



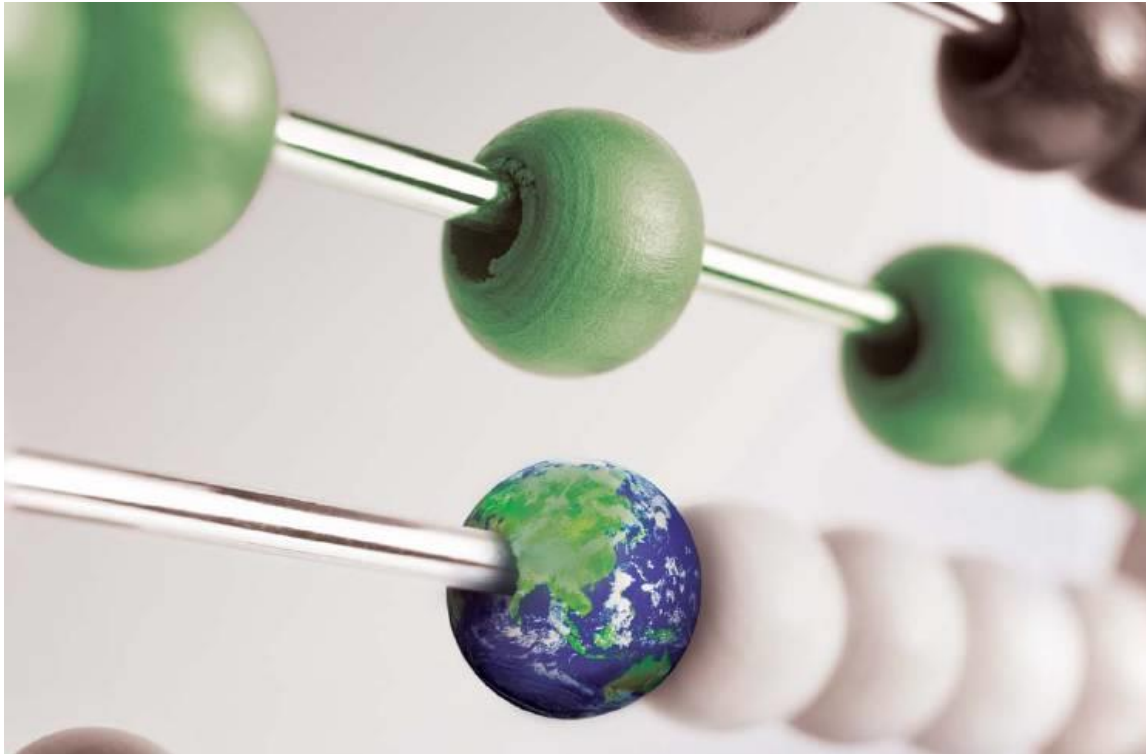
The CLME Information Management System (IMS) and Regional Environmental Monitoring Programme (REMP).

Ecosystem Goods and Services Valuation: A Short Summary and Analysis of Key Concepts and Applications

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The “Sustainable Management of the Shared Living Marine Resources of the Caribbean Large Marine Ecosystem (CLME) and Adjacent Regions” is a GEF funded Project. Its main objective is the Sustainable management of the shared Living Marine Resources of the Caribbean LME and adjacent areas through an integrated management approach that will meet the WSSD target for sustainable fisheries.

Ecosystem Goods and Services Valuation: A Short Summary and Analysis of Key Concepts and Applications



Prepared for:
Dr. Cesar Toro
Secretary IOCARIBE
IOC-UNESCO

Presented to:
Dr. Paul Geerders
Director
IMS-REMP

Written by:
Jacinthe Amyot
Integrated Coastal Area Management Assistant
IOCARIBE-UNESCO

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1. Introduction

In a context of finite public resources and overlapping issues to be addressed to reach sustainable management of marine resources in the Caribbean region, the CLME project will have to rely on the evaluation of [Ecosystem Status Indicators \(ESI\)](#) to propose strategic actions and suggest effective allocation of capital by the Member States. Assigning monetary values to [Ecosystem Goods and Services \(EG&S\)](#) may be used to provide information on the socio-economic status and trend of CLME fisheries, biodiversity habitat degradation, and pollution. However, there are various challenges associated with [monetary valuation](#) of environmental assets and processes.

