Ecological Economics 93 (2013) 20–33

Contents lists available at SciVerse ScienceDirect

Ecological Economics

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

Analysis

A human well-being approach for assessing the value of natural land areas

Angela Kopmann [a,*], Katrin Rehdanz [a,b]

[a] Kiel Institute for the World Economy, Hindenburgufer 66, 24105 Kiel, Germany
[b] Department of Economics, Christian Albrechts University, Ohlshausenstrasse 40, 24118 Kiel, Germany

ARTICLE INFO

Article history:
Received 16 February 2012
Received in revised form 8 April 2013
Accepted 26 April 2013
Available online 24 May 2013

JEL classification:
D1
I31
Q24
Q51
Q57

Keywords:
Ecosystem services
Environmental valuation
Europe
Subjective well-being
Land coverage

ABSTRACT

To decide on the policy measures to be implemented, policymakers need comprehensive information on the costs and benefits of land conversion for society. Accordingly, the EU Biodiversity Strategy requires the member countries to assess their ecosystems and the economic value of their ecosystem services by 2020. This paper takes up and extends the subjective well-being approach to valuing changes in natural land cover, which provides information on willingness-to-pay for landscape amenities such as scenic views or recreational opportunities. Results at the NUTS 2 level for European countries indicate (a) that marginal willingness-to-pay estimates tend to be higher for natural areas that are scarcer, and (b) that a nonlinear relationship between land cover and well-being is preferred to a linear relationship indicating decreasing benefits from individual landscape amenities.

1. Introduction

Ecosystem services generated on cultivated and natural land areas, such as food and bioenergy provisioning, climate regulation, and landscape amenities, are essential for the well-being of mankind (MA, 2005). Population growth and increasing economic activity, however, cause such areas to be converted into artificial land areas and thus threaten the provisioning of these services. Accordingly, it is of major importance to society for policymakers to ensure that land is used sustainably by implementing dedicated policy measures.

To decide on such measures, policymakers must ensure that their benefits to society will outweigh the costs they involve. The German Renewable Energy Sources Act (BMU, 2011) has been implemented without conducting a comprehensive cost–benefit analysis. This act provides incentives for bioenergy provisioning without taking other ecosystem services to society (landscape amenities, etc.) or the functioning of ecosystems into account. These incentives have produced a substantial increase in the area of land used to crop maize for biogas production at the expense of cultivated and natural land usable for other purposes. The resulting "maize deserts" in the German landscape have led to a decrease in landscape amenities such as benefits from scenic views or recreational opportunities, and the well-being of people living in these regions has suffered as a consequence. There have also been functional deficiencies in the ecosystems and a loss of biodiversity, not only on the converted land itself but also in neighboring areas. This indicates how important it is for policymakers to weigh up all the costs and benefits of land conversion for society when deciding on the policy measures to be implemented.

To supply policymakers with the necessary information on the costs and benefits of such measures, economic analyses are needed that attach net economic values to land conversion that induces ecosystem service loss. This is why the European Commission has launched the EU Biodiversity Strategy (EC, 2011), which requires all member countries to assess their ecosystems and the economic value of their ecosystem services by 2020. Economic analyses require information on the prices for ecosystem services, but for most such services, especially those not traded on markets, this information is not available. To obtain this information, economic methods for valuing nonmarket environmental goods can be applied. However, neither the European Biodiversity Strategy 2020 nor the literature provide any guidance on which of these methods to use.

The literature also displays various other limitations. (1) Studies based on preferential methods like contingent valuation or contingent choice modeling (see Mendelsohn and Olmstead, 2009) differ in their research designs and methodologies, which limits comparability. (2) Studies only analyze services for single types of land cover and also have a clear regional focus (see, e.g., Mogas et al., 2006). In a broader

* Corresponding author. Tel.: +49 431 8814329.
E-mail address: angela.kopmann@ifw-kiel.de (A. Kopmann).

0921-8009/$ – see front matter © 2013 Elsevier B.V. All rights reserved.
http://dx.doi.org/10.1016/j.ecolecon.2013.04.014

perspective, the regional coverage across Europe and the number of services assessed so far have been low. To provide the information required by the EU Biodiversity Strategy, i.e. a comprehensive assessment of ecosystem services and their values, many more studies would be needed.

The objective of this article is to propose an alternative – the subjective well-being method – for valuing landscape amenities by analyzing people's preferences for particular types of natural[1] land cover. This method enables us to derive marginal willingness-to-pay (MWTP) estimates providing valuable information on the welfare implications of land cover changes. The advantage of the subjective well-being method is that it requires little in the way of research resources and can be consistently applied for many countries. Previous studies drawing upon information on subjective well-being to investigate preferences for environmental amenities have mostly looked at the amenity value of climate. Far fewer studies exist investigating other environmental aspects.[2] None of these studies has analyzed preferences for land cover. However, there is long-standing evidence in the literature for land cover preferences in housing markets (see Waltert and Schläpfer, 2010 for an overview), so we also expect to find such preferences in a subjective well-being framework.

