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## Economic Valuation of Ecosystem Services: Conflicts in Classification

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*Since the release of the Millennium Ecosystem Approach (MA), studies valuing ecosystem services have grown in the literature. As a consequence, different interpretations exist on the classification of services, and several studies have argued that the classification of services MEA proposes may not be the most appropriate when the aim of the analysis is economic valuation. To illustrate this, we conducted an examination of existing primary valuation studies of water related services provided by tropical forests, that we analyzed under the MA classification and compared with an output-based classification. Our results support the idea that an output-based classification should provide with more accurate values and could contribute to avoid certain problems such as double counting and potential underestimation of services values.*

Keywords: ecosystem services, Millennium Ecosystems Approach, water services, tropical forests.

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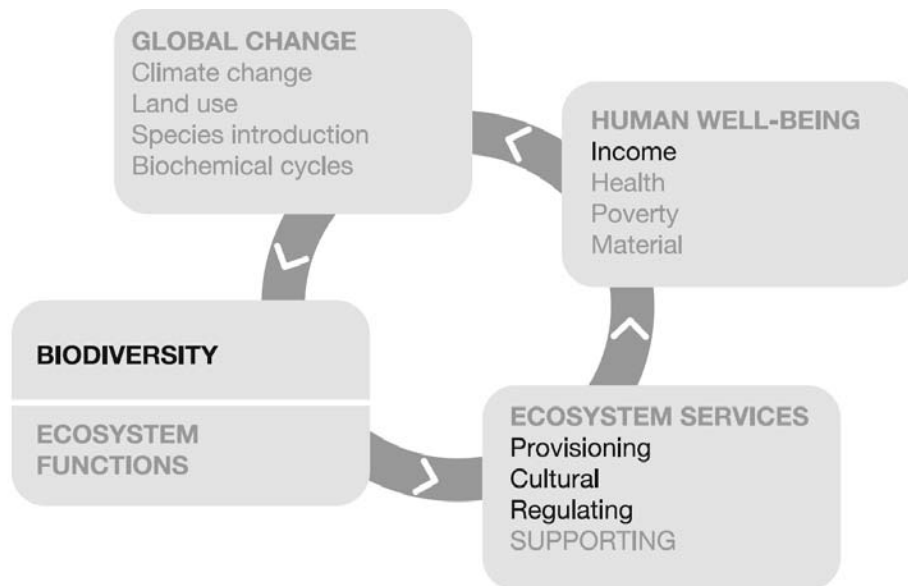
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# 1. Introduction

Ecosystems are recognized around the world as natural capital assets supporting and supplying services highly valuable to human livelihoods (MA, 2005). The estimation of the economic value of ecosystem services (ES now onwards) is expected to play an important role in conservation planning and ecosystem-based management, as well as for ensuring that human actions do not damage the ecological processes on which welfare of present and future generations depends. As a consequence, there is an increasing consensus about the importance of incorporating the “ecosystem services approach” (MA, 2005) into resource management decisions.

The traditional focus of economics has been on valuing single natural assets with commercial use (land, fisheries, forests, energy, etc.) and goods and services provided by nature in the absence of markets (clean air, aesthetics, or recreation). But since the release of the Millennium Ecosystems Assessment both the ecologic and the economic perspectives have changed in order to rely on the MA conceptual framework. The MA framework relates ecosystem functions and biodiversity with ecosystem services that have an effect on human welfare. At the same time, global change is impacting these ecosystem functions and having an effect on ES (Figure 1).

**Figure 1: MA Conceptual Framework**



Source: Adapted from MA (2005) by Simboloxico.

As a consequence of economic valuation, a mismatch between the interpretation of the general ES classification as proposed in the MA and the service-specific valuations has arisen, as the MA approach does not explicitly specify what services should be given a value in order to avoid double counting and other problems. Moreover, the literature on ES valuation is mixed as ecosystem services, functions and benefits are many times used with different meanings among studies (Fischer *et al.*, 2009). Based on this debate, in this study we contribute by identifying which are the current points of conflict derived from the number of different types of classifications of ES and their implications for economic valuation purposes. We also use a set of water valuation studies from tropical forests to illustrate the practical problems of directly applying the MA framework for economic analysis.

## **2. Points of conflict in the valuation of Ecosystem Services**

We have identified four key areas of disagreement in the interpretation and classification of ES for valuation purposes, based on the review of the recent literature. These are summarized here:

*a) The definition of ecosystem services:* classifications of ecosystem services employ different terminology with the subsequent mismatch between what is understood as an ecosystems service and what should be valued in economic terms.

*b) The ecosystem services to be valued:* as a consequence of the first point, every classification focuses on different aspects of ES (including processes, functions, benefits, welfare accounting, etc.) There is still a need for a unanimous and functional definition.

*c) The types of value considered:* A debate also exists regarding the inclusion of non-market values in the ecosystem services valuation, and specially, non-use values, where some authors include them and some others do not.

