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Chapter 1

ECOSYSTEM SERVICES IN THE MEDITERRANEAN SEA: THE NEED FOR AN ECONOMIC AND BUSINESS ORIENTED APPROACH

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ABSTRACT

The relationship of Mediterranean people with the sea still remains close after 4000 long years of history. Different empires and a large number of human generations have been using its environment in a granted way. All these uses have compromised the ability of the sea to operate correctly and put in danger some of its observed process, its structural units, and their functions and with them, the benefits that people get as ecosystem goods and services. Establishing connections between ecosystem change and people's benefit can lead to develop much more proactive approaches for conservation. The ecosystem service concept can be also useful at that point because it emphasizes the real notion of both protecting nature and benefiting man at the same time. Understanding of provision of ecosystem services (quantification), understanding of the benefits to human well-being from ecosystem services (valuation), and creating incentives for the sustainable provision

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of such ecosystem services (policies, good governance, alliances,…) should be recognized as a precondition for a sustainable future of our seas and coasts. In this way Innovative schemes for linking public and private efforts to protect ecosystems by ensuring the provision of ecosystem services need to be raised because whoever benefits from those services should have a responsibility in its proper care. Ecosystems provide many critical life support functions and benefits for human wellbeing and it is time to find the best way to ensure its good environmental status.

Keywords: Ecosystem services. Valuation. Mediterranean Sea

INTRODUCTION

For at least 4,000 years, since the Egyptians, Minoans and Phoenicians were trading across and, probably even early by other communities fishing in their waters, people have been using the Mediterranean Sea. The Mediterranean region has been traditionally recognized as a crossroad of marine routes, biota and civilization. This relatively calm and beautiful enclosed sea with numerous islands as magnificent posts, have provided an ideal setting for humans around their waters using their multiple components mostly in a granted way. Fisheries, navigation, battles, and commercial trading were for more than 3.000 years the main human uses of this environment that constituted the central sea of western civilization and the trade link to the eastern world. The western migration of people to America shifted the center of gravity to the Atlantic coast of Europe and the importance of the Mediterranean decreased. However, the opening of the Suez Canal in 1869 provided an easy route to Asia and increased again the importance of the Mediterranean for worldwide economic activities and human development; a non-ending history up until today.

In 2012, the 21 Mediterranean countries had around 7% of the entire world population (510 million people; CIA World Factbook). Although slowing down its growth, population is still increasing in the Mediterranean region. Some of the trends connected with this growth such as an enormous increase of economic activities in the region, with especial attention to international tourism arrivals and coastal development in the northern rim, a growing population in urban environments especially in the southern rim (it is expected that almost 75% of the total population will inhabit urban areas larger of 10.000 inhabitants by 2025), and an exploding aging population, accelerated new demands on modern facilities and infrastructures, altogether incrementing the pressure on the natural systems of its environment. Due to such trends, during the last decades we have seen a cascade of cumulative pressures on its ecosystems components that yield a tremendous transformation of the Mediterranean natural environment.

The drivers of change seen for the Mediterranean mirror a global anthropogenic-driven transformational change (Crutzen, 2002; Steffen *et al.*, 2007; Rockström et al., 2009). In recognition to such transformation, a decade ago, United Nations launched the Millennium Ecosystem Assessment report (MEA, 2005). This report constituted a global audit on world's ecosystems providing summaries and guidelines for decision-makers. The report concluded that ecosystems have declined more rapidly and extensively over the past 50 years that at any other comparable time in human history, and advised on the issue that this degradation jeopardize not only ecosystems around the globe but also human activities. The report established the link between human activities and good environmental status because healthy ecosystems provide natural conditions that are indispensable for human well-being and societal welfare.

The new ideas included in the MEA report (highly dependence of human populations on natural goods and ecosystem services, indivisible link nature-man inside social-ecological systems, ecosystem approach for management, …) scaled up during the past decade to be settled into the international environmental policy agenda. Between all these applications, in Europe, the new Marine Environmental Policy (Marine Strategy Framework Directive (MSFD) and the Integrated Maritime Policy (IMP)) was conceived to achieve a Good Environmental Status (GEnS) and a sustainable use of marine ecosystems. This new policy structured a common vision and a holistic, integrated approach to the management of the marine environment using the Ecosystem Approach as its basic frame of reference (Farmer et al., 2012). The new Marine Environmental Policy emphasizes the necessity to protect, maintain and/or enhance natural resources, both natural goods and ecosystem services.

The blue waters of the Mediterranean, as well as other enclosed seas and oceans elsewhere, contain myriads of cells that use sunlight to produce organic matter through the photosynthesis process. This organic matter travels around complex trophic chains giving us as a humans living support. This produced biodiversity also help us to obtain other types of goods but also to support other fundamental ecosystem functions such as water depuration, coastal protection or carbon fixation, between others, that benefit man. During the last three decades, an effort has been made to bring not only these ecosystem functions into the concept of ecosystem services through the recognition of the benefits they give to man (Daily, 1997; de Groot, 2002; Gómez-Baggethum *et al.*, 2010), but also to value them in monetary terms, and recently to incorporate this jargon into markets and payment schemes.

Ecosystem services help to make the Mediterranean region much more habitable but despite this fact still they are not entirely understand and widely appreciated by people.The ecosystem services provided by the Mediterranean Sea are today increasingly compromised by human activities. Regional assessments done for the Mediterranean confirm that the capacity of our sea to continue in the delivering of ecosystem goods and services is declining as a result of human activities (Coll *et al*., 2010, 2012; Sala *et al*., 2012) following global trends observed elsewhere (MEA, 2005; Worm *et al.* 2006; Halpern *et al*. 2008; Ewing *et al*., 2010). The new European marine policy was also aimed to stop and reverse this degradation. Having all the above considerations in mind, the aim of this article is twofold; on one hand, to review fundamental ideas around the ecosystem services concept and to analyze how human-related stressors translate into changes not only of the present people's welfare but also of future generation's welfare, and, on the other hand, to advocate for new public-private partnerships to raise innovative models of collaboration that help in the maintenance and/or restoration of vital ecosystem services. Establishing connections between ecosystem change and people's benefit can lead to develop a much more proactive approach in the management of the Mediterranean Sea natural resources.

