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22D Economic valuation and market-based conservation

The Worth of Coastal Ecosystems in the Coral Triangle

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Abstract. In the last decade, much progress has been made to describe how coastal environmental services contribute to a range of economic activities and valuing ecosystem services helps us to understand this flow of ecosystem services. In the Coral Triangle region, there has been an increase in the number of environmental economic valuation studies conducted in the 1980s, particularly in Indonesia and the Philippines. This study reviews more than one hundred economic valuation studies of the region's coastal and marine ecosystem services. This meta-research describes the attributes of these studies to include, amongst others, the type of ecosystem services being valued, the estimation technique used, the distribution of economic benefits according to type of economic agent, their location (whether local, regional or global) and time frame (short versus medium or long term), and the resulting estimated values. Based on these attributes, we provide recommendations to address valuation gaps, and ways of using these valuation studies to advocate for sustainable management of coastal and marine resources.

Key words: Coastal resource management, Ecosystem services, Economic valuation, Knowledge management.

Introduction

The economic value of ecosystems is inextricably linked to its flow of goods and services to the economic system as input to production and consumption activities. In situations where there is a market for ecosystem goods and services, their economic value is reflected by the equilibrium price, the result of the interaction between supply and demand. In the absence of a well-functioning market, where transactions between supply and demand are not readily observable, the value of ecosystem goods and services needs to be estimated using economic valuation techniques. Use of various economic valuation techniques in the Coral Triangle Region have increased in popularity over the past 20-30 years. What ecosystem services have been valued? Which approach and techniques have been used most? What are the results of these valuation studies? This paper aims to answer these questions by grouping economic valuation studies in the Coral Triangle by their key attributes, including the type of ecosystem services being valued, the estimation technique used, the distribution of economic benefits according to type of economic agent, their location (whether local, regional or global) and time frame (short versus medium or long term), and the resulting estimated values. Based on these attributes, we provide recommendations to address valuation gaps, and ways of using these valuation studies to advocate for sustainable management of coastal and marine resources.

Economic valuation in the Coral Triangle

The economic valuation of resources is necessary for many reasons, the most compelling of which is the lack of an effective and efficient market for the good or service in question (Cesar and Chiew 2004). In Indonesia, economic valuation of natural resources and the environment has been done as early as the 1980s, including through the publication of the Indonesian version of a textbook on environmental valuation by Dixon and Hufschmidt (1986). In terms of coastal and marine resource valuation, the series of studies conducted by the BAPPENAS/USAID Natural Resource Management Project for Bunaken, Lombok and other areas comprise early examples. Since then, economic valuation has become a standard method undertaken for most major protected area and other conservation area of significance. It is also a popular research method for undergraduate and graduate thesis in universities in Indonesia, Malaysia and the Philippines.

Material and Methods

Valuation studies in the Coral Triangle were collected through internet research, focusing on searching for relevant keywords in the major university research repositories, and in the major donor agencies (The World Bank, Asian Development Bank and others). For this review, only studies with a major focus on either the coral reef ecosystem or mangrove ecosystems are included. We were able to find studies

for the seagrass ecosystem and damage assessments type studies, but due to time and resources constraint, these were not included in the current review.

Only studies for which a complete report/document can be obtained, are included in the review, to ensure that clear understanding of methods and results of those studies are obtained. Collected studies are then summarized in spreadsheet format (for a complete list of studies included in this review, please contact the corresponding author). At present, 37 valuation studies for the mangrove ecosystem and 19 studies for the coral reef ecosystem (a total of 56 studies) had been reviewed for this paper.

Ecosystem goods and services

There have been several major efforts to categorize ecosystem goods, including that by Lobo (2001), de Groot et al (2002) and Norberg (1999) (cited in UNEP, 2006). After a review of efforts in this area, this study will seek to use the categorization constructed by the Millennium Ecosystem Assessment (UNEP, 2006) and Newcome et al (2005).

