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Research article

Measuring conflicts in the management of anthropized ecosystems: Evidence from a choice experiment in a human-created Mediterranean wetland

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ABSTRACT

Economic valuation of ecosystem services provides valuable information for the management of anthropized environments, where individual preferences can be heterogeneous and even opposed. Here, we discuss how these ecosystem services were approached in the literature and we address the main issues in relation to their economic valuation. We consider that avoiding misspecifications in economic valuation surveys requires considering the linkages between anthropized ecosystems and human intervention. To illustrate, we analyse the case study of a human-created Mediterranean wetland (El Hondo, SE Spain) using a Choice Experiment. Our findings suggest that management strategies in El Hondo should be oriented to improve the water ecological status, to enhance biodiversity and to develop ecotourism, whereas hunting should be strictly limited and controlled. Our measures of conflict (trade-off between ecosystem services and willingness to pay values) can help to find the optimal allocation of public and private goods and services and for the implementation of compensation schemes in the area. According to public preferences, a conservationist management strategy would generate 331,100 €/year in terms of environmental benefits, whereas a tourism-based management strategy would benefit society with 805,200 €/year.

1. Introduction

Motivated by the increasing degradation of ecosystems and depletion of natural resources worldwide, "*The Millennium Ecosystem Assessment - A Framework for Assessment*" (MA, 2005) constituted one key step in the adoption of an integrative basis for ecosystem management. This conjoint work of hundreds of natural and social scientists proposed the *Ecosystem Services Approach* as the model to link ecosystems to social welfare in decision-making processes (Schulp et al., 2016).

Economic valuation of ecosystem services (ES) can provide significant information and social insights to assess projects, plans and policies that affect the environment, being a bridging field between environmental sciences, society and policy. Economic valuation of ES requires adequate design to ensure a consistent and science-based analysis of public preferences to produce significant and reliable information (Marre et al., 2016). The economic valuation of ES has been vastly studied in the literature, covering different perspectives from methodological proposals to empirical applications. Danley and Widmark (2016) analyse the existing definitions of ecosystem services and their implications for ecosystem management, whereas Rakotonarivo et al. (2016) and Oehlmann et al. (2017) assess the validity of economic valuation methods and how to improve economic valuation surveys. Empirical applications deal with a wide range of case studies such as forest management (Juutinen et al., 2014), coasts conservation (Failler et al., 2015), and restoration of rivers (Perni et al., 2012) and wetlands (Newell and Swallow, 2013), among others. Furthermore, economic valuation is often used to guide decisions in water (Martin-Ortega et al., 2011) and agricultural policies (Rodríguez-Entrena et al., 2014).

The economic valuation of ES provided by anthropized and human-created ecosystems has been scarcely addressed in the scientific literature, despite the fact that we can find worldwide many pristine landscapes resulting from the secular action of

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human activities. The conservation of this type of ecosystems is strongly linked to human activities, so that the provision of ES is especially sensitive to changes in such activities (Kaviera et al., 2007; Martínez-Paz et al., 2016; Rova and Pranovi, 2017) that can lead to strong modifications in the landscape structure and subsequently to changes in species distribution (Heneberg, 2013; Řezáč and Heneberg, 2014; Bogusch et al., 2016). These human-nature connections, the competition for scarce natural resources and the implementation of multiple environmental policies complicate anthropized ecosystem management and frequently lead to intense conflicts between among users, other stakeholders and the environment (Scapini and Ciampi, 2010; Hodge et al., 2015). These particular characteristics should be considered in the design of economic valuation exercises.

The contribution of this paper to the on-going research about the economic valuation of ES for decision-making is twofold. Focused on anthropized ecosystems, first, we frame the debate about ecosystem services classification for economic valuation. Second, we address the main issues in relation to the economic valuation of ecosystem services in contexts where individual preferences are heterogeneous and even opposed, so that they are a source of social conflicts. The case study of a RAMSAR wetland (RAMSAR, 2016), El Hondo (SE Spain), is presented here to illustrate. El Hondo provides a wide diversity of ES and is severely threatened by human pressures, leading to conflicts among users and practitioners when dealing with environmental policies (Martín-Cantarino, 2010). Moreover, actions related to a wide set of management options (e.g. nature conservation, agricultural production and water policy) impact on the capacity of this wetland to benefit society and hence it is an ideal room to examine the issues already mentioned.