Concepts on Ecosystem Services and Its Classification

An ecosystem consists of a biological community (biotic component) together with its abiotic environment, interacting as a whole (Chapin *et al*., 2002). Ecosystems are complex (structurally and functionally) adaptive systems that are controlled both by internal and external factors providing a variety of good and services upon which people depend. Ecosystem goods and services are delivered through various combinations of ecosystem functions which are in turn delivered by different components of its biodiversity.

The notion that ecosystems support human societies and that natural resources should not be seen as discrete entities is not new and a variety of terms were offered in the past to describe this issue. It was firstly mentioned in the report "Study of Critical Environmental Problems (SCEP, 1970; reviewed by Daily, 1997) as "environmental services", services that would decline if the functions of ecosystems also decline. The concept was slightly modified by Ehrlich *et al*. (1977) "public services of the global ecosystems", by Westman (1977) "nature's services", and finally it became named as "ecosystem services" (Ehrlich and Ehrlich, 1981; de Groot 1992; Costanza *et al*. 1997; Daily 1997; Gilbert and Janssen 1998; de Groot *et al*., 2002; Boyd and Banzhaf 2007). In 1997 Daily proposed the following definition "*conditions and processes through which natural ecosystems, and species that make them up, sustain and fulfill human life*". The concept was lately popularized and formalized in the Millennium Ecosystem Assessment (MEA, 2005) in a much simple way "*the benefits that people obtain from ecosystems*". Both definitions established the linkages between ecosystem services and human well-being by recognizing that ecosystems, if sustainably managed and protected, benefit current and future people and societies, bringing the idea that the concept of ecosystem services shows the flow of benefits from nature to people, providing a framework that can be used in the management of public goods.

In today's world, natural resources (ecosystem goods and services) cannot be treated as discrete entities that need to be analyzed separately; they are dependent of the social and economic systems with which they interact. The concept of social-ecological systems (Berkes and Folke, 1998) has been developed recently to analyze this complexity. Social-ecological systems (Figure 1) are "*complex adaptive systems in which humans are part of nature and the dynamics of both dimensions are strongly linked at equal weight*". These coupled, co-evolving models, by definition should focus on the ability of the management system to respond to feedbacks from the environment having deeply into consideration the tendencies of goods and services we obtain as benefits from the environment.

Social-ecological systems can be analyzed through different information platforms. Recently Cooper (2012) have proposed the Driver-Pressure-State-Welfare-Response (DPSWR) framework (an evolution of the DPSIR framework, EEA, 1999) to adequately organize information of the interrelation between the human and the natural sub-systems inside. Human systems (people's capabilities and their activities) become drivers of change (D). They pressure constantly or in pulses natural related systems (P). Those Natural systems (structural units and the functions they made) alter their status (S) that in turn can translate into the degradation of fundamental natural resources used by man (natural goods and ecosystem services) diminishing human welfare (W).

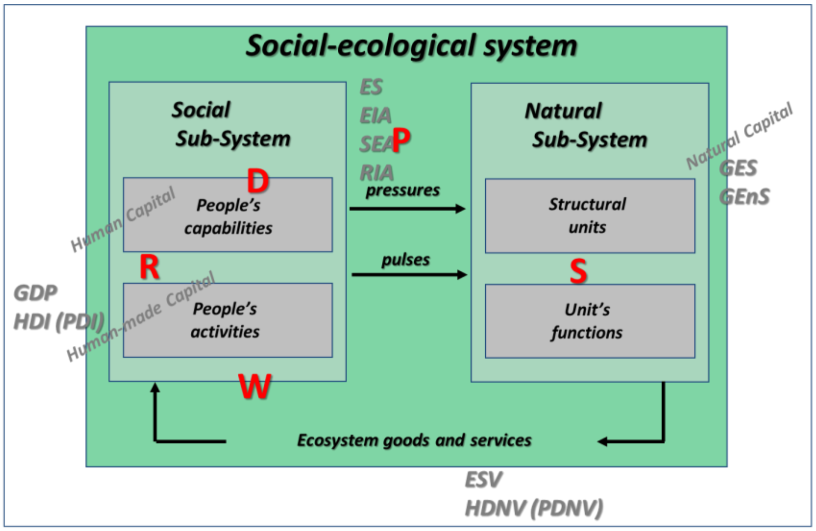

Figure 1. Schematic representation of a social-ecological system with accounting frameworks for its individual parts.

The recognition of such degradation should allow man to made adequate policy responses (R) to solve the pattern of accelerated degradation. The information generated through the DPSWR framework expressed issues in a highly inter-related form which is something that we cannot observe if we use other sets of indicators that inform different pieces of the social-ecological system puzzle in isolation. Human systems are normally monitored through a myriad of economic indicators such as Gross Domestic Product (GDP) or Household and/or Personal Disposable Income (HDI, PDI). When man pressures are analyzed, a large set of impact indicators commonly used in Environmental, Strategic and/or Regulatory Impact assessments (EIA, SEA, RIA) are developed, as well as environmental standards (ES) are set up to have these pressures under control. Indicators for Natural systems (besides the ones used in the Academia) are much more recent; In Europe, the Marine Strategy Framework Directive has introduced recently the notion of Good Environmental Status (GEnS, following the nomenclature recommended by Borja et al. (2010)) in a similar way that the Water Framework Directive did with the Good Ecological Status (GES) indicators; GEnS works with a set of multiple indicators following 11 environmental descriptor. Finally, the benefits obtained by man from natural systems can be assessed using market indicators for marketed natural goods or assessing ecosystem service valuation (ESV) accounting also for Household and/or Personal Disposable Natural Value (HDNV, PDNV).

Different classifications to hierarchically accommodate ecosystem services can be found in the literature (de Groot, 2002; Farber *et al*., 2006; MEA, 2005; TEEB, 2010). These classifications relate ecosystem services to a function analysis approach (de Groot, 2006) because in order to achieve the level of ecosystem services provision by society we need to identify what functions determine what services.

The list below address the four categories of ecosystem services following MEA (2005) including the changes added by TEEB (2010); provisioning services, regulation services, supporting services (including habitat services) and cultural services.

