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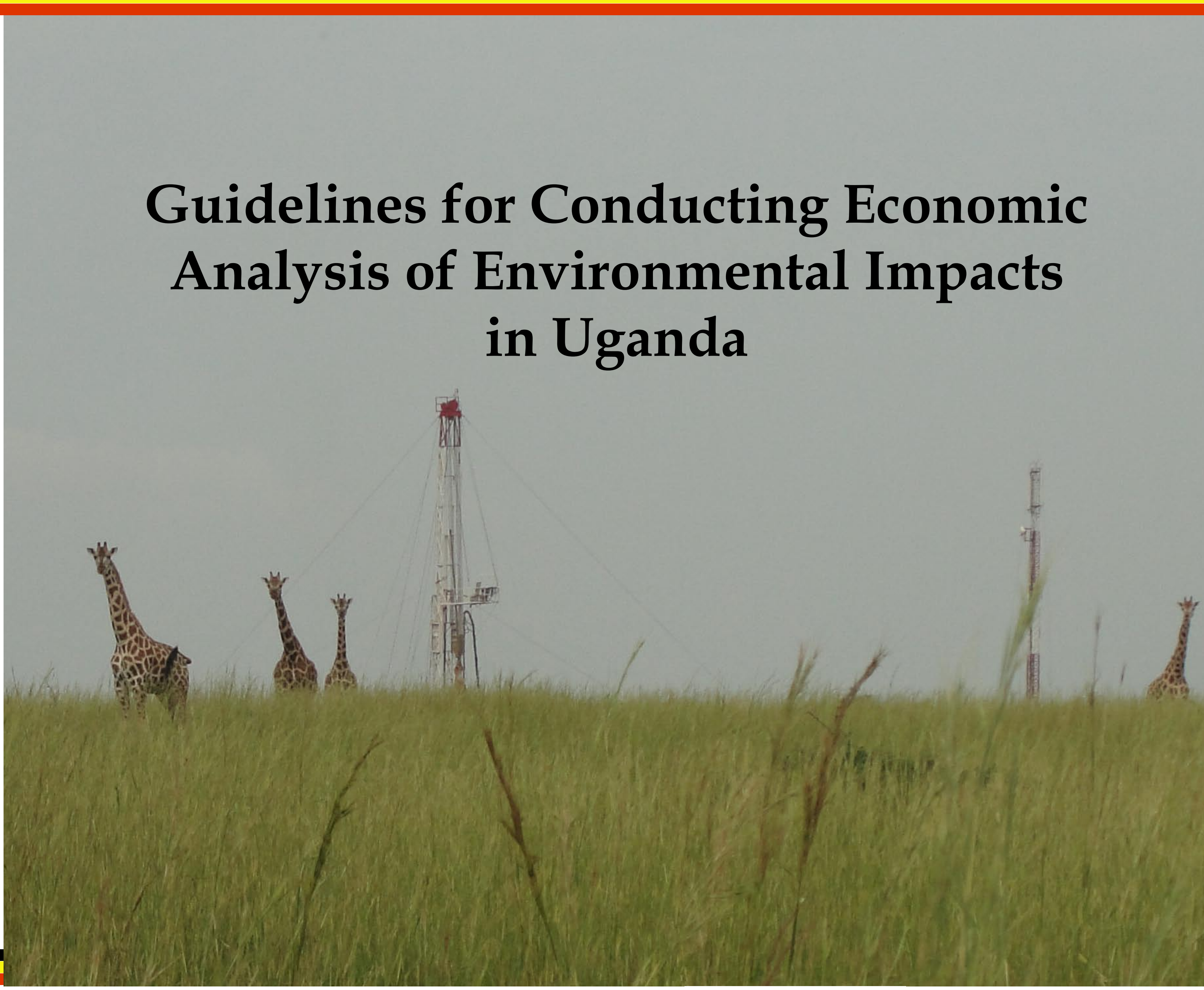
THE REPUBLIC OF UGANDA

Guidelines for Conducting Economic Analysis of Environmental Impacts in Uganda



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Guidelines for Conducting Economic Analysis of Environmental Impacts in Uganda

2014

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Front Cover photo: Co-existence of Oil & Gas activities and Biodiversity in the Albertine Graben, Uganda
Source: National Environment Management Authority (NEMA)

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USAID FROM THE AMERICAN PEOPLE

Acknowledgements

This document was made possible by the support of the American People through the United States Agency for International Development and its program on Biodiversity Understanding in Infrastructure and Landscape Development (BUILD), implemented by Conservation Strategy Fund (CSF) in partnership with the National Environmental Management Authority in Uganda.

NEMA worked closely with Justine Namaalwa, Fred Onyai, Sarah Naigaga, Francis Ogwal, and Christine Akello on this publication.

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PREFACE

The Government of Uganda with support from the Conservation Strategy Fund (CSF) through the National Environment Management Authority (NEMA) has developed these guidelines for economic analysis of environmental impacts as a step forward in the process of environmental impact assessments within the country. Environmental Impact Assessments (EIAs) are at the centre of environmental regulation under the National Environment Act Cap 153. All developers, whether government, private or non-governmental, are required by law to ensure that the actions they undertake, particularly new investments or changes in existing practices, minimize environmental damage.

There has been a growing realization that most of the country's EIA processes do not provide sufficient information for policy and planning in terms of supporting decision making on appropriate actions for either mitigation, auditing and/or declaration of the thresholds of damage for which recommended action is or is or is not adequate. Many of the EIA processes, whereas generally based on biophysical and biochemical assessments describing ecosystems, likely damage, and impacts, do not provide adequate information on decision making criteria for assessing alternative options for a large section of stakeholders.

In Uganda, the nexus between planning for resource allocation and use, and policy decision making has often been linked through cost-benefit analyses. When it comes to cost-benefit analyses for damage to environmental goods and services, establishing an appropriate value for these ecosystems has often proved difficult. The current practice has been for EIAs to adopt a default position comprising socio-economic assessment of status before and after the project and combining that with the physical assessments as the basis for decision making. Whereas these current assessment processes offer a chance for acknowledging and partially accounting for environmental damage, they have often proved inadequate for making choices over the most appropriate way for mitigation or managing the potential damage in future. The economic analysis approaches remain a key avenue for communicating to project developers, planners and policy makers. Therefore, the absence or limited use of economics is an important limitation that if corrected could significantly enhance participation in, monitoring and use of outcomes of environmental impact assessment processes.

These guidelines have been developed in a deliberate and participatory manner. They are organized in a format that will allow for an introduction and growth in the use of economic analyses in EIAs. The guidelines can be used as part of the regulatory requirement for EIA and also at different levels such as exploratory studies of potential projects and for policy and planning purposes. The government of Uganda is particularly grateful to CSF and the team of experts that have supported the development of these guidelines under the leadership of NEMA.

Dr. Tom O. Okurut

EXECUTIVE DIRECTOR
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EXECUTIVE SUMMARY

These guidelines for conducting economic analysis for environmental impacts in Uganda address concerns over serious environmental and natural resource problems that are not fully or appropriately addressed at decision and policy making levels. Uganda's policy and regulatory framework, which includes Environmental Impact Assessment (EIA) regulations and guidelines among others, provides for the use of economic analysis to enable the evaluation of choices and trade-offs to support informed decision making. However, this is hardly done. Many decisions on projects are made without economic analysis of their environmental impacts, in part because no simplified guidelines exist on undertaking such analysis. This document attempts to provide that guidance, targeting project developers, practitioners and decision makers.

The guidelines are intended to encourage and facilitate the use of economic analysis in the design, selection, implementation and evaluation of projects and their associated environment impacts. They aim to help stakeholders make better analyses of potential and actual impact of projects on the environment and natural resources. They will also facilitate a more efficient and accurate decision and policy making process. The specific objectives of the guidelines are to:

(i) Assist policy and decision makers in developing regulations that achieve the highest environmental quality and human health standards at the lowest costs;
(ii) Provide analysts with information needed to prepare high quality economic analyses;
(iii) Develop an overarching framework for economic analyses on proposed projects; and
(iv) Ensure that important subjects such as uncertainty, timing, and valuation of costs and benefits, are treated consistently in all economic analyses.

The guidelines are covered in four chapters, including: the introduction and background, the rationale for environmental economic analysis, economic valuation and decision analysis, and conclusions. The introduction covers: context, gaps and justification, objectives, how to use the guidelines, proposed users, and the guiding principles. The section on rationale covers the purpose of undertaking economic analysis of environmental impacts. The section on valuation and decision analysis provides an introduction on valuation of environmental impacts and the total economic value (TEV) framework. It also reviews the available economic valuation techniques, comprising direct market valuation approaches, revealed preference approaches, stated preference approaches and benefit transfer.

In Uganda, there is already a strong appreciation of direct market valuation approaches, and these are frequently included in policy support documents, including National State of Environment Reports and Annual Sector Performance Reports. Like most other countries, benefit transfer is fairly frequently used in similar policy support contexts. The most frequently used cases include environmental and natural resource valuation work (Yaron and Moyini 2003); natural resource valuation with an emphasis on soil erosion (Slade and Weitz 1991); studies on wetlands (Emerton and Muramira 1999); and recent work on valuation of forestry resources (Masiga et al. 2013).

Overall, there is very little discussion of ecosystem services, and very little valuation is undertaken at the project level, with the exception of disparate valuation efforts for wetlands and in large-scale agricultural investments such as oil palm production in the Buvuma Islands. There is also no consensus on the specific stated preference and revealed preference techniques that can be used for different sectors and/or ecosystems and ecosystem services.

These guidelines therefore provide a careful review of the technical underpinnings, applications, and limitations of each of the major valuation techniques as they apply to the Ugandan context. In particular, the guidelines recommend an economic valuation process comprising seven steps, namely:

(i) Identify which of the goods and services, from a particular ecosystem or landscape, will be evaluated;
(ii) Identify valuation methods and techniques;
(iii) Specify data needed for valuation;
(iv) Research design and instruments for data collection;
(v) Collect primary and secondary data;
(vi) Analyse data, valuation, decision analysis and write report; and
(vii) Develop options and make recommendations for sustainable use and conservation.

It is noted that valuation tools allow for establishment of monetary values for environmental impacts. However, this is not an end in itself. To effect a decision, a decision rule is needed. The most commonly used project and policy evaluation technique in Uganda is cost-benefit analysis (CBA), relying on the net present value (NPV) of the estimated future streams of benefits and costs. A central recommendation of these guidelines is to ensure that valuation informs CBA results by introducing values not directly obtained from market prices. Doing so can better inform decision-makers with regard to projects and efficient natural resource management, including the approval or non-approval of projects and their related mitigation and compensation plans.

Other decision criteria are also considered, including cost effectiveness analysis (CEA) and national income accounting. However, the guidelines find important challenges to the use of these in ensuring that environmental values are adequately taken into account in project development: CEA is often unclear on the value of benefits of a policy or project impact, while national income accounts are more complex and useful for macro-economic analysis of impacts.

The guidelines conclude by considering the practicalities of implementation. It is found that the success of the guidelines will be enhanced by capacity building for decision makers and environmental impact assessment practitioners, development of a specific protocol for sectors, and efforts by sectors to work with partners to undertake valuation of ecosystems and ecosystem services. As an immediate point of action, it is recommended that sectors work with NEMA and other relevant partners in identifying key priorities to start with and gradually adapt these guidelines to other components of the environment and natural resources they manage.

