Economic valuation of ecological functions and services of natural ecosystems

The economic valuation of ecological functions and services of natural ecosystems makes it possible to give evidence to the rationale behind conservation policies on these ecosystems. Most of the planning and development decisions on these natural ecosystems are driven by economic factors, notably their capacity to generate income or to provide food to the riparian population.

Although economic valuation methods have some limitations, the conservation and sound use of natural ecosystems require the consideration of economic parameters. Therefore, giving a monetary value to the goods and services provided by natural ecosystems is a crucial step towards demonstrating the economic relevance of their conservation and / or exploitation. The monetary valuation of natural ecosystems should be understood as an effort towards standardizing the various ecological values of an ecosystem that is actually used by the population, in order to facilitate a comparative analysis of the various uses.

The present guide is a contribution of the International Union for Conservation of Nature to a wider application of simple methods for the monetary valuation of goods and services provided by natural ecosystems in West Africa. It is based on four studies conducted on four wetlands: two studies on the Sourou valley (Burkina Faso and Mali), one on the Basse Casamance (Senegal) and one on the Natural Mangrove Park of Cacheu (Guinea Bissau). The preliminary findings of these studies have made the actors involved in wetlands management and conservation eager to further understand the economic valuation concepts and methods that were used.

This guide aims at making accessible the main concepts and methods of economic valuation of the monetary value of goods and services rendered by natural ecosystems in general. This is the rationale behind the development of a guide on simple methods that is accessible for all actors engaged in the economic valuation of ecological goods and services.

This guide on the use of simple methods for valuing natural ecosystems is designed for all actors involved in the economic valuation of ecological services. It was deliberately simplified in order to enable all economist and non - economist actors to take ownership of it. It allows quick understanding of the most commonly used economic valuation concepts and methods applied by natural ecosystem evaluators. It is not claiming to address all issues relating to the economic valuation of ecological services. However, it enables non specialists of environmental economics to understand the basic principles and to further engage in the application of economic valuation of ecosystems.

This document was written with the inputs of many persons and institutions. We are particularly grateful to Sida for the financial support, without which, the dynamics of economic valuation of natural ecosystems would have taken more time to exist in West Africa. This support helped to bring the debate on this current theme to various conservation and economic actors in five West African countries (Burkina Faso, Mali, Senegal, Guinea and Guinea Bissau) and to refine the assessment of the information needs on the economic value of biodiversity and natural ecosystems.

We extend our appreciation to consultants who tested the economic valuation tools that allow us in identifying the simplest tools that can be applied in the West African context. We are particularly grateful to Drs Abdoulaye Zonon and Jean-Marc Ouadba who tested the tools in the Sourou Valley in Burkina Faso; Dr Cheick Oumar Traoré and Mr. Abdoulaye Idrissa Maïga for the test in the Sourou Valley in Mali; Mr. Justino BIAI and Mr. Alfredo Simão DA SILVA for the Natural Park of the Cacheu River in Guinea Bissau; and Mr. Bourama DIEME and Dr Adrien COLY for the National Park of Basse Casamance in Senegal. More than a hundred participants in different workshops on the dissemination of the findings of four studies have contributed to the refinement of the selection of simple tools for the economic valuation of natural ecosystems. Finally, we wish to thank Dr Omer Combary who revised the earlier version of the document and made significant improvements. Authors alone bear the responsibility for any flaws that still remain in the document.

Natural ecosystems provide goods and services for the well-being of the community. However, most of these goods and services are provided outside the market. Therefore, there is no indicator of the value that allows revealing what users are willing to sacri□ce to use or conserve a unit of these resources. This lack of indicator of value in the form of price has led economic agents to implicitly

Natural ecosystem services include all ecosystem aspects that people directly or indirectly bene□t from. The typology according to the functions of natural ecosystems helps to meet the requirements of economic evaluation. It helps avoiding double counting of natural ecosystem services in the total economic value and producing a more accurate analysis in relation with the evaluation objectives (Fisher et al., 2009; Morse-Jones et al., 2010; Bouscasse et al., 2010).

II.1 SERVICES RENDERED BY NATURAL ECOSYSTEM

The functional approach is the most commonly used to classify natural ecosystems services. The comprehensive identi□cation of natural ecosystem services and their uses makes it possible to account for them in economic evaluations. Figure 1 shows that natural ecosystem services can be analyzed using a logical framework in four components:

Primary ecological functions are the services required for the production of all other natural ecosystems services. They are originated from the functional processes of ecosystems that occur without human interventionR SecRpoaSbgRhumdR SecRpoRiSfhiSfRoSfsR SgR SecRpooaadWRrcReSfRoSfspSfReSfRcSfl probgRhughuSfRcSfRtSfRiSgRoSfRnSfRR SecsSfReSfRrSfRvSgRiSfRcSfhesR SecRpoRiSgRaSfRtSfRR Sec processes such as maintenance of air qualityclimate regulation, water regulatory processes (ground f 6N6K’¡ à&6K6R6J regulations (plant diseases), pollination, and storm regulation.

