



An assessment of the non-market value of the ecosystem services provided by the Catalan coastal zone, Spain

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ABSTRACT

A spatial value transfer analysis was performed to generate baseline estimates of the value of ecosystem services in the coastal zone of Catalonia, Spain. The study used the best available conceptual frameworks, data sources, and analytical techniques to generate non-market monetary value estimates that can be used to identify scarce ecosystem services among competing coastal uses. The approach focused on natural and seminatural, terrestrial and marine systems, which provide essential services that are not considered in current economic markets. Results show that in 2004 a substantial economic value of \$3,195 million USD/yr was delivered to local citizens by surrounding ecosystems. In a spatially explicit manner, the approach illustrates the contribution made by natural environmental systems to the well being of communities in the coastal zone of Catalonia. It is hoped that this study will highlight the need to consider these coastal systems in future management strategies to ensure their proper maintenance and conservation.

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1. Introduction

If sustainably managed and protected, ecosystems offer benefits to current and future generations. The concept of ecosystem services, which is defined as the flow of benefits from nature to people, offers a framework in which to promote this vision [1].

Traditionally, benefits from the use of natural resources have not been fully incorporated into coastal zone management. Ecologically productive and multifunctional ecosystems continue to be converted into simple, single functional land use/land cover zones (e.g. croplands, urban developments, artificial hardening of the shoreline). The result is a biotic homogenization of the coastal environment [2]. One reason why the benefits obtained from these areas is still underestimated is the difficulty in expressing their indirect use value or the importance of their ecological functions in monetary terms. Since most of the economic value of coastal and marine environments lies outside the markets, failure to provide an analogous economic indicator for ecosystem services is potentially more detrimental for coastal and ocean economies than for others.

Ecosystem valuation is the process of assessing the contribution of ecosystem services in achieving a particular goal. Traditionally, this goal is efficient allocation, but other goals are possible [3]. The basic aim of valuation is to determine the preference of the user: how much better or worse off they would consider themselves to be as a result of changes in the supply of certain ecosystem goods and services. By expressing these preferences and relating them to measures of human well-being, valuation aims to make natural capital comparable with other sectors of the economy (e.g. built capital) for appraising investments, planning activities, developing policies, or making decisions about land and resource use.

In this study a spatial value transfer assessment was conducted to generate baseline estimates of ecosystem service values (ESVs) that are not part of existing economic markets in the coastal zone of Catalonia, Spain. The value transfer method constitutes the application of values and other data from the original study site to the present policy site [4]. Due to the increasing sophistication and number of empirical economic valuation studies in the scientific literature, value transfer has become a useful method for assessing ESV when primary data collection is not feasible due to budget and time constraints [5]. This is particularly relevant when resources are negligible (zero value) because they have simply been ignored in the existing markets.

Traditionally, most of the attention on the value transfer approach has been focused on the economic theory behind value

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transfer, while the inherently spatial nature of ESV is largely avoided [6]. Consequently, few practical applications of the methodology exist. Thus, although economists realize the importance of considering the spatial and ecological context of sites in conducting value transfer, it is important to develop ecosystem and landscape classifications for this specific purpose [7].

The key underlying assumption of international value transfer methods is that the economic value of ecosystem goods or services at the study site can be determined with sufficient accuracy by analyzing existing valuation studies at other sites [8]. Despite the known limitations, such as the context sensitivity of value estimates (biophysical and socioeconomic) and of coastal and marine service coverage [9], accuracy clearly improves when the information is more detailed and larger data sets are available [6,10]. Therefore, the quality of primary studies will determine the quality and applicability of the value transfer study.

The purpose of valuation at the regional scale is more similar to national accounting than to estimating exchange values. Moreover, treating the economic value of ecosystem services as zero is sometimes referred to as the “business as usual” alternative (although it is not really an alternative), which has resulted in much more error than value transfer itself has [11].

From the perspective of ecological economics, the assessment of ESV is considered a powerful tool for placing ecosystems on the agenda of integrated coastal zone management (ICZM) [12]. Olsen et al. [13] argue that the fundamental challenge of coastal management is governance and not technology transfer or refined scientific knowledge. This article seeks to contribute to the governance of the Catalan coast by clearly identifying the value of the benefits obtained from ecosystems, the coastal features that provide them, how this value is distributed, and how it impacts the current administrative units used in the coastal zone of Catalonia. This information is expected to help decision makers avoid systematic biases and inefficiencies in coastal management processes.