The Millennium Ecosystem Assessment (MEA) grouped ecosystem services into 24 types, which can further be grouped into 4 large categories: provisioning services, regulating services, cultural services, and supporting services (UNEP, 2006). Newcome et al (2005) categorize ecosystem functions into 7 general categories, i.e. the provision of ecosystem goods and 6 types of ecosystem services, i.e. purification and detoxification; cycling processes; regulation and stabilization; habitat provision; regeneration and production; and information/life-fulfilling services. Most studies look at more than one type of ecosystem service.

In addition to categories of ecosystem service provided, we also compartmentalized valuation studies based on several other features. First, the spatial scope of the study—whether local benefits (village), regional benefits (more than one village) or global benefits count. We initially included a category for national scope, but found there were very few national-level studies, so decided to delete this category and put it together with the 'regional' category.

Secondly, the temporal scope of the study, i.e. flow of benefit, whether in the short term (one year or less), medium term (between 1 and 5 years) or long term (more than 5 years. Studies that assumed a constant flow of benefit beyond the year for which benefits were estimated, is placed in the short term category.

Third, we grouped the studies on the type of beneficiaries included in the study, i.e. whether benefits accrue to the individual, commercial enterprise, or public body. We recognize that there is a range of beneficiary types (or so-called economic agents) outside of these categories; however following Newcome et al (2005), we feel these 3 categories would represent the key types of stakeholders.

Fourth, we looked at whether direct, non-direct and/or non-use values are being estimated. Fifth, we look at the valuation approach (e.g. market price versus shadow price; gross revenue versus net factor income) and technique used (e.g. travel cost model, contingent choice model, averting cost, etc). A thorough discussion of valuation techniques is provided in many textbooks on environmental economics (we recommend Freeman, 2003).

Results

An overwhelming large portion of these studies are done as part of fulfilling university degree requirements, notably at the master's level; about half of all the studies are in the form of a master's thesis. For coral reef ecosystems, valuation comprise of areas between 1 ha to 22 thousand ha; for mangroves, 300 thousand hectares to those less than 10 hectares.

Coral reef ecosystem valuation studies

The subject of coral reef valuation studies reviewed here (19 studies) are mostly provisioning services (17 studies), categorized according to the MEA classification of ecosystem services. As indicated in Fig.1, this is followed by cultural services (15 studies), supporting services (8 studies) and regulating services (7 studies). Fig. 2 shows the studies based on the 7 categories of ecosystem functions per Newcome et al (2005). Consistent with the MEA, most studies focus on estimating the value of ecosystem goods (17 studies), followed by information/life-fulfilling functions (15 studies), habitat provision (7 studies), regulation and stabilization (7 studies), regeneration and production (5 studies) and cycling processes (1 study). None of the studies looked at the purification and detoxification function of a coral reef ecosystem.

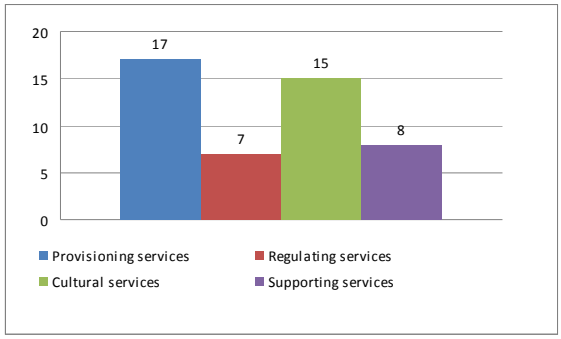

Figure 1: Coral reef ecosystem services valued based on MEA categories (UNEP 2006)