- *Provisioning services:* cover materials or energetic outputs from ecosystems.- Food, Water, Raw Materials, Medicinal resources, Ornamental resources, and Genetic resources.
- *Regulating services:* cover benefits obtained from the regulation of ecosystem processes.- Climate regulation, Carbon sequestration, Disease regulation and Biological control, Water flow regulation and purification. Air quality management. Maintenance of soil fertility, Erosion prevention, and Pollination.
- *Cultural services:* cover non-material (intellectual/cognitive /symbolic) uses from ecosystems.- Spiritual and religious, Recreational and Tourism, Aesthetic enjoyment, Inspirational for culture, art and design, Educational and Cognitive development, and Cultural Heritage.
- *Supporting services:* necessary for the production of all other ecosystem services.- Soil formation, Nutrient cycling, Primary production, Nursery services, Gene pool protection, and Habitat maintenance.

Ecosystem services may not have to be utilized directly and can be differentiated as intermediate a final services (fish production is a final service, primary production is an intermediate service, necessary to get the final service). This separation into intermediate and final services, with the latter yielding welfare benefits is important in any possible valuation exercise because it helps to reduce the risk of double counting the welfare benefits provided to humans by often complex ecosystem functioning. Using another example that will be employed lately, in coastal areas, geodynamics and sediment transport can be considered an intermediate service (provisioning, regulation) of a final service consistent in the creation and maintenance of beaches, dunes and other places for humans which can be seen as benefits for people in flood/storm buffering, shoreline stabilization or recreational activities (security, basic mater for good life, good social relations,…).

Another important consideration about ecosystem services is the need to translate them into benefits that can improve human well-being (Fisher and Turner, 2008). Ecosystem services constitute the link between ecosystems, the way they operate and those things that humans benefit from, in other words, ecosystem services are the ecological phenomena, and the benefit is the realization of the direct impact on human welfare, for instance, using the above commented example, the production of fish is a service, the income derived from fisheries is a benefit. The fundamental concept behind is that ecosystem services are phenomena that provide benefits for man.

ECOSYSTEM SERVICES VALUATION

Valuation Techniques

Valuation is the process of assessing the contribution of a particular object or action to meeting a particular goal, whether or not that contribution is fully perceived by the individual. One reason for the persistent under-valuation of coastal and marine ecosystems is that its economic value has been based on a very narrow definition of benefits for man. Many people tended to see the value of natural ecosystems only in terms of the raw materials and physical products that can generate for our human production and consumption (especially focusing on commercial activities and profits, those values tan can be marketed). These direct uses however represent only a small proportion of the total value of coastal ecosystems, which generate economic benefits far in excess of just physical products or marketed commodities. Confining concepts of ecosystem value to these benefits alone would constitute a huge underestimation, and covers only the tip of the total value.

The most appropriate framework to assess the overall economic value of a particular ecosystem is that of Total Economic Value (TEV). As we have seen previously, ecosystems give rise to a large range of natural goods and ecosystem services that include direct use values, indirect use values and passive (non-use)-use values, the latest comprising option, existence and bequest values (Costanza and Folke, 1997).

- *Direct-use values* are determined by the contribution an environmental asset makes to current production or consumption through direct use of the site.
- *Indirect-use values* include benefits derived from ecosystem services provided to support current production and consumption.
- *Option values* are the premium that consumers are willing to pay for a utilized asset; i.e., to avoid the risk of not-having it available in the future.
- *Existence values* are obtained due to satisfaction of merely knowing that the asset exists, even if there is no intention to using it.
- *Bequest values* are conceptualized when the above satisfaction comes from the idea of leaving the asset for further generations.

Although the goal of ecosystem services valuation is efficient allocation (*i.e.* to allocate scarce ecosystem services among competing uses such as development and conservation), other goals can be identified (Daly 1992): (a) assessing and insuring that the scale or magnitude of human activities within the biosphere are ecologically sustainable; (b) distributing resources and property rights fairly, both within the current generation of humans and between this and future generations, and also between humans and other species; or (c) efficiently allocating resources as constrained and defined by a) and b) above, and including both market and non-market resources, especially ecosystem services. Because of these multiple goals, valuation must be conducted from multiple perspectives, using multiple techniques (including both subjective and objective methodologies) (Brenner, 2007).

Many natural goods and ecosystem services are not traded. In most of the cases undervalued by the market, subjected to prices which are highly distorted, or that have characteristics of public goods which mean that they are not adequately allocated or priced. For these reasons, their value cannot be expressed accurately via market prices. To solve this problem, a range of different valuation techniques have been identified to do the job. There are different methodologies available to estimate the economic value of natural goods and ecosystem services (see list below), however each valuation methodology has its own limitations, often limiting its use to a select range of ecosystem services, and still, many of them are difficult to compare in between and yield different results for the same ecosystems service under valuation.

Market price based values

- *Market values;* value based on market prices taking into account government interventions such as taxes and subsidies.
- *Surrogate price values;* the value of a non-marketed asset is based on the market value of an alternative product providing similar benefits.
- *Productivity change values*; the value is based on the change in quality and/or quantity of a marketed good and the associated change in the total net market value.
- *Damage cost avoided;* the value of the asset is equal to the value of the economic activity that it protects.
- *Expected values;* value based on potential revenues multiplied by its probability of occurrence.

Cost based values

- *Replacement cost;* value based on the price of the cheapest alternative way of obtaining that service.

Revealed preference values

- *Travel cost method;* value inferred from the cost of travel to a site and its expenses.
- *Hedonic price values;* the value is based by computing its individual components which can be determined through regression analysis.

Stated preference values

- *Contingent Valuation;* the value is obtained by asking through questionnaire survey techniques how much people is willing to pay to prevent loss of, or enhance an ecosystem good or service.
- *Choice experiments;* the value is obtained similarly to Contingent Valuation involves also asking respondents to select their preferred package of environmental goods at different prices and then inferring specific components values via econometric analysis.
- *Transfer of values;* the value is estimated by transfer other obtained values from another similar context or location to allow us to estimate the one we desire.

Obviously the choice of any valuation technique will depend on the availability of resources for the study. Normally, the full suite of ecosystem valuation techniques will be required to account for the economic value of goods and services provided by a particular ecosystem. Table 1 is showing a list of ecosystem services together with its normal techniques used for valuation and the evaluation for a further transferability of the value across sites following Farber *et al*. (2006).