The objective of this study was to develop a comprehensive spatial value transfer assessment of the non-market economic benefits provided by natural and seminatural systems along the coastal zone of Catalonia, Spain. By developing a valuation system, the aim was to generate value estimates that can be used to identify scarce ecosystem services related to competing coastal uses such as coastal development and nature conservation.

2. The Catalan coast

Catalonia is located along the northeastern Spanish Mediterranean coast. It is one of the richest and most rapidly developing regions in Spain. It occupies an area of 32,105 km² and about 44% of its population (3 million in 2004) lives in just 7% (70 municipalities) of the territory [14]. The coastline is 699 km long and comprises a variety of temperate coastal systems, of which 270 km are beaches. The coast has a NE-SW orientation and has considerable geo and biodiversity, represented in its cliffs, rocky coasts, sandy beaches, low coastlands, estuaries, and river deltas, such as the Ebro delta. The seagrass species *Posidonia oceanica* constitutes one of the most productive environments in the Mediterranean Sea and is particularly relevant in this study. It hosts a diverse assembly of ecosystem goods and services that directly affect the well being of coastal communities. Although there have been previous efforts to develop a framework of ICZM in Catalonia, the ESV has not yet been estimated to the knowledge of the authors at the time of preparing this manuscript.

Fig. 1 shows the 12 coastal *comarcas* (administrative units) included in the three provinces of the Catalan coast. The Mediterranean climate has helped create the current structure of the area,

which is dominated by typical coastal activities such as tourism, commerce, agriculture and – more recently – residential development. Industrial and commercial activities are strongly associated with the metropolitan areas of Barcelona (Central) and Tarragona (South) but are less significant along the rest of the coast, where other economic activities (mainly tourism) are dominant [15].

The Spanish coast is not only a complex area from the demographic, economic and biophysical points of view, but also because of the way it is regulated. There are three main administrative levels in terms of institutions and legislation relevant to coastal zone management: the central government of the Spanish State, the Autonomous Government of Catalonia (*Generalitat*), and the Municipalities. Within those levels, the Catalan coast is governed through two main legal instruments: the Spanish National Coastal Act of 1988 that represents the jurisdictional framework through which coastal zones are organized, and the Statute of the Autonomous Community of Catalonia that sets out the limited competencies of the *Generalitat* with respect to the Catalan coast and its marine environment. Although in general the Spanish government manages most activities related to the marine public domain (as set out in the Coastal Act), some of the activities that influence the structure and dynamics of the shoreline are managed by the local municipalities (mainly seasonal services such as upkeep and cleaning of beaches, e.g. [16]), and river basin authorities. These two political instruments were reinforced by the adoption in 2002 of the European Parliament and Council Recommendation concerning the implementation of Integrated Coastal Zone Management in Europe (COM/00/545), origin in 2004 of the ICZM Strategic Plan for the Catalan coast. See Barragán [17] for a review on coastal zone management in Spain.

The above mentioned instruments play a role in the practical implementation of new emergent European Union policy (e.g. Integrated Maritime Policy for the European Union, Blue Paper – COM/2007/574), legislation (e.g. Marine Strategy Framework Directive - 2008/56/EC), and regional sea scale policy as the recent Protocol on Integrated Coastal Zone Management in the Mediterranean recently launched in 2009 (EU/34/2009), the first ever legally binding instrument on ICZM in the Mediterranean Sea. The framework developed in this paper is intended to provide a unified conceptual basis for the valuation of ecological services as scientific-support to decision making in these new European Union policy developments.

3. Methodology

The methodological approach was divided into three parts: (i) the estimation of the non-market monetary value of ecosystem services provided by the Catalan coastal zone, (ii) the analysis of the annual ESV flow using relevant coastal management units, and (iii) comparisons and future recommendations. The study focused only on terrestrial and marine goods and services that are not represented in economic markets; marketed goods, such as commercial offshore fisheries (>50 m depth), aquaculture, and agriculture were not considered in this study. Hereafter, non-market ecosystem goods and services will be referred to as ecosystem services.

3.1. Spatial value transfer analysis

The ESV analysis was based on a unit value transfer approach. Its implementation follows the method proposed by Troy and Wilson [6] for estimating and geographically mapping the monetary ESV. It consists of six core steps: (1) selecting the ecosystem services to be valued, (2) defining the study area, (3) establishing a typology to classify land use/land covers that can then be used to predict significant differences in the value and flow of the ecosystem

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