LIST OF ACRONYMS

CBA	Cost Benefit Analysis
CEA	Cost Effectiveness Analysis
CM	Choice Modelling
CVM	Contingent Valuation Method
EEA	Environmental Economic Analysis
EIA	Environment Impact Assessment
GoU	Government of Uganda
IRR	Internal Rate of Return
MA	Millennium Ecosystem Assessment
MTWA	Ministry of Tourism Wildlife and Antiquities
NAMA	Nationally Appropriate Mitigation Actions
NDP	National Development Plan
NPV	Net Present Value
NRC	National Research Council
PPP	Polluter Pays Principle
SEEA	System of Environmental Economic Accounts
SNA	System of National Accounts
TCM	Travel Cost Method
TEV	Total Economic Value
UNEP	United Nations Environment Programme
UPP	User Pays Principle
WTA	Willingness To Accept
WTP	Willingness To Pay

CHAPTER ONE: INTRODUCTION

1.1 Background: context, gaps and justification

The economy and environment are closely interlinked and interdependent. Uganda's economic development is increasingly endangered by the high rate of environment and natural resource degradation. Therefore, to harness and harmonize the linkages between economic development and the environment, the government of Uganda (GoU) through the National Vision 2040 and the National Development Plan (NDP) has endorsed a shift towards creating opportunities for win-win policies. Thus, environmental management, biodiversity conservation and climate change are recognised as enabling sectors that will enhance the performance of primary growth sectors for wealth creation such as agriculture, industry, oil and gas, forestry and tourism.

Globally, since the 1950s and 1960s, environmental economic analysis has contributed to a better understanding of the causes of environmental problems and alternative ways of addressing them using the analytical tools developed by economists. In Uganda, this approach started in the 1990s and has been provided for in the National Environment Management Policy and most of the sector policies and legislations. The goal of environmental economic analysis is to balance the economic activity and the environmental impacts by taking into account and evaluating all the associated project costs and benefits. Environmental economic analysis tools facilitate judgment on the magnitude of harm or loss, ascertaining severity of consequences in human terms based on people's values and preferences.

Environmental impacts are hardly appreciated by policy and decision makers unless supported by a strong economic case. Economic analysis provides tools for the assessment of environmental impacts and puts them in a language better understood by decision makers. It is then that their implications on the realisation of economic goals are understood and the necessary interventions can be made. Economic analysis therefore puts environmental impacts in an economic perspective and helps to influence policy and decision making.

Over the past 20 years or so, many development programmes and projects have been undertaken in Uganda at macro, sectoral and local levels to stimulate rapid economic growth, reduce poverty, and achieve other development goals. Despite the positive economic impacts of these development initiatives, they have caused significant stress on the country's environment and natural resource base.

The National Environmental Management Authority has often highlighted one of the major handicaps in the EIA process as the inadequate economic analysis included in the process. From both a policy and regulatory perspective, it is often unclear whether the management options proposed in the EIA are commensurate with the environmental damage that is likely to result from the change in use of ecosystems and ecosystem services and functions. Even where strong physical assessments have been undertaken communicating with the planners, policy makers and the general public is often constrained by a failure to communicate the trade-off to a wider audience of stakeholders. Economic analyses very often provide an opportunity for reaching a wide audience of stakeholders as well as helping planners and policy makers integrate the environmental management actions in future activities.

These guidelines build on earlier work by seeking to provide simplified guidance that targets project developers, practitioners and decision makers. They are intended to encourage and facilitate the use of economic analysis in the design, selection, implementation and evaluation of projects and their associated environment impacts.

1.2 Scope of the guidelines

These guidelines cover economic analysis techniques for use in: supporting project design, selection, implementation and evaluation; based on a careful assessment of environmental impacts. They give steps to be taken when conducting valuation and analysis of environmental impacts, as well as provide key decision support criteria. Although the guidelines attempt to illustrate the power of economic analysis, they also recognise its limitations.

The guidelines use Ugandan examples to illustrate the application and potential of economic analysis to facilitate environmentally aware policy and decision making

1.3 Objectives of the guidelines

These guidelines are intended to empower decision makers, policy makers and stakeholders to better analyze projects that impact the environment and natural resources and to facilitate timely judgment and decision making.

The specific objectives of the guidelines include the following:

(i) To assist policy and decision makers in developing regulations to achieve the highest environmental quality and human health standards at the lowest costs.

(ii) To provide analysts with information needed to prepare high quality economic analyses.

(iii) To develop an overarching framework for economic analyses on proposed projects.

(iv) To ensure that important subjects such as uncertainty, timing, and valuation of environmental costs and benefits, are treated consistently in all economic analyses.

NEMA and other users can use the same *Guidelines* to evaluate the economic consequences of their regulations and policies to ensure that they contribute to a sustainable environment and a healthy economy.

1.4 How to use the guidelines

In order to make the best use of these guidelines, it is imperative to understand their sequence, content and structure. The guidelines are written in a gradually phased process moving from motivation and purpose in the first chapter to rationale for their use in the second chapter. In the discussion of the rationale, the responsibilities of different stakeholders who are to use these guidelines are described. In the third chapter the tools for valuation and the decision rule for economic analysis are described. It is noted that the outcome of economic analysis is an evaluation of how the monetary and non-monetary gains of a project compare with the losses. Therefore, whereas the valuation tools allow for establishment of monetary values for environmental impacts, ecosystems and ecosystem services, they are not an end in themselves. A decision rule, most likely based on cost-benefit analysis, is needed to effect a decision. The criteria for choosing valuation tools are also delineated.

The fourth and final chapter looks beyond the current guidelines into the need for capacity building, valuation, and the priorities of the sectors and industries that will use these guidelines. Contemporary education at graduate and other levels exists on the use of these instruments. However, to optimally benefit from these guidelines, it is proposed that additional effort will be needed to demonstrate the targeted aspects of economic analysis, through capacity building on valuation as well as cooperation among and between the public and private sectors.

1.5 Users of the guidelines

The audiences targeted for these guidelines are institutions such as: government regulatory agencies and policy makers, academia, interest groups, professionals, developers, those performing duties linked to natural resources management and the environment, including Environment Desk Officers in Ministries and Departments, Lead Agencies, District Environmental Officers, District Local governments, EIA practitioners, Investors, and contractors providing economic reports. However, the Guidelines may also be useful for those teaching courses on benefit cost analysis.

1.6 Guiding principles

The rationale for economic analysis is to establish the magnitude of environmental, social, and economic benefits and costs as well as preventive cost of a project or undertaking. This should be guided by the following principles:

(i) Sustainable decision-making; balancing economic, social and environmental aspects of projects.

(ii) Full environmental and social costs or benefits in projects.

(iii) Relevancy to existing policies, laws, and regulations and institutional needs.

(iv) Consistency/ linkage to national Development frameworks NDP and National vision 2040

CHAPTER TWO: RATIONALE

2.1 Rationale for economic analysis of environmental impacts

Until recently, ecosystem benefits were treated as free goods. Environmental economics recognises the value of goods and services that are usually not placed on the market, and thus, seeks to increase awareness of hidden costs and benefits arising from productive activities. Benefits and costs not transacted in markets can be significant, making valuation essential for analysis of project alternatives.

The evaluation of various project alternatives frequently requires placing monetary values on the benefits and costs, both direct and indirect, of different actions. Economic valuation is an extension of economic analysis including all costs and benefits to society. Economic valuation of environmental impacts relies on careful identification of the biophysical changes produced by a project or alternative project designs. It is rare that a choice must be made *between* development and the environment; rather it is generally a question of understanding and incorporating the most efficient and/or cost-effective measures to restore, sustain and protect natural systems and maintain environmental quality at the earliest stages of planning.

The EIA process, the most commonly used environmental assessment process in Uganda, attempts to identify potential problems so that the environmental impacts and economic feasibility of alternative approaches can be assessed while there is still time to make changes. However, EIA alone is insufficient for decision making on a project. Economic and financial analysis helps the planner to decide among possible options so as to eliminate or reduce negative environmental effects in a cost effective manner. Economic analysis is therefore intended to complement the conventional package of environmental impact analysis and provide practical advice to planners and decision makers. Environmental economic analysis (EEA) is a branch of economic analysis that is concerned with analysis of economic effects of national or local environmental policies around the world. In the context of analysis of environmental impacts, EEA is concerned with the costs and benefits of alternative environmental policies to deal with such environmental problems as: air pollution, water quality, toxic substances, solid waste, and global warming, among others. Very often these environmental impacts are a result of project development or changes in use of the environment and natural resources and occasionally from accidents or natural occurrences. Financial analysis, on the other hand, examines the project from the point of view of the developer/investor. Whereas, the economic analysis examines the project from the point of view of society and incorporates the evaluation of externalities (the costs or benefits that fall on third parties).

The essence is to find ways of measuring benefits which do not enter markets and have no directly observable monetary benefits. Economic analysis of environmental impacts will allow the Government to consider formerly hidden social costs in approving/rejecting/demanding improvements to big projects, i.e. to be able to do a better job in ensuring that projects generate net benefits to Ugandans.

2.2 Purpose of undertaking economic analysis of environmental impacts

Undertaking environmental economic analyses (EEA) provides the following benefits in analysis of environmental impacts and subsequent decision framework, and should start in the earliest stages of environmental impact analysis:

(i) It improves the analytical process by incorporating the costs and benefits to the environment in addition to other project costs and benefits. By so doing, it helps in making more informed decisions based on a wider analytical base. Environmental costs of economic activities (e.g. costs of pollution) can be detected and information about them provided. Because cost-benefit analysis (CBA) is a fundamental tool and provides decision-makers with objective economic information at all levels, ensuring that CBA has full information is an important step.

(ii) EEA provides the basis for fully internalizing the costs of production and consumption of natural resources and therefore advocates that those that pollute and degrade the environment should be made to pay directly for those costs. We thus have the Polluter Pays Principle (PPP) and the User Pays Principle (UPP) as provided for under the National Environment Act. These inform policy on the imposition of environmental levies, fees and charges on activities that pollute the environment and involve the use natural resources.

(iii) Where feasible, EEA places monetary values on environmental goods and services as a reminder that environmental resources are not free. Values show the growing scarcity of environmental goods and services and the need to moderate their use.

(iv) EEA can improve project design, increase efficiency in the use of resources, minimize adverse impacts, and enhance positive impacts. It provides tools for the analysis of alternatives and the costs and benefits associated with each of them. EEA is an integral part of the project planning cycle; from project conception/identification through feasibility analysis, project design, implementation, and monitoring and evaluation.

(v) EEA is critical in establishing national priorities and resource management policies. It identifies environmental problems that are severe and requiring urgent attention, as well as the most effective and economically efficient interventions.

(vi) EEA is useful in correcting market failure. Market failure refers to the inability of free markets to deliver an efficient allocation of resources, to the detriment of society. Markets fail for a variety of reasons, which EEA can address as follows: (a) Information failure: EEA can provide missing values, enabling development and production decisions to reflect the full set of costs and benefits; (b) Externalities: EEA can identify costs imposed by one group's activity on the wellbeing of another, specify tradeoffs, and identify the least costly and most socially appropriate counter measures; and (c) Public goods: EEA can identify values that require government intervention if they are to be provided at optimal levels.