2. An ecosystem services classification for anthropized ecosystems

The identification of ES for economic valuation purposes requires a precise and consistent definition. This has to be necessarily constructed on an operational and coherent classification of ES suitable for a certain environmental and policy context. Otherwise, the misspecification of the economic valuation exercise would mislead decision-making and thus prevent from an efficient allocation of natural and public resources (Just et al., 2004). As for anthropized ecosystems, this discussion is still lacking in the literature (Barot et al., 2017).

The MA defines 'ecosystem services' as 'the benefits people obtain from ecosystems', so that once ES are identified and characterized with appropriate biophysical data, they can be valued in monetary terms to assist policy making by using economic valuation methods (MA, 2005). The MA classifies ecosystem services in four categories: provisioning services (e.g. freshwater), regulating services (e.g. water purification), cultural services (e.g. recreation) and supporting services (i.e. ecological processes underpinning the other services). Hein et al. (2006) present a systematic classification for ES, which is based on the MA, and discuss how they relate to market and non-market values. According to the authors, the stakeholders can attribute the following values to ES:

i. Provisioning services: direct use values and option values.
ii. Regulating services: indirect use values and option values.
iii. Cultural services: direct use values, option values and non-use values.

The identification of ES, their biophysical interrelationships and their values within the field of economic valuation is not straightforward. The following works illustrate how the debate about the definition and classification of ecosystem services has evolved over time: de Groot et al. (2002), Boyd and Banzhaf (2007), Wallace (2007), Fisher et al. (2009), Ojea et al. (2012), Haines-Young and Potschin (2013) and Barot et al. (2017).

Economic valuation has to deal with the complex relationships among the different brands of ES. For instance, supporting and regulating services do not benefit society directly, but they sustain the provision of food, freshwater or landscape. In that case, the estimation of the total economic value of an ecosystem as the sum of the value of all its individual ecosystem services based on MA classification would double count the value of some services (Fisher et al., 2009). It means that estimates of such ecosystem services values will be biased and likely inflated, and thus alternative schemes should be used.

Johnston and Russell (2011) point out that avoidance of double counting necessarily requires the identification and aggregation of values only for final services. Other authors refer to final services as *endpoints* (Dias and Belcher, 2015). In this definition, regulating and supporting services can be denominated as intermediate services, i.e., they are inputs in the production of final services. Then, intermediate services can be valued through their marginal impacts on valued final services. To distinguish final from related-intermediate ES, Johnston and Russell (2011) propose a set of operational rules, which were satisfactory translated into an application to the restoration of migratory fish in a Rhode Island watershed in USA (Johnston et al., 2011). In particular, the authors argued that *"for biophysical outcome h to serve as an ecosystem service for beneficiary j, h must represent the output of an ecological system prior to any combination with human labour, capital or technology*". In short, ecosystem services are only natural outputs. This implies a strong separation between natural outputs and human production, which is noted in some works. Brown et al. (2007) state that the production of ecosystem services does not require inputs of labour or capital; Fisher et al. (2009) who call 'benefits' the increased social welfare resulting from the combination of ecosystem services with other forms of human capital, but these benefits do not exactly correspond to the value of the ecosystem service provided. However, this rule could be inconsistent with the origin of certain services from anthropized ecosystems.

Agriculture is an example in which human inputs are utilised to transform ES (e.g. fertile soil) into human benefits (e.g. food for markets), but this relationship can also be observed from a different perspective (Aldanondo and Almansa, 2009). Human capital employed in agricultural activities can foster the ES provision. For instance, Wilaarts et al. (2012) and Nieto-Romero et al. (2014) find that the abandonment of extensive Mediterranean agroecosystems provokes losses in the provision of regulating services linked to freshwater flows (Martínez-Fernández et al., 2014). Other ecosystems also closely linked to human intervention are salt marshes in traditional saltworks that are common in coastal areas, which maintain high and singular biodiversity and have often been designated as RAMSAR wetlands (Conesa and Jiménez-Cárceles, 2007; Ballesteros, 2013). For example, the continued traditional salt exploitation of saltpans contributes directly to the conservation of threatened species (Picazo et al., 2010).

Human capital can even *create* new anthropized environments able to provide services that benefit society. The scarcity of water resources acting as limiting factor also drives the distribution of wildlife towards anthropized environments. Rare examples are the establishment of White-headed Duck (*Oxyura leucocephala*) in maturation lagoons used as tertiary treatments in water treatment plants (LIFE, 2009) and power-plants producing fly ash deposits, commonly viewed as biotic wastelands, that paradoxically provide crucial refuges for vanishing biodiversity (Tropek et al., 2013).

In all the above cases, if the human activity ends, ES may be