Using a critical thinking approach, this short summary discusses EG&S values and the main valuation methodologies, reviews its advantages and limitations, and evaluates the potential of its application in the context of the CLME Information Management System and the Regional Ecosystem Monitoring Program (IMS-REMP).

2. Ecosystem Goods & Services values

Ecosystem Goods & Services represent the direct and indirect benefits obtained by people from ecosystems to enhance their wellbeing (MA, 2005). The four categories of EG&S include:

1. [Provisioning services](#) including food, building materials, fresh water, etc.;
2. [Regulating services](#) such as storm protection, water filtration, etc.;
3. [Cultural services](#), representing nonmaterial benefits like spiritual and cultural values;
4. [Supporting services](#), which maintain all other ecosystem services (e.g. primary production).

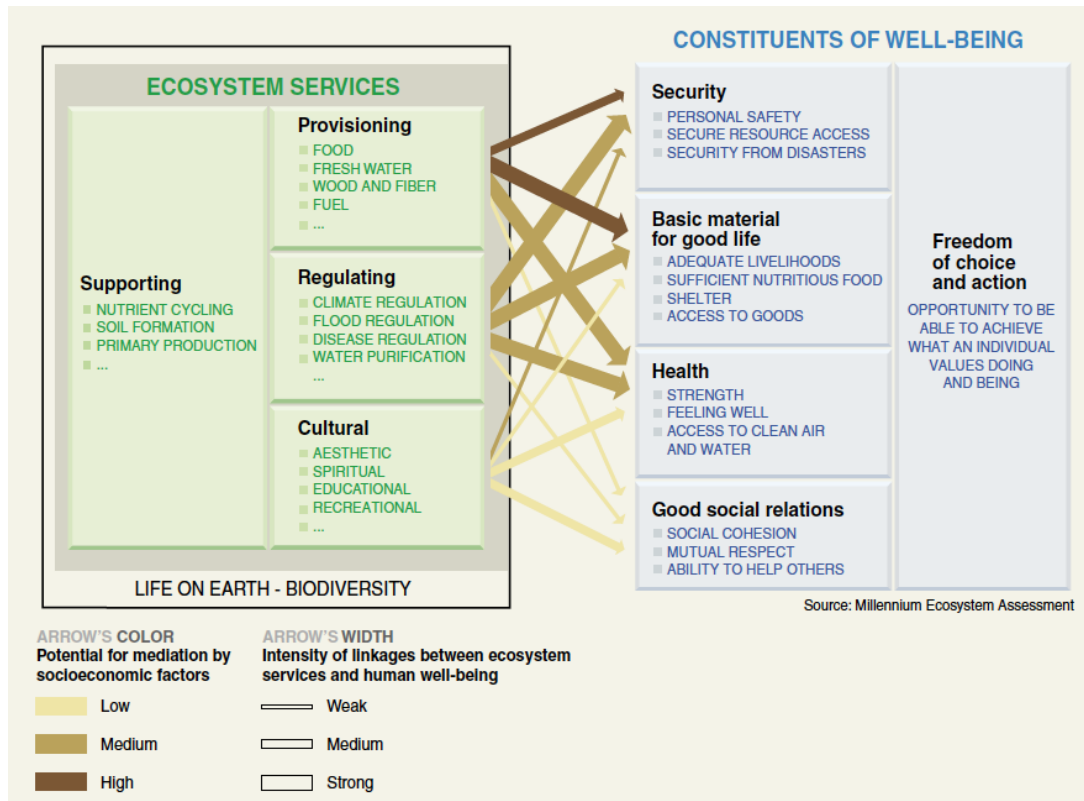


Figure 1. The arrow's width illustrates the intensity of linkages between ecosystem services and human well-being. In addition, the arrow's color intensity indicates the potential for socio-economic factors to mediate these linkages (MA, 2005).