The structuring of natural ecosystems services in a logical chain preventsdouble counting of such services. According to Bouscasse et al. (2010), the following characteristics may induce double counting of ecosystem values:

- The possibility for an ecosystem service to provide several bene□ts to different sub-groups of population;
- Interconnections among ecosystem services in such a way that some services are directly useful to human being (end services), but can also be mobilized in processes using other services (intermediate services) ;

APPROACH TO ECONOMIC VALUATION

The approach to the economic valuation of a natural ecosystem should make it possible to account for all its ecological services, understand its functioning system and interactions with the external environment. To this effect, the approach to total economic value helps to consider the various economic values of ecological services.

TOTAL ECONOMIC VALUE

The total economic value provides a theoretical and operational framework for the economic valuation of a natural system. It represents an overall measurement of all ecological goods and services of an ecosystem. The total economic value differentiates the use values from the non use values or future use.

- Use values include: (i) direct use through the use of ecosystem goods and services that can be directly consumed, (ii) indirect use through benefits derived from functions provided by the ecosystems and (iii) future use or optional value through potential uses of ecosystems. These values may be linked to an existing or non existing market.

- Non use values refer to people's readiness to pay for the conservation of a good that they do not actually use, do not intend to use or they cannot use (Pearce et al., 2006). Such values include: (i) inheritance values through conservation for future generations, and (ii) existence values through the value placed on the very existence of the ecosystem.

Figure 3 illustrates the economic valuation framework of the total economic value of natural ecosystems. It highlights the fact that some ecosystem services are more tangible than others. For instance, direct use values that include the production of food, timber, biomass, and. other externalities are more tangible than existence values. As a result, valuation methods for the monetary value of more

The estimation of the total economic value requires that the evaluator takes a comprehensive approach in several steps.

III.2 STEPS TOWARDS ECONOMIC VALUATION OF NATURAL ECOSYSTEMS

Economic evaluation of a natural ecosystem requires an understanding of the studied system, its operation, and its interactions with other related sites as well as its effects on the economic, recreational and culturWgjRcSWcRmbjhptcSWgjRaSWcRnSWcRdWbaRcSWbaRtSWbaRiSWbaSWcR SWg

III.2.1 Step one : Analysis of policy processes and management objectives

The □rst step in the economic valuation process consists of taking cognizance of the context in which the natural ecosystem is being tapped on. The idea is to have a full understanding of policy praoafRcSfRySfRyS

The economic valuation of natural ecosystems is only possible if the actors concerned are well known and their participation secured. Identifying the main actors from the start of the process helps to: (i) ensure their participation in all stages of the valuation process, (ii) determine the main policy and management objectives, (iii) de□ne the main relevant services, (iv) estimate the economic value of ecosystem services and (v) make comparisons among the various uses of ecosystem services.
Apart from policy-makers involved in the □rst step, there are other actors whose decisions at much lower levels in□uence the functioning of ecosystems. These actors are among others, the users (communities, households, individuals) of the services of the ecosystem concerned and organizations (local, national and international) involved in one way or the other in the management of the ecosystem.

The actions undertaken by these actors have in□uences on the functioning of the ecosystem under valuation and hence on its economic value. These are therefore the main actors of the economic valuation of the ecosystem and as such they should be well informed. At this stage, it is important to collect information on ecosystem goods and services used and their importance to the well-being of the actors. Information on the various uses of the ecosystem will enable the veri□cation of the consistency and relevance of the policy objectives (step 1) and those of the other actors.

The main elements to be considered in the analysis of actors are: (i) information on the characteristics of groups or individuals affected by the decisions, (ii) a categorization of actors or groups of actors based on their signi□cance and in□uence with regard to the ecosystem under review, (iii) explanation of potential con□icts among major groups and (iv) identi□cation of domains where trade-offs are possible.

Stakeholder analysis can be done based on the collection and use of secondary data on the actors involved in the use of ecosystem services. Secondary data may be drawn from earlier surveys, recent data or speci□c studies conducted in the area hosting the ecosystem. Such data may come from several sources (Municipality, local NGOs, organizations and institutions involved). The use of secondary data has the advantage of being less expensive. But under African conditions, such data are often incomplete and may required update.

Stakeholder analysis can also be done using primary data from questionnaire survey. This approach is best used when there is virtually no information on the actors. It helps gather data on a large number of respondents to enable statistical analysis of the □ndings. The design of a questionnaire requires training on survey techniques. But in general terms, the procedure to design a questionnaire should include the following steps: (1) de□ne survey objectives, (2) de□ne the sample group, (3) prepare the questionnaire, (4) administer the questionnaire and (5) interpret the □ndings.

