GEF GUIDANCE DOCUMENTS TO ECONOMIC VALUATION OF ECOSYSTEM SERVICES IN IW PROJECTS

GEF International Waters Learning Exchange And Resources Network

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Subcomponent 4.1
Systematic consideration of the economic valuation of natural resources into the TDA/SAP process

United Nations Educational, Scientific and Cultural Organization

Intergovernmental Oceanographic Commission

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Table of Contents

Boxes

Tables

Figures

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ABBREVIATIONS/GLOSSARY

CBD	Convention on Biological Diversity
EPA	Environmental Protection Agency (United States)
FAO	Food and Agriculture Organization
FIRMS	Fisheries and Resources Monitoring System
HSA Protocol	Hydropower Sustainability Assessment Protocol
IUCN	International Union for Conservation of Nature
MEA	Millennium Ecosystem Assessment
RFB	Regional Fisheries Bodies
SAP	Strategic Action Programme
TDA	Transboundary Diagnostic Analysis
TEV	Total Economic Value
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNIDO	United Nations Industrial Development Organization
WCD	World Commission on Dams


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INTRODUCTION TO THE METHODOLOGIES

I.1 Who is this Guidance for?

The Guidance Document to Economic Valuation is aimed at GEF International Waters project managers, economic experts and other stakeholders involved in GEF International Waters projects and more generally those interested in including the economic valuation of ecosystem services into Transboundary Diagnostic Analyses (TDA) and Strategic Action Programmes (SAP) and linked processes, such as policy and decision makers and environmental and development planners.

I.2 Introduction and Context

The GEF funded project “GEF International Waters: Learning Exchange And Resources Network” (IW:LEARN 4) is jointly implemented by UNDP and UNEP, with UNIDO having the thematic lead of the “economic evaluation subcomponent” 4.1 (“Systematic consideration of the economic valuation of natural resources into the TDA/SAP process and targeted learning”). This document, as well as the Guidance Documents and toolbox of methodologies, was developed with the feedback of the IW:LEARN-community. IUCN, UNECE and GRID ARENDAL on behalf of UNEP provided valuable inputs.

I.2.1 Setting the Scene – what are Ecosystem Services?

“Ecosystem services” are the many and varied benefits that humans obtain from the natural environment and from properly-functioning ecosystems - for free (definition from TEEB Interim Report, adapted). The present idea and concept of ecosystem services was developed and described in several important reports and publications, starting in the late 1990s with publications by, for example, Costanza et al. (1997) and Daily (1997, 2000). The concept was covered globally in considerable detail by the United Nations´ “Millennium Ecosystem Assessment” (MEA 2005), and in an increasing number of publications from that point forward. More recently, the TEEB Report (“The Economics of Ecosystems and Biodiversity”; De Groot et al. 2009), particularly the “TEEB for Water and Wetlands” (Russi et al. 2013), along with several international initiatives. These initiatives include the UN´s Intergovernmental Platform on Biodiversity and Ecosystem Services/IPBES, the EU´s Common International Classification of Ecosystem Services/ CICES and the EU´s Mapping and Assessment of Ecosystems and their Services (MAES) initiative, all of which are underlining the potential of the concept for sustainable policy and decision making. Recent research by UNDP (2017) shows that economic valuation of ecosystem services can effectively inform in-country decision-making in ways that support the transformation of how development is planned and acted upon towards sustainable solutions, depending on certain features of the valuation exercise. These features include an economic analysis that is based on solid science and focused on a clear policy question, careful identification and engagement with decision-makers, broad participation by local stakeholders, and effective communication and collaboration (UNDP 2017a, UNDP 2017b).

In the TEEB report, ecosystem services are categorized into four broad categories, representing different "services" or "goods" that are provided by different ecosystems/habitats. The TEEB categorization is used in the GEF Guidance Documents:

MAIN SERVICE - TYPES			
PROVISIONING SERVICES	REGULATING SERVICES	HABITAT SERVICES	CULTURAL SERVICES
1. Food (e.g. fish, game, fruit) **2.** Water (e.g. for drinking, irrigation, cooling) **3.** Raw materials (e.g. fiber, timber, fuel wood, fodder, fertilizer) **4.** Genetic resources (e.g. for crop improvement and medicinal purposes) **5.** Medicinal resources (e.g. biochemical products, models & test organisms) **6.** Ornamental resources (e.g. artisan work, decorative plant, pet animal, fashion)	**7.** Air quality regulation (e.g. capturing (fine) dust, chemical, etc.) **8.** Climate regulation (incl. C-sequestration, influence of vegetation on rainfall, etc.) **9.** Moderation of extreme events (e.g. storm protection and flood prevention) **10.** Regulation of water flows (e.g. natural drainage and drought prevention) **11.** Waste treatment (especially water purification) **12.** Erosion prevention **13.** Maintenance of soil fertility (incl. soil formation) **14.** Pollination **15.** Biological control (e.g. seed dispersal, past and disease control)	**16.** Maintenance of life cycles of migratory species (incl. nursery service, etc.) **17.** Maintenance of genetic diversity (especially gene pool protection)	**18.** Aesthetic information **19.** Opportunities for recreation & tourism **20.** Inspiration for culture, art & design **21.** Spiritual experience **22.** Information for cognitive development

Figure I.1: The typology for ES according to the TEEB Report (Source: De Groot et al. 2009)

Ecosystem services can be also divided into "use values" and "non-use values", according to the concept of the "Total Economic Value" (TEV). The TEV is a common approach from the field of environmental economics (Plottu/Plottu 2007) to create a single monetary metric that combines all activities within an area and to express the levels of each activity in units of a common monetary measure, such as US$. (Hoagland et al. 2006). It is a useful tool for exploring what types of values each ecosystem service provides. This helps in determining the valuation methods required to capture these values (DEFRA 2007).

Before the concept was introduced, economic values have quite narrowly been defined as "benefits". Values of ecosystems have been attributed only to raw materials and physical products that ecosystems generate for human production and consumption. These direct uses however represent only a small proportion of the total value of ecosystems, which generate economic benefits far in excess of just physical or marketed products. Instead of focusing only on direct commercial values the TEV also encompasses the subsistence and non-market values, ecological functions and non-use benefits. Broadly defined, the TEV includes:

USE VALUES

Direct use value: Individuals make use of a resource in either a consumptive way (e.g. the fishing industry and agriculture) or a non-consumptive way (e.g. cooling water).

Indirect use value: Individuals benefit from ecosystem services supported by a resource rather than actually using it (e.g. watershed protection for flood mitigation, cycling processes for agriculture or carbon sequestration).

NON-USE VALUES

Non-Use Values are associated with benefits derived simply from the knowledge that the natural environment is maintained. By definition, non-use values are not associated with any use of the resource or tangible benefit derived from it, although users of a resource might also attribute a non-use value to it. Non-use value can be split into three basic components:

Altruistic value: Derived from knowing that contemporaries can enjoy the goods and services the natural environment provides.

Bequest value: Associated with the knowledge that the natural environment will be passed on to future generations.

Existence value: Derived simply from the satisfaction of knowing that ecosystems continue to exist, regardless of use made of them by oneself or others now or in future (also associated with "intrinsic value").

For simplicity, the GEF Guidance Documents continuously speak of "ecosystem services", which also includes raw goods, and of "ecosystems", which could also mean "habitats" or "landscape".

I.2.2 Setting the Scene – why and when to conduct Economic Valuations of Ecosystem Services

Ecosystem services are crucial for the well-being of people, but their contribution to economic systems is difficult to quantify in monetary terms. Since some of them are not quantified (e.g. not traded in commercial markets), they are often given too little (or no weight at all) in decision making, e.g. in the course of the development of big infrastructure projects. Thus, final decisions may favor outcomes which do have a commercial value, turning unsustainable use of ecosystems more profitable in a short term while having considerable economic long term costs.

Economic valuation is a tool for valuing ecosystems and their services in monetary terms. It quantifies the benefits provided by ecosystems and the impact of ecosystem changes on the wellbeing of people. However, economic evaluations can be resource-intensive, and significant expert´s knowledge is needed to conduct an analysis "from scratch" (an "original valuation study", collecting primary data/ empirical knowledge through field research).

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In cases where such knowledge and resources are limited, the "benefit transfer" method is often used to estimate economic values for ecosystem services that cannot be valued otherwise, by transferring available information from detailed original studies already completed in another location and/or context. Benefit transfer is hence used when it is too resource intensive (in terms of money and expertise) and/or there is too little time available to conduct an original valuation study (i.e. an independent, individual assessment of e.g. a hotspot ecosystem), yet some measure of benefits is needed.

In the scope of the GEF IW:LEARN, such situations are referred to as "tier 1" projects, i.e. areas/regions which can only provide limited resources towards an economic valuation. The methodologies for a benefit transfer in tier 1 projects and a database of reference studies (the "repository") are presented in the tier 1 Guidance Document in chapter II.5.

Projects with more resources at hand, i.e. projects which can dedicate adequate funds for an original valuation of ecosystem services, are referred to as "tier 2" projects (see figure below). In such tier 2 projects/areas, IW managers can conduct a study/studies on the value of a specific ecosystem at risk of being damaged or destroyed, on the ecosystem services provided by a hotspot ecosystem, or on ecosystem services which are endangered by a specific pressure, such as eutrophication. Options and methodologies for tier 2 projects are presented in the tier 2 Guidance Document.

Depending on the policy context of the assessment (see chapter I.2.3 on policy contexts below, and the tier 2 Guidance Document for more details), or the current situation the project area is in terms of a starting or running TDA/SAP process (see chapter I.2.4 on TDA/SAP below for details), each economic valuation will be an individual and specific exercise from any other EV performed before or thereafter. For example and as described above, the resources available for an EV will differ, making it necessary to conduct a rather "rough" screening of the ecosystems, or to prioritize certain ecosystem services above others. Alternatively, the specific objectives of the EV could make it necessary to concentrate on a very specific, localized ecosystem of high value (e.g. a biodiversity "hotspot"), or on a certain pressure affecting a region or system.

The later utilization of the results also depends on the resources, the time and expertise invested in the economic valuation. A tier 1 economic valuation using the benefit transfer methodology will generate values that provide rough overview of potential values of ecosystem services in the region. Hence, these can be used for communication and awareness raising purposes, but should be handled with care and transparency when introduced into decision making processes. Also, assessments of all ecosystem services in a large region, such as a Large Marine Ecosystem (LME), will be less precise than assessments on a subnational or even local scale (see chapter I.2.5 on uncertainties).

I.2.3 Policy Appraisal Context

Depending on the specific situation and circumstances in the IW project area, any economic valuation will be embedded in an individual "policy appraisal context", which could also be part of a Transboundary Diagnostic Analysis (TDA) or Strategic Action Program (SAP).

The tier 1 and tier 2 approaches are flexible, to be usable in all kinds of policy situations.

The most common policy appraisal contexts, or "use cases", are:

- An economic valuation as a "screening analysis", assessing the overall value of all ecosystem services in a whole LME or transboundary river basin in a resource-efficient way, i.e. without conducting resource-intensive in-depth analyses. Such a screening will most likely be conducted using the easier tier 1 methodology, and be used mainly for communication and awareness raising purposes, possibly in the context of a TDA. Such a "screening" could also form the basis for a following in-depth analysis of all or some ecosystem services in the LME/river basin, which would then follow the tier 2 methodology.
- An economic valuation as a "hotspot analysis", i.e. an in-depth analysis of very biodiversity rich and important ecosystems or areas (e.g. the Great Barrier Reef in Australia). Such a hotspot analysis would also follow the tier 2 methodology.
- An economic valuation as an analysis of the impacts on ecosystems and ecosystem services of a planned,

concrete project, i.e. an in-depth assessment of the economic costs and benefits in a specific area that will be impacted by the project - positively or negatively. Thus, while some development/infrastructure projects may lead to the deterioration of important ecosystem services, a conservation project such as the establishment of a new Marine Protected Area (MPA) - as in the example below - could result in maintained or improved provision of ecosystem services by the ecosystem in question. Consequently, such an analysis could have the objective of demonstrating the economic values at risk or the economic values that can be maintained/increased by the project to be analyzed, with the aim of influencing policy decisions, and would also use the tier 2 methodology. Such an analysis could also support the identification of options and alternatives in a TDA/SAP process (see chapter I.2.4 below).

- An economic valuation focusing on a single ecosystem type of special interest (e.g. mangroves in the Niger basin) and the ecosystem services it provides (using the tier 2 methodology).
- Similarly, an economic valuation can be dedicated to one specific ecosystem service of relevance (e.g. carbon sequestration) in the project area of interest (e.g. river basin/LME) and will be also conducted based on the tier 2 methodology.
- Finally, in certain cases it may be of interest to consider an important singular pressure or an impact resulting from a pressure, and the resulting losses in ecosystem services. Examples of pressure are e.g. climate change, high levels of nitrates in the water body, whereas sea level rise, increased flood risks and eutrophication could be the resulting impacts. Such in-depth analyses are also using the tier 2 methodology.

The following flow diagram depicts the various policy appraisal contexts and whether tier 1 or tier 2 methodologies will be used.

Akumal Beach, Yucatan Peninsula/Robin Mahon

Figure I.2: Policy Contexts and methodology used

Box I.1: Example of Policy Appraisal Context 3 - Concrete Project Assessment

Belize's coastal zone has complex and dynamic marine ecosystems that support numerous ecological processes and a vast array of marine life and habitats, as well as a broad range of economic activities, social and cultural values to the Belizean people. However, development activities associated with tourism and recreational facilities, and others have led to increasing pressure on the coastal zone. Clarke et al. (2013) assessed how alternative coastal and marine zoning plans in Belize would affect ecosystem services.

Three scenarios were developed based on alternative visions for Belize's coastal zone. The first scenario depicted a "conservation" future, in which MPAs and the preservation of ecosystems and biodiversity were heavily favoured over development of the coastline and other economic activities. The second scenario illustrated a balanced approach to planning for economic development and conservation of critical resources, called "informed management". The third scenario visualised a "development heavy" future, where multiple, competing economic activities were permitted without central coordination and planning and were prioritized over preservation of coastal natural resources. These alternative options were established using existing coastal plans, policy documents, and future forecasts for Belize. In order to understand the implications of each zoning scenario, models were run to map and quantify the resulting changes in ecosystem services, in particular the changes in benefits from tourism and recreation, spiny lobster fishing, and coastal protection from storms and inundations. Scenarios were measured against the current conditions and to each other to establish which vision provided the greatest benefits to Belizean society and economy.

The study identified areas for coastal development that limit impacts on habitats and the services they provide, as well as areas most critical for conservation and the sustainable delivery of ecosystem services. Also, the stakeholders had the opportunity to visualise the results first hand and to see the effects of each human use especially on the marine habitat: mangroves, seagrass and corals, which led them to make informed recommendations for each zone based on each scenario.

I.2.4 Integration into the TDA/SAP Process

The Transboundary Diagnostic Analysis/Strategic Action Programme (TDA/SAP) approach is a collaborative process and served for a long time as a major strategic planning tool for GEF International Waters Projects. It is described in a comprehensive three volume manual, the "GEF Transboundary Diagnostic Analysis/Strategic Action Programme Manual"[1], of which the second is currently (in 2017) being revised in order to inter alia better accommodate the economic valuation guidance.

The main technical role of a TDA is to identify, quantify, and set priorities for environmental problems that are transboundary in nature. In particular, the TDA aims to:

- Identify and prioritize the transboundary problems.
- Gather and interpret information on the environmental impacts and socio-economic consequences of each problem (possibly including the economic valuation of ecosystems services, functions).
- Analyze the immediate, underlying, and root causes for each problem, and in particular identify specific practices, sources, locations, and human activity sectors from which environmental degradation arises or threatens to arise.

A TDA provides the factual basis for the formulation of a SAP, which is a concrete policy document. In addition to this, however, the TDA should be part of a process of engagement of stakeholders through the initial TDA development steps and the subsequent development of alternative solutions during the formulation of the SAP.