Ecosystem Services Valuation in the Mediterranean

We have seen a complete range of possibilities to make valuation on ecosystem services depending on the spatial scale used (ecosystems explored) and the employed methodologies (valuation techniques). A huge compilation effort has been made recently by the Marine Ecosystem Services Partnership to construct a database (http://www.marineecosystemservices.org/explore) of peer and non-peer reviewed empirical studies to extract ecosystem service valuation data. Table 2 provides information on ecosystem services valuation exercises from the Mediterranean region mostly extracted from this database. Information has been assessed based on ecosystem service type, land-cover type and geographical area of the Mediterranean, as well as on valuation methods. From the data presented we can assess that still we are in the infancy of this kind of approximations, we have very few empirical data.

Table 1. Categories of ecosystem services, economic methods for valuation and transferability across sites (adapted from Farber et al., 2006)

Ecosystem services		Amenability to Economic valuation	Most appropriate method for valuation	Transferability across sites
Provisioning	Water supply	High	AC,RC,M,TC	Medium
	Food	High	M,P	High
	Raw materials	High	M,P	High
	Genetic resources	Low	M,AC	Low
	Medicinal resources	High	AC,RC,P	High
	Ornamental resources	High	AC,RC,H	Medium
Regulating	Gas regulation	Medium	CV,AC,RC	High
	Climate regulation	Low	CV	High
	Disturbance regulation	High	AC	Medium
	Biological regulation	Medium	AC,P	High
	Water regulation	High	M,AC,RC,H,P,CV	Medium
	Soil retention	Medium	AC,RC,H	Medium
	Waste regulation	High	RC,AC,CV	Medium to high
	Nutrient regulation	Medium	AC,CV	Medium
Cultural	Recreation	High	TC,CV	Low
	Aesthetics	High	H,CV,TC	Low
	Science & education	Low	Ranking	High
	Spiritual & historic	Low	CV	Low
Supporting	Soil formation	Medium	CV,AC,RC	Medium
	Habitat maintenance	High	CV,TC	Medium
	Nursery service	High	CV, TC	Medium

Most appropriate method for valuation: AC = avoided cost; CV = contingent valuation; H = hedonic pricing; M = market pricing; P = production approach; RC = replacement cost; TC = travel cost.

Table 2. Ecosystem service valuation data from the Mediterranean region (adapted from the Marine Ecosystem Services Partnership organization).(data presented in black boxes were obtained by contingent valuation techniques; data presented in dark grey obtained by travel cost methodology; data presented in light grey obtained by transfer value methodology and the rest of data obtained by other methodologies)

		SPAIN	ITALY	GREECE	TURKEY
Continental Shelf	Atmospheric gas & Climate regulation				
	Disturbance regulation				
	Freshwater regulation & Supply	1287 (1)			
	Erosion control & Soil formation				
	Nutrient regulation & Cycling	1787 (1)			
	Waste treatment				
	Pollination				
	Biological control	49 (1)			
	Habitat refugium			366000-1708000 (10)	
				6.2 (11)	
	Aesthetic & Recreation				
	Cultural & Spiritual	86 (1)			
Beach or Dune	Atmospheric gas & Climate regulation				
	Disturbance regulation	67400 (1)			
	Freshwater regulation & Supply				
	Erosion control & Soil formation				
	Nutrient regulation & Cycling				
	Waste treatment				
	Pollination				
	Biological control				
	Habitat refugium				
	Genetic resources				
	Aesthetic & Recreation	36687 (1)	13.3-28.4 (3)		11 (13)
	Cultural & Spiritual	59 (1)			
Seagrass bed	Atmospheric gas & Climate regulation				
	Disturbance regulation				
	Freshwater regulation & Supply				
	Erosion control & Soil formation				
	Nutrient regulation & Cycling	24228 (1)			
	Pollination				
	Biological control				
	Habitat refugium				
	Genetic resources				
	Aesthetic & Recreation				
	Cultural & Spiritual				

Salty wetlands	Atmospheric gas & Climate regulation				
	Disturbance regulation	766 (1)		42.5 (8)	
	Freshwater regulation & Supply			43.3 (8)	
	Erosion control & Soil formation			40.9 (8)	
	Nutrient regulation & Cycling			44.4 (8)	
	Waste treatment	13376 (1)			
	Pollination				
	Biological control				
	Habitat refugium	497 (1)	30.4 (4)	40.2 (8)	
			41-65 (5)		
				12.0-50.3 (9)	
	Genetic resources				5064.7 (12)
	Aesthetic & Recreation	64 (1)			
	Cultural & Spiritual	445 (1)	1300 (3)		
	Fisheries		2607 (6)		
	Multiple		607-660 (7)		

(1)	per ha ($)	Brenner J., Jimenez, J., Sardá, R., Garola A. (2010).
(2)	per ha (euro)	Ariza, E. Ballester, R., Rigall, R., Saló, A., Roca, E., Villares, M., Jimenez, J.A., Sardá, R. (2012)
(3)	per ha ($)	Gren, I.M., Soderqvist, T. (1994).
(4)	per ha ($)	Nunes, P., Rossetto, L. (2004).
(5)	per household (French Francs)	lberini, A., Rosato, P. (2004).
(6)	per household (French Francs)	Zanatta, V., Alberini, A., Rosato, P, Longo, A. (2005).
(7)	per fisherman ($)	Nunes, P., Silvestri, S. (2008).
(8)	per person (euro)	Ragkos, A., Psychoudakis, A. (2006).
(9)	per person (euro)	Stithous, M. (2009).
(10)	per year	Togridou, A., Hovardas, T., Pantis, J.D. (2006).
(11)	per person (euro)	Peters, H., Hawkins. J. (2009).
(12)	per ha year($)	Gurluk, S., Rehber, E. (2006).
(13)	per person (UK and)	Blakemore, F., Williams, A. (2008).

In addition, the information provided normally is difficult to compare by the different techniques used and the different values expressed (value per area-year, value per person, value per household, ..); nevertheless, it can serve to understand the urgent need to carry out new empirical studies that need to be commissioned to end up with more satisfactory estimations.

Using this database we can see some of its examples. This section presents three case studies on ecosystem service valuation for the Catalan coast (North-Western Mediterranean) and its open waters in which we have been involved. These examples vary on the geographical scale that is considered for the analysis (from large spatial areas as the entire Catalan coast to a particular beach environment in the municipality of Lloret de Mar) and can serve to understand the way in which ecological and socioeconomic assessments can be carried out and can be used by policy makers or managers to find out the best policy decisions.