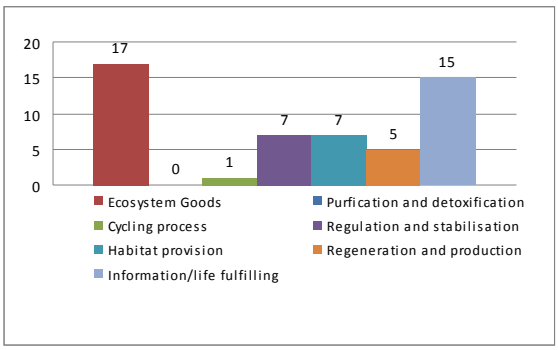

Figure 2: Coral reef ecosystem services valued based on Newcome et al (2005) categories

Other attributes of the collection of coral reef valuation studies are given in Table 1. Most studies are regional in scope; 12 studies looked at the international/global benefits of ecosystem services. Only very few studies (4) modeled the medium and/or long term flow of ecosystem goods and benefits; all of them modeled the flow in the short term (less than one year). About half of all coral reef studies looked into benefits accruing to commercial enterprises, and only 5 studies looked at those benefits accruing to public bodies.

All studies looked at the direct use values of goods and ecosystem benefits; indirect use and non-use values are the subject of 11 and 8 studies, respectively. In terms of technique, almost all (16) studies used market prices, with the rest (3) employing shadow pricing methods. To elicit information, revealed preference techniques are the most popular; stated preference technique (i.e. contingent choice model) is employed by 10 studies. Other approaches and techniques used in the studies are listed in point 5 of Table 1.

Mangrove ecosystem valuation studies

A review of 37 mangrove valuation studies revealed that most look at the provisioning services provided by an ecosystem (35 studies), followed by supporting services (31 studies), regulating services (28 studies), and cultural services (26 studies), detailed in Fig. 3. This is based on categories according to the MEA classification of ecosystem services.

No.	Category/Description	n
1	**Spatial scope**	
	Local (village level)	6
	Regional (more than 1 village)	16
	Global	12
2	**Temporal scope**	
	Short term	19
	Medium (1-5 years) & long term (> 5 ye	4
3	**Beneficiary**	
	Individual	19
	Commercial enterprise	9
	Public Body	5
4	**Value type**	
	Direct Use	19
	Indirect Use	11
	Non-use	8
5	**Valuation technique used**	
	Market value	16
	Shadow Pricing	3
	Benefit transfer	4
	Averting cost	1
	Change in productivity	6
	Contingent choice	10
	Damage assessment	1
	Gross revenue	6
	Hedonic	0
	Net factor income	8
	Replacement Cost	6
	Travel cost	10

Table 1: Attributes of 19coral reef valuation studies

Fig.4 shows the studies based on the 7 categories of ecosystem functions per Newcome et al (2005). Consistent with the MEA, most studies focus on estimating the value of ecosystem goods (35 studies), followed by habitat provision (31 studies), regulation and stabilization (27 studies), regeneration and production (27 studies), information/life-fulfilling functions (25 studies), cycling processes (7 studies) and purification and detoxification function (3 studies).

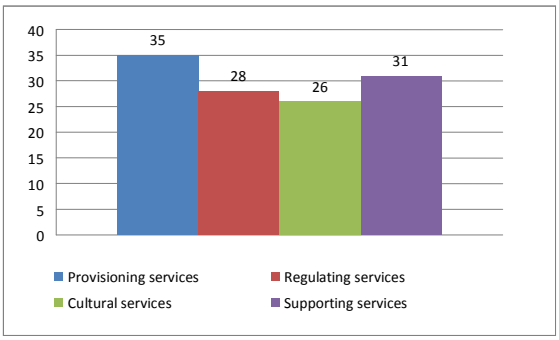

Figure 3: Mangrove ecosystem services valued based on MEA categories (UNEP 2006)

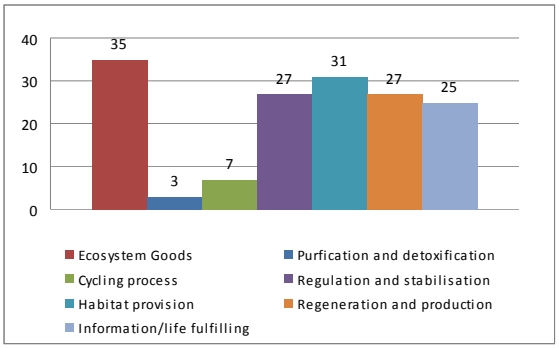

Figure 4: Mangrove ecosystem services valued based on Newcome et al (2005) categories