[1] *https://iwlearn.net/manuals/tda-sap-methodology*

The SAP is a negotiated policy document that should be endorsed at the highest level of all relevant sectors of government. It establishes clear priorities for action (for example, policy, legal, institutional reforms, or investments) to resolve the priority transboundary problems identified in the TDA. In order to carry out an effective TDA and to design a SAP that is likely to be approved, there is a need to have at least an approximation of the economic value of the project area´s ecosystem services. This is difficult, especially when it comes to considering the non-use values. Leverage points have to be based on an action that a government is prepared to finance. Hence, a good economic valuation is certainly of great importance for the TDA/SAP process in addressing the identified main environmental pressures.

An economic valuation - tier 1 or tier 2 - can be part of several steps in the TDA/SAP process as described in the TDA/SAP Guidelines, which include:

- In the TDA, assisting the collection and analysis of data/information.
- Also in the TDA, contribute to the determination of the environmental and socio-economic impacts (including economic valuation of transboundary ecosystems and services).
- In the Strategic Thinking Phase of the SAP, an EV can be a major support for identifying options and alternatives.
- An EV can also be a useful tool in identifying benefits and the social and economic groups which profit from these (the "users", in terms of IWRM), and whether benefits occur mostly on the national or the transboundary level.

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I.2.5 Uncertainties involved in Economic Valuations of Ecosystem Services

There are considerable uncertainties and challenges connected with economic valuations of ecosystem services, linked to a lack of data and information, methodological issues surrounding assumptions and constraints, but also to a general lack of understanding of the complex interactions between human activities, impacts on ecosystems and habitats (e.g. of infrastructure development), and their ramifications for the provision of ecosystem services. Such uncertainties, or the opaque communication of these, often hinder the uptake and use of economic valuation studies in policy making and as decision support.

Hence, when conducting an economic valuation, regardless of whether using tier 1 or tier 2, it is of utmost importance to clearly describe the uncertainties involved in the exercise, and to transparently communicate any assumptions taken, for example in order to bridge data and information gaps!

The most commonly discussed uncertainties in economic valuations include:

- How a given human activity impacts on the provision of ecosystem services, i.e. how a degradation of the quality of the ecosystem affects ecosystem services.
- The question how different ecosystem services are interlinked with each other and to the various components of ecosystem functioning (and to which degree).
- Uncertainties regarding the role of biodiversity and in biophysical modeling.
- The methodological issue of "double counting", i.e. the fact that some ecosystem services are not complementary or influence each other (e.g. provision of fish/fisheries and spawning grounds, two values that should not be added).
- Discussions of the metrics to be applied show that other approaches beyond those showing values in US$ could also be useful depending on different factors. Such other metrics involve, for example, the number of people/households depending upon the service(s), or the number of people (or even children) suffering or not suffering from diseases linked to ecosystem degradation.

- Major uncertainties are also based on the simplifying assumption that the economic value of ecosystem services provided by one hectare of a certain ecosystem equals the value of ecosystem services provided by one hectare of the same ecosystem somewhere else (internationally when using a benefit transfer, but also within the same region). The point is that all hectares of an ecosystem do not have the same productivity, which means that increasing the size of e.g. a protected area by the factor 10 does not mean that the value of the ecosystem services provided also increase by the same factor.

- In stated preference methods, such as the Contingent Valuation method, it is assumed that the stated preference is similar to the revealed preference (i.e. such studies assume that questioned people would in reality pay the same amount of money for the assessed ecosystem services that they stated in the study, confronted by interviewer and/or questionnaire). To policy makers who do not share this belief, such studies are not credible. Similar methodological problems lie in the calculation of the number of benefitting people, the proper discount rate, etc.

- When assessing the value of ecosystem services using the market price approach, it is often difficult to deduct the costs from the value (e.g. regarding fishing). While on the national scale this may be still a good indicator, it is more difficult when countries or regions need to be compared.

- Other issues and uncertainties involve questions of marginality, environmental limits and thresholds, the appropriate consideration of spatial and temporal issues and dealing with possible cumulative effects.

I.3 Ecosystem Services and extractive Industries

At some point during the work on the valuation of ecosystem services, the question of how to handle the extraction of mineral resources (water, sand, oil, limestone etc.), the provision of "water for shipping", agriculture and hydropower will arise. In other words: it needs to be clarified whether economic activities that are in a certain way based on the ecosystem(s) and natural resources, but which at the same time endanger, damage or destroy the ecosystems (sometimes even far away from the activity itself), should or can be considered "ecosystem services", and hence put on the same level as, for example, the provision of nursery grounds for fish species by mangroves.

Ecosystems are interacting and dynamic systems consisting of biotic and abiotic factors and are not a static composition of elements. In every ecosystem animals, plants, micro-organisms, mineral resources, climatic and other factors interact. The provision of ES by an ecosystem is the result of specific interactions, whereby only a healthy ecosystem can provide the full set of potential ecosystem services. The task of EV is to assess the economic value of this output.

The extraction of crude oil, sand, gravel or other mineral resources, also produces a value - a revenue/financial benefit. But this value does not derive from the living, functioning ecosystem but just happens to be derived from the same spatial area, whereby the unsustainable extraction of mineral resources can lead to a loss of many other vital and valuable ES (negative externalities). As a result, the revenue from the extraction of non-living resources such as crude oil can in this context not be regarded as a service provided by the ecosystem. Economic valuation of ES is furthermore not about summing up the value of every economic activity in the area of investigation, but to value those goods and services that directly derive from the existence of a healthy ecosystem and its functioning. This applies to shipping as well, and to a certain extent to fisheries (a sustainable, i.e. long-term usage of fish stocks without risking depletion/extinction, is in line with the above definition of ES).

Hence, in the context of the methodology/ toolbox for the EV of ES, the extraction of mineral resources and the provision of "water for shipping" are not considered to be ecosystem services. Regarding fisheries, the sustainable annual output/ yield should be taken as the basis for the valuation as ES, rather than the total value of all available fish stocks or the revenues generated from any fish harvesting activities which result in the depletion of the natural capital stock (e.g. in a situation of an overfished stock).

Similar arguments apply to built water infrastructure for hydropower generation and the provision of irrigation water for agriculture - water to serve the infrastructure needs would still be available even in cases where the "new" river/ lake ecosystems would cease to support the complex interactions of animals, plants and micro-organisms, as it did prior to the introduction of the infrastructure. However, the provision of water for different purposes upstream and downstream of any built infrastructure that affects flow and sediment movement - e.g. drinking water, irrigation, flood recession farming, floodplain grazing and fisheries, cooling - is one of the major ES linked to river and lake ecosystems (be they formed by built or natural infrastructure), which should not be excluded from an ES analysis.

Hence, in an EV of ecosystem services, the benefits derived from hydropower generation and irrigation water for agriculture should be included in the analysis only as long as they are provided on a sustainable basis both upstream and downstream of the built water infrastructure. Which means especially without severely impacting ecosystems or reducing the potential of an ecosystem to provide to the different stakeholders the full set of ES downstream.

For hydropower, this means theoretically that criteria developed by the World Commission on Dams (WCD) or the Hydropower Sustainability Assessment (HSA) Protocol should be respected (see box I.2 below), e.g. gaining public acceptance for all key decisions and comprehensive options assessment[2].

For irrigation water, this means that groundwater tables are not lowered by water abstraction and minimum ecological flows for surface waters are sustained and no water-dependent ecosystems (such as wetlands) are negatively impacted (in quantity and quality, due to the pollution caused by pesticides and fertilizers for example).

[2] A summary of the report of the WCD (2001) can be found at: http://pubs.iied.org/pdfs/9126IIED.pdf

Box I.2: Sustainability of Hydropower Projects

In practical terms, the following limited 2-step approach could be considered, as an extreme minimum, to help with a quick analysis of the sustainability of one or several dams (including for multipurpose needs: hydropower, irrigation, fisheries, recreational, water supply). Indeed, the task is highly complex as a dam can provide and affect vital and valuable water and ecosystem services at the same time in the river basin, even far away from the infrastructure localization downstream and upstream.

Step 1 – Look for documentation and evidence of dams' sustainability in the basin: available or not?
The search for documentation needs to be limited in time and targeted to the national and/or basin authorities as the primary actors/decision makers concerned.

NO – If there is no documentation available from national/basin authorities, then the dams being analysed should be evaluated as "non-sustainable" and the relevant hydropower production values not be considered to be ecosystem services.

YES – If there is some documentation available at least from national/basin authorities, then go to step 2.

Step 2 – Check the evidence and respond to the key questions against the WCD "Strategic priority 4 – Sustaining Rivers and Livelihoods"

WCD policy principle 4.1: A basin-wide understanding of the ecosystem's functions, values and requirements, and how community livelihoods depend on and influence them, is required before decisions on development options are made.

Key question 1: *Assessment of the ecosystem consequences of the cumulative impact of dams, dam induced development and other options along the full length of the river reaching as far as the delta, even where this extends into neighbouring provinces or countries –* ***Conducted and available Y/N?***

Key question 2: *Supporting document(s) of the formal decision made on this assessment of alternatives –* ***Available Y/N?***

WCD policy principle 4.2: Decisions value ecosystems, social and health issues as an integral part of project and river basin development and prioritise avoidance of impacts in accordance with a precautionary approach.

Key question 3: *Environmental and social impact assessment made at the same time as the economic and technical studies –* ***Available and implemented Y/N?***

Key question 4: *Strategic impact assessment of ecosystem, social and health impacts and evaluation of any cumulative or inter-basin impacts –* ***Conducted and available Y/N?***

WCD policy principle 4.3: A national policy is developed for maintaining selected rivers with high ecosystem functions and values in their natural state. When reviewing alternative locations for dams on undeveloped rivers, priority is given to locations on tributaries.

Key question 5: *National policy(ies) that excludes major intervention on selected rivers to preserve a proportion of their aquatic and riverine ecosystems in a natural state –* ***Existing and available (and dam is not built in one of these rivers) Y/N?***

WCD policy principle 4.4: Project options are selected that avoid significant impacts on threatened and endangered species. When impacts cannot be avoided viable compensation measures are put in place that will result in a net gain for the species within the region.

Key question 6: *Record of implementation (by governments) of the UN Convention on Biological Diversity and the Ramsar Convention on Wetlands applied to dams (avoidance of significant impacts on threatened and endangered species or effective compensation measures put in place) –* ***Available Y/N?***

WCD policy principle 4.5: Large dams provide for releasing environmental flows to help maintain downstream ecosystem integrity and community livelihoods and are designed, modified and operated accordingly.

Key question 7: *Ecologically effective environmental flows put in place through local processes and with evidence (supporting documents) –* ***Available Y/N?***

Key question 8: *Regular monitoring and a five yearly evaluation of environmental performance –* ***Done Y/N?***

If the answers cannot be "Yes" for all of these questions and the evidence, that the aspects described have been considered and integrated into formal planning/implementation activities is missing, then the dams cannot be considered as sustainable and the relevant hydropower production values should not be considered to be ecosystem services.

In addition to the WCD criteria, references like the HSA Protocol or Climate Bonds Initiative (to come) can be used for further analysis work, for example for a Tier-2 valuation work.


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At the same time, it needs to be noted that the economic valuation of ecosystem services is only one aspect that policy makers need to take into consideration when taking decisions. Other benefits (e.g. financial revenue, employment) and economic or social costs (potential destruction of ecosystems and their services, such as mangrove conversion for aquaculture, or the displacement of local communities) of oil extraction and other extractive activities should not be ignored by decision making, even if the assessment of these values are not part of an ES valuation. If of interest for decision making, for example in the context of a Transboundary Diagnostic Analysis (see above), a broader economic analysis could consider the extraction of mineral resources and shipping similarly as direct use values. Similarly, costs, i.e. potential damages, must not be ignored in such an analysis. Such an analysis exceeds the scope of this document.

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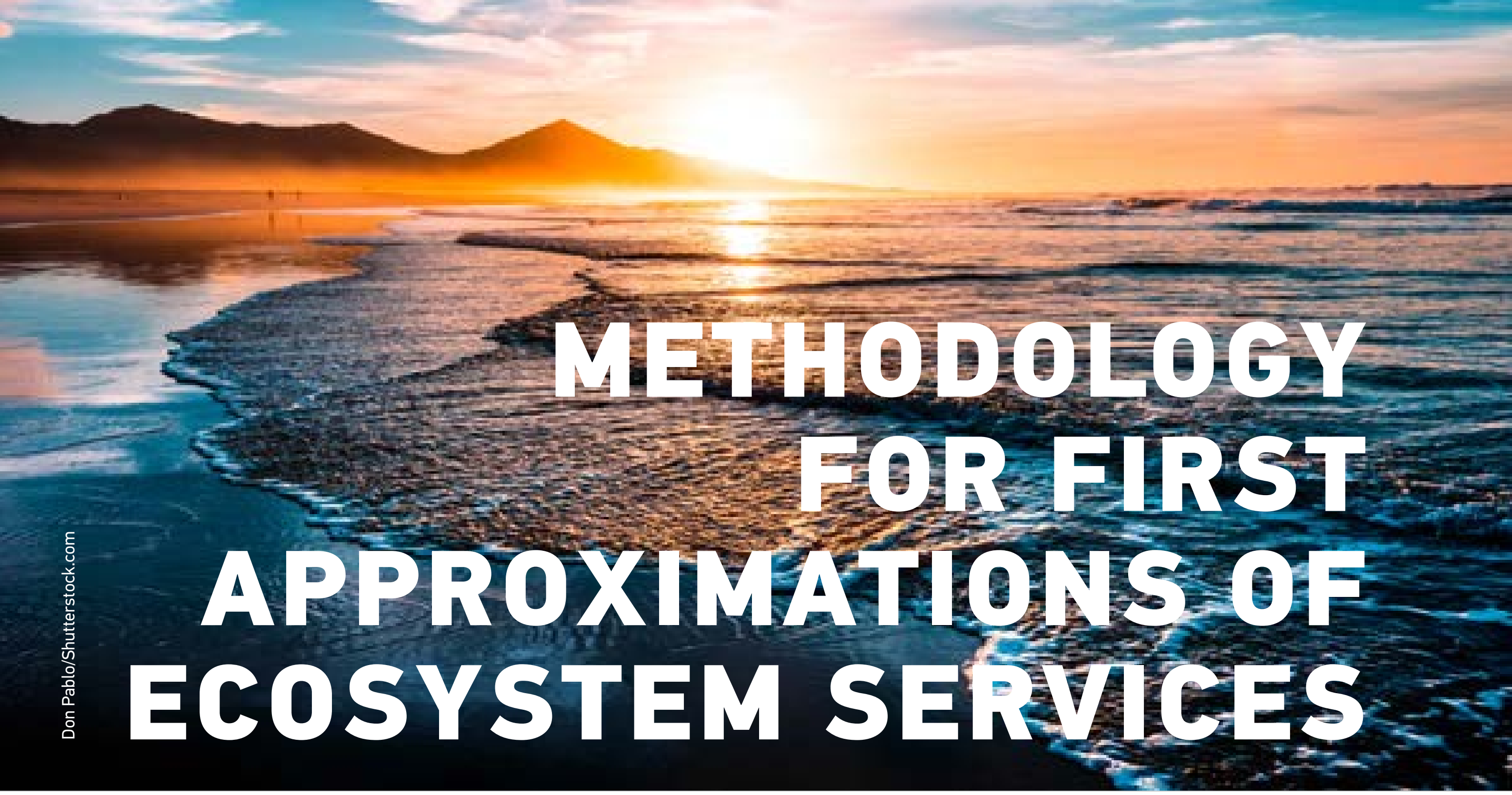

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METHODOLOGY FOR FIRST APPROXIMATIONS OF ECOSYSTEM SERVICES

II.1 Introduction: Aim and Scope of a Tier 1 Economic Valuation

This is the first part of the GEF IW Guidance to Economic Valuation of Ecosystem Services. It presents an introduction to economic valuations in tier 1 IW projects, i.e. areas/regions which can only provide limited resources towards an economic valuation (see introduction to the Guidance Documents for more details), a step-by-step guidance for conducting an economic valuation in an IW project area, and a proposal for an outline of a tier 1 economic valuation report. In addition, a ToR-template for an economic expert to conduct such a valuation is included.