Ecosystem services valuation in the Catalan coast

Catalonia (32,105 km^2) is located at the North-eastern Spanish Mediterranean coast (Figure 2). Seven per cent of its surface is occupied by 70 municipalities that are in its coastal fringe (699 km long of which 270 km are beaches) and that form part of 12 coastal counties. These coastal environments (coastal counties, called "*comarques*" in Catalonia) are affected by different socio-economic activities, being most relevant industrial and urban development, services (mainly tourism) and agriculture. The Catalan coast natural environment is composed of a diverse mixture of forests, grasslands, wetlands, rivers, beaches, seagrass beds, and platform environments that provide many different valuable goods and ecosystem services to human beings. A valuation exercise (Brenner, 2007; Brenner *et al*., 2006, 2010) was developed using a value transfer methodology to assess the ecosystem services annual flow that coastal ecosystems were providing.

Ecosystem services valuation provided by the Catalan coast was computed using the method proposed by Troy and Wilson (2006) that follows spatial value transfer analysis. The study focused on terrestrial and marine goods and services which are not counted in the economic markets, therefore marketed goods, such as commercial offshore fisheries (> 50 m depth), aquaculture and agriculture were not part of the scope of this study. Using this method, the analysis of the ecosystem services value (ESV) annual flow by relevant coastal management units was then computed. Ecosystem services classification followed the scheme of Farber *et al.* 2006.

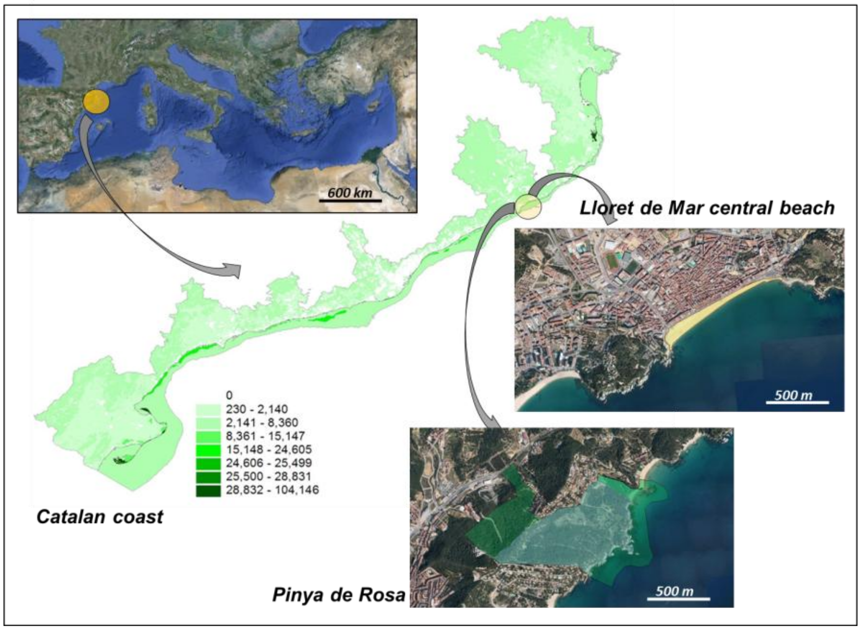

Figure 2. Cartographic representation of examples given for ecosystem service valuation in the Catalan coast. Ecosystem services value included for the Catalan coast is given in 2004 US$ per ha and year.

The geographical definition of the Catalan coastal zone was made by its coastal counties ("comarques") and near-shore marine areas (less or equal to 50 m depth). The terrestrial and marine cover typology used in this study constituted a merge of the Catalonia habitats (DMAH, 2006), the Catalan Sea bathymetry (DARP, 2000) and the seagrass beds vector layers (DARP, 2002). For the transfer value approach, scientific literature included in the analysis was basically empirical analyses in peer reviewed journals and book chapters that use conventional economic valuation methods and restricted to preference based valuations (*e.g.*, travel cost, hedonic pricing, contingent valuation); only meta-analysis of peer reviewed and non-peer reviewed studies were used when no data was available on the other group. Studies were limited to results that can readily be translated into spatial equivalencies focused on similar socioeconomic and biophysical regions as the North western Mediterranean, and primarily on non-consumptive resource use and ecosystem services (*i.e.*, non-market value). Estimation of ecosystem services value per area unit were standardized to average 2004 US dollars (USD) equivalents per hectare and per year to provide a consistent basis for comparison (for further comparisons, we used 1 USD = 133.94 Peseta, and 166.38 Peseta = 1 Euro set in 1994 by the Bank of Spain). The final calculation of the value of annual flow followed the recommendations of Bateman *et al.* (2002) on the application of Geographical Information System to environmental economics. An area of 931,460 ha was valuated in this study, 22.2% of this area corresponded to the coastal and marine domain (saltwater wetlands, beach and dunes, seagrass beds and the platform shelf shallower than 50 m depth) while 77.8% was terrestrial. The annual flow of non-market value of ecosystem services shown for each land and marine cover type in the Catalan coast (USD/yr in 2004) was calculated as 3.2 billion dollars (59% of this value coming from the terrestrial environment and 40.3% for the marine one). The value estimates calculated in the present study were compared with current market economic indicators to explore the contribution made from the natural capital in the coastal zone of Catalonia. Results show that total ESV flow was comparable to be around 2.8% of the Gross Domestic Product (GDP) in the study area ($114.8 billion USD in 2004), and the total ESV flow was around 4.3% of the available household disposable income ($74.4 billion USD in 2004).

The Natural area of Pinya de Rosa (Girona, Catalonia-Spain)

Pinya de Rosa is a beautiful natural coastal area located between the municipalities of Blanes and Lloret de Mar (Girona, Catalonia-Spain) (Figure-2). Despite the fact that the region form part of a highly touristic region (one of the most visited sites in Spain) the area have been preserved due to its private ownership for more than 60 years (all the period of high coastal development in Spain). After the owner's death, Pinya de Rosa was declared for sale at a price of 12 million euros in 2002. A socio-environmental public platform was born at that time to protect the space from a radical transformation by developers into an urbanized area. The platform was successful enough and finally, in 2003, Pinya de Rosa was formally protected by the Law 25/2003 of the Autonomous Government of Catalonia under one of the most important protected figures in Catalonia ("*Paratge Natural d'Interès Nacional*"-PENIN). Ninety-six ha of land were preserved under this Law.