CHAPTER THREE: VALUATION AND DECISION ANALYSIS

3.1 Valuation of environmental impacts

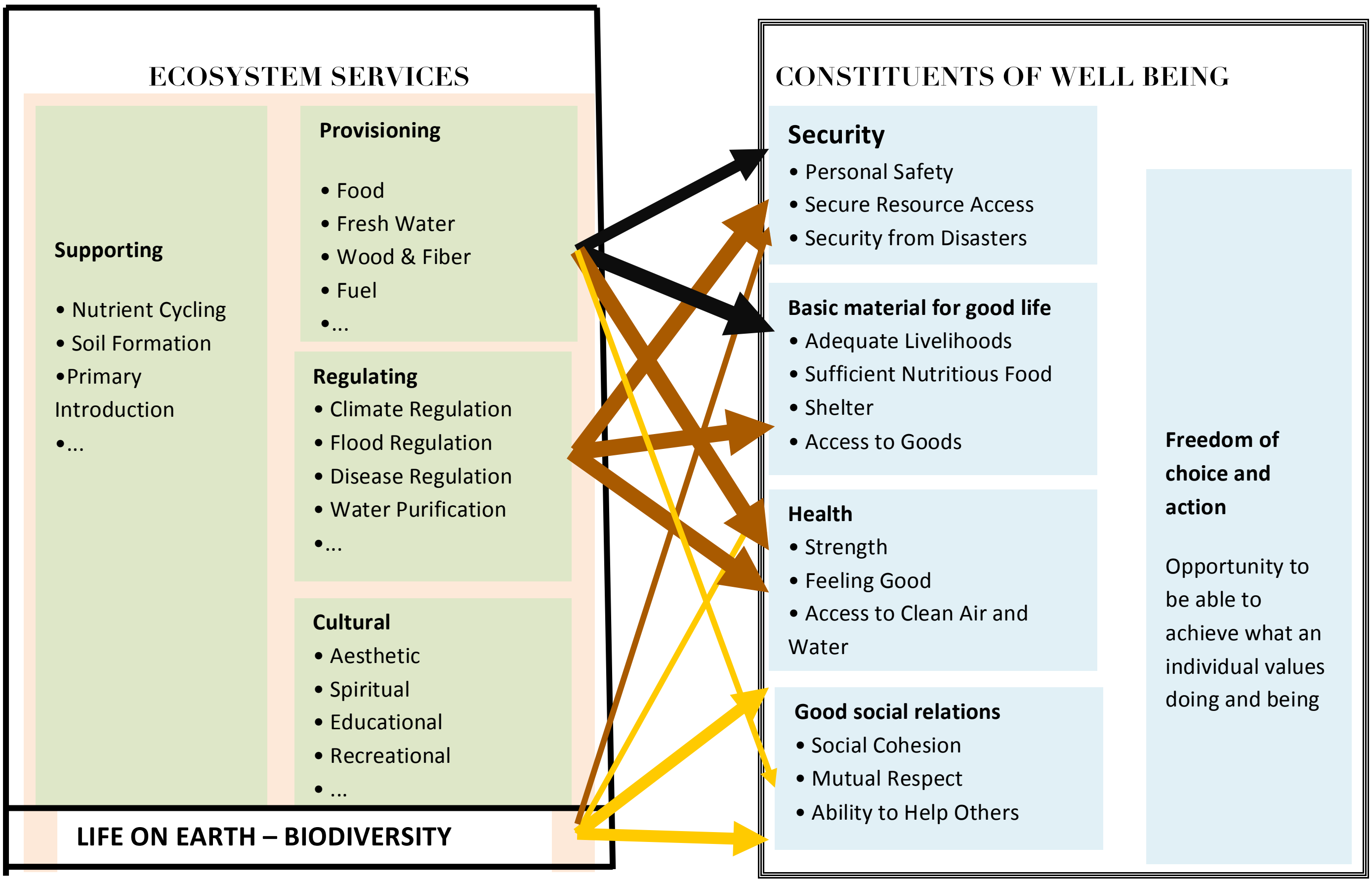
Ecological life support systems underpin a wide variety of essential ecosystem services. The Millennium Ecosystem Assessment (MA 2005) defines four basic categories of ecosystem services each of which contributes to and sustains various elements of economic activity and human well-being. These include (*Figure 1*): provisioning services such as food, water, timber, fibre and genetic resources; regulatory services such as regulation of climate, floods, disease, water quality and waste treatment; supporting services such as soil formation, pollination and nutrient cycling; and cultural services such as recreation, aesthetic enjoyment and spiritual fulfilment.

In its simplest form, ecosystem valuation refers to a process of quantifying and estimating monetary values for ecosystem services (Brander et al. 2013). Ecosystem valuation seeks to explicitly show the complexities of the socio-ecological relationships, how human decisions could affect ecosystem service values, and express these values in units (typically monetary) that would allow for their incorporation into public-decision making, including through cost-benefit analysis CBA (TEEB 2009; DEAT 2004). Ecosystem valuation is most useful as an input into environmental decision-making when the exercise is framed in the context of the specific policy question or decision under consideration; however, this presents several challenges as well. Such an analysis should have the following components (NRC 2005): estimating the changes in ecosystem structure and function that would result from implementing the policy; estimating the changes in ecosystem services that result from the changes in structure and function; and estimating the value of those ecosystem service changes.

There are structural limitations on the ability of current markets to provide a comprehensive picture of ecological values involved in decision making, because current markets only provide information on the value of the small subset of ecosystem processes and components that are priced and incorporated in market transactions as commodities or services (MA 2005). In addition to structural limitations, the convention accounting systems adopted from Uganda's system of national accounts (SNA) are generally oriented towards man-made physical actions of infrastructure development, value addition from farm or ecosystem level, neglecting a large section of ecosystem services (Constanza et al. 1997).

Some of the reasons for conducting valuation studies are (Brander et al 2010) are: (i) missing markets for ecosystem and ecosystem services; (ii) imperfect markets and market failure which make it difficult to attribute ecosystem services and/or their value appropriately; (iii) understanding and appreciating alternative uses of certain biodiversity goods and services; (iv) uncertainty involving demand and supply of natural resources especially in future; (v) more appropriately design ecosystem conservation projects and interventions; and (vi) integrating values of environment and natural resources in national accounting frameworks.

Figure 1: Ecosystem services and constituents of human well being



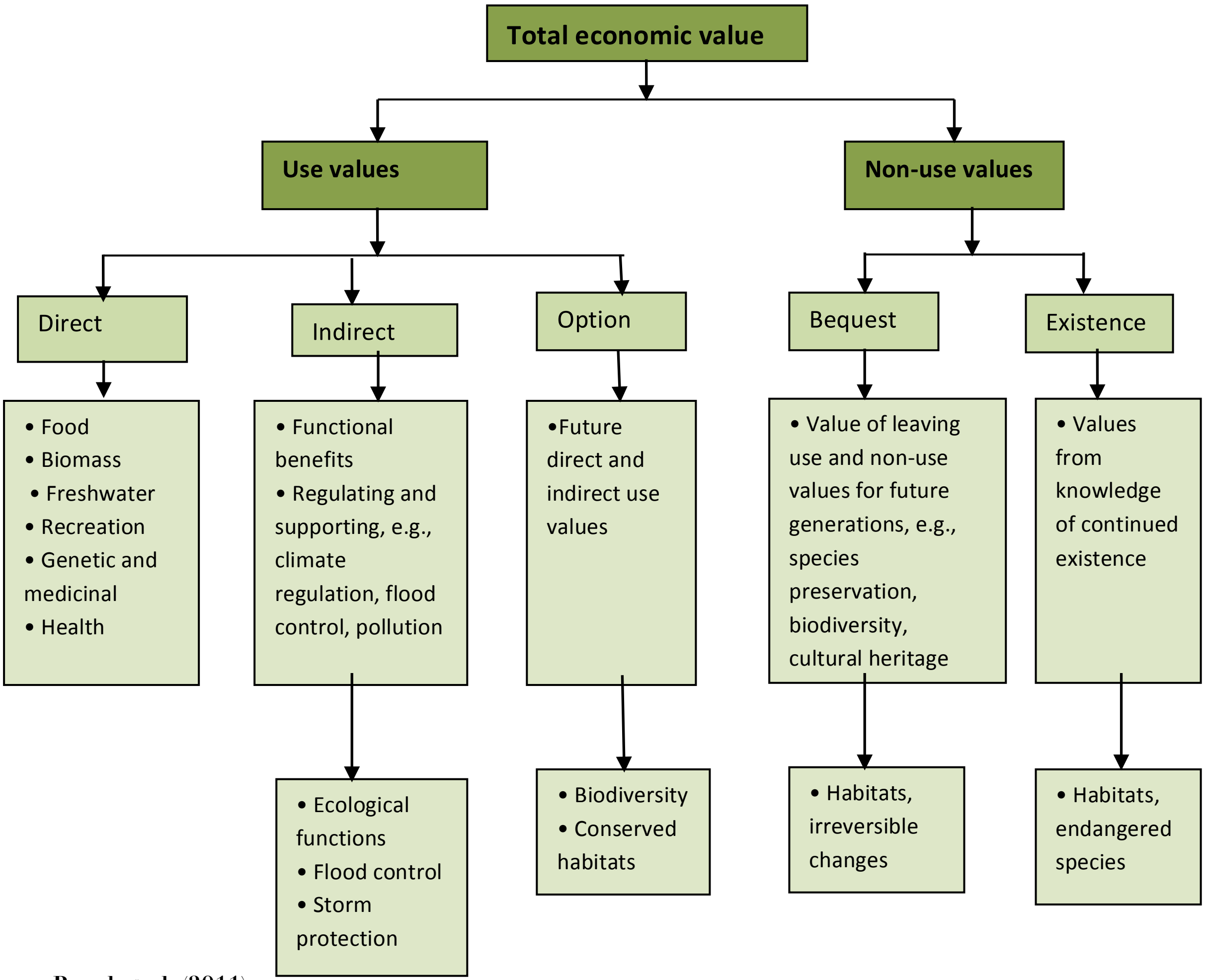
Source: MA 2005

3.2 The total economic value (TEV) framework

The TEV framework is based on the presumption that individuals can hold multiple values for ecosystems (NRC 2005). It recognizes that economic value can stem from the use of an environmental resource (use values), including both commercial and noncommercial uses, or from its existence even in the absence of use (nonuse value). The broad array of values included under this approach is captured by using the total economic value (TEV) framework to identify potential sources of this value (NRC 2005). Use of the TEV framework provides a checklist of potential values that need to be considered in understanding potentially impacted ecosystem services as comprehensively as possible.

The TEV framework is able to capture the 'total economic value' of ecosystem services (Pearce and Turner 1990). Benefits derived from these services are grouped into two broad categories: 'use values' and 'non-use values' (Figure 2). Use values are further subdivided into direct use values, indirect use values, and option values. Direct use values are those that derive from both the consumptive uses of ecosystem goods and services (such as food, fibre, fuel wood, and medicine) and the non-consumptive uses (such as satisfaction and recreation). Indirect use values are those that arise from indirect ecosystem support in production, regulation, and supporting services, such as nutrient cycling, climate regulation, hydrological recycling, and flood control. Option values are those that are associated with maintaining the availability of certain ecosystem services with the awareness that it is difficult to accurately anticipate future demand for such resources. Non-use values are commonly divided into existence values and bequest values. Existence values derive their economic worth from the fact that people appreciate knowing that certain ecosystems or resources exist, even if they have no intention of actually using them. Bequest values are related to the satisfaction that people derive from ensuring the continued existence of ecosystem resources for future generations (Rasul et al. 2011).