Depending on the specific situation and circumstances in the IW project area, a tier 1 economic valuation will (most likely) be embedded in an individual "policy appraisal context". The most common policy appraisal contexts for tier 1 economic valuations are:

- A "screening analysis", assessing the overall value of all ecosystem services in a whole LME or transboundary river basin in a resource-efficient way, i.e. without conducting resource-intensive in-depth analyses. Such a screening could be, for example, part of a Transboundary Diagnostic Analysis (TDA) and inform the preparation of a SAP (see box II.1 below for an example)[1], and be mostly for communication and awareness raising purposes.
- Such a screening could also form the basis for a following in-depth analysis of all or some ecosystem services in the LME/river basin/GW basin, which would then follow the tier 2 methodology.

The average tier 1 projects will only be able to dedicate limited resources towards an economic evaluation. Thus the methodology presented in this Guidance Document follows a (as simplified as possible) benefit transfer approach, in which available information from original economic valuation exercises already completed in another location and/or context are transferred to the area analyzed. Only some services are valued directly, using local market prices.

[1] The TDA/SAP Guidance is under revision at the moment.

As stated in the overall introduction to the guidance and toolbox, an economic valuation of ecosystem services conducted according to this guidance specifically excludes several economic uses/activities:

- The extraction of mineral resources (sand, oil, gravel, etc.).
- Water for shipping.
- Hydropower plants not built according to the strategic recommendations of the World Commission on Dams (WCD) or the Hydropower Sustainability Assessment (HSA) Protocol.
- Irrigation water not provided on a sustainable basis.

The Guidance Document will guide the user through a step-by-step process that will enable the user to independently conduct an economic valuation of ecosystem services using a customized benefit transfer approach and market prices evaluation. As far as possible, each step is accompanied by an illustrative example. Additionally, in Annex II a proposal for an outline of a tier 1 economic valuation report is presented.

The steps incorporate:

- The identification of ecosystems and ecosystem services present in the IW area/project (including a checklist to select them for analysis).
- A guidance to obtaining local market prices to assess the value of e.g. food and building materials.
- A guidance how to use the repository of original valuation studies.
- A guidance to the benefit transfer methodology.

Box II.1: Guinea Current Large Marine Ecosystem - Screening Analysis of the Ecosystem Services provided by a whole LME

The Guinea Current LME comprises the transboundary waters off the coast of 16 West African countries extending from the Bissagos Island (Guinea Bissau) to Angola, and includes their associated river basins. It is rich in living marine resources, with the fishing industry providing livelihood for hundreds of thousands of fishermen and foreign exchange for the countries. At the same time, it faces a number of challenges involving population growth and urbanization, fisheries depletion, water pollution, public health and sanitation, habitat degradation, coastal erosion, loss of biological diversity and unsustainable land-use. Many of the countries in the subregion are oil producers, and the region is exposed to oil pollution.

In 2008, a TDA/SAP process was completed, and an additional economic valuation study was conducted in 2010 (Interwies 2010). The study assessed the most relevant ecosystem services in the region, across the 16 countries, but excluded any mineral resource extraction. To accomplish this, a combination of existing market price data of the GCLME region, benefit transfers from case studies of other marine ecosystems and replacement cost assessments were being used.

The report demonstrated the value of the GCLME´s ecosystem services for human wellbeing, social welfare and economic growth, and conservatively estimated the yearly TEV of to be at US$ 16.5 bn. excluding tourism (because of too significant uncertainties). Furthermore, the study demonstrated that the destruction of one hectare of mangrove ecosystems in 2010 would have amounted to an economic loss of at least US$ 32,000 in the coming 50 years.

II.2 Tier 1 First Approximation to Economic Valuation - what and how

As explained above, the tier 1 Guidance Document provides guidance to IW managers on how to carry out an EV in a project context with far less resources as compared to an in-depth economic valuation (tier 2). To nevertheless enable IW managers to come up with a first approximation of the value of ecosystem services in their project area, it presents an approach that values ecosystem services with the benefit transfer approach, and via local market prices.

A benefit transfer includes different steps. In the beginning, the ecosystems and ecosystem services present in the area, as well as existing data of other studies ("source studies"), need to be identified. Then the transferability of the data from source studies has to be analyzed, i.e. the question has to be answered whether the ecosystems to be compared have similar or the same characteristics and qualities, the socio-economic background of the sites is comparable etc.

Box II.2: Unit Value Transfer and Benefit Function Transfer

Principally there are two different approaches to transfer benefit values from study sites to a policy site: unit value transfer and benefit function transfer.

The **unit value transfer** approach directly transfers the (mean) benefit estimate (e.g. mean WTP/household/year) from the study site to the policy site. The unit value transfer approach is most appropriate if the characteristics of the study sites and the policy sites are relatively similar.

The **benefit function transfer** approach transfers the entire benefit function instead of transferring benefit estimates (i.e. values), entailing a model that statistically relates benefits with study factors such as characteristics of the population and the resource being evaluated. The transfer process requires to adapt the function to the characteristics and conditions of the policy site. It offers the opportunity to transfer value functions if the study and policy sites are less similar and differences between the sites need to be incorporated into the calculation, but required high quality data from the study sites, which is rarely available, as well as considerable resources in terms of time and expertise.

While the unit value transfer is more easy and resource-efficient to apply, the benefit functions transfer is to be more accurate - at the price of high data requirements, resources and knowledge.

Besides these two principal approaches, two more methods are sometimes applied: the meta-analysis function and the preference calibration approaches. Due to high complexity, these methods are not appropriate for a tier 1 valuation and thus are not presented further in this guidance.

After this, the information/results of the source study need to be adjusted to the site under consideration, involving the adjustment of different currencies and the calculation of the net present value.

There are some ecosystem services, however, for which a different approach should be used also in a tier 1 project: provisioning services, i.e. products that are derived directly from the ecosystem (food, raw materials, etc.), and some other services (e.g. recreation and tourism). As these products are directly traded in markets, or in a certain way replace products usually obtained in a (local) market or store, their value is best assessed using the local market prices that would need to be paid for the replaced product. These differ from country to country and region to region significantly, but are relatively easy to obtain and provide a much more precise idea of the actual, local value of the service.

Hence, in this tier 1 economic valuation methodology, ecosystem services traded on local markets are not assessed via a benefit transfer, but using local market prices.

Summarizing, the tier 1 methodology entails the following steps:

1. Setting the Scene: Determination of the spatial boundaries of the area to be studied, i.e. deciding on whether to exclude some areas, and include others (e.g. urban areas).

2. Setting the Scene: Identification of ecosystems and ecosystem services present in the site to be studied/assessed (see the tables on marine and freshwater ecosystems in chapter II.3.2).

3. Setting the Scene: Determine the size of the ecosystems present in the area under investigation (chapter II.3.3).

4. Identification of which ecosystem services can be assessed directly via (local) market prices, and which need a benefit transfer (see chapter II.3.4).

5. Assess the values of provisioning services via local market prices (chapter II.4).

6. Assess the values of other ecosystem services using the simplified Benefit Function Transfer approach (chapter II.5).

7. Summing up the values and determining the Total Value.

Finally, in Annex II a proposal for an outline of a tier 1 economic valuation report is presented, which could be used, either directly or adapted to the specific circumstances of the study (with additional chapters, if necessary).

II.3 Tier 1 First Approximation to Economic Valuation – Setting the Scene

In the following sub-chapters, you will be taken through several easy to follow steps to set the scene and then perform your tier 1 economic valuation. The steps are outlined in the following flow diagram:

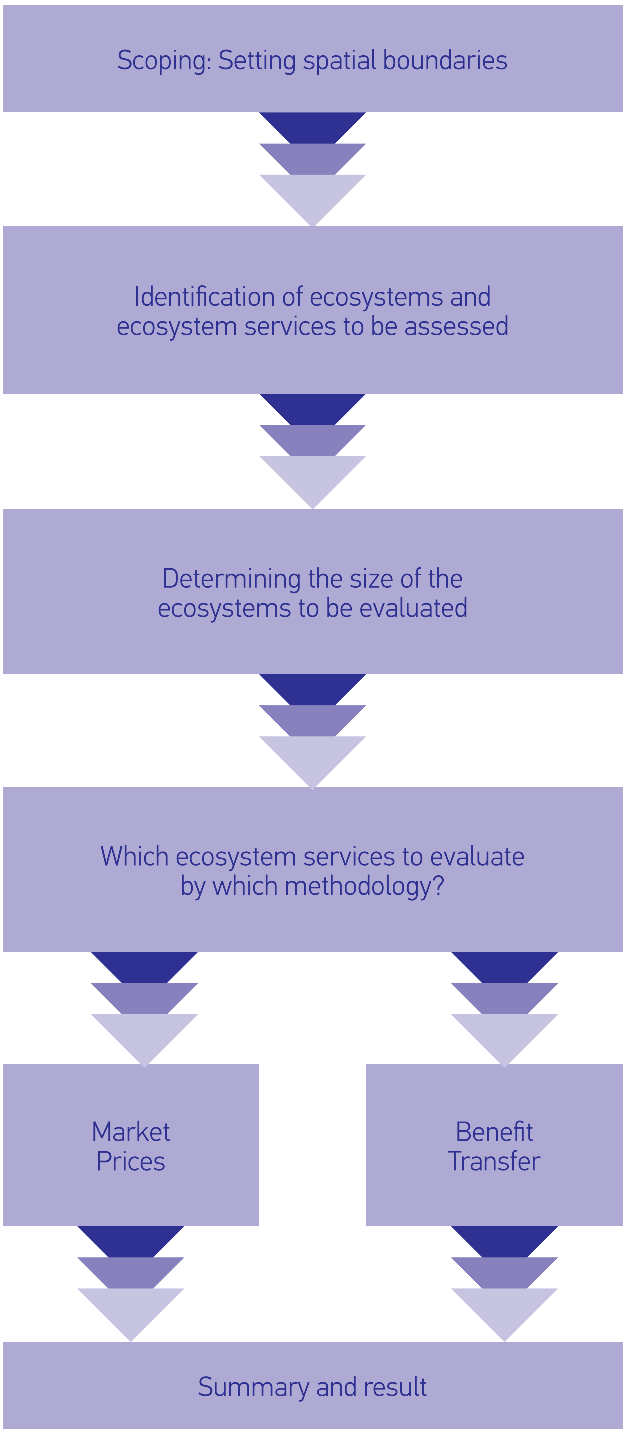

Figure II.1: Setting the Scene - Flow Diagram

II.3.1 Scoping: Setting spatial Boundaries

As an initial step, you have to determine the spatial boundaries of the area under scrutiny. This may seem logical and not necessary, and can well enough be the case, for example in Large Marine Ecosystems (LMEs), where it might be obvious that the boundaries of the study area are the same as the boundaries of the LME. Also, because of administrative or policy reasons, some parts of the project area might be excluded from the analysis - e.g. in case a neighboring country is not part of the funding agreement etc. In other cases, however, it can be more complex - in some river basins, for example, the question might arise whether to exclude urban areas, or areas under intensive agriculture, to avoid "watering down" the results of the whole exercise (by relating resulting values to areas which do not provide the same ecosystem services, for example). Or an IW manager might want to exclude small tributaries of major rivers, to reduce the complexity of the analysis. Also, upstream and downstream relations could play a role in determining spatial boundaries.

Setting spatial boundaries may also be part of a participatory approach, i.e. setting the boundaries with the help of focus and/or stakeholder groups[2].

Drawing the spatial boundaries, hence, depends on the area under investigation, and the specific aims and objectives you as an IW manager might have. The following guiding questions should help you to decide whether it is necessary to exclude or include certain areas from the analysis:

- Do you want to demonstrate the value of the natural and undisturbed ecosystems in your project area? If yes, urban/heavily used areas should be excluded.
- Are there significant urban agglomerations in the study area which provide ecosystem services (e.g. recreation benefits of an urban park)? If yes, these areas should be included in the valuation, or treated separately.
- Are the other areas that are very strongly affected by human activities (such as intensive agriculture, military bases, etc.)? If yes, these areas should be excluded, or treated separately.
- How are the relations with regard to size between natural ecosystems and heavily impacted areas (e.g. urban agglomerations, areas of intense agriculture etc.), i.e. is the size of heavily impacted regions significant in the overall basin (say more than 5 or 10%)? If yes, this fact should be communicated clearly, and the respective areas should be excluded or treated separately.

RESULT

As a result of this exercise, you should be able to produce a map of the whole project area, clearly showing where the boundaries of the analyzed area are located, and which parts are possibly excluded from the economic valuation. Alternatively, a textual description detailing the decisions taken with regard to spatial boundaries will work equally well.

EXAMPLE

An IW manager of a transboundary freshwater ecosystem/river basin decides to limit the economic evaluation to the areas stretching 50m to the left and right of the river and its main tributaries, the major lakes and the delta region. He/she furthermore decides to exclude urban and agriculturally used areas, to simplify the analysis. A simple GIS map or textual description is drawn to act as "basis" for the whole analysis.

[2] WRI's Guidebook on Coastal Capital has a helpful section on "setting the scene" in a participatory way: http://www.wri.org/publication/coastal-capital-guidebook

II.3.2 Identification of Ecosystems and Ecosystem Services to be assessed

As a second step, you will have to identify which ecosystems are present within the spatial boundaries set in step 1, and which ecosystem services are provided by these ecosystems. This is a straightforward step, making use of the checklist presented in Annex I, and the tables II.1 and II.2 below. The checklist has the aim to guide you through the processes that follow, and provides a "template" (a table) that you can fill in while you progress with the following steps.

The ecosystem services listed in the checklist and the tables below are categorized according to the concept of the "Total Economic Value" (TEV; see box below), dividing ecosystem services into "use values" and "non-use values", and to the TEEB classification system (see chapter I.2.1 in the introduction to the Guidance Documents), which distinguishes between provisioning, supporting, habitat and cultural services (of the latter, the four cultural services "aesthetic information / inspiration for culture, art and design / spiritual experience /information for cognitive development" were grouped into one single category).

In a second step, the ecosystem services provided by the ecosystems present/selected can be prioritized/excluded from the analysis, in accordance with the policy context and/or the data situation (see box II.3 for an example).

Box II.3: Canary Current Large Marine Ecosystem - Selection and Exclusion of Ecosystem Services for a Screening Analysis

The Canary Current LME extends northwards from the coasts of Guinea and Guinea Bissau (Bissagos archipelago), up to the Atlantic coast of Morocco/Western Sahara, including - it its marine area - the Canary Islands and Madeira. The CCLME represents an important upwelling area (cold, nutrient-rich waters ascending from the deep ocean), and is one of the world's most productive, having the highest fisheries production of any African LME.

In the CCLME, the following coastal (the area between 50 meters below mean sea level and 50 meters above the high tide level or extending landward to a distance 100 kilometers from shore) marine ecosystems are present: Estuaries, marshes, salt ponds, and lagoons; mangroves; intertidal habitats, deltas, beaches, dunes; seagrass beds or meadows; and coral reefs and atolls (only marginally present). Pelagic marine ecosystems are not sub-classified any further.

In the frame of a TDA/SAP process, the ecosystem services provided by the CCLME ecosystems were to be assessed in a tier 1 benefit transfer exercise (Interwies/Görlitz 2013). Due to the size of the CCLME, it was difficult to obtain information on every single ES provided by every single ecosystem. Instead, the study assessed those goods and services directly linked to the major problems that were identified by a preliminary TDA, which are: declining fisheries and changes in ecosystems, habitat modification and declining water quality.

After such a selection mechanism was applied, several ecosystem services were excluded from the analysis, e.g. climate regulation of marine ecosystems; several ecosystem services of seagrass beds and beaches/dunes (food, raw materials (fodder, agar), medicinal resources, moderation of extreme events, maintenance of life cycles of migratory species and maintenance of genetic diversity of beaches and dune ecosystems). Due to severe data limitations, it was also decided that non-use values except for tourism and recreation of marine ecosystems were not considered.

II.3.2.1 Freshwater Ecosystems

The ecosystems/habitats providing the ecosystem services presented in the table below are selected according to the MAES typology (European Commission 2013), distinguishing between rivers and lakes. Beside the open water bodies themselves, closely linked riparian ecosystems are also considered (e.g. riparian wetlands and groundwater-dependent ecosystems, listed as “other inland wetlands”) that can be partly vegetated.