Before protection, a scientific assessment was carried out. From all the information provided (Sardá et al., 2002), an ecosystem services valuation was established for this particular area to guide a social cost-benefit analysis before decision was made. The transfer value assessment methodology used in the previous example for the Catalan coast valuation was also used here. The 96 ha protected gave an ESV flow of around 400,000 euros per year. Although market and non-market valuations are difficult to compared, the provision value of the ecosystem services in Pinya de Rosa could be balance against investment values to be spend in land transformation and further societal benefits.

After protection, in 2004, the Government of Catalonia made an offer to heirs worth about 4 to 5 million euros for the acquisition of Pinya de Rosa as non-urbanized protected area.

The offer was rejected, and, at the same time, the property owners demanded 24 million euros to the Government for compensation for the land-use reclassification done to protect this area. Some years later, in 2008, a private investment company group bought 70 ha of Pinya de Rosa property for 24 million euros, a higher quantity to the one initially demanded at the beginning but enough to compensate the owners. The intention behind this acquisition was, and it is still, obscure because no transformation can be done in an area protected by an strong Law in the future but it shows how natural pristine areas can sometimes been undervalued by people, even for market prices.

The central beach of Lloret de Mar (Girona, Catalonia-Spain)

In Spain, as in many regions of the Mediterranean, beaches play a key role in the maintenance of the Tourism Industry, an essential sector for the economic welfare of some countries (Sardá and Fluvià, 1999; Sardá, 2001). Yepes (2004) described how the 0,001% of the Spanish surface (beaches that holds the "sun and beach" tourism model), are indirectly responsible of more than 10% of the Spanish Gross Domestic Product.

Consequently, beaches are considered to be one of the country's major assets. In the case of Lloret de Mar, its central beach (1.3 km; 5.6 ha) is considered one the most popular beaches in the entire Catalonia. Sardá *et al*. (2009) estimated in 22,036 the users per day of this beach during high season (the most visited days during summer, around 30 days during July and August).

As other coastal ecosystems beaches play multiple functions, being three the most important ones: to act as natural reservoirs, to offer coastal protection, and to provide human recreation.

A long list of ecological services is provided by these three assigned functions. The recreational service of the Lloret de Mar central beach was assessed using in this case the Travel Cost Methodology (TCM) as a valuation technique (Ariza *et al*., 2012). TCM computes individuals' willingness to pay for participating in a given recreation activity (i.e. visiting a beach) by taking into account the costs (e.g. travel costs, access fees, equipment costs, or the opportunity cost of time) incurred by the individuals to participate in the activity. For the central beach of Lloret de Mar, the total consumer surplus in one day at the peak of summer, using the number of daily users estimated in Sardá *et al.* (2009), was computed as 1.23 million euros.

Doing an exercise of a low estimation (30 similar days during the summer peak and the same amount, 30 days during the rest of the year) we obtained an annual value of 73.8 million euros for this beach. Nineteen percent of this money (13.3 million euros) went into taxes received by different administrations.

The results also show an important gap between investments made by managers (less than 1 million euros for all municipal beaches during this year) and users' economic valuation (more than 1 million euros per day at the peak of the season). With all these data, the value per meter square of the central beach of Lloret de Mar was computed as 1320 euros and its annual value per ha on 13.2 million euros.

Methodologies used for estimating non-marketed resources present limitations and still we have a long way to go before general acceptance of these values. These methodologies need to be calibrated using information generated with other techniques. In the case of TCM, values are highly site dependent.

A similar exercise done in beaches of Southern New England (Kline and Swallow, 1998) yield a value an order of magnitude lower than the one computed for Lloret de Mar (93,536 US$ per ha). Brenner *et al.* (2010) computed the recreational value of beach ecosystem services using the Value Transfer approach; in this case, the value for the central beach of Lloret de Mar was calculated as 36,687 US$ per ha. A contingent valuation exercise done in the beach of S'Abanell (Blanes, Girona) just 5 kilometers south of the central beach of Lloret de Mar yield an annual value of 315,864 euros, (13,375 beach users per day; 16.4% willing to pay 2.4 euros per day as average; 30 similar days during the season and another similar 30 days computed during the rest of the year) which accounts for a value of 63,811 euros per ha. (Lozoya, 2012).

Obviously all these estimates need to be handled with care because they are clearly methodologically dependent but they just present information about the value of the beach as a provider of ecosystem services for people.

ECOSYSTEM SERVICES: A BUSINESS POLICY ORIENTED APPROACH

Following the publication of the Millennium Ecosystem Assessment report (MEA, 2005), a new social-ecological paradigm have emerged to change the way we relate with natural systems. These systems are starting to be seen much more as capital assets that provide a flow of natural goods and ecosystem services to man. This view deals with the identification and analysis of the ecosystem services provided by nature but also with its valuation. Here is when the ecosystem service concept, if correctly explained, becomes highly useful to convince people about the importance to protect such sources of man's welfare, the ecosystems that are providing with these services to us. The ecosystem service concept also offer the possibility for changing the way we protect nature, moving from traditional conservational positions, many times seen by people as contra posed to development, towards a logic of conservation for development (Folke, 2006; Gómez-Baggethun and Ruiz-Pérez, 2011). Although this view is receiving more attention in the northern part of Europe where interdisciplinary collaboration to look things differently it is more rooted, Mediterranean countries should not avoid this particular way to see the future, a way that can be seen in a couple of examples.

Seagrass beds

Seagrass beds provide a high number of ecosystem services from provisioning, supporting, regulating and cultural services (Barbier *et al.*, 2011), they protect the coastal area from erosion, they serve as source of carbon sequestration, they are able to purify waters by concentrating pollutants without any apparent adverse effects, they constitute nursery ground for many species of fishes, and more. In many forms people is benefiting from such type of services. However, in the Mediterranean we are losing seagrass beds in an alarming way. In 1986 we estimated a total area for *Posidonia oceanica* beds of 6.8 million ha (Bethoux and Copin Montegut, 1986). Fifteen years later, Buia *et al.* (2000) estimated this area between 2.5-5.5 million ha; a loss of 1.3-4.3 million ha in a short time. We do not have proper economic figures of such loss but an economic service valuation done recently indicates that the value lost is going to be very high (Emma Jackson personal communication) and the possibilities for recovering this value is minimal due to the low intrinsic growth of the *Posidonia oceanica* species.