Figure 2: TEV Framework



Source: Rasul et al. (2011)

3.3 Economic valuation techniques

Economic valuation is generally categorised under market-based valuation and non-market valuation techniques, as well as benefit "value" transfer techniques. In these guidelines, market based valuation approaches such as market price method, cost based approaches and production functions are considered. The conclusion reached is that market based approaches are used to establish the value of those ecosystem services that can be quantified and where markets and market prices exist. Indirect market-based approaches include revealed preference techniques such as hedonic pricing and travel cost methods, and stated preference methods such as contingent valuation method (CVM) and choice modelling. Benefit Transfer approaches are also used in valuation where surrogate estimates can be obtained and are transferable under specified conditions.

3.3.1 Direct market valuation approaches

Direct market valuation approaches are divided into three main approaches: market price-based approaches, cost-based approaches, and approaches based on production functions. The main advantage of using these approaches is that they use data from actual markets, and thus reflect actual preferences or costs to individuals. Moreover, such data – i.e. prices, quantities and costs- exist and thus are relatively easy to obtain (Brander et al. 2010). Whereas production functions are extensively used in some industries, for example agriculture and industry, they are reasonably complicated and require extensive model building and testing. The techniques of direct market valuation include the following:

(i) *Market price-based approaches* are most often used to obtain the value of provisioning services, since the commodities produced are often sold on, e.g., agricultural markets. In well-functioning markets, preferences and marginal cost of production are reflected in a market price, which implies that these can be taken as accurate information on the value of commodities[1]. The price of a commodity times the quantity of the ecosystem service is an indicator of the value of the service. Consequently, market prices can also be good indicators of the value of the ecosystem service that is being studied.

(ii) *Cost-based approaches* are based on estimations of the costs that would be incurred if ecosystem service benefits needed to be recreated through artificial means (Garrod and Willis, 1999). Different techniques exist, including: (a) the *avoided cost method*, which relates to the damages that would have been incurred in the absence of ecosystem services. Avoided cost method refers to costs people pay to protect themselves from damages if ecosystem services are degraded; (b) the *replacement cost method,* which estimates the costs incurred by replacing ecosystem services with technological solutions, as in the case of sewage treatment facilities to replace wetlands, or pharmaceutical drugs to replace traditional medicines. An alternative use of this terminology refers to the cost of protecting natural areas equivalent to those destroyed or degraded by a project, as in the case of national offset or compensation programs); and (c) *mitigation* or *restoration cost method*, which refers to the cost of mitigating the effects caused by the loss of ecosystem services, or the cost of restoring those services.

(iii) *Production function-based approaches* estimate how much a given ecosystem service (e.g., regulating service such as pollination) contributes to the delivery of another service or commodity which is traded on an existing market. In other words, the production function approach is based on the contribution of ecosystem services to the enhancement of income or productivity (Mäler, 1994; Pattanayak and Kramer, 2001). The idea thus is that any resulting "improvements in the resource base or environmental quality" as a result of enhanced ecosystem services, "lowers costs and prices and increases the quantities of marketed goods, leading to increases in consumers' and perhaps producers' surpluses" (Freeman 2003).

[1] Strictly speaking, the value of a particular product is the difference between the price and what consumers would be willing to pay (consumer surplus) plus the different between price and producers' costs of production (producer surplus). However, for many purposes, it is sufficient to use market price as an indicator of this value.

The production function approach generally consists of the following two-step procedure (Barbier, 1994). The first step is to determine the physical effects of changes in a biological resource or ecosystem service on an economic activity. In the second step, the impact of these changes is valued in terms of the corresponding change in marketed output of the traded activity. A distinction should be made then between the gross value of output and the value of the marginal product of the input. Hence, the production function approach generally uses scientific knowledge on cause-effect relationships between the ecosystem service(s) being valued and the output level of marketed commodities. It relates to objective measurements of biophysical parameters. As Barbier et al. (2002) note, for many habitats where there is sufficient scientific knowledge of how these link to specific ecological services that support or protect economic activities, it is possible to employ the production function approach to value these services.

Some of the limitation of direct market valuation approaches is their primary reliance on production or cost data, which are generally easier to obtain than the kinds of data needed to establish demand for ecosystem services (Ellis and Fisher, 1987). In the case of market price-based approaches, demand is also included. However, when applied to ecosystem service valuation, these approaches have important limitations, mainly due to ecosystem services not having markets or markets being distorted. The direct problems that arise are two-fold. Firstly, if markets do not exist either for the ecosystem service itself or for goods and services that are indirectly related, then the data needed for these approaches are not available. In cases where markets do exist but are distorted, for instance because of a subsidy scheme or because the market is not fully competitive, prices will not be a good reflection of preferences and marginal costs. Consequently, the estimated values of ecosystem services will be biased and will not provide reliable information on which to base policy decisions. Secondly, some direct market valuation approaches have specific problems. Barbier (2007) illustrates that the replacement cost method should be used with caution, especially under uncertainty. The production function approach is similarly limited in that information on the cause-effect linkages between the ecosystem services and the marketed commodities are often lacking (Daily et al., 2000). In other words, "production functions" of ecosystem services are rarely understood well enough to quantify how much of a service is produced, and in particular how changes in ecosystem condition or function will translate into changes in the ecosystem services delivered (Daily et al., 1997). Furthermore, the interconnections and interdependencies between ecosystem services may increase the likelihood of double-counting ecosystem services (Barbier, 1994).

Market price, cost based and production function based approaches are regularly used in valuation. One would envisage that, for a natural resource based economy like Uganda, direct market valuation is commonly used. This is in fact the case in estimating values for compensation for infrastructure developments and mitigation for EIAs. These approaches alone, however, are unable to provide an accurate estimate of the value of ecosystem services and will almost always have to be complemented with other valuation approaches, described below.

3.3.2 Revealed preference approaches

Revealed preference techniques are based on observation of individual choices in existing markets related to the ecosystem service that is the subject of valuation. In this case it is said that economic agents "reveal" their preferences through their choices. The two main methods within this approach are: travel cost method (TCM) and hedonic pricing (HP).

(i) The travel cost method is most relevant for determining recreational values related to biodiversity and ecosystem services. It is based on the rationale that recreational experiences are associated with a cost (direct expenses and opportunity costs of time), which reflects a minimum value that people place on their visit. The value of a change in the quality or quantity of a recreational site (resulting from changes in biodiversity) can be inferred from estimating the demand function for visiting the site that is being studied (Kontoleon and Pascual, 2007).

(ii) The hedonic pricing approach utilizes information about the implicit demand for an environmental attribute of marketed commodities. For instance, houses or property in general consist of several attributes, some of which are environmental in nature, such as the proximity of a house to a forest or whether it has a view on a nice landscape. Hence, the value of a change in biodiversity or ecosystem services will be reflected in the change in the value of property (either built-up or land that is in a (semi) natural state). By estimating a demand function for property, the analyst can infer the value of a change in the non-marketed environmental benefits generated by the environmental good.

The main steps for undertaking a revealed preference valuation study are (Brander et al. 2010):

a) determining whether a surrogate market exists that is related to the environmental resource in question;
b) selecting the appropriate method to be used (travel cost, hedonic pricing);
c) collecting market data that can be used to estimate the demand function for the good traded in the surrogate market;
d) inferring the value of a change in the quantity/quality of an environmental resource from the estimated demand function;
e) aggregating values across relevant population; and
f) discounting values where appropriate.

Limitations of revealed preference approaches include market imperfections and policy failures that can distort the estimated monetary value of ecosystem services. Scientists need good quality data on each transaction, large data sets, and complex statistical analysis. As a result, revealed preference approaches are often expensive and time-consuming. Generally, these methods have the appeal of relying on actual/observed behaviour but their main drawbacks are the inability to estimate non-use values, and the dependence of the estimated values on technical assumptions about the relationship between the environmental good and the surrogate market good (Kontoleon and Pascual, 2007).

Where a market does not exist for key ecosystem services, revealed preference approaches are an improvement on market based approaches; however, they are still unable to estimate non-use values. Revealed preference techniques complement other valuation approaches but cannot capture the full value of ecosystem services. They are particularly appealing when valuing biodiversity, especially in wildlife and nature conservation areas. In Uganda, revealed preference approaches have been used in the valuation of sections of Murchison Falls National Park, and forestry resources valuation (NEMA 2011; Masiga et al. 2013).

3.3.3 Stated preference approaches

Stated preference approaches simulate a market for ecosystem services by means of surveys on hypothetical changes in the provision of those services. Stated preference methods can be used to estimate both use and non-use values of ecosystems and/or when no surrogate market exists from which the value of ecosystems can be deduced. The main types of stated preference techniques are:

(i) Contingent valuation method (CVM): Uses questionnaires to ask people how much they would be willing to pay to increase or enhance the provision of an ecosystem service, or alternatively, how much they would be willing to accept for its loss or degradation.

(ii) Choice modeling (CM): Attempts to model the decision process of an individual in a given context (Hanley and Wright 1998; Philip and MacMillan 2005). Individuals are faced with two or more alternatives with multiple attributes of the services to be valued, but at different levels. One of the attributes is always the money people would have to pay for the service.

(iii) Group valuation: Combines stated preference techniques with elements of deliberative processes from political science (Wilson and Howarth 2002). This method is increasingly used as a way to capture value types that may escape individual based surveys, such as value pluralism, incommensurability, non-human values, or social justice.

Contingent valuation is different from choice modelling because the former usually presents one option to respondents. This option can be associated with an open question about willingness to pay, or some (varying across respondents) price-tag (Kontoleon and Pascual 2007). In the latter case, respondents are asked to vote on whether they would be willing to support this option and pay the price or if they would support the status quo (and not pay the extra price). The distinction between voting as a market agent versus voting as a citizen has important consequences for the interpretation of CV results (Brander et al. 2010). An important distinguishing characteristic of choice modelling is the ability to distinguish which attributes of ecosystems and biodiversity generate which level of value. In simple contingent valuation, the result is simply a "value," but the analyst cannot distinguish which ecosystem services contribute what percentage of the total.

The limitations of stated preference approaches are highlighted as follows:

a) Stated preference techniques are the only way to estimate non-use values. It is often asserted that the interview process "assures" understanding of the object of choice, but the hypothetical nature of the market has raised numerous questions regarding the validity of the estimates (Kontoleon and Pascual, 2007). The major question is whether respondents' hypothetical answers correspond to their behaviour if they were faced with costs in real life.

b) Another issue that has been flagged in the literature on stated preference methods is the divergence between willingness-to-pay (WTP) and willingness-to-accept (WTA) (Hanneman, 1991). From a theoretical perspective, WTP and WTA should be similar in perfectly competitive private markets (Diamond 1996). However, numerous studies have demonstrated that for identical ecosystem services, WTA amounts systematically exceed WTP. This discrepancy may have several causes: faulty questionnaire design or interviewing technique; strategic behavior by respondents and psychological effects such as "loss aversion" and the "endowment effect" (Garrod and Willis, 1999). It is generally accepted, however, that if respondents are asked a question that corresponds to their actual situation (i.e., WTP if they might actually pay something or WTA if the might actually have to give something up), then this divergence is not problematic.

c) Another important problem is the "embedding", "part-whole bias" or "insensitivity to scope" problem, in which respondents appear unable to account in a consistent way for differences in the scale of environmental change being considered. For instance, respondents in a CVM survey in Canada were willing to pay the same amount to prevent the drop in fish populations in one small area of Ontario as in all of Ontario Province (Brander et al. 2010).

d) There is also a controversy on whether non-use values are commensurable in monetary terms (Brander et al. 2010). The problem here is whether, for instance, the religious or bequest value that may be attributed to a forest should be considered within the same framework as the economic value of logging or recreation in that forest. Such an extreme range of values may not be equally relevant to all policy problems, but the issue has remained largely unresolved for now.

e) Furthermore, the application of stated preference methods to public goods that are complex and unfamiliar has been questioned on the grounds that respondents cannot give accurate responses as their preferences are not fully defined. Sometimes stated preference methods incorporate basic upfront information in questionnaires (García-Llorente et al., 2008; Tisdell and Wilson, 2006). Christie et al. (2006) argue that valuation workshops that provide respondents with opportunities to discuss and reflect on their preferences help to overcome some of the potential cognitive and knowledge constraints associated with stated preference methods. Typically deliberative monetary valuation methods will provide upfront information to stakeholders as well. The bias in deliberative monetary valuation approaches is likely less than in CV studies that do not offer space for reflection prior to asking willingness to pay or accept questions (de Groot et al., 2006). Such methods may further reduce non-response rates and increase respondents' engagement.