*d) The nature of the services:* Some authors claim that ecosystem services should be strictly defined as ecological phenomena, and thus cultural and scenic values should be excluded from the classification of ES. Other authors claim that services which are directly linked or interacting with human activity such as recreation (through the tourism business) or timber production (through forestry) should not be considered as a service from the ecosystem. Several reasons have been used for including cultural values: first, if excluding cultural values then existence values of the resource are not considered, since they may fall into the category of cultural values; second is that non-use values contribute to the total economic

value of the ecosystem; and third is that cultural values such as recreation, scenic beauty or the existence value of a resource may be determined by ecological phenomena. As an example, people's preferences for recreation may be conditional to the good ecological status of the ecosystem, the species composition, biodiversity richness and other ecological functions of the ecosystem.

This review evidences that there is still an important need for research on the definition, interpretation and classification of ecosystem services to successfully go beyond the MEA framework for valuation purposes.

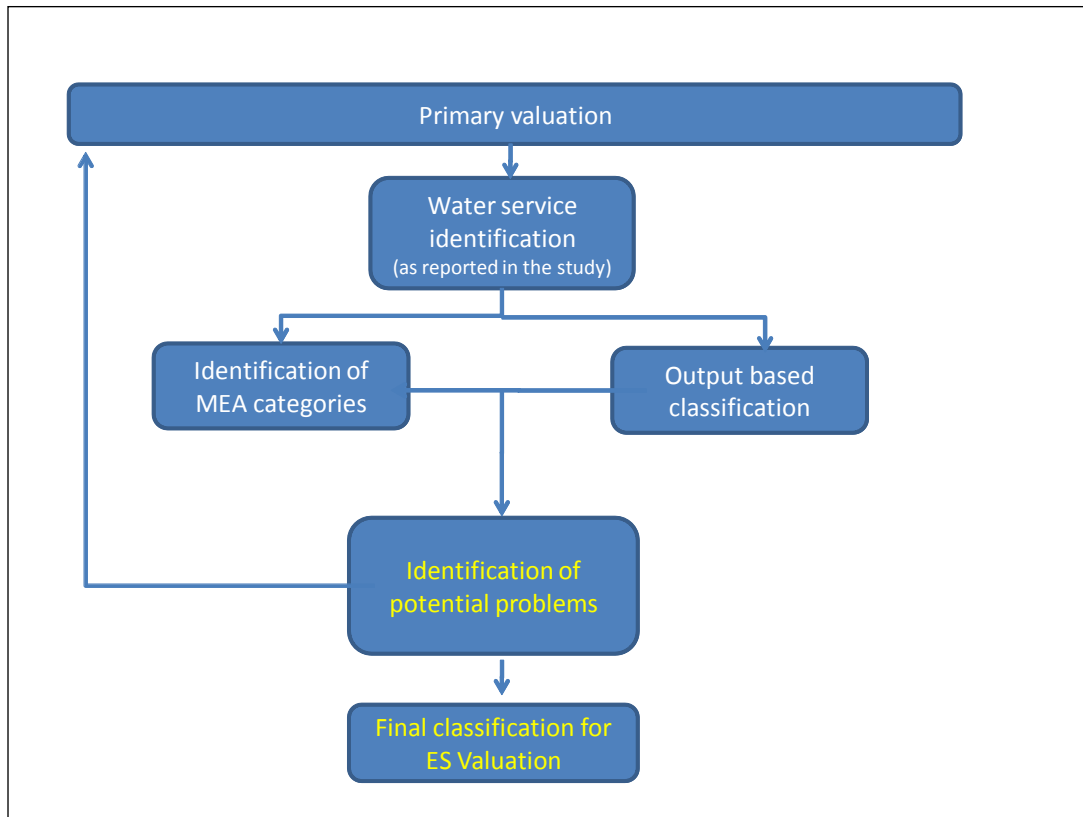
### **3. Valuing forest water related services**

To a large extent, the above mentioned problems are derived from the fact that the MA classification is not clearly focused on the final outcomes that ES's provide to humans, which are what generate an impact (positive or negative) in human welfare, and therefore are susceptible to have an economic value. Some classifications of ES do not always clearly distinct between the structure of the ecosystem, the ecosystem processes and the impacts they produce (outcomes or benefits). In this line, Lele (2009) highlights that structural changes in ecosystems (e.g. timber plantations) can influence several watershed processes (e.g. erosion rates, increase/decrease in water flow). These changes can result in different kinds of human impacts (that can be negative, decreased reservoir capacity due to salinitation; or positive, increased fertilization of floodplain lands). These impacts can affect different stakeholders (farmers, drinking water users, livestock owners, floodplain residents, hydropower companies) and can be positive or negative (e.g. increase in groundwater recharge can imply more water availability; while increase in sediment load represents a negative impact in terms of for example, water use for hydropower). According to this approach, the 'process' should not be the focus of valuation, but it is the outcome of the process what has an economic meaning, as it represents an impact on human welfare (benefit or cost).