Beaches

Beaches play a key role in the Mediterranean environment. However beaches are being eroded today in a very fast manner (Eurosion, 2004). Urbanization of the coast has turned coastal erosion from a natural phenomenon into a problem of growing intensity. In Catalonia, a recent study (CIIRC, 2010) showed that Catalonian beaches (excluding the ones of the Ebro Delta) are eroded at a rate of 1.07 m per year. If we take into consideration half of the value calculated for the central beach of Lloret de Mar (660 euros per meter square) as an average value for the Catalan coast, Catalonia would be losing every year 136.5 millions of euros as a consequence of erosion problems by resource disappearance. Obviously, tourist expenditure of not using this space can be substituted by another activity or by occupying other parts of the beach when beaches are still width enough, but if this trend is not reverse, it will reach one point in which such losses could just be considered irreversible and its values lost forever.

Most people believe that public institutions (sometimes non-governmental organizations) should take care about public goods and should be leading conservation planning for ecosystem services. As ecosystem services could go hand by hand with biodiversity protection (Chan *et al.,* 2006), public institutions could just take the potential to manage both things together. In this case, the impact that man (as individuals or as companies) made on the environment should be regulated by those institutions to take proper care of its use and abuse. Although it sounds logical, this is not working properly due, in most cases, to a lack of priorities in the protection of public goods by the authorities, and if we do not change the course of our actions, we may end up without anything to take care. The ecosystem services concept can be also useful at that point because it emphasizes the real notion of both protecting nature and benefiting man at the same time. We need to modify our way of thinking in our relation with natural systems and its conservation. Nature, in this case the Mediterranean Sea, brings us benefits through ecosystem goods and services, and, in a way, whoever benefit from those goods and services should have a responsibility of its degradation. Solutions for these problems require much more public-private partnerships and the involvement of all actors to come up with fresh ideas to protect those natural resources in a sustainable way.

Innovative schemes for linking public and private efforts to protect ecosystems by ensuring the provision of ecosystem services are becoming more and more used today. Some research suggests that some schemes like the "payment for ecosystem services (PES)" could be a fundamental move in this way (Wendland *et al.*, 2009; Farley and Costanza, 2010; Farley *et al.*, 2010). PES schemes are voluntary transactions where a well-defined ecosystem service is being "bought" by at least one buyer from (a minimum of one) ecosystem service provider if, and only if, the ecosystem service provider secures its provision. Although we can find the utilization of some of these schemes worldwide (almost all of them are done for terrestrial environments) their real impact on ecosystem services is still negligible. PES schemes differ greatly from conventional markets to address negative externalities of our activities following the "polluter pays principle" by the introduction of the "steward earns principle" in which positive externalities are addressed from the very beginning (Gómez-Baggethun and Ruiz-Pérez, 2011).

The use of payment schemes into the marine domain remains in its infancy with small movements today. One good example could be the "blue carbon" idea. Wetland areas and seagrass beds are common in the Mediterranean. They provide plenty of ecosystem services to people from which we benefit. These natural systems have demonstrated a large capacity for carbon sequestration in both the dominant plants and the sediments immediately below (Mateo *et al.*, 1997; Kennedy *et al.*, 2010). The Blue Carbon International Scientific Working Group, under UNESCO Patronage (Pidgeon *et al.*, 2011) have built a program to coordinate and guide establishment of coastal "blue carbon" as a conservation and management tool contributing to climate change mitigation and the development of associated conservation financing mechanisms. Assessing its feasibility, providing implementable recommendations, diminishing data gaps, designing and implementing programs of action, analyzing its possible use in voluntary schemes of carbon markets,… these are actions that require a bunch of work for as many actors as possible including private organizations. The protection of wetland areas and seagrasses is vital for society due to the provision of those different ecosystem services. The carbon sequestration service provided by those ecosystems can be marketed through a PES scheme. Several projects are right now trying to put forward the idea of introducing such type of frameworks for these ecosystems into voluntary or mandatory carbon markets through Clean Development Mechanisms (CDM) where different stakeholders would have the possibility to work on conservational strategies while they are benefiting themselves in a marketed way.

More conservation efforts in the fisheries industry need to be taken as soon as possible because in the Mediterranean, as well as in other parts of the world, fisheries are collapsing. The ability to maintain fishermen's income levels by protecting fish populations should be an essential element for success. In this case, a PES scheme also could work by providing an economic incentive to fishermen to adopt fisheries and/or management practices favorable to the sustainability of fish stocks. In the problem of fish depletion, doing nothing (no taking actions) or moving business to other sites are no solutions for the problem. Working with regulatory tools alone have been demonstrated many times to fail due to a lack of enforcement, so providing incentives by using public-private partnerships could be feasible and it have been proven possible as in the Chilean artisanal fisheries (Castilla and Defeo, 2005; Gelcich *et al*., 2008). This requires understanding fishermen, understanding the science behind the problem, matching both by using a participatory process, and finally introducing an incentive package that give security to fishermen to cover its living styles while the restoration of fish stocks takes place using adequate co-management tools.

Working with ecosystem services also incorporate the need to properly account for the valuation and management schemes of single ecosystem services or of multiple ecosystem services. For example, clean drinking water, sediment transport, and coastal productivity are all benefits arising from a well-managed river ecosystem, but normally these services are managed independently in isolation one from another and tradeoffs over management options depend on partial negotiations and lobbying. In addition, sediment transport is an intermediate service for the final service which is having a safe recreational space in a beach to lay-down in summer time which is basic for the maintenance of the tourism industry. As we do not properly account for these relationships, many times we end up with decisions that are not the best ones for the entire society. Beneficiaries of the latest service can be local actors such as hoteliers or global actors such as tour-operators, but, in any case, they are normally far from the room in which important decisions that affect their business are taken on the provision of ecosystem services that benefit them.

It is time to develop proper structured methodologies that help people to understand, valuate, and manage risks and opportunities arising from our dependence to ecosystems and the provision of its services. It is not just public managers and non-profit organizations that should do the job, private companies and private managers should be aware of the status of such ecosystem services on which they depend for its future taking part on its protection. Recently, United Nations, an organization that usually only was talking with national bodies, have made large efforts to start to talk directly with other stakeholders such as companies in the protection of natural systems (MEA, 2005). Different organizations are incorporating this message into its portfolio of actions (TEEB, 2010; WBCSD, 2011; WBCSD-MI-WRI, 2012).