In ecological economics, the extent of benefits provided by EG&S is calculated by summing its **Total Economic Value (TEK)**, which includes all use and non-use values. In order to adequately measure TEK, and use its calculation as a socio-economic indicator in the context of the REMP, it is crucial to have a holistic view of EG&S values. Here are the different elements to consider.

Use values represent the monetary appraisal associated with the exploitation of EG&S. Use values can be direct, indirect, or optional (option value).

- **Direct use value** represents consumptive uses, such as food consumption or drinking water, and non-consumptive uses such as tourism and recreation.
- **Indirect use value** includes many regulating services such as coastal hazard protection and water filtration.

- *Option use value* corresponds to the benefit of preserving EG&S for its future use, which also includes *bequest value* - the appraisal associated to the use of future generations (WRI, 2009).

On the other hand, *non-use values* include existence, and intrinsic values.

- *Existence value* represents the benefit of knowing that EG&S exists without ever experiencing it. For example, the satisfaction of knowing that a rare and endangered species (which you never saw and never will) is still found in its natural habitat.
- *Intrinsic value* corresponds to the innate value associated with “the right to live” for all living organisms. For example, despite the fact that we have yet to discover and understand the role of all marine life, it is recognized that all unknown species hold value simply because they are part of the living system.

Non-use values are certainly the most controversial aspect of the monetary valuation exercise, and represent a significant methodological challenge.

3. Valuation techniques

There are various economic valuation applications to measure EG&S values, but none without limitations. The relationship between EG&S and human benefits can be converted into monetary value only if a market exists. However, many human relationships to biodiversity have no market value. In those cases, other valuation methods can be used to assess public preferences.

3.1 Market-based: Production approach

When a market exists for EG&S, valuation methods are based on observation of human behavior. These methods include: economic impact analysis, financial analysis, and effect on productivity. *Economic impact analysis* can be evaluated directly, using the gross revenue of an activity that relies at least partially on EG&S (e.g. diving, natural park fees). It can also be assessed indirectly by measuring the economic impact an industry has on a region, or a country. A *financial analysis* follows a similar method except that it subtracts all costs, which yields a net value (WRI, 2009). Finally, the *effect on productivity* method, evaluates the change in value of an EG&S after an environmental change has occurred. For example, evaluating the effect of a fisheries’ productivity after an oil spill. The challenges of this method relies on the ability of the researcher to link the environmental damage or change to the EG&S productivity, which is not always an easy task.

3.2 Surrogate technique: Revealed preferences

Valuation methods can also be based on existing market data, which are referred to as revealed preferences. Revealed preferences are calculated indirectly by using the effect of a physical or behavioral change of individuals associated with a service from an existing market (Spangenberg, & Settele, 2010). Revealed preferences assess non-consumptive use-values (e.g. bird watching) and consumptive use-values (e.g. fishing).

Although *travel cost (TC)* and *hedonic prices (HPs)* are the most used methods, *replacement cost (RC)*, *tourism revenues*, *production function (PF)*, and *preventative expenditures* can also be used when valuating EG&S. TC uses all costs encountered by an individual to access his or her leisure sites and activities, including the total number of days used to do so. Unfortunately, this technique is limited to existing recreational markets and does not address potential environmental improvement for an enhanced recreational activity (Cornelis van Kooten & Bulte, 2000).

HP is yet another behavioral linkage surrogate market based technique that is focused on people's preference for certain environmental attributes through the price they pay to enjoy them. More specifically, HP uses land property price, and its associated environmental characteristics, to value the change between them. However, not only does this assume perfect knowledge of the market, but HP may be misleading when looking at negative externalities such as pollution (Cornelis van Kooten & Bulte, 2000).

3.3 Simulated market: Stated preference

In the absence of a market or data for a specific EG&S, *contingent valuation (CV)* can be used as a stated preference valuation method. A CV is a survey in which a sample of individuals is asked how much money they are willing to accept for a certain loss of an environmental feature (Macmillan, Duff, & Elston, 2001). CV uses the *willingness to pay (WTP)* associated with a monetary exchange for an environmental improvement. For example, how much would you be willing to pay to save an Atlantic Right Whale from a ship collision, or for improved water quality at your favorite surf spot? Although, using the WTP appears to offer great insights on EG&S monetary value by creating a hypothetical market, it ignores the *willingness to accept (WTA)* – the monetary subsidy someone is ready to exchange for an environmental loss. In fact, ruling out the WTA turns out to be a fundamental conceptual issue in CV. This point, along with other methodological biases, is discussed in section 5.1.