Please note that only the ecosystems functionally linked to the river and/or its tributaries in terms of flows should be considered, e.g. forests or other significant ecosystems for water-related services like water storage also present in the watershed are excluded from this analysis (otherwise, basically all ecosystems would need to be analyzed). Groundwater bodies are included as part of groundwater-dependent ecosystems (i.e. wetlands).

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Table II.1: Ecosystem services and the freshwater ecosystems providing them

Type of Ecosystem Service (TEEB)	Ecosystem Service(s)	Category (TEV): (direct/indirect; use value / non-use value)	Provided by which ecosystems (MAES)
Provisioning Services	Food: -Fish -Cultured products / Aquaculture	Direct use	Rivers, lakes, other inland wetlands.
	Other Food products		
	Genetic resources		Rivers, lakes, other inland wetlands.
	Medicinal resources		
	Fiber, timber, fuel		Other inland wetlands.
	Water (drinking, irrigation, cooling)		Rivers, lakes.
Regulating Services	Air quality regulation (e.g. capturing dust)	Indirect use	Other inland wetlands.
	Climate regulation (Carbon sequestration)		

Regulating Services	Moderation of extreme events (e.g. floods, storms)	Indirect use	Other inland wetlands.
	Water treatment		
	Erosion prevention		
	Nutrient cycling and maintenance of soil fertility		Rivers, lakes, other inland wetlands.
Habitat Services	Maintenance of life cycles of migratory species (including nursery service for commercially valuable fish species)		
	Maintenance of genetic diversity (gene pool protection)		
Cultural Services	Opportunities for tourism/recreation	Direct use	
	Aesthetic information, Inspiration, Spiritual experience, Education	Non-use	

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II.3.2.2 Marine Ecosystems

The ecosystems/habitats providing the ES presented in the table below are selected according to the Millennium Ecosystem Assessment (MEA 2005) and Naber/Lange/Hatziolos (2008): open water marine ecosystems/habitats (deeper than 50m below sea level), coastal ecosystems/habitats and brackish/transitional waters (the area between 50 meters below mean sea level and 50 meters above the high tide level or extending landward to a distance 100 kilometers from shore: estuaries, marshes, salt ponds, and lagoons; mangroves; beaches/dunes; seagrass beds/meadows; coral reefs and atolls).

Table II.2: Ecosystem services and the marine ecosystems providing them

Type of Ecosystem Service (TEEB)	Ecosystem Service(s)	Category (TEV): (direct/indirect; use value / non-use value)	Provided by which ecosystems (MEA and Naber/Lange/Hatziolos 2008)
Provisioning Services	Seafood products: -Fish/fisheries -Other Seafood products (e.g. shellfish, molluscs) -Cultured products / Aquaculture	Direct use	Marine; estuaries/marshes; saltponds/lagoons; mangroves; beaches/dunes; seagrass beds/meadows; coral reefs and atolls.
	Genetic resources		
	Medicinal resources		Marine; estuaries/marshes; salt ponds/lagoons; mangroves; coral reefs and atolls.
	Fiber, timber, fuel		Estuaries/marshes; salt ponds/lagoons; mangroves.
	Water (drinking, irrigation, cooling)		Estuaries/marshes; salt ponds/lagoons.
Regulating Services	Climate regulation (Carbon sequestration)	Indirect use	Marine; estuaries/marshes; mangroves; seagrass beds/meadows; coral reefs and atolls.
	Moderation of extreme events (e.g. floods, storms)		Marine; estuaries/marshes; salt ponds/lagoons; mangroves; beaches/dunes; seagrass beds/meadows; coral reefs and atolls.
	Water/Sewage treatment		Marine; estuaries/marshes; salt ponds/lagoons; mangroves; seagrass beds/meadows; coral reefs and atolls.

Regulating Services	Erosion prevention	Indirect use	Estuaries/marshes; salt ponds/lagoons; mangroves; beaches/dunes; seagrass beds/meadows; coral reefs and atolls.
	Nutrient cycling and maintenance of soil fertility		Marine; estuaries/marshes; salt ponds/lagoons; mangroves; seagrass beds/meadows; coral reefs and atolls.
Habitat Services	Maintenance of life cycles of migratory species (including nursery service for commercially valuable fish species)		Marine; estuaries/marshes; salt ponds/lagoons; mangroves; beaches/dunes; seagrass beds/meadows; coral reefs and atolls.
	Maintenance of genetic diversity (gene pool protection)		
Cultural Services	Opportunities for tourism/recreation	Direct use	Marine; estuaries/marshes; salt ponds/lagoons; mangroves; beaches/dunes; coral reefs and atolls.
	Aesthetic information, Inspiration, Spiritual experience, Education	Non-use	Marine; estuaries/marshes; salt ponds/lagoons; mangroves; beaches/dunes; seagrass beds/meadows; coral reefs and atolls.

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RESULT
At the end of step 2, you will have a filled checklist/matrix which lists the ecosystems present in the area under investigation, and the ecosystem services selected for the analysis.

EXAMPLE
A filled checklist/matrix could, for example, look like this:

Ecosystem Services/Ecosystem	Rivers	Other inland wetlands
Food	Y	Y
Genetic resources	N	N
Medicinal resources	N	N
Fiber, timber, fuel	N	Y
Water (drinking, irrigation, cooling)	Y	N
Air quality regulation	N	Y
Climate regulation	N	Y
Moderation of extreme events	N	Y
Water treatment	N	Y
Erosion prevention	N	Y
Nutrient cycling and maintenance of soil fertility	Y	Y
Maintenance of life cycles of migratory species	Y	Y
Maintenance of genetic diversity	Y	Y
Opportunities for tourism/recreation	N	N
Aesthetic information, Inspiration, Spiritual experience, Education	Y	Y

This matrix shows which ecosystem services of which ecosystems will be further analyzed ("Y"), and which not ("N"). In this case, the ecosystem category "lakes" is completely excluded from the analysis. The following steps will focus on the selected ecosystem services only.

II.3.3 Determining the Size of the Ecosystems to be valuated

Following step 2, in step 3 you need to determine the size (area) of the ecosystems present in your area of investigation (which are selected in the checklist/matrix). For this, it is also recommended to continue working with the checklist, where an additional table (table C3) is presented that can easily be filled and used to further track the progress of the analysis.

You as the IW manager of your project area are uniquely positioned to have access to the kind of information needed here. It should be easy to find it in e.g. TDA/SAP documents (if available), scientific literature and/or environmental reports. If there are data gaps, you should consider consulting scientists or local stakeholders (e.g. environmental NGOs). As each project is unique, we do not provide more concrete guidance on how to obtain the basic information. If there is no information available at all for an ecosystem type in your project area, you will probably have to exclude this ecosystem from the economic valuation, or use the best estimates available based on expert judgment.

RESULT

At the end of step 3, you should have information on the size of the ecosystems selected in step 2, at best filled into table C3 provided in the checklist.

EXAMPLE

At this point, table C3 could look like this:

Ecosystem(s)	Size/area (in hectares)	Ecosystem Services selected/relevant
Rivers	1,500	Food
		Water (drinking)
		Nutrient cycling and maintenance of soil fertility
		Maintenance of life cycles of migratory species
		Maintenance of genetic diversity
		Aesthetic information, Inspiration, Spiritual experience, Education

II.3.4 Which Ecosystem Services to valuate by which Methodology: local (Market) Prices or Benefit Transfer?

While most ecosystem services are not traded on markets, there are some that are, i.e. products that are derived directly from the ecosystem (food, raw materials etc.), and some other services (e.g. tourism). As these products are directly traded on markets, or in a certain way replace products usually obtained in a (local) market or store (e.g. in case of building materials), their value is best assessed using the local market prices that would need to be paid for the replaced product. These differ from country to country and region to region significantly, but are relatively easy to obtain and provide a much more precise idea of the actual, local value of the service.

Hence, in this tier 1 economic valuation methodology, the ecosystem services traded on local/national markets are not assessed via a benefit transfer, but using local market prices.

In this step, you have to make clear which ecosystem services are to be evaluated by using local market prices, and which not. For provisioning services, it is highly recommended to use such prices, for other services (tourism and recreation), it is optional.

For this, it is also recommended to continue working with the checklist, where an additional table (table C3) is presented that can easily be filled and used to further track the progress of the analysis

Table II.3: Ecosystem services of marine and freshwater ecosystems and the methodology to be used for economic valuation

Type of Ecosystem Service (TEEB)	Ecosystem Service(s)	Category (TEV): (direct/indirect; use value / non-use value)	Methodology to be used for economic valuation
Provisioning Services	Seafood products: -Fish/Fisheries -Other Seafood products (e.g. shellfish, molluscs) -Cultured products/ Aquaculture	Direct use	Use values/ Market Prices
	Genetic resources		
	Medicinal resources		
	Fiber, timber, fuel		
	Water (drinking, irrigation, cooling)		

Regulating Services	Climate regulation (Carbon sequestration)	Indirect use	Benefit Transfer
	Moderation of extreme events (e.g. floods,storms)		
	Water/Sewage treatment		
	Erosion prevention		
	Nutrient cycling and maintenance of soil fertility		
Habitat Services	Maintenance of life cycles of migratory species (including nursery service for commercially valuable fish species)		
	Maintenance of genetic diversity (gene pool protection)		
Cultural Services	Opportunities for tourism/recreation	Direct use	Direct use values/ Market Prices or Benefit Transfer
	Aesthetic information, Inspiration, Spiritual experience, Education	Non-use	Benefit Transfer

RESULT
After finishing this step, you will have a clear idea of which ecosystems and ecosystem services you will evaluate in your economic valuation, and with which methodology - markets prices (chapter II.4) or benefit transfer (chapter II.5). This should be noted in the checklist, in table C3.

EXAMPLE
At this point, table C3 could look like this:

Ecosystem(s)	Size/area (in hectares)	Ecosystem Services selected/relevant	Assessment by Market Prices (MP) or Benefit Transfer (BT)
Rivers	1,500	Food	MP
		Water (drinking)	MP
		Nutrient cycling and maintenance of soil fertility	BT
		Maintenance of life cycles of migratory species	
		Maintenance of genetic diversity	
		Aesthetic Information, inspiration, Spiritual experience, Education	

ALTERNATIVE
If you are not able to obtain market prices, you could also use globally derived values for provisioning services, accepting the greater uncertainty that comes with using global estimates. If you nevertheless choose to do so, you will find the respective studies on the IW website, under the *URL http://iwlearn.net/learning/manuals/economic-valuation/further-reading-supporting-the-economic-valuation-guidance*


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II.4 Assessment via local Market Prices

In this chapter, you are provided with the guidance and information you will need to evaluate ecosystem services that are traded on (local/national) markets, using local market prices as substitute for the value of the ecosystem services.

Market prices are relatively easy to obtain, and provide a fairly exact estimate of the value of ecosystem services to the local community. It is therefore strongly recommended to use local market prices as much as possible in an economic valuation of ecosystem services.

The chapter provides information and guidance to obtain market prices for several types of ecosystem services: the provisioning services comprise food and non-food products, including timber and water, and the cultural services comprise tourism/recreation.

It is recommended to use table C3 of the checklist as a form of note pad, to keep track of the information you add in this step, as well as the final result. Also, it is recommended to consult chapter I.2.5 on uncertainties in the introduction to the Guidance Documents about common methodological errors.

II.4.1 Food Products

Food products incorporate fish/fishery products (for marine and freshwater ecosystems), any other seafood (shellfish, mollusks; mostly marine ecosystems), and aquaculture products (both marine and freshwater ecosystems).

Information on food products is generally available in two "forms": either as absolute value in monetary terms, e.g. for fisheries ("The fishermen of the area catch fish worth 100,000 US$ per year"), or as relative value per kilo or ton ("Aquaculture in the area produces seafood worth 50 US$ per kilo"). In the second case, the value needs to be completed with information on the absolute amount harvested (e.g. "150,000 kg per year").

NOTE

Fisheries should only be included in the economic valuation as long as it is provided on a sustainable basis, i.e. the Maximum Sustainable Yield (MSY[3]) should be taken as the basis for the valuation as ecosystem service, rather than the total value of all available fish stocks.

This means that if you have information on the annual catches, and at the same time know that these are not sustainable (i.e. above the MSY), then you need to reduce the amount/value down to MSY levels.

Both types of information for food products should be readily available from local or international sources. We strongly recommend to assess local sources first: authorities on fisheries management, on aquaculture (sometimes located in the same department as agriculture), or statistical offices/authorities in the country or region. As an alternative, you should assess international sources and/or literature.

[3] See Wikipedia for information and sources: https://en.wikipedia.org/wiki/Maximum_sustainable_yield#References

Box II.4: Example of a Study using Market Prices of Fisheries

McClanahan (2010) examined the effects of the adoption of fisheries closures and gear restrictions on the long-term profitability of fishing in coral reefs of Kenya. The study examined the trends in the prices by taxonomic (i.e. by species) or commodity price (i.e. canned fish, fresh fish etc.) groupings, and by relation of size to price in order to estimate the profits to fishermen under i) gear restrictions, ii) gear and area restrictions, and iii) no restrictions.

The study analysed a) fish catches, b) prices, c) revenues, and d) costs over a 12-year period when gear restrictions increased in sites with and without closing off areas from fishing. The landing sites were polled into three distinct management treatments (intensively managed, moderately managed, not managed) based on the fish catch and gear use. At each landing site, the number of gear used and the number of fishermen and boats were recorded.
A) Fish catches were evaluated for the size and weight of fish, and catch composition, categorised by the six taxonomic groups used locally to price and sell fish.
B) From these evaluations, an average monthly price per kilogram of fish in each category was recorded.
C) The average yearly price was multiplied by the yearly mean catch per unit effort (CPUE) of each catch group (number of fish in a defined period of time) to estimate income for each catch category and all categories combined. Fishing occurred on all days except Friday and during extreme weather, therefore 306 fishing days per year were used to determine annual revenues.
D) The capital investment and operational costs of fishing with different gear were evaluated at the beginning and end of this survey, and the average costs from these two surveys were used to estimate fishing costs. Regarding the gears, only costs of purchased materials were included in the evaluation, engines or fuel were not used in the fishery, and fishing effort per day per person was assumed to be relatively constant and was not evaluated further.

The study found that areas with fishing restrictions saw profitability increase by about 50%. Profits increased because under gear restrictions and area closures larger fish were caught and larger fish fetched higher per weight prices. Closures increased the catch of valuable fish and this further enhanced per person profits, such that when both gear and closures were enacted together, profits increased further.

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It has to be noted that a significant part of freshwater catches are for subsistence and very diffuse and hard to track. Therefore, information on these can be much more challenging than on marine catches.

The following international sources could be helpful:

- FAO - Fisheries and Aquaculture Department: *http://www.fao.org/fishery/statistics/collections/en*
- The FAO Fisheries and Aquaculture Statistical Yearbook: *http://www.fao.org*
- The Fisheries and Resources Monitoring System (FIRMS): *http://firms.fao.org/firms/en*
- The Regional Fisheries Bodies (RFB): *http://www.fao.org/fishery/rfb/en*
- For the EU: *https://datacollection.jrc.ec.europa.eu/*
- For the USA: *https://www.st.nmfs.noaa.gov/commercial-fisheries/commercial-landings/annual-landings/index*

Absolute and relative values

After collecting the information available, you either have a "total value" for the specific ecosystem service (in case of absolute values, e.g. "total value of all fish catches in the area"), or a figure relative to a single unit of measurement (in case of relative values, e.g. "value per ton caught" or "value per m^3 harvested").

In the first case, you might want to relate the absolute value to a single hectare or square kilometer. You simply do this by dividing the absolute value through the size of the area (we recommend to use hectare, as most economic values are stated in "value per hectare").

In the second case, you need to calculate the absolute value by multiplying the value per kg/ton/m^3 with the overall amount produced or harvested.