For all their limitations, stated preference approaches are able to address a component of valuation that is not addressed by the other options considered above. These guidelines recommend that the lead agencies and the regulators will approve, on a case by case basis, when and how willingness to pay/accept approaches will be used. Choice modelling allows for multiple choices and, given its frequent use in agricultural and market econometric research, would be a useful tool for Uganda. However, a deliberate effort is needed in developing research consensus on the results and whether or not they can be used.

There is a need to establish a database on research and support benchmarking research to precede decision analysis based on stated preference techniques. All the five limitations noted above need to be minimal before its effective use can be ensured.

3.3.4 Benefit transfer

Benefit transfer or value transfer in more recent literature (Brander et al. 2013) refers to the procedure of estimating the value of ecosystem services of current policy interest (at a "policy site") by assigning an existing valuation estimate for similar ecosystem elsewhere (at a "study site"). A benefit transfer produces a surrogate estimate for the monetary benefits or costs of a new policy using existing findings. The benefit transfer method is used when direct estimation of values is too time consuming and/or expensive (Kaul et al. 2013).

Benefit transfer is the most common valuation method used to compute benefits and costs of environmental regulatory impact analysis (U.S. EPA, 2010). In the absence of adequate financial and technical resources to undertake comprehensive primary valuation, the benefit transfer will be the recommended approach. On a similar note, there will be considerable effort by national institutions, national research centres and universities to develop a sufficient information base to support appropriate use of benefit transfer techniques. The proposed steps for conducting transfer of benefit estimates from study case(s) to policy case are (Brander et al. 2013; Kaul and Boyle 2013):

(i) Ensure transparency and stakeholder engagement:
Valuation of ecosystem services using benefit transfer cannot be conducted with complete certainty. It is therefore necessary to measure and communicate the level of uncertainty regarding a transferred value. The acceptable level of accuracy is dependent on the decision making context. The purpose of conducting economic valuation of ecosystem services is to inform and improve decision making regarding the management of the environment. Any value transfer application should be designed to provide information that is directly useful and understandable to the decision makers involved. This requires stakeholder engagement in the value transfer process and clear communication of results. Stakeholder engagement in a value transfer application may take several forms and occur at different stages of the process. Most importantly, engagement at the initial stage should be used to frame the value transfer in terms of the type of information required, relevance of different ecosystem services, geographic scope and identification of beneficiaries.

(ii) The key challenge to conducting accurate and credible benefit transfer (beyond selecting good quality study cases) is to account for important differences in the characteristics of the study and policy sites. Differences in characteristics of ecosystems, services, their beneficiaries and biophysical surroundings can potentially result in very large differences in the provision and value of ecosystem services, especially when "direct" or "point transfer" rather than "function transfer" is used (see below). Therefore, it is important to select the most similar study sites.

(iii) Implementation of the benefit transfer may be by direct value transfer, or function transfer. Value transfer involves producing an estimate without adjusting for differences across the study case and new policy application; for example, transferring a point estimate or mean of existing estimates. On the other hand, function transfer involves calibrating an existing estimate to a new application's conditions. For example, use a function from existing studies and predict the benefit by making adjustments to transferred values to reflect differences in important determinants of value at the policy site.

(iv) Making the results of a value transfer accessible to the stakeholders requires various communication strategies. The main steps that should be part of a communication plan are identifying the audience(s), formulating the main message(s) and developing the communication tools. In Uganda, the benefit transfer approach will involve seeking out estimates for a similar good or service in other locations and then transferring those estimates. This can be thought of as an historical approach to the valuation problem, because it uses the results of past studies. To ensure a high level of accuracy, analysts will be required to use studies of comparative ecosystems, and consider adjustments based on the differences of the two sites under comparison. Therefore, benefit transfer will be used where the user can provide a concise description of the new site and associated ecosystems, along with analysis of the socio-economic alignments between the historical value and the new valuation. The quality of the historical valuation will also be key to helping regulators determine whether the values produced are justifiable.

3.3.5 Case study of contribution of forestry resources to national economy in Uganda

Between 2010 and 2012, the National Environment Management Authority (NEMA) used some of the valuation approached described above to undertake a valuation study aimed at establishing the annual economic contribution of forestry resources to the national economy. Because the main interest was to influence national budgetary allocations, NEMA compared the economic contribution using a natural resource accounting approach because its development is very similar to the process through which the government's own annual budget are developed. The national forest accounts show the physical and monetary value of stocks and flows of forestry resources in the country and estimate the aggregate contribution of forestry resources to the national economy (NEMA 2012).

The physical stocks and flows showed that over 27.5 million m^3 of wood is supplied from the country's standing timber. More than 90 per cent of the wood supplied is used for wood fuel and 80 per cent of the wood fuel is used for domestic purposes in households. Saw logs and poles contribute less than 10 per cent of the volume of wood supplied and used. There is a small but growing trade in wood and wood products that contributes less than 3 per cent of the volume and value of wood supply and use in the country (Masiga et al. 2013).

The monetary accounts indicated, based on conservative estimates, that the forestry resource contributed about US$ 1,277 million to the national economy in 2010, equivalent to Ushs 2,960 billion. Based on the national gross domestic product GDP for 2009, at current prices, of Ushs 34,166 billion, the forestry sector contribution was equivalent to 8.7 per cent of the GDP, more than double the 3.2 per cent acknowledged in the national statistical abstract.

Table 1: Monetary value of forest ecosystems services and management for national accounts

Description of forest products, services, management and regulatory components	Value in million UGX	Monetary Value in Million US$	% of total
1. Forested Land	741,984.04	321.4	25.17%
2. Timber flows recorded in Statistical Abstract	258,955.66	112.17	8.78%
3. Other Timber Trade Exports	9,430.63	4.09	0.32%
4. Less Other Timber Trade Imports	-8,421.77	-3.65	-0.29%
5. Non Wood Forest Products	65,224.40	22.14	1.73%
6. Carbon Sequestration Service	627,939.20	272	21.30%
7. Biodiversity Conservation Service	357,371.30	154.8	12.12%
8. Recreational Services	182,726.58	79.15	6.20%
9. Soil protection Services	670,794.00	291	22.79%
10 Hydrological Services	-	-	-
11. Forestry Management, Regulation, Education and Research	54,873.56	23.85	1.87%
Estimated Total Contribution of Sub-Sector	**2,960,877.60**	**1,276.95**	100.00%

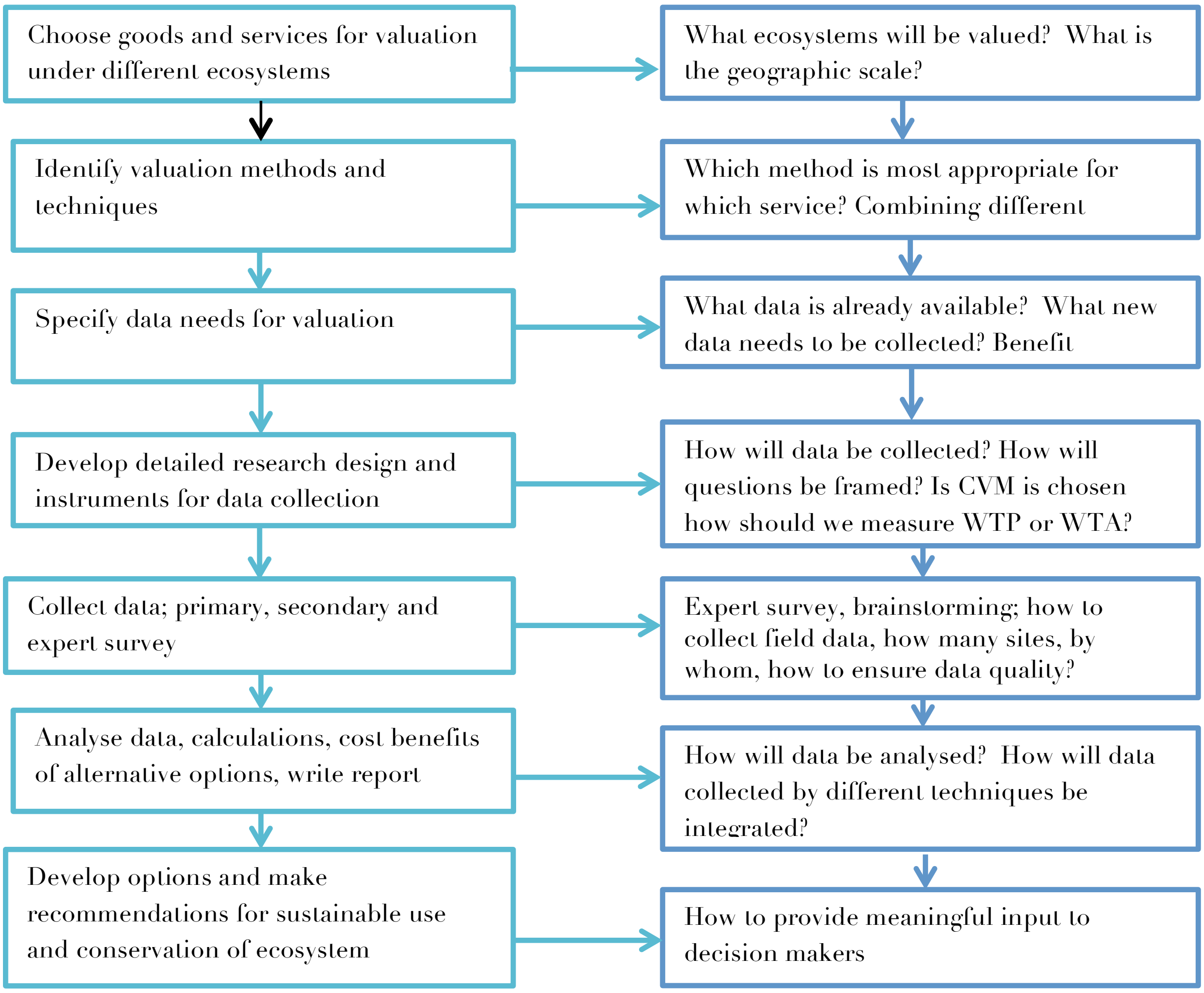
Source: Masiga et al. 2013

3.4 Economic valuation process

The process of economic valuation begins with a scoping exercise in which the goods and services to be evaluated from a particular ecosystem or landscape are identified; this is followed by application of appropriate methods and techniques for capturing their use and non-use values. The process of valuation ends with a policy appraisal, although economic analysis extends to understanding the drivers of change, and identifying the course of action to arrest the degradation and improve the health of the ecosystem. As shown in Figure 3 below, the specific steps are:

(i) scoping exercise in which the goods and services to be evaluated from a particular ecosystem or landscape are identified;
(ii) identify valuation methods and techniques;
(iii) specify data needed for valuation;
(iv) research design and instruments for data collection;
(v) collect primary and secondary data;
(vi) analyse data, valuation, decision analysis and write report; and
(vii) develop options and make recommendations for sustainable use and conservation.