Nonetheless, using a robust survey and conceptual framework which addresses all potential biases, the CV method can offer a significant contribution to the information base of public perspectives on EG&S.

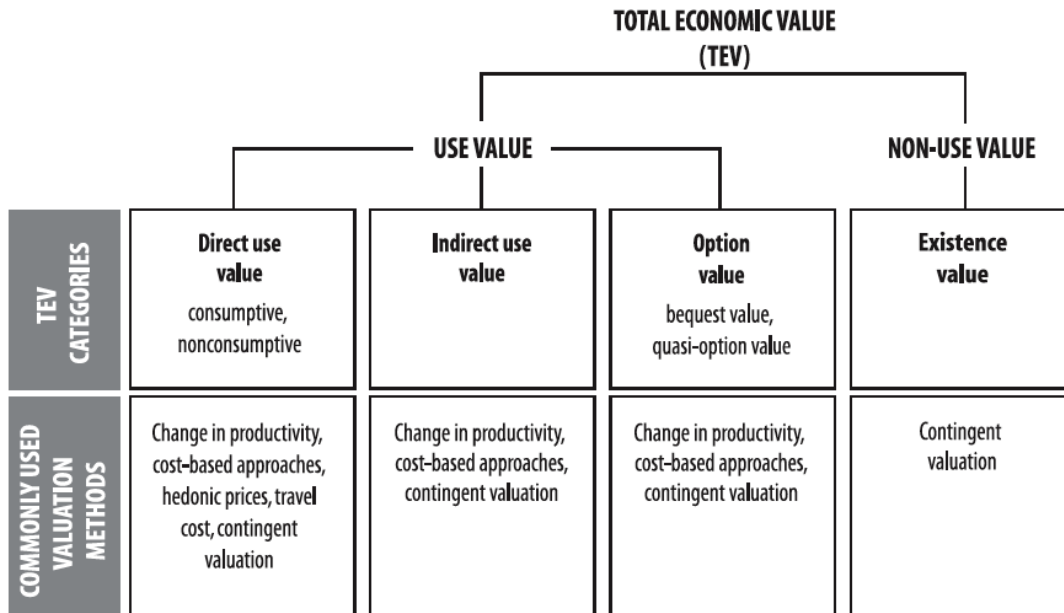


Figure 2: The Total Economic Value Framework illustrates which valuation method is most commonly used to measure use and non-use value of ecosystem goods and services (MA, 2005)

4. Valuation rational

The idea to successfully price EG&S using monetary valuation, offers numerous advantages from a governance perspective. The following key arguments for EG&S monetary valuation have promoted its use and research in the field of common resource management.

4.1 Common language

A clear advantage of monetary valuation is that it offers a common language between all stakeholders, and can be used in many industries. For example, the fishery industry can use EG&S valuation to define the threshold at which it is no longer profitable to use high impact fishing gear such as bottom trawlers, and fixes standards for investment in mitigating practices. Since monetary valuation can provide central economic information on EG&S, it can be used to evaluate and compare costs and benefits associated with a project through a [Cost-Benefit Analysis \(CBA\)](#). This is especially useful to decision-makers when assessing competing projects. In addition, for *social CBA*, which analyses costs and benefits of a project in relation to its impact

its has on people, ecosystem monetary valuation provides significant insights to account for environmental externalities, such as pollution. Including monetary valuation in social CBA can thus lead to better decision-making (Van Kooten & Bulte, 2000).