NOTE

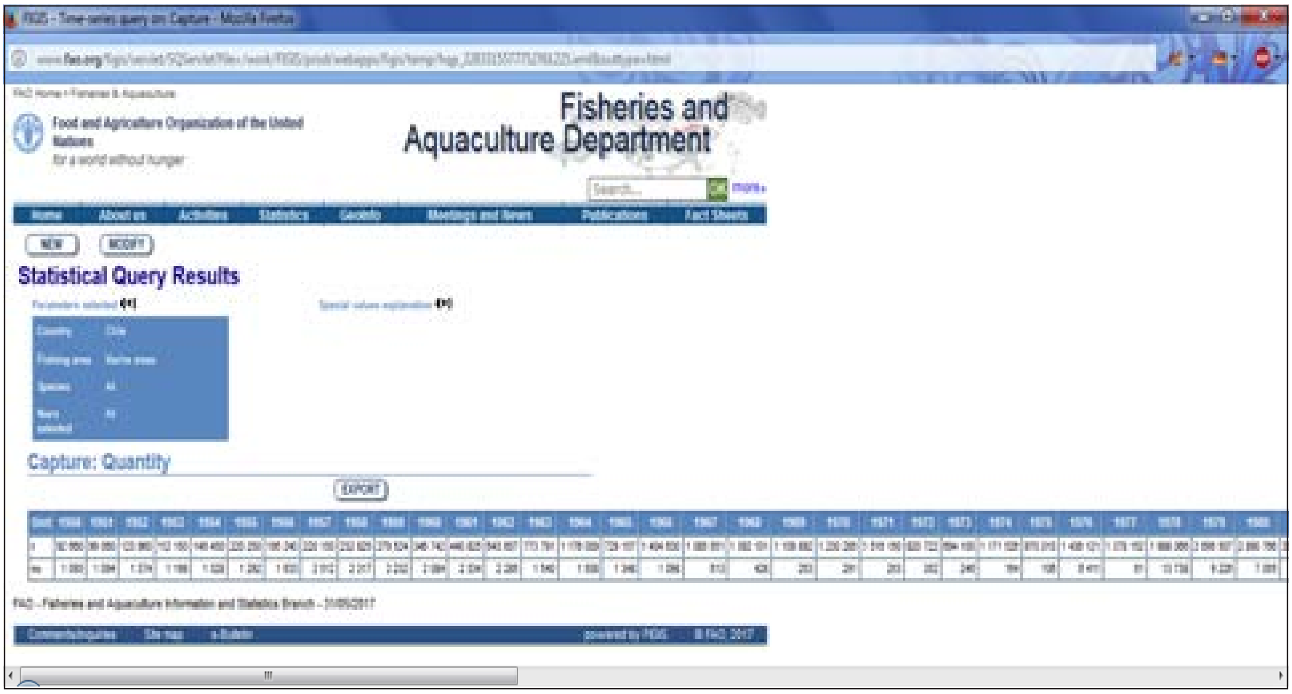
The information listed in these and other sources will not always be clear and transparent about the methodologies applied for calculating the value/prices. One major issue here is whether the costs for capturing fish (like wages, fuel, equipment) is included in the values/prices, or not. Also, subsidies and taxes may create distortions of the "actual" price or value, or raise questions as to whether the price actually reflects the "real" value" etc. These issues are important, but also very complex to solve. In the context of a tier 1 evaluation, you should not waste too much time and resources getting into these issues. Instead, note whatever information you acquire from the source about these issues, and make clear to the reader what is included, what is not included, and where you just don´t know how the values stated have been calculated (see also UNEP-WCMC 2011, and box II.5 below).

MrIncredible/Shutterstock.com

EXAMPLE

The case study for the example is Chile, and the value of fisheries in the Chilean marine waters is needed. For the purpose of this example, we ignore regional or national sources of information, to give a more general overview of how to use international sources.

FAOSTAT/FIGIS state that Chile produced (in 2014) 2,592,817 tons of marine fish products - the corresponding data query is shown below:



In the FAOSTAT Statistical Yearbook for the year 2014, a global average value per ton for marine fisheries products is stated: US$ 1,339/ton (page 50). Assuming that the catches are realized in the Chilean Exclusive Economic Zone (EEZ), with a size of 3,648,532 km^2, the resulting calculation is as follows:

Annual production of 2,592,817 tons x US$ 1,339/ton = annual total value US$ 3,471,781,963/year.

Annual total value US$ 3,471,781,963/year / EEZ size 3,648,532 km^2 = US$ 951.6/km^2 (or US$ 9.5/ha).

This value, of course, varies from year to year (in 2015, for example, the production was 3,190,079 tons). Averaging the values would be more accurate, therefore. Similarly, taking the average global value for marine fisheries is not as accurate as using national/regional statistical information and values, which may take into account market prices for different species etc.

This calculation also assumes that the national catches stated by FAO are not above MSY levels.

At this point, table C3 could look like this:

Ecosystem(s)	Size/area (in hectares)	Ecosystem Services selected/ relevant	Assessment by Market Prices (MP) or Benefit Transfer (BT)	Market Prices: absolute or relative value, and source	Market Prices: absolute amount provided
Marine (open sea)	3,648,532 km^2	Seafood: fisheries	MP	US$ 1,339/ton (FAOSTAT)	2,592,817 tons (in 2014)

II.4.2 Non-Food and Timber Products

Non-food and timber products incorporate genetic and medicinal resources, fiber, timber and fuel, as well as water for drinking, irrigation and cooling purposes (all of these provisioning services occur in both marine and freshwater ecosystems).

> **NOTE**
> Irrigation water for agriculture should only be included in the economic valuation as long as it is provided on a sustainable basis, i.e. without severely impacting ecosystems or reducing the potential of an ecosystem to provide the full set of ecosystem services (i.e. groundwater tables are not lowered by water abstraction, minimum ecological flows for surface waters are sustained and no water-dependent ecosystems - such as wetlands - are negatively impacted).

Information on non-food products are generally available in two "formats": either as absolute value in monetary terms, e.g. for timber ("The local population uses timber worth US$ 1,000 per year" or "Water for drinking water purposes in the area is worth US$ 10,000 per year"), or as relative value per unit of measurement ("The area provides irrigation water worth US$ 50 per m^3"). In the second case, the value needs to be completed with information on the absolute amount harvested (e.g. "100,000,000 liters per year").

Both types of information should be available from local sources, but finding it can be challenging. We strongly recommend to assess mostly local sources, e.g. statistical offices/authorities in the country or region and reports/local experts, or to engage stakeholders/the local population and directly ask about their use of non-food products. It is unlikely that international sources will have such kind of information.

In case of water supply, information is easier to find, as you could simply use the price of water supply charged by the local/regional water supply company or charged as water fee/charge by the government authorities.

> **NOTE**
> In many areas, water is abstracted/extracted illegally and without permit from private wells/boreholes. If there are estimations on such abstractions, the "value" should be derived in the same way (i.e. via the regular water prices), but treated separately, as it is highly likely that the water use will not be sustainable.
>
> Also, using water prices as basis for the value of provided water raises a multitude of controversial ethical issues, e.g. the question whether water should or can be treated solely as an economic commodity as well as distributional/equity issues. Additionally, although the water is directly provided by a lake or river, it is actually produced by other ecosystems as well, which are not included in the economic valuation (an example would be the Himalayan´ ecosystems being responsible for water provided to Bangladesh and southern Pakistan).
>
> As there is no single best solution to these issues, we recommend to discuss them with your team/experts, and decide on a case-by-case basis how to handle these.

Absolute and relative values

After collecting the information available, you either have a "total value" for the specific ecosystem service (in case of absolute values, e.g. "total value of drinking water in the area"), or a figure relative to a single unit of measurement (in case of relative values, e.g. "drinking water worth X US$ per m^3").

In the first case, you might want to relate the absolute value to a single hectare or square kilometer. You simply do this by dividing the absolute value through the size of the area (we recommend to use hectare, as most economic values are stated in "value per hectare").

In the second case, you need to calculate the absolute value by multiplying the value per kg/ton/m^3 with the overall amount produced or harvested.

EXAMPLE

The population living close to a small mangrove forest (1 hectare) in coastal Bangladesh extracts 250 kg of fuelwood per year from the mangroves, without significantly damaging it.

In Bangladesh, the price of fuelwood on local markets is between 1.5 and 5 Taka per kg, or US$ 0.01-0.06 (average: 3.5 Taka or US$ 0.03). The calculation, hence, is the following:

Annual (sustainable) extraction of fuelwood 250 kg x average value US$ 0.03 = US$ 7.5.

As the area in this example is only one hectare in size, the total annual value of fuelwood collected in the mangrove forest in US$ 7.5.

At this point, table C3 could look like this:

Ecosystem(s)	Size/area (in hectares)	Ecosystem Services selected/ relevant	Assessment by Market Prices (MP) or Benefit Transfer (BT)	Market Prices: absolute or relative value, and source	Market Prices: absolute amount provided
Mangroves	1 ha	Fuelwood	MP	US$ 0.03/kg	250 kg/yr

II.4.3 Tourism/Recreation

Tourism and recreation describes the service of providing a place to visit, both for national as well as foreign visitors. The service applies to both marine and freshwater ecosystems.

Information on tourism and recreation is generally available in two "forms": either as absolute value in monetary terms, e.g. as total revenue per year from tourism and/or recreation (it is rarely distinguished between the two), or as relative value, e.g. data on the revenues "per visitor" or "per visit". In the second case, the value needs to be completed with information on the total number of visits or visitors in the region.

Information on tourism and recreation should be available from local sources, such as tourism ministries/agencies. We strongly recommend to assess mostly local sources, e.g. statistical offices/ authorities in the country or region. It is unlikely that international sources will have information on the tourism and recreation in a narrow region.

In case there is no information at all to be found for the region/area, the numbers/figures for the national level can also be used, which should be available in some form. These then need to be "broken down" to the level of the region/area. This could happen either by consulting experts, or by finding information on the share of e.g. coastal tourism in the total national tourism revenue (in the case of marine ecosystems being evaluated).

Box II.5: Example of a Study using Market Prices for assessing Tourism Values

Under the Coastal Capital: Belize project (Cooper et al. 2009), the World Resources Institute (WRI) worked closely with Belize-based partners at WWF-Central America and World Conservation Society, along with more than 10 Belizean NGOs and government departments, to design and conduct an assessment of the economic importance of Belize's coral reefs and mangroves focusing on three critical ecosystem goods and services: tourism, fisheries, and shoreline protection.

The value of coral reef- and mangrove-associated tourism was calculated by estimating gross revenues and taxes from marine recreation, as well as revenues from accommodation and other tourist spending, in areas with coralline beaches, reefs, or mangroves. More specifically, published accommodation statistics for each region of the country, local expert opinions, data on tourist activities (snorkeling, diving, kayaking, water-based wildlife, fishing) from the Belize Tourism Board (BTB 2007) and average prices for tourist´s activities, were used. The value of coral reef- and mangrove-associated fisheries was calculated by estimating gross revenues from commercial fishing and processing activities. Gross revenues did not include any costs, such as operating costs, as little to no information was available. However, they are considered a good indicator when an economic evaluation is done at a national scale. This methodology used existing data and, where these were poor or scarce, grey literature and expert opinion. This part did not take into account whether these resources are being used at a sustainable level (heavily used by other activities or pristine sites). A modified "avoided damages" approach was used to estimate the value of coral reefs or mangroves for coastal protection along coastal segments protected by these ecosystems. This involved estimating the likely economic losses (in property value) to a coastal area from a given storm event, both with and without the reefs and mangroves present. However, it did not take into account the level of the protection value, which might be lost during the gradual degradation of a coral reef and/or mangrove. Such an analysis would require scenarios of reef degradation over time, coupled with estimates of the reduced wave mitigation associated with the reef at different stages of degradation. There were inevitably uncertainties associated with this multi-stage modeling approach, combined with the limited availability of data on wave-induced storm damage, making the calibration of the model difficult. To reflect these uncertainties, ranges were established around the central estimates.

The study found that coral reef- and mangrove-associated tourism contributed an amount equivalent to 15% of Belize's GDP in 2007, and that the shoreline protection avoided potential damages equivalent to more than 20% of GDP. Also, the study contributed to a new fishing regulation, and informed decision making in Belize.

Unfortunately, in the study there was no information on which areas/regions were defined as "coastal", or where the boundary was drawn between coastal and inland areas/regions.

Alternatively, information on the national level can also be found at the UN World Tourism Organization (UNWTO): *http://www.e-unwto.org/toc/unwtotfb/current*

In case there is no direct information available on the value of tourism even on the national level, the share of tourism in the national GDP can serve as the basis for calculating it (e.g. "X % of national GDP originate from tourism").

Total national values, however, need to be related to the ecosystems evaluated, which can be challenging (e.g. how many tourists come because of the lakes, and how many because of other (natural or not) attractions).

EXAMPLE

The case study region are the Maldives, and the value of tourism/recreation is needed. For the purpose of this example, we ignore regional or national sources of information, to give a more general overview of how to use international sources (i.e. the UNWTO).

The statistical information on inbound tourism on the Maldives is quite accurate: in 2015, 1,234 million tourists visited the islands, spending US$ 2,664 bn.

This figure would then need to be related to the size of the ecosystems evaluated, for example the marine area. Via other sources, the main attractions could be identified, to specify this number. For example, if there is information available that states that 50% of the visitors come mainly for snorkeling and diving in coral reef areas, the total figure could be divided by half, and applied to the total area of coral reefs in the Maldives´ marine area.

At this point, table C3 could look like this:

Ecosystem(s)	Size/area (in hectares)	Ecosystem Services selected/ relevant	Assessment by Market Prices (MP) or Benefit Transfer (BT)	Market Prices: absolute or relative value, and source	Market Prices: absolute amount provided
All marine ecosystems	(unknown)	Opportunities for tourism/ recreation	MP	US$ 2,664 bn. (UNWTO)	

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II.4.4 Summary and Results

As result of the steps above, you should now have a part of the economic valuation of ecosystem services complete: the valuation of several ecosystem services with market prices, documented in table C3 of the checklist. The values at this point will be in a total or relative form, and need to be related to the total area of the respective ecosystems in the project area (see chapter II.6).


Mangroves, Portland Bight protected area, Jamaica/Hanneke Van Lavieren

II.5 Step-by-Step Guidance to the simplified Benefit Function Transfer Approach

In this chapter, you are provided with the guidance and information you need to evaluate ecosystem services that are not traded on local markets, using a customized benefit function transfer methodology.

It is recommended to use table C3 of the checklist as a form of "note pad", to keep track of the information you add in this step, as well as the final result.

II.5.1 Starting Point

At this point, you should have the checklist/matrix filled with information crucial for the application of the benefit transfer methodology: the ecosystems selected, the ecosystem services you want to evaluate, and the size of the ecosystems in the project area.

If for some reason this information is not available yet, you should go back to chapter II.3, and follow the steps listed there for filling the checklist/matrix.

There are some specifications and assumptions to be made, depending on the type of ecosystem services at hand. These are first explained in the sub-chapters II.5.1.1 to II.5.1.3, and mostly refer to uncertainties involved in the economic valuation in general, and the benefit transfer methodology specifically, as described in the introduction to the Guidance Documents (chapter I.2.5).

If the issues in the following sub-chapters are clarified and understood, please proceed with the analysis in chapter II.5.2.

II.5.1.1 Regulating Services

Regulating services (see introduction to the Guidance Documents, chapter I.2.1) encompass a wide array of ecosystem services that are crucial to the functioning of the ecosystems themselves, and often crucial for the safety and welfare of human populations living close. As two situations are never equal in different regions of the world, however, it needs to be clear that a benefit transfer is only an approximation to the value of the respective ecosystem to humans. A closer and more precise estimation could be done in a tier 2 in-depth analysis (see tier 2 guidance).

Climate regulation (carbon sequestration)

As climate change is a global phenomenon, the ecosystem service climate regulation is theoretically well suited for being evaluated by a benefit transfer. However, it is often evaluated using the price of carbon on national or international markets (e.g. in the EU´s Emission Trading System), which are highly flexible and dependent on market forces/speculation and political decisions.

Hence, it is recommended to clearly state if the benefit transfer is based on carbon market prices, and if possible look for reference studies that evaluate the service with other methods (e.g. the replacement cost method, see tier 2 Guidance Document below).