No.	Category/Description	n
1	**Spatial scope**	
	Local (village level)	16
	Regional (more than 1 village)	25
	Global	18
2	**Temporal scope**	
	Short term	37
	Medium (1-5 years) & long term (> 5 years)	6
3	**Beneficiary**	
	Individual	37
	Commercial enterprise	13
	Public Body	3
4	**Value type**	
	Direct Use	37
	Indirect Use	32
	Non-use	23
5	**Valuation technique used**	
	Market value	35
	Shadow Pricing	21
	Benefit transfer	23
	Averting cost	7
	Change in productivity	5
	Contingent choice	23
	Damage assessment	0
	Gross revenue	11
	Hedonic	0
	Net factor income	13
	Replacement Cost	26
	Travel cost	4

Table 2: Attributes of 39 mangrove valuation studies

Most mangrove valuation studies look at regional economic benefits/values (that is, the benefits accruing to an area greater than village level) that accrue to the individual or households. All studies estimate direct use; 32 studies look at indirect use, and 23 at non-use values. Value estimates based on market prices make up an overwhelming majority of the valuation approach used; contingent valuation technique is also popular (23 studies). A summary of other features of the mangrove valuation studies reviewed is given in Table 2.

Discussion

Several observations can be made based on a review of the collected valuation studies thus far. First, the Coral Triangle countries have sufficient expertise to undertake such studies. Many of these experts are academics; however, many are also researchers at government agencies who chose to undertake valuation as part of their post-graduate research degree, and some were conducted during personal time.. Secondly, it is quite surprising that many researchers chose to undertake primary data collection through a stated preference survey (such as contingent valuation survey) for quantifying one type of benefit, yet on the other hand, quite loosely use benefit transfer methods for quantifying other benefit. Willingness to pay surveys, especially for non-use values, are notoriously unreliable and prone to biases (see for example Freeman (2003) for a discussion). On the other hand, some benefit transfers observed in the research are wildly outdated and inaccurate. Ruitenbeek (1992) is oft-cited for biodiversity values, which he calculated based on the allocation of international project funding for mangroves in pristine condition $1,500/ha). It seems that many researchers fail to read the original research and cite, inaccurately, from secondary sources, and in our research we found the number to be $15/ha for non-pristine mangroves such as in Jakarta; and non-mangrove (coral reef) ecosystems.

A third observation is that overall, the beneficiaries of ecosystem services being valued are not well described. As can be seen from the Table 1 and 2, most beneficiaries are attributed to individuals for two reasons, i.e. either because the beneficiary is not identified in the study, or that only the benefits to individuals were counted. On the other hand, we know, for example, that commercial enterprises and the public sector play a dominant role in the decision-making on resource allocation in all countries of the Coral Triangle. What are the incentives they experience that lead to the current management regime? This can be answered by a careful scrutiny of

economic benefits they enjoy. It is often said that the battle for conservation is against economic interest. This is inaccurate because essentially all interests have an economic dimension. What is more relevant is that the economic interest of different agents (individuals versus commercial enterprises versus the public sector) differ across time and space (i.e. future flow of benefits for individuals versus present flow of benefits for current reigning government official).

In addition to the general observations above, resource valuation may play a future strategic role that includes internalizing environmental cost – for which there exists a strong legal basis in the Coral Triangle Region; - to support the evaluation of externalities or potential damage to ecosystems. Secondly resource valuation can be used as a tool for weighing the policy options and their distributional impacts (across agents, time and space). For example the trade-offs between extractive or non-extractive activities in a coral reef ecosystem of high value.

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