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Analysis

A global map of coastal recreation values: Results from a spatially explicit meta-analysis

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ABSTRACT

This paper examines the welfare dimension of the recreational services of coastal ecosystems. First, we construct a global database of primary valuation studies that focus on recreational benefits of coastal ecosystems. Second, the profile of each of the 253 individual observations is enriched with characteristics of the built coastal environment (accessibility, anthropogenic pressure, human development level), natural coastal environment (presence of protected area, ecosystem type, marine biodiversity), geo-climatic factors (temperature, precipitation), and sociopolitical context. We then propose a meta-analytical framework that is built upon a Geographic Information System (GIS) and allow for the exploration of the spatial dimension of the valued ecosystems, including the role of spatial heterogeneity of the selected meta-regression variables as well as the spatial profile of the transferred values. The empirical outcome results in the first global map of the values of coastal recreation, which may play a crucial role in identifying and ranking coastal area conservation priorities from a socio-economic perspective.

1. Introduction

The sustainable management of recreational activities is of increasing importance for the stewardship of the natural capital in coastal areas worldwide. Coastal tourism and recreation have dramatically increased over the past decades and have become a primary contributor to the gross domestic product (GDP) of several countries and wellbeing of large coastal populations. Tourism and recreation-related development are, however, among the principal causes of conversion and degradation of coastal habitats, which, together with nutrient pollution, are the main anthropogenic threats to the sustained provision of coastal ecosystem services (MA, 2005). The current trends are towards an increase in the impact of both stressors particularly in developing countries, where coastal tourism is often among the primary economic development strategies.

From an economic perspective, sustainable management strategies for coastal tourism and recreation are founded on a thorough assessment of their value in the relevant policy context. The economic valuation of recreationally oriented activities in the coastal margin is a particularly challenging undertaking because they include both extractive and non-extractive uses, whose welfare impact is for a large part not reflected in market transactions. A series of valuation techniques capable of capturing such values has been developed over the past decades, some based on the observation of the actual consumption behavior of recreationists, such as the travel cost method (Bockstael et al., 1991), and others relying on the response to changes in hypothetical markets, such as the contingent valuation (Mitchell and Carson, 1989) and contingent behavior methods (Hanley et al., 2003). Although the number of applications of such techniques to coastal recreation is rapidly growing, non-market valuations typically have a limited geographical scope and are restricted in the considered range of socio-economic contexts.

Value transfer techniques are an attractive option for policy-makers facing time and budget constraints when reliable primary valuations are absent. Value transfer makes use of results from earlier empirical studies and applies their conclusions to a policy site that differs from that of the study for which the values were originally estimated (Florax et al., 2002; Nijkamp et al., 2008). Since local characteristics such as the accessibility of a site to potential users are crucial in determining the extent of coastal tourism and recreation, value

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transfer is particularly challenging when study and policy sites are located in different geographic and socio-economic contexts. Such context dependence is left implicit in the analysis of valuation studies, which generally focus on a single site or group of sites within a homogeneous context.

Meta-analysis is the only tool available in value transfer to distinguish between phenomenon-intrinsic and context-specific factors, including the method used in the primary valuation study (Florax et al., 2002). Meta-analysis is generally applied by using regression-based techniques (i.e., meta-regression) to infer the impact of moderator variables – such as context variables – on the formation of values in a set of study sites. In value transfer applications, out-of-sample predictions are carried out to infer the unobserved value in one or more policy sites by evaluating the meta-regression function with the estimated parameters and the variable levels associated with the policy site(s). Previous meta-analyses of coastal ecosystem values have been carried out with a restricted focus on a specific ecosystem type, i.e., coral reefs (Brander et al., 2007), or valuation method, i.e., contingent valuation (Liu and Stern, 2008), and relying on a relatively small sample of value observations. Such meta-analyses rely on a substantial simplification of the geographic context that underpins the provision and fruition of the coastal ecosystem services and no attempt is made to scale up the results to support strategic policy planning and evaluation in a larger geographical setting than the case-by-case value transfer.