Moderation of extreme events (e.g. floods, storms) and erosion prevention

The value of ecosystems for storm/flood protection and preventing land erosion is generally difficult to estimate, as many reference studies are based on avoided damages (which are very much dependent on local circumstances).

Hence, it is recommended to clearly state if the benefit transfer is based on avoided damages, and if possible look for reference studies that evaluate the service with e.g. the replacement cost method.

In the case of mangroves and their role in flood/storm protection, it can be assumed that a 100m strip of mangroves offers similar protection as a stone dike/coastal protection infrastructure (Barbier 2007 and 2008).

Water treatment and nutrient cycling/maintenance of soil fertility

Water treatment and nutrient cycling/maintenance of soil fertility are services that are often evaluated with the replacement cost approach. General uncertainties of the benefit transfer methodology apply and should be noted.

Air quality regulation (e.g. capturing dust, micro climate)

The regulation of air quality (capturing dust or regulating the micro climate) is a very localized ecosystem service with little transferable information available. If there is no specific study done in your areas, insufficient data available, or significant uncertainties, it is recommended to exclude this service from the analysis, and rather describe it qualitatively.

II.5.1.2 Habitat Services

When evaluating habitat services (i.e. the maintenance of life cycles of migratory species and of genetic diversity; see introduction to the Guidance Documents, chapter I.2.1), it needs to be kept in mind that these often provide the basis for the provision of the two provisioning services "seafood" and "genetic resources", as well as for biodiversity-related non-use values.

If these provisioning services are also part of the economic valuation, there is a risk of double counting, i.e. of counting the economic benefits of certain ecosystem services twice (see chapter I.2.5 in the introduction to the Guidance Documents).

To prevent this from happening, it is recommended to subtract the total values determined for the maintenance of life cycles of migratory species and of genetic diversity, if evaluated, from the total values of the provisioning services "seafood" and "genetic resources".

II.5.1.3 Cultural Services

Cultural services (see introduction to the Guidance Documents, chapter I.2.1) encompass two very different ecosystem services or ecosystem service types: tourism/recreation, which can be evaluated relatively easy with market prices (general revenues from tourism/recreation), and the non-use values "aesthetic information, inspiration, spiritual experience and education", which are grouped into one single service for reasons of simplicity[4]. You are free to evaluate only a single one of these services, i.e. to differentiate between them, but you would need a fitting reference study that evaluates also only an individual one.

One remark has to be made with regard to "biodiversity", which is often included with "cultural services" or generally part of the canon of non-use values. In this Guidance Document, we understand that important parts of the value of "biodiversity" is included in provisioning (e.g. food), regulating (e.g. carbon sequestration), habitat (e.g. nursery service) and cultural (tourism/recreation) services. The intangible existence value of biodiversity is included in the "grouped" service "aesthetic information, inspiration, spiritual experience and education".

II.5.2 Identification of existing Studies and Values – the Repository of Economic Valuation Studies

In this step, you will be guided to search for existing studies and values that can be used for the benefit transfer, via the online repository of economic valuation studies.

The repository of EV studies (short "the repository"), which is available online under the URL *http://iwlearn.net/learning/manuals/economic-valuation-of-wet-ecosystems/the-repository-of-economic-valuation-studies* and in summary form attached as Annex II, contains information on studies considered directly usable for tier 1 benefit transfers, i.e. studies with values/benefit information that can be transferred to another area - your project area, in this case. It is the result of an extensive search, screening hundreds of valuation studies and selecting the few

[4] In the TEEB classification system, these are four separate services: Aesthetic information / Inspiration for culture, art and design / Spiritual experience / Information for cognitive development.

that are directly usable. The repository is structured to allow an IW project manager undertaking a benefit transfer to easily identify the studies available for the transfer to her/his project area, to select the most appropriate ones, and to have all information at hand to perform any adjustments to the values cited that might be necessary (which are detailed in the chapters below).

The repository provides the following information:

- **Authors/name of the study/year.**
- **Marine or freshwater ecosystems:** whether the study covers marine or freshwater, or both, ecosystems.
- **Specific ecosystems covered:** which specific ecosystems the study covers (e.g. mangroves or seagrass beds/meadows).
- **Ecosystem and study area characteristics:** some information on the specific site at question, if available (such as size or whether an assessed wetland is situated in a urban area or a national park; this information is highly dependent on the quality of the study at hand).
- **Ecosystem services covered:** the specific ecosystem services covered by the study (e.g. moderation of extreme events; see also the tables above).
- **Valuation Method(s) used:** the methods used to evaluate the ecosystem services assessed.
- **Values per area (i.e. per hectare) monetary unit used (year):** the "core information", i.e. the results the study lists regarding the values of the specific ecosystem services, presented as "values per hectare per year", to allow an easy transfer to another area.
- **Monetary unit used,** and which year (for adjustments of currency and inflation).
- **Socio-economic characteristic:** population density of the area (low/medium/high, to allow an adjustment of the values in a benefit transfer).
- **Socio-economic characteristic:** per capita income (national level 2015, to allow an adjustment of the values in a benefit transfer).
- **Socio-Economic characteristic:** population density (high/medium/low, to allow an adjustment of the values in a benefit transfer).
- **Socio-Economic characteristic:** urban or rural area (to allow an adjustment of the values in a benefit transfer).
- **Socio-Economic characteristic:** area is economically (agriculture, fishery etc.) used Y/N (to allow an adjustment of the values in a benefit transfer).
- **Socio-Economic characteristic:** density of use by tourists/visitors (highly visited/medium/rarely, to allow an adjustment of the values in a benefit transfer).
- **Warm or cold-water ecosystem** (to allow an adjustment of the values in a benefit transfer).

After entering the following URL *http://iwlearn.net/learning/manuals/economic-valuation-of-wet-ecosystems/the-repository-of-economic-valuation-studies*, you click the button "Open Repository". With this, you open the search function of the repository:

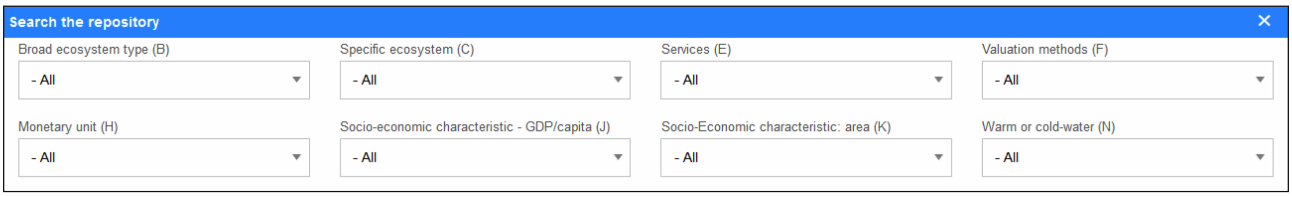

Figure II.2: Screenshot of the search function of the repository of EV studies

The search function offers eight search fields with predefined search options, which you should fill according to the ecosystems and ecosystem services to be evaluated. The search fields and options are the following:

- **Broad ecosystem type:** marine/freshwater/all.
- **Specific ecosystem:** list of specific ecosystems (such as mangroves, lakes etc.).
- **Services:** list of specific ecosystem services.
- **Valuation methods:** list of valuation methodologies.
- **Monetary unit:** US$, and other currencies listed in the repository.
- **Socio-economic characteristics - GDP/capita:**

list of the countries/regions for which there are studies in the repository.

- **Socio-economic characteristics - area:** rural or urban.
- Warm or cold-water ecosystem.

If you search, for example, for the ecosystem service "moderation of extreme events" of "mangrove ecosystems", which were calculated with the "damage cost avoided" approach in "US$", your filled search field should look as such:

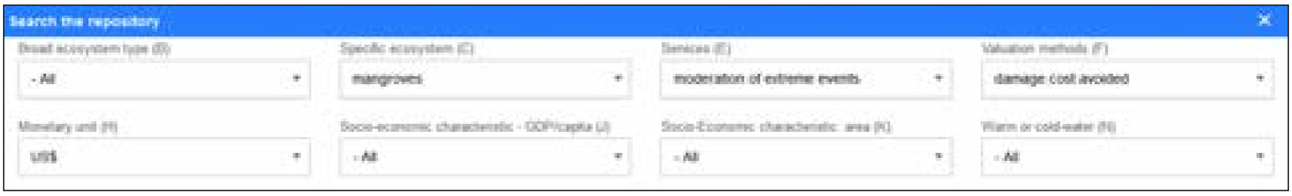

Figure II.3: Example for filled search fields

Below these filled fields, you´ll find the result of the search - a link for exporting the results to Microsoft Excel, and a list of the studies found:

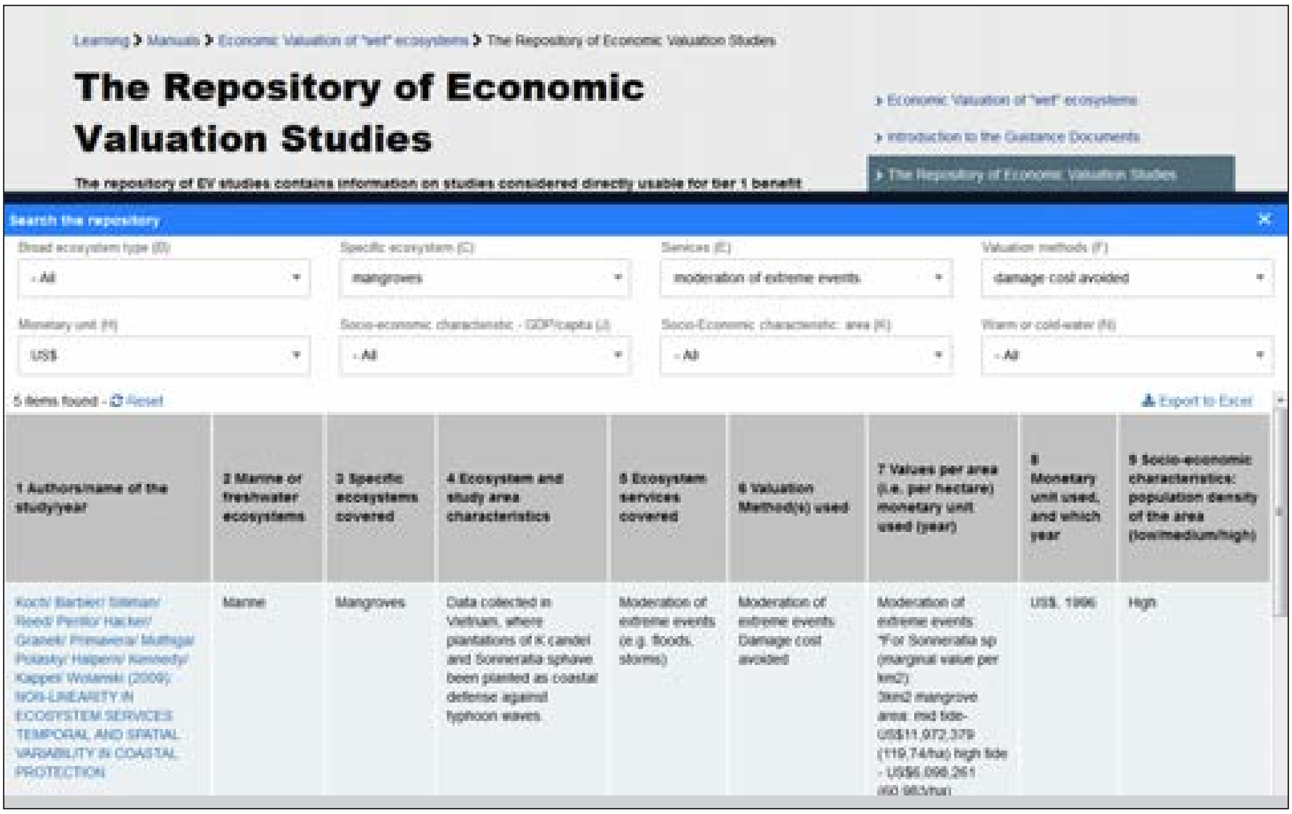

Figure II.4: Results of the search function

The studies found should be checked and assessed - the PDF versions of the original studies are to be found in the first column of the results table (via hyperlink). You could then directly proceed to the next step, or refine the search by adding criteria, such as GDP/capita levels, to get results that fit better in your project area´s context.

RESULT

As result of this step, you will have a number of studies selected from the repository which roughly "fit" for your project area - for example, if you have mainly mangroves and seagrass beds to evaluate, you now have a selection of all studies evaluating these two ecosystems selected from the repository. In the next step, it needs to be decided which of the selected studies can be used for the benefit transfer, i.e. the aim is to select the one/ones which fit best.

II.5.3 Decide whether the existing Values are transferable

At this step, the ecosystems and ecosystem services to be evaluated are already identified, as well as several potentially relevant evaluation studies from the repository. You now have to determine whether the economic values of the ecosystem services identified can be transferred to your project area.

In order to do this, a set of "criteria" - characteristics and traits of the area/areas which are evaluated in the study/studies taken from the repository - will guide you through the process. Basically, the characteristics of the study area should be as similar as possible to your project area.

In order to decide whether the existing values are transferable, the following criteria are regarded as crucial:

- The population density of the site, ranked as high (above 150 people/km²), medium (51-150 people/km²), low (0-50 people/km²).
- Per capita income should not differ by more than 100% (i.e. it should not be less than half and not more than double as high).
- Whether it is an urban or a rural area.
- Whether the area is economically used, i.e. through agriculture, fisheries etc.
- The intensity of its use by tourists/visitors, ranked as highly visited/medium/rarely visited.
- Whether it is a warm or cold-water ecosystem.

Naturally, not all of these criteria apply to all ecosystems (e.g. the criterion "urban/rural" does not apply to marine open sea habitats, etc.). The table II.4 below lists the above-mentioned criteria, and an overview of which criteria are applicable in which ecosystems.

Table II.4: Criteria for transferability and applicability

Ecosystem(s)	Population Density	Per capita Income	Urban/Rural area	Economically used (Y/N)	Density of touristic use	Warm/Cold water ecosystem
Marine						
Marine/ Open sea				X	X	X
Estuaries/ Marshes	X	X	X	X	X	X
Salt ponds/ Lagoons	X	X	X	X	X	X
Mangroves	X	X	X	X	X	
Intertidal habitats	X	X	X	X	X	X
Deltas	X	X	X	X	X	X
Beaches/ Dunes	X	X		X	X	X
Seagrass beds/ Meadows		X		X	X	X
Coral reefs		X		X	X	X
Atolls	X	X	X	X	X	X
Freshwater						
Rivers		X	X	X	X	X
Lakes		X	X	X	X	X
Riparian wetlands	X	X	X	X	X	X

In order to choose the studies that will finally be used for the benefit transfer, you should sort out the ones that do not fit well, leaving only the better/ more fitting ones (i.e. the ones with several criteria matching), and repeat the step until you are left with the ones matching best. The decision which of the studies selected from the repository to choose for the benefit transfer is then basically dependent on the studies available in the repository - if there are many studies on the ecosystems you want to evaluate, you will probably find one or more that fits your project area quite well; if there are less studies, you might need to use a study/studies that does not fit so nicely.

RESULT

As result of this step, you will have the final selection of the studies to be used in the benefit transfer, either a single one for each ecosystem/ecosystem service, or several. These studies will be taken forward to the next step, in which the values from the studies have to be adjusted to better reflect the circumstances in your project area.

On the IW economic valuation website, under the URL *http://iwlearn.net/learning/manuals/economic-valuation/further-reading-supporting-the-economic-valuation-guidance,* you will also find a selection of studies about ecosystem services, their values and benefits that are of a more general interest, i.e. which are not directly transferable, but nevertheless interesting. You might want to have a look at these for a broader understanding of the topic.

II.5.4 Adjustment of the existing Values to reflect the Values for the Site under consideration by calculating the Net Present Value

As a final step of preparing a benefit transfer for tier 1 projects, an adjustment of the values of the benefit transfer study to the socio-economic circumstances of project area is needed, in order to get current values (present value) as well to adjust the values to the differences in the socio-economic background of the two sites.

The following steps need to be taken for each study selected separately. It is recommended to use table C3 of the checklist as a form of "note pad", to keep track of the information you add in this step, as well as the final result.