III.2.3 Step three : Functional analysis

Functional analysis of a valued ecosystem consists of identifying and quantifying as much services as possible of this ecosystem. It involves a critical literature review and also complementary surveys or interviews to ensure that the major services of the ecosystem have been identi□ed and quanti□ed.
Finally, it is important to make sure that all actors and policy makers concerned by the assessed zone have agreed with the major services identi□ed and quanti□ed in appropriate units (ecological, socio-cultural and economic indicators). The quantity of services agreed on will be multiplied by their prices to obtain the economic value of the ecosystem.

In the case of on-going management policy options, the findings can lead policy makers and other actors concerned to taking corrective measures that take into account the various economic values of the services provided by the ecosystems. In the case of a future management policy option, the findings can contribute to making a decision based on the estimated economic potential of the ecosystem. Communicating estimated economic values of an ecosystem is a critical step towards promoting behavioural change and policy choices that would enhance the management of a given ecosystem.

Although the five steps in the analysis seem to follow sequences, it may be necessary to revert to a previous step to revise the valuation process, improve the analysis and refine information needs. The implementation of the approach to economic valuation of ecological services provided by natural ecosystems requires the use of sound monetary valuation methods.

The benefit transfer method consists of using the findings of existing similar studies to estimate the monetary value of a natural ecosystem. It thus uses secondary data. This method generally helps to obtain an initial estimate of the value of an environmental good or service. This may be complemented based on needs (political use, etc.) with a primary study of the contingent or transport cost- type of study.

Table 1 is an illustration of a short critical overview of major ecosystem monetary valuation approaches and techniques. It describes the capacity of techniques to capture the full range of economic values of ecosystems, some of their benefits and disadvantages.

[illegible]

There are no rules to select the most appropriate methods for the monetary valuation of a natural ecosystem. The monetary valuation team should have good command of the various methods in order to make a judicious choice depending on ecosystem services and valuation purposes.

[illegible]

Based on a critical review of monetary valuation methods of natural ecosystems, four methods were selected for a detailed presentation owing to the simplicity of their implementation.

[illegible]

The market price-based method estimates the value of goods and services supplied by a natural ecosystem using their prices on the market. It can be used in the monetary valuation of end or intermediate ecosystem goods and services. Ecosystem goods that are considered to be end goods are the products obtained from collection, catching and harvesting by human beings with little or no

The travel cost-based method evaluates the economic value of an ecosystem that is used for recreation purposes based on expenses made by users that travel to the site. The basic idea is to estimate people's willingness to pay in order to use a leisure place with the money and time that they devote to travel to the site.

The implementation of the travel cost-based method requires the evaluator to be able to determine the surface area of the recreation place and subdividing it into areas in which travel costs are more or less the same. Within each area, a sample of visitors should be selected for information collection on the cost of visiting the ecosystem, reasons for travelling to the place, frequency of visits, features of the site and socio-economic variables such as origin of the visitor, his or her income, age, level of education, etc.

The data collected will help to estimate the rate of visitors to each zone, the total number of visits per day and per capita in the location, travel costs including direct expenses (fuel, visit taxes, food,

Despite the limitations in the monetary valuation of natural ecosystems, the information produced is critical for decision-making.

The loss of natural ecosystems has direct economic impacts which are generally underestimated. Making their economic values visible for policy-makers and societies helps to see development and environmental conservation as the two faces of the same coin. Major progress has been achieved in the development of ecosystem economic valuation methods. These methods are being continuously

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Term designating the satisfaction of an individual or a community.

Pu When a person can bene□t from the existence of an ecological good or service without reducing the advantage that someone else can get from the same good or service.

Amount of money that a person is ready to pay for acquiring a good or using a service independently from the fact that it has a market price or that the good or service in question is free of charge.

the science of interactions between living organisms (including human beings) and the environment, and among living organisms.

an ecosystem can be de□ned as a complex and dynamic entity composed of plant and animal populations, micro-organisms and their biotope (geological, soil and atmospheric), interacting in a functional manner. As such, human beings are part of ecosystems.

direct valuation method using a questionnaire to know what people are willing to pay for.

Monetary quanti□cation of the value of a good or service.

Processes inherent to the various biological, chemical and physical elements of a wetland such as the nutrients cycling, biological productivity and recharging groundwater.

A range of human infrastructures used to tap on a natural ecosystem.

Use of the real market price of a similar good or service to value the non market use of the wetland.

goods and services that are directly supplied by nature without any processing.

ecosystem services cover all aspects of ecosystems from which humans directly or indirectly bene□t.

value that is not derived from current, direct or indirect use of a wetland, for instance, the cultural heritage.

value derived from direct use or interaction with wetland resources and services, for example, the value of □sh.

Indirect support and protection assured to the economic activity and goods by the natural functions of wetlands or their regulating services. For example: oods mitigation.

non use value that is simply related to the fact that a heritage exists.

the notion of total economic value provides a comprehensive measurement of the economic value of any environmental good or service .It is divided into use and non use values which in turn can be divided into sub categories.

wetlands are transition zones between terrestrial and aquatic environments. They are characterized by the permanent or temporary presence of fresh, salted or brackish water at the surface or at low depth.