4.2 Promotes and justifies conservation and environmental policies

EG&S monetary valuation determines the importance people place on nature's assets and advocates for conservation and environmental protection measures. It is argued that "free" EG&S can only lead to their overexploitation or loss, while pricing leads to their protection and stewardship. This pragmatic justification also reiterates the common language of money by taxpayers and policy-makers (O'Neill, 1997). Based on this reasoning, environmental standards and protection legislation can be founded on democratic principles that support the public's preferences and aspirations.

4.3 Measures well-being

Perhaps the most philosophical argument supporting the use of EG&S valuation, suggests that monetary valuation aims to maximize happiness. Independent of the method, all EG&S valuation seeks to optimize human well-being, and economic efficiency (O'Neill, 1997). Because it is based on these two fundamental principals, monetary valuation should be seen as an important tool to bridge the gap between private benefits, and common costs associated with the use of shared resources.

5. Limitations

Although the various benefits of valuation are politically attractive, serious limitations are associated with its methodologies, and practice. These shortcomings are not easily addressed since they are based on human bias, and divergent mental models.

5.1 Decision-making biases

The methodological issues and conceptual challenges surrounding valuation methods are numerous. This is especially true in the stated preference method, where people have to objectively assign a dollar value to an environmental asset. In fact, King and Mazzotta (2000) have identified 12 different biases that can affect the ability of surveyed individuals to offer a fair evaluation of their preferences. Any of these biases can lead to a misevaluation of their WTP and presents a flawed perspective of an EG&S monetary value.

Table 1. Summarized list of decision-making biases influencing the willingness to pay in the contingent valuation method (King & Mazzotta, 2000).

Lack of experience - People are making decision on their WTP on markets goods everyday. However, individuals are unaccustomed to assign dollar value to goods or services they never bought or never thought of buying. This lack of experience may affect the true value of their WTP.

Warm glow effect - Respondents might answer a different question than intended by the researcher. For example, someone may react positively to the valuation experience itself and feel good about giving to the cause of the protection of a common good. On the other hand, someone may react negatively to the valuation exercise and believe that they should not have to pay for the EG&S they enjoy daily and under evaluate their WTP.

Association bias – Surveyed individuals might make association independently of the information provided in the CV questionnaire. Someone may be asked about their WTP for decreased number of annual beach closure (through improved wastewater management), while the individual being surveyed might answer on the basis of the health risks associated with untreated water.

Hypothetical bias - relates to the incredulity people have when placing their bids on an environmental amenities. Surveyed participant may not actually believe that they will exchange “real” money for the environmental improvement proposed thus, affecting their bids. Conversely, respondent might undervalued their WTP if they believe that they will have to pay for the EG&S in question.

WTP ≠ WTA - Given that people value loss more than they do gain, the theory that the willingness to pay equals the willingness to accept is incorrect. Thus, monetary values obtained using CV and the WTP underestimates the loss society will endure in the event of the degradation or loss of an ecosystem good or service For example, the WTP for a sea turtle conservation project might yield relatively high value. However, if surveyed individuals were asked about their WTA the loss of a popular recreational beach site for the conservation of nesting sea turtles, results might be show a lower value.

Embedding effect – This happened when the WTP of respondents for a multiunit ecosystem is not proportionally larger than the WTP for a single component of that system. For example, when asked about their WTP to conserve one coral reef followed by the WTP for the coral reef barrier, the value may be similar.

Ordering problem – It has been found that some individuals will value different EG&S according to where it is place on the list.

Payment vehicle bias – Some respondents may adjust their WTP according to the payment vehicle used by the CV survey question. For example, people may react negatively to a payment vehicle such as a tax. On the other hand, if the vehicle payment is in a form of a donation, respondent might answer according to what they believe is “fair” instead of how they value an environmental asset.

Starting bid effect – This occurs when surveyed individuals are first suggested with an initial value, or a bid. Then, depending if the respondent agreed or refused this initial value, surveyor may increase or lower the bid. This has been shown to influence the respondents final WTP.

Strategic bias – This occurs when respondent purposefully provide a biased answer in order to influence the survey’s results. For example, if the valuation exercise is meant to inform about a decision to establish a Marine Protected Area (MPA) to protect coral reefs and fish, respondents that enjoy nature tourism or recreational diving may overestimate their WTP as a way to guarantee a high value outcome.