In order to illustrate the problems arising from the classification of ES for economic valuation purposes, we have undertaken a review of existing primary valuation studies of hydrological services in tropical forest, that we have examined according to the MA classification and an alternative output based categorization (we use Brauman *et al.* 2007's classification of water services). This review includes valuation studies for water quality and quantity improvements in watershed communities and payment

for ecosystems schemes for agri-forests systems, among others <sup>2</sup>. Central American tropical forests are the focus of our analysis, from which we indentified 25 valuation studies that were published from 1985 to 2009, providing over 100 value observations. Once the valuation studies were identified, a four-step methodological approach was followed (Figure 2).

**Figure 2: Methodology for the classification of water related ES from a sample or primary valuation studies.**



## 4. Results

From the analysis of the valuation studies we find two main potential problems when willing to assess the economic value of ES:

- **Double counting:** When the service valued corresponds to a process and not an output, there is a risk of double counting. For example, there are studies reporting the value for water flow as a service. The outcome of that process (water flow) could be for instance hydropower generation. If an additional

<sup>2</sup> See Ojea, et al. (2010) BC3 Working Paper Series for the complete list of studies.

value is given to hydropower (as a provisioning service) we would be double counting. Another source of risk of double counting arises when the service valued can fit into two different MA categories, but it can be considered as an output of the same nature. This is the case of studies valuing water quality and water quantity. Under the MA framework water quantity is considered a provisioning service while water quality is regulating. However, when analyzing the studies, one realizes that in most cases the value is given to one single output: water consumption, and therefore the value refers to the improvement of extractive water supply.

- **Potential value underestimation:** In some cases, two services of a different output nature are valued together, and correspond to a single MA category. This is the case, for example, of studies valuing the maintenance of water flow together with the reduction of sediment load. Under the MA framework, these two services correspond to regulating services, but under an output-based classification they are actually of a different nature as one corresponds to a regulating service related to the in-stream use of water, while the second relates to damage mitigation. Using a single value for these two types of services can result into an underestimation of the total value. In other cases studies report the compounded value of outcomes of an essentially different nature. For example, the protection of habitat of migratory bird species and upland vegetation for protecting *dry-season water supplies*. As the service buyers are jointly compensating individual upstream landowners the value can only be considered as the compounded value of the water flow and supply and the non-use value of the preservation of habitat, so provisioning, regulating and supporting services all together.

## 5. Implications

The case of water related services is a good example for illustrating the potential problems of classifying ecosystem services given the current discussion in the literature. The review of the literature of existing studies shows clearly how the valuation studies up to date have focused on different aspects of water services, which are sometimes valued at different stages of the same process providing human welfare and sometimes put a single value in two services of a different nature.

From a detailed analysis on water related services in tropical forests, we obtained that a straightforward application of the MA categories can potentially generate problems, not only double counting, but also the potential underestimation of the services value. Our results support the idea that an output-based classification should provide with more accurate values. Valuation should therefore focus on the outcomes of ES and pay attention on the interactions among services on a given ecosystem, putting an



additional effort to develop output-based classifications that help in a more accurate valuation. This is particularly important in the context of national accounting such as the System of Integrated Environmental and Economic Accounting SEEA (UN 2003), which is a satellite accounting system to measure and assess the value of natural capital and the cost of its depletion. Water services are among the main natural resources that should be included in the national accounts, together with other non-marketed services such as recreation, biodiversity, etc, and the first step towards an appropriate measurement is the classification of these services based on the output they produce.

Future research should therefore explore what classifications of ecosystem services are more suitable for economic valuation at the case study level.

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## References

- Brauman, K.A., Daily, G.C, Duarte, T.K., Mooney, H. 2007. The nature and value of ecosystem services: an overview highlighting hydrologic services. *Annual Review of Environment and Resources* 32: 67-98
- Fisher, B., Turner, K.R., Morling, P. 2009. Defining and classifying ecosystem services for decision making. *Ecoogical Economics* 68(3), 643–653.
- Lele, S. 2009. Watershed services of tropical forest: from hydrology to economic valuation of integrated analysis. *Current Opinion in Environmental Sustainability* 1(2): 148-155.
- MA, Millennium Ecosystem Assessment, 2005. *Ecosystems and Human Well-Being: Current State and Trends*. Island Press, Washington, DC.
- UN, United Nations, European Commission, International Monetary Fund, Organization for Economic Co-operation and Development and World Bank. 2003. *Handbook of National Accounting Integrated Environmental and Economic Accounting (SEEA) 2003*. Final draft circulated for information prior to official edition. United Nations, European Commission International Monetary Fund, Organization for Economic Co-operation and Development, World Bank

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