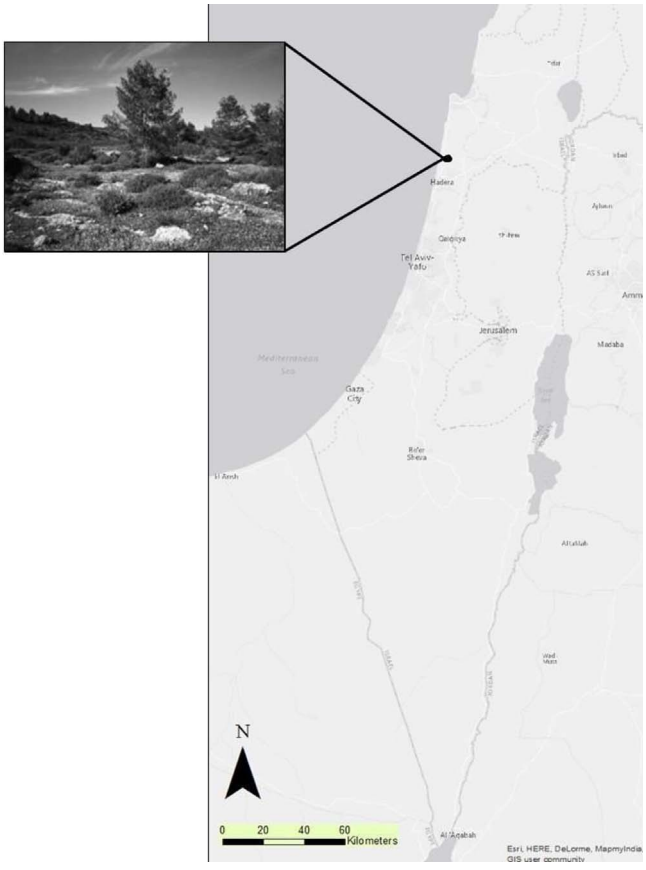

Fig. 1. Research area.