II.5.4.1 Incorporate inflation to adjust the value to present values

In this first step, the values stated in the benefit transfer study are transformed to their current value, i.e. adapting the value to inflation using the appropriate inflation rate (in most cases of the country in which the study was conducted). The inflation rate is always stated as a percentage, e.g. "2%".

For the adaptation, inflation rates according to the Consumer Price Index[5] (CPI) will be employed, a method which compares the cost of things that the average household buys, such as food, housing, transportation, medical services, etc., over the years. For earlier years, it is the most useful series for comparing the cost of consumer goods and services. It can be interpreted as how much money is needed today to buy an item in the year in question if its price had changed the same percentage as the average price change.

[5] A consumer price index measures changes in the price level of market basket of consumer goods and services purchased by households.

The following specifications apply:

- For studies that used revealed or stated preference methodologies (travel cost, hedonic pricing etc.; the methodology used is listed in the repository for each study), the CPI/inflation rate of the country in which the benefit transfer study was conducted will always be used.
- For studies that used cost-based approaches (e.g. damage costs, replacement costs; the methodology used is listed in the repository for each study) in the currency of the country in which the benefit transfer study was conducted, also the CPI/inflation rate of this country will be used.
- For studies that used cost-based approaches (e.g. damage costs, replacement costs) in US$ or €, the CPI/inflation rate of the United States or the Euro zone, respectably, will be used.

Anusorn Nakdee/Shutterstock.com

Box II.6: CPI and Inflation Rate

While the CPI/inflation rate is an established and sure way of transforming past domestic values to current price levels, it is more difficult to apply when values incorporate both national as well as international elements, as might be the case in infrastructure projects (labor: domestic prices; materials etc.: partly domestic, partly international prices).

Hence, it can be difficult to decide on the country or region from which the CPI should be used. Imagine the case of a country with a very high inflation rate: a 1990 value stated in US$ would then be transferred to 2016 US$ values, using the CPI of that country - resulting in an extraordinarily high Dollar value.

The specifications above represent a pragmatic approach, which is also easy to apply. It is not perfect, as in the case of studies that use cost-based approaches it equals the US inflation with the inflation in the country at hand, but it would be all but impossible to separate domestic and international costs of a project based on the limited resources for tier 1-projects.

The underlying theoretical assumption of this approach can therefore be summarized as follows: values stated in US$ in the original study (i.e. mostly project and investment costs) are less dependent on the domestic/inland price level than on international/global price levels of goods and commodities. Hence, for such values, the CPI of the United States or the Euro zone, respectably, should be used.

In some cases, CPI values might not be available; in these cases, the inflation rate based on other indices have to be used.

NOTE

Applying an inflation rate to past values in most cases increases the figure - i.e. the result is a higher number than before. Only in cases of negative inflation do the figures actually decrease. Adapting past values for inflation simply increases the value/figure by the inflation rate, for each year separately (see example box below).

The CPI inflation rate for the US$ can be calculated easily via the following website:
http://data.bls.gov/cgi-bin/cpicalc.pl?cost1=1&year1=1995&year2=2016

▸ The result is a rate, stated as, for example: "1 US$ in 1995 has the same purchasing power as US$ 1,58 in 2016".

▸ This ratio of 1.58 has to be applied to the original value (i.e. the original value has to be multiplied by this number, raising the values).

The CPI inflation rate for the Euro zone and several other industrial or semi-industrial countries can be extracted via the following website:

Current inflation: *http://www.inflation.eu/inflation-rates/cpi-inflation.aspx* Historic inflation: *http://www.inflation.eu/inflation-rates/historic-cpi-inflation.aspx*

▸ The website lists the current inflation rate (i.e. 2016 or 2017); links provide information of past years (year by year information, so this step needs some work of extracting the data; then, the past value has to be increased year by year by the stated percentage number, increasing it).

The inflation rates of the last years are displayed in a summarized way only in the CIA World Factbook: *https://www.cia.gov/library/publications/the-world-factbook/fields/2092.html#th*

▸ Here, the latest available information on inflation rates in all countries of the world is listed. It is suggested to use these inflation rates as average rates in case no other, more specific information is available.

EXAMPLE

The IW project site is located in Cameroon, and the study to be used for benefit transfer dates from 2014, also from Cameroon. It uses a cost-based approach, e.g. analyzes the replacement costs for flood protection measures to determine the economic value of riparian wetlands. The values are stated in the national currency of Cameroon, the CFA franc (XAF), and are at 10,000 CFA/ha.

The task is now to adapt the 2014 XAF value to its current, 2017 value.

The inflation rates for Cameroon is stated on the website CIA World Factbook (see link above): 1.9% in 2014, 2.7% in 2015 and 2.4% in 2016.

2014: 10,000 + (1.9% = 190) = 10,190
2015: 10,190 + (2.7% = 275) = 10,465
2016: 10,465 + (2.4% = 251) = 10,716

The resulting 10,716 XAF/ha is the current value (beginning of 2017) in local/national currency.

II.5.4.2 Transfer the adapted value into US$ of the same year

In the second step, the present value of the benefit transfer study calculated in step 1 above is converted into present-day US$. It is recommended to use the following website, although many others exist (this one goes back to January 1990; public sources, such as World Bank or IMF, were also assessed but found to be not user-friendly - the private website "oanda" is easy-to-use and reliable): *https://www.oanda.com/currency/converter/*

If the original study is already in US$, this step can be skipped.

EXAMPLE

The 10,716 XAF/ha resulting from step 1 above are converted into US$ using oanda.com - a simple data mask. Choosing 1st January 2017 as the date for the currency rate to be applied, the result is as follows:

10,716 XAF (2017) = US$ 17.19 (2017)

If the value was already in US$, this step can be skipped.

II.5.4.3 Incorporate the difference in price levels between benefit transfer site and project area and adjust the present value to the area under consideration

In this third step, the difference in price levels between the benefit transfer site and your project area are accounted for. This is done by comparing the gross domestic product (at purchasing power parity) per capita (GDP PPP).

Comparisons of national wealth are frequently made on the basis of nominal GDP and savings (not just income), which do not reflect differences in the cost of living in different countries; hence, using a PPP basis is more useful when comparing generalized differences in living standards between nations because PPP takes into account the relative cost of living and the inflation rates of the countries, rather than using only exchange rates, which may distort the real differences in income.

The following specifications apply:

- For studies that used revealed or stated preference methodologies (travel cost, hedonic pricing etc.; the methodology used is listed in the repository for each study), this methodology will be used.
- For studies that used cost-based approaches (e.g. damage costs, replacement costs; the methodology used is listed in the repository for each study) in the currency of the country in which the benefit transfer study was conducted, also this methodology will be used.
- For studies that used cost-based approaches (e.g. damage costs, replacement costs) in US$ or €, this step will be skipped, as it can be assumed that values/prices stated in the original study reflect more global than local prices (which are the same in both countries[6]).

A list of countries rated according to the GDP (PPP), based on IMF and World Bank data, can be found at Wikipedia - it is recommended to use this list as a basis, because extracting the information from IMF or WB databases is difficult: *https://en.wikipedia.org/wiki/List_of_countries_by_GDP_(PPP)_per_capita*

The adjustment is done by calculating the ratio in GDP between the benefit transfer site and the project area, resulting in a factor that will be applied to the current US$ value calculated in the steps 1 and 2 above.

[6] Similarly to the approach chosen regarding which CPI/inflation rate to use, to calculate the ratio of domestic to global prices in evaluations is too complex for a tier 1 benefit transfer exercise.

EXAMPLE

The project area is located in Cameroon, whose GDP (PPP) per capita in 2015 amounted to 3,148 International Dollars (IMF data). The ratio is calculated by relating this number to the GDP (PPP) of the benefit transfer site in Vietnam, with a GDP (PPP) per capita in 2015 of 6,037 International Dollars (IMF data):

Cameroon 3,148 / 6,037 (Vietnam) = Factor 0.52

This factor has then to be applied to the current US$ value calculated in steps 1 and 2.

II.5.5 Result

As result of the steps above, you should now have the second part of the economic valuation of ecosystem services complete: the valuation of several ecosystem services with the benefit transfer methodology, documented in table C3 of the checklist.

At this point, the results will be stated as "per hectare per year/annum" values, which need to be upscaled to the size of the ecosystems providing the services (see following chapter II.6).

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II.6 Calculation of the Total Value: Summing up Market Prices and Benefit Transfer Results

At this part of the valuation, you will have two different sets of results at hand, documented in table C3 of the checklist:

- Values for provisioning services and potentially tourism/recreation values, derived from the market prices analysis.
- Values for any number of other ecosystem services, derived from the benefit transfer.

At this point, however, the values will still be in a "rough" form, and need to be upscaled and related to the size of the ecosystems providing the respective services.

For market prices, this means that the total value for the respective services (food, timber and non-food, and potentially tourism/recreation) needs to be related to the size of the ecosystem(s) providing the services:

Total annual value of the service / Hectares of the ecosystem = Annual value per hectare

The values derived through the benefit transfer, on the contrary, need to be multiplied with the hectares of the ecosystems providing the services:

Annual value derived through the benefit transfer x Size of the area in hectares = Total annual value

At this point, you´ll have several values for the ecosystem services selected for this analysis, but all in the same "unit of measurement": annual values per year. These values will now have to be summed up, to create the total value of the ecosystem services selected.

EXAMPLE

After conducting the markets prices analysis and a benefit transfer, the IW manager has obtained the following results for her IW project area, which consists of mangroves (2,000 hectares) and seagrass beds (100 hectares):

Market Prices:
- Provisioning services (fisheries in the mangroves): total value of US$ 30,000 /yr or US$ 15/ha/yr.
- Provisioning services (timber and fuelwood from the mangroves): total value of US$ 20,000/yr or US$ 10/ha/yr.

Benefit Transfer:
- Flood Protection (mangroves): US$ 350/ha/yr
- Flood Protection (seagrass beds): US$ 140/ha/yr
- Maintenance of life cycles of migratory species (including nursery service for commercially valuable fish species) (mangroves): US$ 55/ha/yr
- Maintenance of life cycles of migratory species (including nursery service for commercially valuable fish species) (seagrass beds): US$ 80/ha/yr

Summing up these values, the IW manager calculates the total values of the selected services for mangroves and seagrass beds: US$ 430/ha/yr for mangroves and US$ 220/ha/yr for seagrass beds.

The resulting individual and overall values are now based on a number of uncertainties inherent in the methodologies used, and on assumptions you took during the valuation exercise. Hence, use caution in presenting the results, and always be clear and transparent about these uncertainties and assumptions! Doing so will increase your credibility and the overall impact of the study.

In Annex II a proposal for an outline of a tier 1 economic valuation report is presented, which could be used and filled with the results of the steps above, or adapted according to your specific circumstances and needs.

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II.7 Summary

This Guidance Document provided information and guidance how to carry out an economic valuation in a GEF IW projects. It presented an introduction to economic valuations in tier 1 IW projects, and a step-by-step guidance for conducting an economic valuation in an IW project area, consisting of a benefit transfer methodology, and tips for valuation via local market prices.

Depending on the policy appraisal context, the results of the application of this guidance can be used in different ways.

- If the assessment was a "screening analysis", assessing the value of all ecosystem services in a whole LME or transboundary river basin in a resource-efficient way, and part of a Transboundary Diagnostic Analysis (TDA), it will serve as a starting point for discussions, and setting policy priorities in a following Strategic Action Program (SAP).
- The screening could also form the basis for a following in-depth analysis of all or some ecosystem services in the LME/river basin, which would then follow the tier 2 methodology (which is presented in the separate tier 2 guidance).
- Besides, the results could serve in various other ways, informing policy makers and facilitating discussions on development and trade-offs.

One point has to be made clear, however: the results can only be seen as a "first approximation". While market prices are methodologically quite a sound approach for valuating ecosystem services, the benefit transfer methodology has some significant uncertainties (see chapter I.2.5 in the introduction to the Guidance Documents). Nevertheless, if these uncertainties are made transparent, and if mostly conservative assumptions and estimations are being made, the results should provide strong indication of the overall value of ecosystem services in the project area.


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II. Annex I

Checklist for the Identification of Ecosystems and Ecosystem Services to be assessed

At this point in the valuation exercise - i.e. at the beginning of the "scoping" (see chapter II.3 of this document) - you are about to identify which ecosystems are present within the spatial boundaries determined in step 1, which ecosystem services are provided by these ecosystems, and which of these might not be relevant. This process is supported by this checklist.

You start by taking a closer look at the pre-filled matrices below (table C1 for freshwater ecosystems, and table C2 for marine ecosystems): this matrices show the ecosystems that can be present in transboundary freshwater or marine ecosystems, and the ecosystem services that are usually provided by these ecosystems (according to the MAES typology (European Commission 2013) for freshwater, and to the Millennium Ecosystem Assessment (MAE 2005) and Naber/Lange/Hatziolos (2008) for marine ecosystems).

NOTE

The information necessary to fill the check-list should be easily available to you as the IW project manager. It should be easy to find it in e.g. TDA/SAP documents (if available), scientific literature, environment reports, or via local stakeholders and experts. As each project is individual, we do not provide more concrete guidance on how to obtain the basic information.

The Checklist is also provided as separate Word-Document *(http://iwlearn.net/learning/manuals/economic-valuation/accompanying-documents-and-training-materials).* We recommend to use the Word-version of the Checklist, to directly work in the matrices and tables below.

Step 1. Your task is now to first eliminate all ecosystems which are not present within the spatial boundaries set in step 1 from the respective table C1 or C2, by simply deleting/eliminating the whole column(s). Please note that only the ecosystems functionally linked to the river and/or its tributaries should be considered, e.g. forests or other significant ecosystems also present in the watershed are excluded from this analysis.

EXAMPLE

In a freshwater river basin, there are no lakes of significant size to be evaluated. Hence, the IW manager decides to exclude lakes from the analysis, by deleting the whole column "lakes" in table C1.

Ecosystem Services/Ecosystem	Rivers	~~Lakes~~	Other inland wetlands
Food	Y	~~Y~~	Y

Step 2. In a second step, you select the ecosystem services which are similarly not present or not relevant in the ecosystems left, and change the "Y" to a "N". In case this is unclear, mark the respective cell with a "U", and go to step 3 below.

EXAMPLE

In the above example, tourism and recreation play no role in the river basin, as it is very remote. The IW manager therefore decides to exclude "opportunities for tourism/recreation" from the analysis, by changing the "Y" to a "N" in the respective cells.

Ecosystem Services/Ecosystem	Rivers	~~Lakes~~	Other inland wetlands
Food	Y	~~Y~~	Y
Genetic resources	Y	~~Y~~	Y
Medicinal resources	Y	~~Y~~	Y
Fiber, timber, fuel	N	~~N~~	Y
Water (drinking, irrigation, cooling)	Y	~~Y~~	N
Air quality regulation	N	~~N~~	Y
Climate regulation	N	~~N~~	Y
Moderation of extreme events	N	~~N~~	Y
Water treatment	N	~~N~~	Y
Erosion prevention	N	~~N~~	Y
Nutrient cycling and maintenance of soil fertility	Y	~~Y~~	Y
Maintenance of life cycles of migratory species	Y	~~Y~~	N
Maintenance of genetic diversity	Y	~~Y~~	Y
Opportunities for tourism/recreation	~~Y~~N	~~Y~~	~~Y~~N
Aesthetic information, Inspiration, Spiritual experience, Education	Y	~~Y~~	Y

Step 3. In a third step, which is reserved for ecosystem services where you are uncertain about their presence or relevance in the project area´s ecosystems, you should reflect about the following guiding questions to come to a conclusion about whether to include or exclude the respective ecosystem service:

• Is there another study evaluating this ecosystem service in your project area?
→ In case the answer is YES, you should consider excluding the ecosystem service from the analysis, and instead use the results from the existing study; if the answer is NO, answer the next question.

• Is there sufficient data/information about the ecosystem service to allow an evaluation (e.g. is there information on the size of the ecosystem providing the service, on the amount provided in case of food or non-food products)?
→ In case the answer is YES, you should consider including the ecosystem service; if the answer is NO, you should consider excluding the ecosystem service from the analysis. As a result, you should fill the respective answer (Y/N) in the matrix C1 or C2.