Figure 3: Key stages of the valuation process



Source: Rosul et al. 2011

3.5 Protocol of valuation technique

A detailed summary of economic valuation techniques, their applications, and limitations has been delineated in Table 2 below. Suffice to note that all of the valuation techniques have strengths and weaknesses as we have seen. The decision on which valuation technique to use for a particular application requires experience and judgment on the part of the analyst. However, some general points to consider when making a choice of valuation techniques are delineated below:

(i) The selected method should be technically acceptable with respect to its validity and reliability. Measures obtained from the technique should be consistent and accurate. For instance, comparing similar valuations across multiple sites would serve to identify outlier results that might require additional scrutiny. Methods suffering random errors require reliability checks to judge their predictive capacity. Methods suffering non-random errors contain bias problems, thereby reducing reliability and the validity of the measurement results.

(ii) Revealed preference and stated preference measures often suffer from validity and reliability biases. For stated preference measures this can be overcome if a strict statistical and econometric approach is followed, which often means higher skill level. However, to ensure reliability and validity of data, the analyst will provide the methodology used for the analysis as basis for acceptance of their results. Similarly, hedonic pricing and travel cost methods often result in validity and reliability biases. There are good data sets for conducting travel cost analyses with Uganda Wildlife Authority (UWA) and the Ministry of Tourism Wildlife and Antiquities (MTWA). However, conducting the analysis may pose some difficulties and will require support from national institutions. Hedonic pricing is only feasible with clear spatial analysis, requiring GIS skills. To ensure a reliable methodology is chosen, a thorough literature review is a necessary pre-requisite to launching any "new" type of valuation in Uganda. The literature review will be presented by an analyst who seeks to undertake the valuation, and should be introduced at the beginning of each study.

(iii) The technique chosen should be institutionally acceptable such that it fits into the current decision making processes. There are differing views as to the acceptability of monetizing the environment. A list of institutional methodologies will be developed as an annex to these guidelines.

(iv) It is important to consider the needs of the user(s) of valuation studies, and recognize they may prefer the use of one valuation technique over another. For example, estimates obtained from travel cost or hedonic property value models may be considered too theoretical or too complex. On the other hand it may be felt that contingent valuation estimates are too subjective and unreliable to support policy debate and discussion. The analyst carrying out policy work must be sensitive to such concerns. The technique should also fit within the capacity of the analyst.

(v) The financial cost of the study needs to be weighed against the value of the information gained. Prudence is required in undertaking economic analyses to ensure cost-effectiveness. Therefore, these guidelines have been developed for cost-effective economic analysis of environmental impacts in Uganda.

Finally, it will often be possible to use more than one valuation technique and compare the results. The estimates of value obtained from all the methods described will be somewhat uncertain. If the analyst has multiple estimates, then they will have greater confidence in the magnitude of the value of the proposed change. Several of the valuation techniques typically use data from a household survey, e.g. contingent valuation, travel cost model, and hedonic property value model. When the implementation of a valuation technique requires that primary data be collected with a household survey, it is often possible to design the survey to obtain the data necessary to undertake more than one valuation method.

Table 2: Valuation methods, applications and limitations in Uganda

Method	Approach	Applications for Uganda	Examples of usage in Uganda	Limitations to usage in Uganda
Direct market approaches				
Market price High Usage	Use prices that are directly observed in the market	Traded or tradable goods and services	Wood products, agricultural products, abstracted water	Distortions by subsidies, price caps and regulatory requirements
Public pricing High Usage	Use of public expenditure pricing as indicator of value	Public provided utility	Public water in rural areas & available budget for compensation of displaced persons	Little direct link of benefits of ecosystem services to beneficiaries
Replacement cost Low Usage	Estimate cost of replacing ecosystem service with man-made elements, or improving management of a similar ecosystem to offset the services lost.	Ecosystem services that can be replaced with a man-made element, or that can be offset by protecting a similar area	No direct example, efforts being made to use method for oil & gas developments	High risk of underestimating or over estimating the replacement cost
Restoration cost High Usage	Estimate cost of restoring degraded ecosystems to ensure provision of ecosystem services	Any ecosystem that can be provided by restored ecosystem	Frequently used in restoration orders issued by NEMA	There is a very little link between size of ecosystem, ecosystem services and cost there is a general under estimation bias
Net factor income Low Usage	Revenue from sales of environmental related goods minus cost of other inputs	Ecosystems that provide an input in the production of marketed good	There are no known uses in Uganda	Tendency to overestimate values since method attributes all normal profit to the ecosystem service
Production function Low usage	Estimates value of ecosystem services as input of production of marketed good	Ecosystems that provide input in the production of marketed good	Soil quality or water quality there is a general acceptability in crop, livestock, fisheries research; however, the attribution is not used	Technically difficult; high data requirements. Likely to depend on scientific research
Revealed preference approaches				
Hedonic pricing Low usage	Estimate influence of environmental characteristics on price of marketed good	Environmental characteristics that vary across goods (usually buildings)	Urban open space no clear examples in Uganda	Technical difficulty, data requirements data usually not available spatial data required
Travel cost moderately used	Use data on travel costs and visit rates to estimate demand for recreational sites	Recreational sites	Moderately used, wildlife (EPRC and NEMA 2009; NEMA 2011; Masiga et al. 2013)	Technically difficult, data requirements, although fairly good data available, complicated for multiple purpose trips, attribution
Stated preference approaches				
Contingent valuation method (CVM) moderately used	Asks people to state their willingness to pay or willingness to accept for an ecosystem service through surveys	All ecosystem services	Examples of use for wetlands (WRI 2008)	Expensive, technically difficult, prone to biases
Choice	Asks people to make a	All ecosystem	Examples for use in	Expensive and technically

Method	Approach	Applications for Uganda	Examples of usage in Uganda	Limitations to usage in Uganda
modelling Low Usage	trade-off between an ecosystem service and other goods to elicit a willingness to pay	services	agriculture but not extensive in valuing ecosystem services	difficult (harder than CVM)
Group/participatory valuation Low usage	Asks groups of stakeholders to state their willingness to pay for an ecosystem service through group discussion	All ecosystem services	No known examples but clearly feasible in Uganda	Prone to biases for large groups

3.6 Decision-support frameworks

The principle decision-support tool for environmental impact analysis in Uganda is cost-benefit analysis. Cost effectiveness analysis (CEA) is rarely applied in Uganda, but it is becoming increasingly relevant, especially for new technologies as well as climate change mitigation evaluation activities. Nonetheless, these guidelines recommend the use of cost-benefit analysis. The use of CEA is restricted to unique cases and requires permission from the lead agencies such as Uganda Wildlife Authority (UWA), National Forestry Authority (NFA), Climate Change Unit (CCU), Directorate of Water Development (DWD), Directorate of Water Resources Management (DWRM), Wetlands Department and other agencies in the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF), Ministry of Trade and Industry (MTI), Ministry of Energy and Mineral Development (MEMD), Ministry of Works and Transport, Ministry of Lands, Housing and Urban Development, and Urban Authorities, among others. Regulators such as NEMA, DWRM or CCU may also have a say in whether or not CEA can be used. There is an effort to develop national income accounts to also support policy decision making at a macro-economic level; however, only a brief description is made in these guidelines

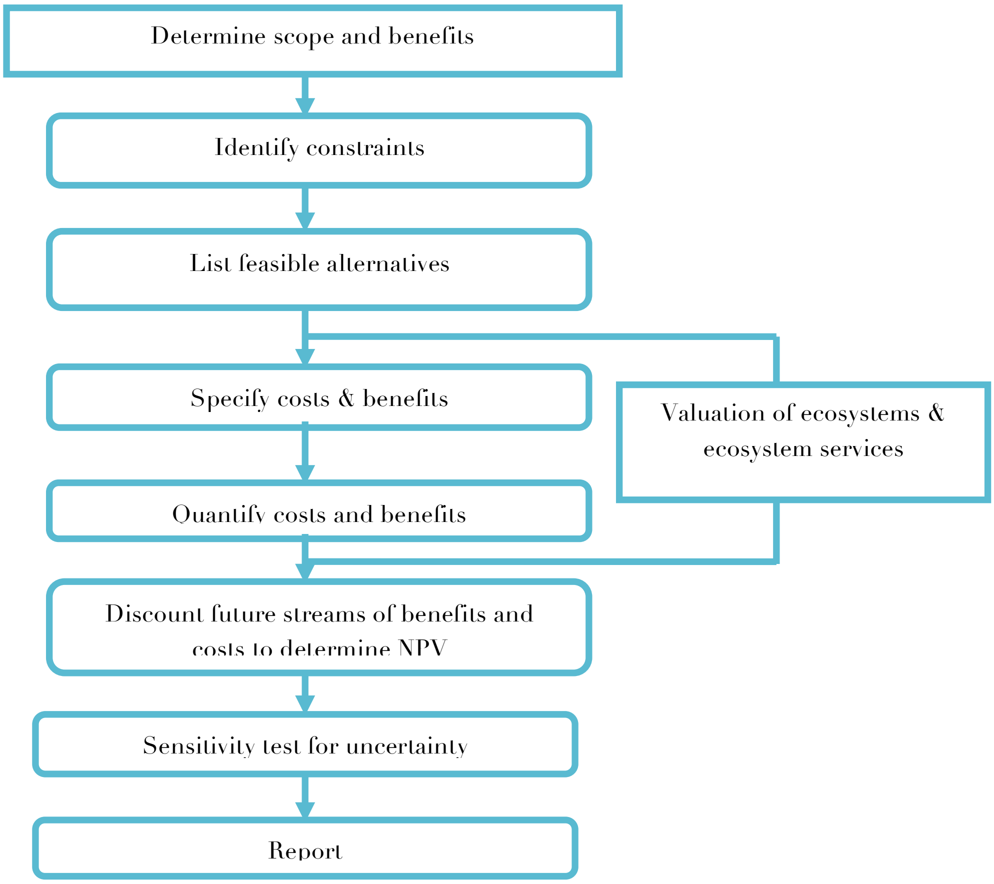
3.6.1 Cost-benefit analysis

Cost-benefit analysis (CBA) is an evaluation method which assesses the economic efficiency of policies, projects or investments by comparing their costs and benefits (Brander et al. 2013). CBA serves as a quantitative analytical tool to aid decision-makers in the efficient allocation of resources. It identifies and attempts to quantify the costs and benefits of a programme or activity and converts available data into manageable information. The strength of the method is that it provides a framework for analysing data in a logical and consistent way (Commonwealth of Australia 2006).