In this study, a comprehensive framework for the meta-analytical transfer of the value of recreational activities is developed and applied to produce a global map of coastal recreation values. The structure of the paper is as follows. Section 2 presents the global dataset of primary valuations, identifies the moderator variables, and describes the methodology for integrating spatially explicit, geo-referenced information in the analytical framework. Section 3 puts forward the meta-regression models and discusses the econometric estimation results. Section 4 defines the procedure for value transfer and scaling up, presents the global map of coastal recreation values, and discusses the accuracy of the transferred values. Section 5 concludes.

2. Preparation of a Global Dataset

2.1. Primary Values of Coastal Recreation

The analysis in this paper relies on an extensive global dataset of non-market valuations of the recreational services of coastal and estuarine ecosystems with 253 distinct value observations from 79 primary valuation studies. The search was intended to be comprehensive, including studies in the peer-reviewed scientific literature as well as unpublished working papers, theses and reports, which constitute about 40% of the primary valuation studies of our dataset. To be eligible, a study had to report a primary valuation of a recreational use of coastal ecosystems; estimates of non-use values (e.g., existence, option and bequest values) or mixed use/non-use values were excluded. Eligible recreational activities include both extractive uses (e.g., fishing, shellfishing, and hunting) and non-extractive uses (e.g., swimming, sun-bathing, boating, wind-surfing, bird-watching, snorkeling, and diving).

Table 1 and Fig. 1 provide an overview of the valuation studies and location of the valued sites. The geographic extent of each of the valued coastal ecosystems was characterized in a spatially explicit manner by means of Geographic Information System (GIS) tools. For each of the sites, a linear shapefile (polyline) of coastline was created, which features the shoreline path as identified based on remote sensing Landsat imagery accessed through Google Earth (http://earth.google.com). Table 1 shows the range of coastline length of the valued sites calculated as the length of the polyline features (see also Fig. 3).

Valued ecosystems in the dataset are located in 34 countries. The largest number of observations is from the USA (82 observations), Australia (22 observations), France (18 observations), and Sweden (13 observations). Fourteen observations are from the Small Island Developing States. In the World Bank classification of economies (http://data.worldbank.org/country), eighteen countries in the dataset are high-income economies, eight upper–middle-income, five lower–middle-income, and three low-income economies (Kenya, Tanzania and Vietnam). The majority of values are from sites located in the North Temperate Zone, i.e., at a latitude comprised between 23.5°N and 66.5°N (151 observations). A relatively large number of observations are located in the Tropical Zone, between 23.5°S and 23.5°N (88 observations), while only 14 observations are from the South Temperate Zone. Overall, the Southern hemisphere accounts for 14% of the observations.

For each observation in the dataset, the value estimates as well as study- and site-specific information were recorded. All the studies in the dataset were estimated with non-market valuation techniques. Regarding stated preference techniques, contingent valuation and choice experiments account, respectively, for 93 and 18 observations. The travel cost method accounts for slightly less than half of the observations (117 observations). Finally, 25 values were estimated with the contingent behavior method.

Most studies examine the recreational values of a sample of the whole population of recreationists at the investigated site, irrespective of where the recreation trips have originated (e.g., whether the recreationists are local excursionists or international travelers). The subsample of observations exclusively pertaining to local residents counts 24 valuations, while 35 estimates were specifically derived for international tourists. Regarding the evaluated scenarios, several

Table 1
Overview of studies and valued sites included in the meta-regression.

Prevailing ecosystem type	Valuation method	Year of survey	Coastline length, km	Nr. of value estimates
Estuary	Stated preference	2000–2003	12–1540	4
	Travel cost	1995–2003	12–1718	8
	Contingent behavior	1995	1718	1
Beach	Stated preference	1991–2006	3–2268	27
	Travel cost	1992–2003	1–233	22
	Contingent behavior	1986–2003	20–233	12
Coral reef	Stated preference	1996–2007	1–694	33
	Travel cost	1996–2005	15–5618	18
	Contingent behavior	2004–2008	678–5618	2
Marsh/lagoon	Stated preference	1983–2002	2–53	7
	Travel cost	1992–2002	2–53	8
	Contingent behavior	1992	53	1
Mangrove	Stated preference	1997	16	8
	Travel cost	1974	21	3
Other	Stated preference	1994–2007	6–1171	32
	Travel cost	1981–2007	5–8322	58
	Contingent behavior	1995–2007	5–1064	9

Note: the references of the studies used in the meta-analysis are given in Appendix A.