This article avoids some of the limitations of existing research by using data from the second and most recent European Quality of Life Survey (EQLS) from the year 2007, which provides information on 31 European countries up to the NUTS 2 level for 292 regions with a total of 35,634 observations.[3] The first advantage of this dataset is its high level of disaggregation. This is an asset because it has been established that the relationship between environmental amenities and subjective well-being is more significant at the local than at the national level (see Welsch, 2006). The second advantage is that households disclose exact figures on their net incomes. Other datasets, including the European Value Survey and the European Social Survey, provide information on income deciles only.[4]

The remainder of the article is structured as follows: Section 2 reviews the environmental valuation literature on ecosystem services and briefly summarizes other researchers' attempts to estimate preferences for environmental amenities using the subjective well-being method. Section 3 presents the empirical model and describes the data used for the analysis. Section 4 reports the results of the econometric analysis and shows implicit MWTP estimates for changes in land cover. Section 5 discusses the limitations of the analysis and draws some conclusions.

2. Literature Review

Environmental valuation methods based on stated preferences, such as contingent valuation or choice modeling, have been widely applied in attempts to value changes in ecosystem services by asking people to state their willingness-to-pay (WTP) (see Mendelsohn and Olmstead, 2009 for a review). However, few studies exist that investigate people's preferences in connection with changes to the size of particular areas (see e.g. Mogas et al., 2006). More studies can be found that evaluate conservation programs for natural habitats (see e.g. Adams et al., 2008; Kramer and Mercer, 1997; Lehtonen et al., 2003; Siikamaki and Layton, 2007; White and Lovett, 1999). But here the area to be conserved is already covered by the biome in question, so the use of WTP estimates from these analyses to increase natural area in policy decisions may underestimate the true welfare implications.

Although stated preference methods are generally very flexible in their application, the surveys involved are costly and time-consuming. In addition, it is usually difficult to explain the full complexity of ecosystem services to respondents. As a consequence, values are typically site-specific and refer to only one or a few specific ecosystem services (see e.g. Birol et al., 2006). Furthermore, differences in research designs and the methodologies applied complicate comparisons across studies.

Revealed preference methods such as hedonic pricing infer preferences for changes to land cover from decisions on house purchases. Hedonic pricing methods have been widely applied for the valuation of changes to land cover in the U.S., while for Europe the evidence derived from this approach is limited (see Waltert and Schläpfer, 2010 for an overview). There are several studies that focus on scenic views (see, e.g., Gillard, 1981 or Benson et al., 1998). An increasing number of studies explicitly focus on changes to land cover (see, e.g., Irwin, 2002).

The advantage of the hedonic pricing method is that values for changes to land cover are directly derived from observed decisions. One major shortcoming of the method, however, is that it requires the housing market to be in equilibrium, which might not hold (see Greenwood et al., 1991).

A recent alternative in the field of environmental economics is the subjective well-being method. It is based on the assumption that environmental amenities are one of the factors determining quality of life. In this approach, life satisfaction is estimated as a function of factors such as environmental amenities and income, while at the same time controlling for other socio-economic, demographic, and geographical information. This estimated relationship is used to derive an implicit MWTP based on the marginal rate of substitution (MRS) between income and the environmental amenity in question.

The first empirical economic analysis of subjective well-being was conducted by Easterlin (1974), estimating at both national and international levels how changes in income affect happiness. A large body of literature now links subjective well-being with economic indicators (see Clark et al., 2008 or Welsch and Kuehling, 2009 for an overview). A small but growing number of studies exist estimating the trade-off between life satisfaction and environmental amenities such as climatic conditions (see e.g. Brereton et al., 2008; Frijters and van Praag, 1998; Moro et al., 2008; Rehdanz and Maddison, 2005), natural flood disasters (see e.g. Luechinger and Raschky, 2009), the occurrence of drought (see Carroll et al., 2009), proximity to infrastructure (see Brereton et al., 2008), air quality (see e.g. Di Tella and MacCulloch, 2007; Levinson, 2012; Luechinger, 2009; MacKerron and Mourato, 2009; Rehdanz and Maddison, 2008; Welsch, 2006), and scenic views (see, e.g., Ambrey and Fleming, 2011).[5]

None of the previous studies based on self-reported levels of life satisfaction explicitly focuses on people's preferences for land cover. Studies investigating the amenity value of climate (e.g. Rehdanz and Maddison, 2005 or Moro et al., 2008) only implicitly control for differences in natural land cover, since vegetation is determined by climate. However, the extent is limited since most of the natural areas, at least in densely populated industrialized countries, are converted for other uses and managed by humans. In addition to the conversion of natural areas into artificial areas, land management such as the irrigation of agricultural soil or the logging of forests can have major impacts on natural vegetation.

Exceptions are Brereton et al. (2008) and Ambrey and Fleming (2011), where the measure for land cover is based on proximity of infrastructure (such as landfill, hazardous waste facility, airports, etc.) or by a scenic view index constructed from an ex-ante survey on

[1] We distinguish between "artificial" and "natural" land cover throughout the paper, with the latter encompassing both cultivated and natural varieties.

[2] For a recent overview of the literature focusing on environmental aspects, see Welsch and Kuehling (2009).

[3] NUTS stands for Nomenclature des Unités Territoriales Statistiques, a classification system for dividing up the EU into regional economic territories. Category 2 provides the average population size in the region (between 800,000 and 3 million).

[4] The EVS can be found on the following website: http://www.europeanvaluesstudy.eu/. The ESS is available on the following website: http://ess.nsd.uib.no/.

[5] For a recent overview on the literature focusing on environmental aspects, see Welsch and Kuehling (2009).