Cost-benefit analysis is the main analytical framework for decision making in Uganda (Ssewanyana et al. 2013). In theory, CBA is simple (Figure 4). All the benefits and costs of a proposed policy or project are valued, added and compared. When the benefits outweigh the costs (i.e., the 'net benefit' is positive), the proposed change is considered to be economically efficient. The policy option that generates the largest net benefit is considered to be the best choice for investment. CBA arguably dominates economic decision making because it allows decision makers to justify expenditures (important in an atmosphere where resources are constrained), appears uncontroversial (mirrors the way people today make consumption choices), and is often either legislated or given preference at powerful levels of government.

The results of the economic valuation process should be integrated with the CBA process. While conventionally, all costs and benefits should be specified and quantified, this is often not the case with ecosystems and ecosystem services for reasons detailed earlier in these guidelines.

Figure 4: Steps of cost-benefit analysis framework



Source: adapted from Commonwealth of Australia (2006)

Several technical issues related to CBA are worthy of note here:

(i) An important element in CBA is to examine the incremental impact of the project; "that is how net receipts, net cash flows or net economic benefits with the project in the presence of the project under study can be expected to differ from those that would prevail in its absence (Jenkins et al. 2013). One should make the with/without distinction clearly and carefully so as not to include in the "with-project" scenario any benefits or costs that would exist "without" the project being undertaken. The "without project" situation does not mean that nothing is done to the current situation if the project is not undertaken.

(ii) One should conceptualize two states of nature: one with the project and the other without the project. The former identifies the revenues and expenditures associated with the case in which the project is undertaken, while the latter refers to all relevant benefits and costs that would likely prevail if the project were not undertaken. Comparing the two, a project usually involves incremental net expenditures in the construction phase followed by incremental net benefits in the operating phase. The incremental net cash flow (or net economic benefits) refers to the net of benefits minus outlays that occur with a project less the corresponding figure that would have occurred in the absence of the project. In this way, we would properly identify the additional net benefit flow that is expected to arise as a result of a project. And from it, the corresponding change in economic well-being that is attributed to it can be measured (Jenkins et al. 2013).

(iii) People tend to value future costs and benefits less than immediate ones; when stakeholders are asked why they choose overexploitation (harvesting timber at a rate higher than the growth rate), they respond that they do so in order to meet immediate needs. *Discounting* describes the practice of reflecting this "rate of time preference" by placing more value on immediate costs or benefits as compared with those that occur in the future. The social discount rate used for cost-benefit analysis in Uganda is usually 12% (NEMA 2012; Nature Uganda 2009). This social discount rate is comparable to that used by international development institutions such as the World Bank and the African Development Bank (AfDB). The difference between the sum of discounted benefits and the sum of discounted costs will be the net present value (NPV). The NPV is the decision criteria; a positive NPV indicates a viable policy decision while a negative NPV indicates that the policy option is not viable. Discounting and rate of time preference issues pose important challenges to sustainable management of resources in Uganda and elsewhere, but discussion of these is beyond the scope of this report.

(iv) Estimation of uncertainties through *sensitivity analysis* is imperative for NPV (Brander et al. 2011). Sensitivity analysis provides an estimate of the robustness of the result obtained. When the sensitivity analyses have been completed, a full report to support the decision criteria of NPV is made. In the case of Uganda where policy implementation can be affected by other factors like weather, governance, and infrastructure, these can be introduced in the sensitivity analysis to improve interpretation of results and offer a platform for managing uncertainty in policy implementation.

(v) The NPV is computed as the sum of the stream of future total benefits (TR) minus the stream of future costs, (TC), discounted at the 12% social discount rate for Uganda (Mooney 2007; Nature Uganda 2009).

3.6.2 Cost-effectiveness analysis (CEA)

Cost-effectiveness Analysis (CEA) is an evaluation method that assesses the desirability of alternative policies, projects, or investments by computing the cost of attaining a specified objective (Brander et al. 2013). CEA is linked to CBA in that it is also a decision-support tool for policy appraisal. Unlike CBA, it evaluates only the costs of implementing a given plan. CEA is therefore useful in circumstances where a policy decision has been made but several implementation options exist (Brander et al. 2011). CEA is especially useful when decision makers are legally obliged to meet a broad policy objective. For example, comparison of different options for achieving greenhouse gas (GHG) mitigation standards, or in the case of Nationally Appropriate Mitigation Actions (NAMAs) where firms seek to comply with a national policy or standard.

CEA is useful most often when the benefits of a proposal are difficult to quantify in monetary terms but the government wishes to know which option will achieve social benefits or government objectives most cost effectively (Commonwealth of Australia 2006). However, CBA is the preferred decision analysis tool in Uganda, because the benefits are expressed in monetary units as opposed to the physical units used in CEA.

3.7 National income accounts

While CBA and CEA are decision-making tools relevant to projects and regulations, national income accounts are a key indicator framework for setting priorities in domestic macroeconomic policies. National income accounts are a long-standing economic convention by which economic performance is measured. In essence, the accounts measure national output from all sources (known as Gross Domestic Product - GDP), and then deduct a measure of depreciation, which is the amount of (typically) manmade capital that is used up in production. The result is a figure that depicts, in economic terms, how well off a country is year on year. While conventional accounts already include many biological products (e.g. production of timber and fish), in the last two decades there have been numerous attempts, at national and international levels, to include environmental externalities and some measure of environmental depreciation to reflect the environmental losses that occur as a result of economic activities. The United Nations Statistics Division, together with other organisations, has developed the System of Economic and Environment Accounting (SEEA). It was introduced in 1993 and revised in 2003, and consists of a satellite system to the UN System of National Accounts (SNA), in which changes in important natural assets are accounted for in physical terms.

Due to the challenges involved in assessing values in a comprehensive manner, most work in this area focuses on those that can be measured comparatively easily. It mainly includes direct use values that are traded on markets, opportunity costs for protected areas, and sometimes also the impact of pollution. Some methods focus on the use of natural resources, both renewable and non-renewable, as an indicator for the use of nature. For instance, recent work by the World Bank on an adjusted GDP and adjusted measurements of national capital stocks adopted the concept of genuine savings or adjusted net savings, which measure the true rate of savings in an economy after taking into account investments in human capital, depletion of natural resources and damage caused by pollution.

Uganda has used the natural resource accounting approach to determine the annual contribution of forestry resources to the national economy (NEMA 2012; Masiga et al. 2013). One of the benefits of natural resource accounting is that the values obtained can be easily transformed to establish the value in entirety of ecosystems and ecosystem services. The valuation techniques used are similar to those described under the total economic value approach. In principle, the main difference is the focus on the annual economic contribution of resources to the wealth, or depreciation of wealth, of a country compared to the estimation of the full value of ecosystems and ecosystem services flows under the TEV approach.

CHAPTER FOUR: CONCLUSIONS

4.1 Need for capacity building for practitioners and regulators

Policy and decision makers
Within the framework of the National Environment Act Cap 153, NEMA is obligated to coordinate the actions of lead agencies of government. Uganda needs to develop capacity among public sector managers of natural resources, specifically around which valuation techniques that can be applied to different sectors and circumstances. A shortlist of valuation techniques approved by sector, accompanied by a list of analysts available to conduct studies, will be developed through trainings and consensus building with lead agencies.

Regulatory support
A fundamental objective of economic analysis guidelines is to provide information for regulatory support for managers of natural resources and the environment. Environmental management, while coordinated by NEMA, is largely a function of lead agencies, sectors, sub-sectors and sub-national agencies, where environmental impacts occur. These lead agencies have limited technical capacity in utilizing these guidelines. A training programme, including a series of trainings and follow-up support, will be undertaken and coordinated by NEMA to ensure the success of these guidelines.

Specific guidelines for existing and new sectors
These guidelines are developed for all environmental challenges in general. But more sector and industry specific guidance can be extrapolated from these current guidelines. The need for sector or industry specific guidelines will be important where considerable environmental damage is envisaged. For example, in the road and transport infrastructure and oil and gas industries, which are newer, there is less clarity on what aspects of ecosystems and ecosystem services can be quantified. These guidelines, and the capacity building activities to follow, will allow for a sector specific focus and discussion leading to either development or improvement of existing sector guidelines

Training programmes and course with certificates
Training programmes and courses leading to award of certificates will be conducted with partners in the private sector, especially the environmental practitioners and public training institutions. The training programmes will aim at ensuring adequate rigour among future practitioners of environmental economic analyses for policy and decision making in the country.

Creation of a platform for information sharing and updates
NEMA will partner with stakeholders in research institutions, private sector and public training institutions to establish a database of case studies that can be used as data sources and as secondary approved literature. Sectors are urged to partner with NEMA and research institutions to undertake valuation activities that will form a baseline for regulatory support using these guidelines.

Identifying additional benefits e.g. job creation, cooperation among stakeholders etc.
These guidelines will create opportunity for an intensified effort to improve decision making at the regulatory and policy level with regard to the use of environment and natural resources. There may

be a need for sectors and agencies to identify personnel who will be dedicated to providing support in these areas. In addition to support sought from research institutions, these guidelines may be an opportunity to explore new career opportunities and human resource enhancement. These guidelines will also support current green economy efforts to introduce cleaner technologies in areas of sustainable consumption and production for sectors and industry.

4.2 Valuation for ecosystems and ecosystem services

NEMA recommends that all sectors consider partnering with research institutions and NEMA to undertake valuation studies for ecosystems and ecosystem services. These valuations will be aimed at piloting the use of different valuation approaches to arrive at techniques that will be viable in Uganda. Some of the priority ecosystems and ecosystem services for valuation are listed below:

(i) Freshwater systems
(ii) Wetlands
(iii) Land and soils
(iv) Forestry
(v) Wildlife
(vi) Minerals
(vii) Oil & gas

4.3 Priority steps for lead agencies seeking to implement these guidelines

(i) Identifying potential externalities associated with projects undertaken in different sectors

(ii) Identifying analytical approaches that will highlight the most appropriate response that enhances the performance of agency or sector

(iii) Choosing appropriate and cost-effective means for verifying compliance to environmental regulations

(iv) Regular review of instruments and analytical approaches

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ANNEX I: CHECKLIST/GUIDELINES FOR CONDUCTING ECOSYSTEM VALUATION

The following is a checklist to aid in that assessment. It identifies questions that should be discussed openly (and in some cases debated) and satisfactorily resolved in the course of the valuation exercise.

THE POLICY FRAMEWORK

1. What is the purpose of the valuation exercise?
    - What is the policy decision to be made?
    - What decision criteria will be used and what role will the results of the valuation exercise play?
    - How will the valuation results be used?
    - What information is needed to answer the policy question?
2. What is the scope of the valuation exercise?
    - What ecosystem services will be valued?
    - Is it necessary to value only one or a few ecosystem services, or is it necessary to value all services?
3. What is the appropriate geographic scale of the valuation exercise?
    - Is it a local, regional, or national analysis?
    - What is the relevant population to include in the value estimates (i.e., whose values to include)?
4. How is the valuation question framed?
    - Is it seeking to measure willingness to pay or willingness to accept as a measure of value? Is the question framed in terms of losses or gains?
    - What effect is framing likely to have on the valuation estimates? Is it likely to introduce systematic biases? What effect would alternative frames likely have on the value estimates?
    - What are the advantages and the limitations of the frame that is chosen?
    - Is the frame responsive to stakeholder needs and will it generate information useful to stakeholders?