Information bias – When respondent have limited experience with the environmental asset being valued, individuals tend to rely disproportionately on the information being provided. It has been shown that the quantity and quality of the information being presented affects responders’ answers.

Non-response bias – The CV methodology does not allow for the absence of value as an answer. Thus, when a respondent refuses to assign a price to an EG&S, their entry is considered invalid, and discarded. Since people who chose not to answer may have a different value system than people who do, this ultimately may affect the type of individuals being surveyed.

Aside from bias associated with the CV method, other important fundamental limitations exist.

5.2 Unaccounted non-use values

Although the monetary valuation exercise provides decision-makers with compelling economic indicators concerning EG&S use values, it poorly accounts for its non-use values. In fact, it is very difficult to quantify intrinsic or existence values in economic measurements, ultimately affecting EG&S TEV.

5.3 Low transferability

EG&S monetary valuations are only valid at a fixed point in time and in a specific context. They are not transferable in time or scale without facing major bias (Pearce and Moran, 1994). This is especially problematic for the application of monetary valuation of EG&S in the Wider Caribbean regional level. For example, it might be flawed to use the monetary valuation of flying fish stocks evaluated in Trinidad to inform decision-making in Barbados. This is due to the fact that both nations might not value this fishery equally based on their socio-cultural preferences and/or availability of other fisheries.

5.4 Lack of interdependence

Most EG&S economic valuations fail to underline the extent of all fundamental ecological functions and their interdependence levels (Turner et al., 2003). The systematic valuation of independent use value ignores nature's complex dynamics and primary life support functions. Unless all interconnections between EG&S are recognized, understood, and evaluated, monetary valuation of EG&S will always suggest an under-estimation of its TEV.

5.5 The moral paradigm

There is also a moral concern related to ecosystem pricing. Many sense that it is immoral to assign a tradeable value to nature's capital. The moral view states that the existence of EG&S should be viewed as a right, and not a privilege. Our moral responsibility to provide similar opportunities to future generations, comply with indigenous rights, and acknowledge the intrinsic value of all species are poorly represented in an economic valuation approach (Pearce & Moran, 1994). This also relates to the non-response bias in the CV method, described above.

6. Implication for IMS-REMP & Conclusions

The goal of the IMS-REMP is to provide relevant information on a suite of marine and coastal EG&S to support the management and decision-making process within the CLME project. It has been recognized that various sources of information and types of data are necessary to inform on an ecosystem-based management approach. In this context, economic valuation of EG&S can provide key information on the value people place on marine and coastal resources and processes. Thus, EG&S economic valuation estimates should be included as part of the IMS-REMP.

Given that economic valuation methods are embedded in human behavior trends based on choices, the inclusion of this data could be used as a form of public participation in the governance of transboundary issues in the Caribbean region. Economic valuation also accounts for EG&S that are not included in present markets, and addresses negative externalities. Although based on utilitarian views, which poorly account for non-use values, monetary valuation of EG&S allows decision-makers to compare, dollar for dollar, between management strategies and specific actions. This enhances the legitimacy of conservation and management programs, and eases understanding of the significance of marine issues by stakeholders. At a time where government's budgets are considerably reduced and external financing sources are scarce, any information that allows for enhanced economic efficiency and welfare of communities, should to be assessed, analysed, and included in the policy cycle.

However, the various limitations associated with valuation methodologies are not trivial. This suggests that information obtained using economic valuation should be complementary to a broader range of indicators. In fact, it is argued that the subjectivity, and fundamental limitations embedded in the economic valuation exercise leads to an under-evaluation of EG&S total economic value. Although some bias can be addressed through meticulous development of surveys, the cumulative effect of people's ability to correctly assess EG&S values can be questioned. Also, present EG&S values demonstrate low transferability from one context to the next, and from one scale to another, which is problematic for a regional approach such as the CLME. At best, these economic valuations can be used to express the lowest monetary value of nature's capital.

Continuous research and development in economic valuation techniques, along with a more integrated approach, should be used in the quest to include EG&S in our markets, and implement holistic environmental policies.

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