The World Business Council for Sustainable Development (WBCSD) together with the Meridian institute and the World Resource Institute developed recently a Corporate Ecosystem Service guidelines for identifying business risks and opportunities arising from ecosystem change. This methodology is aimed to help companies understand their dependence and impact on ecosystems and the resulting business risks and opportunities in a coherent, systematic manner (WBCSD-MI-WRI, 2012). By choosing the boundaries for the study, making an identification and analysis of the ecosystem services used by them, and developing strategies to address risk and opportunities connected with the trends observed for those ecosystem services, companies can benefit as well man does.

Public-private partnership alliances need to be developed to find the way to manage correctly ecosystem services. Contrarily to what it can be seen in the terrestrial environment, given the difficulties in sampling and understanding the processes occurring in the marine environment, comparatively little is known of how marine biodiversity contributes to the delivery of these goods and services relied upon by people (Austen et al., 2008). However, we can take examples from such type of actions done on carbon and water related services of watersheds (www.ecosystem marketplace.com) . Although the participation of the private sector in the protection and payment for ecosystem services in the marine domain is in its infancy, the potential for improvement and growth is large. We still need to work hard to inform better all parts of society; however the business community is recognizing the importance of ecosystem health and ecosystem functions to provide goods and services that are necessary to maintain the competitiveness and sustainability of business operations, being more and more involved with time in the effort to guarantee and adequate functioning of natural systems.

CONCLUSION

The relationship of Mediterranean people with the sea still remains close after 4000 long years of history. In its northern rim, coastal and marine environments have become the most popular tourism destination for the entire world. In the southern rim people is changing the remarkable resilient stability reached during last decades by emphasizing needs for democracy and development asking for more plentiful reforms. However, as more people get into coastal areas and more activities are observed there, more habitat is lost, more seafood need to be extracted to satisfy local demand, more highways in the sea are open to transport goods and people, and our appetite for its colonization to extract sand, minerals and other materials or to satisfy our demand for energy goes up. All these uses (food, transport, dumping rubbish, recreation, …) have compromised the ability of the sea to operate correctly and put in danger some of its observed process, its structural units, and their functions and with them, the services that benefit man. The sea's functioning has been stretched beyond its limit and today everybody is starting to know what are the ecological, social and economic implications of this degradation. Understand the economic benefits of a healthy environment could be also useful to empower marine European policy prioritizing proactive actions to avoid further environmental degradation. Better information to allow people to understand about ecosystem services and to have well-formed preferences is one of the first goals to be reached in a near future in this area of knowledge.

As other worldwide coastal and marine environments, the ecosystems of the Mediterranean Sea provide ecological functions that directly or indirectly translate into benefits to humans through resources (natural goods and ecosystem services) that can be renewable and sustainable if properly managed. However those resources often are taken for granted and commonly are overused; even for important and dependent economic activities such as fisheries and tourism, efficient management and sustainable exploitation can be considered as exceptions rather than normal rules leading to resources depletion and collapse. In order to protect these resources, a much more functional-based approaches to ecosystems need to be developed to help identify the relevant dependences of ecosystem services provision. These approaches should provide qualitative and quantitative analytical capabilities of elements, processes and services which are responsible for human well-being as a way to translate the ecological complexity into a structure useful in natural resource management. Understanding of provision of ecosystem services (quantification), understanding of the benefits to human well-being from ecosystem services (valuation), and creating incentives for the sustainable provision of such ecosystem services (policies, good governance, alliances,…) should be recognized as a precondition for a sustainable future of our seas and coasts. The development of information-based platforms to understand these relationships can be observed as a second important goal to protect ecosystem services.

The approaches above have been recognized in the new European marine policy. In this policy, Good Environmental Status (GEnS), becomes the final desired vision to be reached using an ecosystem approach to management. The preamble 8 of the Marine Strategy Framework Directive (MSFD) mentions "*by applying and ecosystem-based approach to the management of human activities while enabling a sustainable use of marine goods and services, priority should be given to achieving or maintaining good environmental status in the Community's marine environment to continuing its protection and preservation, and to prevent subsequent deterioration*". Following this policy, new tools are developed to avoid global degradation of ecosystems and the services they provide. New managerial standards as the Ecosystem-Based Management System-EBMS (Sardá *et al*., 2010) or the Corporate Ecosystem Service guidelines (WBCSD-MI-WRI, 2012), between others, are just some of the tools we are developing to help us in the move to protect ecosystems through the protection of the services they are given to us.

Valuing Nature by the natural goods and ecosystem services that provide is not new but incorporating monetary terms into this recognition it is. Introducing market-based instruments for conservation (Paterson *et al*., 2010) have still detractors and it is still in debate; however, this issue has opened the language used in biological conservation to other stakeholders facilitating a common jargon to advance into sustainable ecosystem management models. Valuation of non-marketed ecosystem services need to be made with care because different techniques can produce different monetary outputs, and we are just now at the beginning of this new way to see nature, the possibility to give unit values to something was not valued before, opened the conservation movement to other actors making this much more relevant for people. Accounting for ecosystem services is important also for public policy because these services contribute significantly to human welfare and are not captured in existing welfare accounts (Boyd and Banzhaf, 2007). This opens a large research need to come up with a clear structure of what can be economically quantified as ecosystem service, in which way sand availability in a beach give us an economic value independently of all indirect multiplier posterior effects this service has in economy?. The development and application of valuation techniques that can be accepted by society in public accounts is also a fundamental objective to reach in a near future.

The importance of coastal and marine ecosystems for future development is enormous and the ecosystem service concept can be useful to move us in this recognition. In order to properly value ecosystems, a large interdisciplinary collaboration is required; ecologists, economists, sociologists, and others, need to work together in a high intellectual way to develop procedures that can facilitate the introduction of this protective schemes in daily societal operations. Still we have too much terminology with too little understanding of it, and few real proactive actions. If, in addition, we need to develop private-public collaborations, this used terminology and language styles (scholar, business, society,…) need to come up with something standard and simple to allow the analysis of integrated decision-making processes and solutions. Protecting the marine environment like the one in the Mediterranean (from small organisms to large ecosystems) is necessary, not only for its own health but also for our people's welfare. The new framework opened by the introduction of the ecosystem service concept into the management of public goods should help us to advance into the conservation of natural systems.

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