THE UNDERLYING ECOLOGY

1. How well understood is the ecosystem of interest?
    - Are the important dynamics understood and reflected in the analysis?
    - Does the ecosystem exhibit important nonlinearities or threshold effects as they relate to expected impacts?
    - If the analysis covers multiple ecosystems (e.g., an analysis of a national wetlands policy), how similar or heterogeneous are the included ecosystems?
    - How do important sources of heterogeneity link to important variations in value?
    - Are the interlinkages between different ecological services well understood?
    - Are the complexities of the ecosystem adequately captured by the valuation method? If not, what are the implications for the valuation exercise?
2. How precisely can the changes in ecological services that are likely to result from the policy be predicted?
    - Is the level of precision sufficient given the nature and purpose of the valuation exercise?
    - If not, how will the underlying ecosystem effects of the policy be characterized (e.g., as hypothetical changes in services)?

FROM ECOLOGY TO ECONOMIC VALUATION

1. Is the study designed so that the output from the ecological models can be used as an input to the economic models?
    - Does the ecological model give outputs in terms of things that people value?
    - With cost-effectiveness analysis (or use of replacement cost), are the alternatives providing the same goods or services with the same reliability?
2. Given the services to be valued, what existing valuation methods are available?

- Which seem most appropriate?
- To what extent is integrated ecological-economic modeling required to capture multiple services and their values, and the "interconnectedness" between the structure and functioning of ecosystem and the services of value generated?
- For any given method, which services are captured in the estimated values and which are not?
- Whose values are captured by the method?
- Is the measure a "true" measure, an underestimate (e.g., a lower bound), or overestimate of the true value?
  - o Under what conditions can it serve as a reasonable proxy for true values?
  - o Are those conditions met?
  - o Do the values reflect the relevant scarcities?
  - o Are there close substitutes for the ecological services being valued (i.e. other means of providing the service)?
  - o Does the valuation technique adequately reflect the uniqueness of the ecosystem service or the availability of substitutes?
  - o Will the values capture important nonlinearities or possible threshold effects?

3. What are the data needs?
   - Are original values to be generated, or are estimates of value generated from previous studies being used ("benefits transfer")?
   - If benefits transfer is to be used, how transferable are the available estimates to the ecosystem services of interest?
   - If original estimates are to be generated, what is the appropriate sample to be used in gathering data?
     - o What is the likely effect of the sample choice on the valuation estimates?
     - o Have the quality of the data been evaluated adequately?
4. How is aggregation handled?
   - Do benefits/values extend over time?
     - o Is discounting used to aggregate over time?
     - o If so, what discount rate is used?
     - o What are the implications for intergenerational resource allocation using alternative decision rules?
   - How are individual values aggregated across individuals?
   - How are values aggregated across services?
     - o If estimates derived by different methods are combined, is there the potential for double counting? What steps have been taken to avoid double counting?

UNCERTAINTY

1. What are the primary sources of scientific uncertainty affecting the valuation estimates?
   - What are the possible scenarios or outcomes?
   - Can probabilities be estimated and with what degree of confidence?
2. What methods (such as sensitivity analysis and Monte Carlo simulation) will be used to address uncertainty?
   - Can the results of the valuation exercise be used to calculate not only point estimates but also estimates of the range of value estimates?
   - Do the value estimates capture risk aversion?
3. If benefits or values extend over time, are there important irreversibilities?
   - Is it likely that significant learning will occur?
   - Is the value of being able to respond to new information (flexibility) adequately reflected in the valuation estimates?

OVERARCHING RECOMMENDATIONS FOR CONDUCTING ECOSYSTEM VALUATION

Where possible, policymakers should seek to value ecological impacts using economic valuation approaches as a means of evaluating the trade-offs involved in environmental policy choices. If the benefits and costs of an environmental policy are evaluated, it is imperative that the benefits and costs associated with changes in ecosystem services be included as well. Without this, ecosystem impacts may not be adequately acknowledged and included (i.e., they will be implicitly given a value of zero). This does not imply that economic values are the only source of value or that decisions should be based solely on a comparison of benefits and costs; other forms of value and other considerations will undoubtedly be important as well. Rather, it implies that an assessment of benefits and costs should be part of the information available to policymakers in choosing among alternatives.

1. To provide meaningful input to decision-makers, it is imperative that the valuation exercise be framed properly. In particular, it should seek to value the *changes* in ecosystem services attributable to the policy change, rather than the value of an entire ecosystem.

2. A valuation exercise should recognize and delineate explicitly the sources of value from the ecosystem and identify which sources are and which are not captured in the economic approach to valuation. It should acknowledge the implications of excluding sources of value that are not captured by this approach.

3. For policy evaluation, it is necessary to go beyond a listing and qualitative description of the affected ecological services. Where possible, ecological impacts should be quantified. Care should be taken to ensure that the quantification reflects the complexities, nonlinearities, and dynamic nature of the ecosystem.

4. Economists and ecologists should work together from the beginning to ensure that the ecological and economic models can be appropriately linked (i.e., the output from ecological modeling is in a form that can be used as an input into economic analysis). This requires that ecosystem impacts be expressed in terms of changes in the ecosystem goods and services that people value.

5. The valuation exercise should seek to value those goods and services that are most important for supporting the particular policy decision. In addition, the valuation exercise should identify the subset of services for which the economic approach to valuation can be applied with relative confidence, as well as those services or sources of value that are important but for which impacts are less easily quantified and valued. For these, it is imperative to identify the sources of uncertainty relating to the understanding of the relevant ecology, the relevant economics, or the integration of the two.

6. Economic valuation of ecosystem changes should be based on the comprehensive definition embodied in the total economic value (TEV; see Chapters 2 and 4) framework. Both use and nonuse values should be included.

7. The scope of the valuation exercise should consider all relevant impacts and stakeholders (although in some cases considering only a subset may be sufficient). The geographic and temporal scale of the analysis should be consistent with the scale of the impacts.

8. Extrapolations across space (from one ecosystem to another), time (from present impacts to future impacts), or scale (from small changes to large changes) should be scrutinized carefully to avoid extrapolation errors.

ANNEX II: GLOSSARY OF IMPORTANT TERMS

Contingent valuation (CV) – An economic valuation technique based on the stated preference of respondents as to how much they would be willing to pay for specified benefits, or how much they would need to be paid to be willing to accept specified costs. A detailed description of the goods or service involved is given, together with details on how it will be provided. CV is designed to circumvent the absence of markets by presenting consumers with hypothetical markets in which they have the opportunity to pay for the goods or service in question, or accept compensation for the loss of those goods or services.

Cultural services – The non-material benefits people enjoy from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experience.

Direct use value – In the Total Economic Value framework of an ecosystem, the benefits derived from the goods and services that are used directly by an economic agent. These include consumptive uses (e.g., harvested goods) and non-consumptive uses (e.g., enjoyment of scenic beauty).

Environmental Economic Analyses (EEA) refers to theoretical or empirical studies of the economic effects of national or local environmental policies around the world. Particular issues include the costs and benefits of alternative environmental policies to deal with air pollution, water quality, toxic substances, solid waste, and global warming, among others.

Ecosystem – A dynamic complex of plant, animal, and microorganism communities and their non-living environment interacting as a functional unit.

Ecosystem approach – this is a strategy for the integrated management of land, water, and living resources that promotes conservation and sustainable use in an equitable way. An ecosystem approach is based on the application of scientific methodologies at the level of biological organisation; it encompasses the essential structure, processes, functions, and interactions between organisms and their environment. It recognises that humans are an integral component of many ecosystems.

Ecosystem boundary – this is the spatial delimitation of an ecosystem, typically based on discontinuities in the distribution of organisms, the biophysical environment (soil types, drainage basins, depth in a water body), and spatial interactions (home ranges, migration patterns, fluxes of matter).

Ecosystem function – An intrinsic ecosystem characteristic related to the set of conditions and processes whereby an ecosystem maintains its integrity (such as primary productivity, food chain, and biogeochemical cycles). Ecosystem functions include processes such as decomposition, production, nutrient cycling, and fluxes of nutrients and energy.

Ecosystem services – The benefits that people obtain from ecosystems. These include provisioning services such as food and water; regulating services such as flood and disease control; cultural services such as spiritual, recreational, and cultural benefits; and supporting services such as nutrient cycling, that maintain the conditions for life on Earth. The concept 'ecosystem goods and services' is synonymous with ecosystem services.

Existence value – this is the value that individuals place on knowing that a resource exists, even if they never use that resource (sometimes also known as conservation value or passive use value).

Financial Feasibility Study - examines the project from the point of view of the developer/investor.

Economic Feasibility Study - examines the project from the point of view of society; it usual uses the whole country as the accounting entity. This incorporates the evaluation of externalities.

Externalities - are the costs or benefits that fall on third parties. A situation in which an individual or firm takes an action but does not bear all the costs (negative externality) or receive all the benefits (positive externality).

Hedonic price methods – Economic valuation methods that use statistical techniques to break down the price paid for goods and services into the implicit prices for each of their attributes, including environmental attributes such as access to recreation or clean air. For example, the price of a home may be broken down to see how much the buyers were willing to pay for it in a neighbourhood with cleaner air.

Indirect use value. The benefits derived from the goods and services provided by an ecosystem, which are used indirectly by an economic agent. For example, an agent at some distance from an ecosystem may derive benefits from drinking water that has been purified as it passed through the ecosystem.

Non-use value. These are benefits, which do not arise from direct or indirect use of ecosystem services.

Opportunity cost – The value of the next best alternative when an economic decision is made, or the foregone benefits of not using land/ecosystems in a different way. Examples include: the foregone income from agriculture when conserving a forest or, conversely, the foregone value from ecosystem services when clearing a forest.

Option value – This refers to the value of preserving the option to use services at a future date either by oneself (option value) or by others or heirs (bequest value). Quasi-option value is the value of avoiding irreversible decisions until new information determines whether certain ecosystem services have values of which society is not currently aware.

Production function (PF) approach – The production function approach values ecosystems as an input to production of a marketed useful good. It attempts to calculate the difference in that value under different states of the ecosystem. Changes in the availability of the ecosystem good or service can affect the cost and supply of the marketed good, the returns to other factor inputs, or both.

Provisioning services – The products provisioned by ecosystems, including, for example, genetic resources, food and fibre, and freshwater.

Regulating services – The benefits obtained from the regulation of ecosystem processes, including, for example, the regulation of climate, water, and some human diseases.

Replacement cost – An approach to valuing ecosystem services that uses the cost of replacing them: either the cost of restoring the ecosystem to a state where it once again provides the service, or the cost of obtaining the same service in some other way.

Supporting services – these are ecosystem services that are necessary for the production of all other ecosystem services. Some examples include biomass production, production of atmospheric oxygen, soil formation and retention, nutrient cycling, water cycling, and provisioning of habitat.

Threshold – A point or level at which new properties emerge in an ecological, economic, or other system, frequently invalidating predictions based on mathematical relationships that apply at lower levels. For example, the species diversity of a landscape may decline steadily with increasing habitat degradation up to a certain critical threshold of degradation, after which they then decline sharply.

Travel cost method – An economic valuation technique that uses the observed costs of travel to a destination to derive demand functions for that destination. There are two approaches to travel cost methods – the individual travel cost model and the zonal travel cost model. The individual travel cost model estimates the value of a recreational site by developing the individual's recreation demand function; whereas the zonal travel cost model estimates the aggregate or market demand function for a recreational site using statistical techniques. Travel cost methods have limited applicability outside this context.

Total economic value – A framework for considering various constituents of value, including; direct use value, indirect use value, option value, quasi option value, and existence value.