EXAMPLE
Again using the same example, the IW manager is uncertain whether the provision of medicinal and genetic resources in rivers and other inland wetlands is relevant for the economic valuation or not. After searching without positive results for other studies evaluating these (question 1 above), and not being able to find any information on whether medicinal and genetic resources are provided by her ecosystems (question 2 above), she decides to exclude these two provisioning services from the analysis, by changing the “Y” to a “N” in the respective cells.

Ecosystem Services/Ecosystem	Rivers	~~Lakes~~	Other inland wetlands
Food	Y	~~Y~~	Y
Genetic resources	~~Y~~N	~~Y~~	~~Y~~N
Medicinal resources	~~Y~~N	~~Y~~	~~Y~~N
Fiber, timber, fuel	N	~~N~~	Y
Water (drinking, irrigation, cooling)	Y	~~Y~~	N
Air quality regulation	N	~~N~~	Y
Climate regulation	N	~~N~~	Y
Moderation of extreme events	N	~~N~~	Y
Water treatment	N	~~N~~	Y
Erosion prevention	N	~~N~~	Y
Nutrient cycling and maintenance of soil fertility	Y	~~Y~~	Y
Maintenance of life cycles of migratory species	Y	~~Y~~	Y
Maintenance of genetic diversity	Y	~~Y~~	Y
Opportunities for tourism/recreation	~~Y~~N	~~Y~~	~~Y~~N
Aesthetic information, Inspiration, Spiritual experience, Education	Y	~~Y~~	Y

After completing these steps, you have a filled matrix which shows which ecosystems and corresponding ecosystem services are to be included in your economic valuation. The following main steps of the guidance will focus on these ecosystem services only.

Step 4. After the matrix has been filled, the Checklist is used to keep track of the steps that follow the identification of ecosystems and ecosystem services to be assessed - the determination of the size of the ecosystems to be evaluated, and the evaluation itself, using local market prices or the benefit transfer methodology.

For this, it is recommended to use table C3 below; this table is deliberately left empty, and needs to be filled by yourself, according to the ecosystems and ecosystem services selected in the matrix - however, this is easily be done and can then be used to track the progress of the analysis.

MATRIX C1 - Freshwater Ecosystems

Ecosystem Services/Ecosystem	Rivers	Lakes	Other inland wetlands
Food	Y	Y	Y
Genetic resources	Y	Y	Y
Medicinal resources	Y	Y	Y
Fiber, timber, fuel	N	N	Y
Water (drinking, irrigation, cooling)	Y	Y	N
Air quality regulation	N	N	Y
Climate regulation	N	N	Y
Moderation of extreme events	N	N	Y
Water treatment	N	N	Y
Erosion prevention	N	N	Y
Nutrient cycling and maintenance of soil fertility	Y	Y	Y
Maintenance of life cycles of migratory species	Y	Y	Y
Maintenance of genetic diversity	Y	Y	Y
Opportunities for tourism/recreation	Y	Y	Y
Aesthetic information, Inspiration, Spiritual experience, Education	Y	Y	Y

Note: brackish/transitional waters are listed under marine ecosystems

MATRIX C2 - Marine Ecosystems

Ecosystem Services/Ecosystem	Marine/ open sea	Estuaries/ marshes	Salt ponds/ lagoons	Mangroves	Beaches/ dunes	Seagrass beds/ meadows	Coral reefs/ atolls
Food	Y	Y	Y	Y	Y	Y	Y
Genetic resources	Y	Y	Y	Y	Y	Y	Y
Medicinal resources	Y	Y	Y	Y	Y	Y	Y
Fiber, timber, fuel	N	Y	Y	Y	N	N	N
Water (drinking, irrigation, cooling)	N	Y	Y	N	N	N	N
Climate regulation	Y	Y	N	Y	N	Y	Y
Moderation of extreme events	Y	Y	Y	Y	Y	Y	Y
Water treatment	Y	Y	Y	Y	N	Y	Y
Erosion prevention	N	Y	Y	Y	Y	Y	Y
Nutrient cycling and maintenance of soil fertility	Y	Y	Y	Y	N	Y	Y
Maintenance of life cycles of migratory species	Y	Y	Y	Y	Y	Y	Y
Maintenance of genetic diversity	Y	Y	Y	Y	Y	Y	Y
Opportunities for tourism/ recreation	Y	Y	Y	Y	Y	N	Y
Aesthetic information, Inspiration, Spiritual experience, Education	Y	Y	Y	Y	Y	Y	Y

TABLE C3

Ecosystem(s)	Size/area (in hectares)	Ecosystem Services selected/ relevant	Assessment by Market Prices (MP) or Benefit Transfer (BT)	Market Prices: absolute or relative value, and source	Market Prices: absolute amount provided	Per hectare value(s) from the repository and source	Per hectare value from the repository - adjusted for the IW project area	Notes

II. Annex II

Outline for Tier 1 First Approximation

Executive Summary

1. Introduction - Background and Rationale of the Analysis
- Description of the Policy Appraisal Context
- Integration into TDA/SAP processes (if relevant)

2. The Role of Economic Valuation of Ecosystem Services in IW projects
- Importance and possible role of economic valuation in policy decisions

3. The Methodology for valuating the Ecosystem Services in the Project Area
- Rationale for a rough approximation through benefit transfer and market prices
- Reference to the Guidance Document
- Analytical Framework: TEV and TEEB
- Description of uncertainties and assumptions taken

4. The main Ecosystems, Ecosystem Services and relevant Uses in the Project Area
- Short overview on studies assessing ecosystem services (if relevant)
- Short overview of literature/studies on the project area
- Socio-Economics of the countries in the project area
- Ecosystems in the project area (importance, quality, size)
- Ecosystem services in the project area (socio-economic importance, functions)

5. The Valuation Approach for the Project Area - Practical Considerations
- Description of available data and information, as well as data gaps
- Description of the assumptions and limitations of the chosen approach (exclusion of certain ecosystems, exclusion of certain ecosystem services, specific approaches for certain ecosystem services due to data limitations etc.)

6. Valuation/Results
- Sub-chapters per ecosystem
- Summary of results

7. Summary and Outlook
- Summarizing the results, highlighting specific figures of importance
- Description (again) of assumptions and underlying uncertainties
- Reflection on current versus potential values of ecosystem services

8. References

II.Annex III: Overview of the Values of the Repository

Examples of values from the repository of EV studies - coral reefs			
Authors/name of the study/year	Marine or freshwater ecosystems	Specific ecosystems covered	
Barbier / Hacker / Kennedy / Koch / Stier / Silliman (2011): THE VALUE OF ESTUARINE AND COASTAL ECOSYSTEM SERVICES	Marine	Coral reefs	
Kallesøe / Bambaradeniya / Iftikhar / Ranasinghe / Miththapala (2008): LINKING COASTAL ECOSYSTEMS AND HUMAN WELL-BEING: LEARNING FROM CONCEPTUAL FRAMEWORKS AND EMPIRICAL RESULTS [CASE STUDIES ON TSUNAMI AFFECTED SRI LANKA AND THAILAND]			
Emerton (2014): ASSESSING, DEMONSTRATING AND CAPTURING THE ECONOMIC VALUE OF MARINE COASTAL ECOSYSTEM SERVICES IN THE BAY OF BENGAL LARGE MARINE ECOSYSTEM			
Samonte-Tan / White / Tercero / Diviva / Tabara / Caballes (2007): ECONOMIC VALUATION OF COASTAL AND MARINE RESOURCES: BOHOL MARINE TRIANGLE, PHILIPPINES			
O'Garra (2012): ECONOMIC VALUATION OF TRADITIONAL FISHING GROUND ON THE CORAL COAST IN FIJI			
Ledoux / Turner (2002): VALUING OCEAN AND COASTAL RESOURCES: A REVIEW OF PRACTICAL EXAMPLES AND ISSUES FOR FURTHER ACTION			
UNEP (2007): PROCEDURE FOR DETERMINATION OF NATIONAL REGIONAL ECONOMIC VALUES FOR GOODS AND SERVICES AND TOTAL ECONOMIC VALUES OF COASTAL HABITATS IN THE CONTEXT OF UNEP/GEF PROJECT: "REVERSING ENVIRONMENTAL DEGRADATION TRENDS IN THE SOUTH CHINA SEA AND GULF OF THAILAND			

Ecosystem services covered	Values per area (i.e. per hectare) monetary unit used (year)
Moderation of extreme events (coastal protection) Maintenance of life cycles of migratory species (including nursery service for commercially valuable fish species)	**Moderation of extreme events:** *Coral reefs: US$ 174/ha/yr for the Indian Ocean (US$, 1998) **Maintenance of life cycles of migratory species:** *Coral reefs: US$ 15-45,000/km²/yr (US$ 0,15-450/ha/yr) for sustainable fishing for local consumption and US$ 5-10,000/km²/yr (US$ 0.05-100/ha/yr) for live-fish export in the Philippines (US$, 2000)
Opportunities for tourism/recreation	**Opportunities for tourism/recreation:** US$ 933/ha/yr
Erosion prevention (shoreline stabilization and erosion control) Moderation of extreme events Water/Sewage treatment (Wastewater processing, sediment trapping) Maintenance of life cycles of migratory species (nursery service)	**Erosion prevention:** *Coral reefs: US$ 1,005/ha (total 851 million) **Moderation of extreme events:** *Coral reefs: US$ 1,413/ha (total 1,197 million) **Water/Sewage treatment:** *Protection against saline intrusion: US$ 554/ha (total US$ 859 million) *Wastewater processing and sediment trapping: US$ 1,220/ha (total 1,926 million) **Maintenance of life cycles of migratory species:** *Coral-reef dependent species: 5,890 US$/ha/yr (total US$ 4,990 million)
Opportunities for tourism/recreation	**Opportunities for tourism/recreation:** *Coral reefs: US$ 405-1,625/ha/yr
Moderation of extreme events (coastal protection)	**Moderation of extreme events:** *Coral reefs and mangroves: US$ 990,721/8km coastline/yr (123,840/km coastline/yr)
Erosion prevention (coastal protection) Water/Sewage treatment Opportunities for tourism/recreation	*Coral reefs: **Erosion prevention:** US$ 2,570/ha/yr **Water/Sewage treatment:** US$ 58/ha/yr **Opportunities for tourism/recreation:** US$ 3,008/ha/yr
Opportunities for tourism/recreation Erosion prevention (coastal protection)	*Coral reefs: **Opportunities for tourism/recreation:** US$ 1,043/ha/yr **Erosion prevention:** US$ 383.8/ha/yr

Examples of values from the repository of EV studies – seagrass beds/meadows

Authors/name of the study/year	Marine or freshwater ecosystems	Specific ecosystems covered
Barbier / Hacker / Kennedy / Koch / Stier / Silliman (2011): THE VALUE OF ESTUARINE AND COASTAL ECOSYSTEM SERVICES	Marine	Seagrass beds/ meadows
Kallesøe / Bambaradeniya / Iftikhar / Ranasinghe / Miththapala (2008): LINKING COASTAL ECOSYSTEMS AND HUMAN WELL-BEING: LEARNING FROM CONCEPTUAL FRAMEWORKS AND EMPIRICAL RESULTS [CASE STUDIES ON TSUNAMI AFFECTED SRI LANKA AND THAILAND]		
UNEP (2007): PROCEDURE FOR DETERMINATION OF NATIONAL REGIONAL ECONOMIC VALUES FOR GOODS AND SERVICES AND TOTAL ECONOMIC VALUES OF COASTAL HABITATS IN THE CONTEXT OF UNEP/GEF PROJECT: "REVERSING ENVIRONMENTAL DEGRADATION TRENDS IN THE SOUTH CHINA SEA AND GULF OF THAILAND		

Examples of values from the repository of EV studies – salt ponds/marshes

Authors/name of the study/year	Marine or freshwater ecosystems	Specific ecosystems covered
Barbier / Hacker / Kennedy / Koch /Stier / Silliman (2011): THE VALUE OF ESTUARINE AND COASTAL ECOSYSTEM SERVICES	Marine	Salt marshes
WWF (2008): THE VALUE OF OUR OCEANS- THE ECONOMIC BENEFITS OF MARINE BIODIVERSITY AND HEALTHY ECOSYSTEMS		

	Ecosystem services covered	Values per area (i.e. per hectare) monetary unit used (year)
	Maintenance of life cycles of migratory species (including nursery service for commercially valuable fish species)	**Maintenance of life cycles of migratory species:** *Seagrass beds: loss of 12,700 ha of seagrass in Australia is associated with lost fishery production of AU$ 235,000 (AU$, 2006)
	Maintenance of life cycles of migratory species (including nursery service for commercially valuable fish species) Moderation of extreme events (e.g. floods, storms). Climate regulation (carbon sequestration) Sewage treatment (pollution treatment)	**Maintenance of life cycles of migratory species (Thailand):** *Fish nursery for Ban Naca: US$ 995-1,975/ha/yr *Fish nursery for Ban Bangman: US$ 2,462-4,887/ha/yr *Total average value: US$ 1,946/ha/yr **Climate regulation:** US$ 75.5/ha/yr **Sewage treatment:** US$ 4,494/ha/yr
	Opportunities for tourism/recreation Erosion prevention (coastal protection) Climate regulation (carbon sequestration)	*Seagrass beds: **Opportunities for tourism/recreation:** US$ 153.20/ha/yr **Erosion prevention:** US$ 58.41/ha/yr **Climate regulation:** US$ 0.06/ha/yr

	Ecosystem services covered	Values per area (i.e. per hectare) monetary unit used (year)
	Moderation of extreme events (coastal protection) Climate regulation Maintenance of life cycles of migratory species (including nursery service for commercially valuable fish species)	**Moderation of extreme events:** *Salt marshes: US$ 8,236/ha/yr in reduced hurricane damages (US$, 2008) **Climate regulation:** *Salt marshes: US$ 30.50/ha/yr (US$,2000) **Maintenance of life cycles of migratory species:** *Salt marshes: US$ 6,471/acre and US$ 981/acre capitalized value for recreational fishing for the east and west coasts, respectively, of Florida, USA (US$,1997)
	Erosion prevention	*Salt Marshes: **Erosion prevention:** A 80m wide salt marsh stretch could provide savings on costs for sea defence of US$ 0.76 million to US$ 1.42 million/ha in investment costs, and US$ 14,182/ha/yr in maintenance costs (US$, 2002) US$ 464/ha/yr (US$, 1997)

Examples of values from the repository of EV studies - mangroves

Authors/name of the study/year	Marine or freshwater ecosystems	Specific ecosystems covered	
Barbier / Hacker / Kennedy / Koch / Stier / Silliman (2011): THE VALUE OF ESTUARINE AND COASTAL ECOSYSTEM SERVICES	Marine	Mangroves	
Kallesøe / Bambaradeniya / Iftikhar / Ranasinghe / Miththapala (2008): LINKING COASTAL ECOSYSTEMS AND HUMAN WELL-BEING: LEARNING FROM CONCEPTUAL FRAMEWORKS AND EMPIRICAL RESULTS [CASE STUDIES ON TSUNAMI AFFECTED SRI LANKA AND THAILAND]			
Emerton (2014): ASSESSING, DEMONSTRATING AND CAPTURING THE ECONOMIC VALUE OF MARINE COASTAL ECOSYSTEM SERVICES IN THE BAY OF BENGAL LARGE MARINE ECOSYSTEM			
Samonte-Tan / White / Tercero / Diviva / Tabara / Caballes (2007): ECONOMIC VALUATION OF COASTAL AND MARINE RESOURCES: BOHOL MARINE TRIANGLE, PHILIPPINES			
O'Garra (2012): ECONOMIC VALUATION OF TRADITIONAL FISHING GROUND ON THE CORAL COAST IN FIJI			
Ledoux / Turner (2002): VALUING OCEAN AND COASTAL RESOURCES: A REVIEW OF PRACTICAL EXAMPLES AND ISSUES FOR FURTHER ACTION			
UNEP (2007): PROCEDURE FOR DETERMINATION OF NATIONAL RE-GIONAL ECONOMIC VALUES FOR GOODS AND SERVICES AND TOTAL ECONOMIC VALUES OF COASTAL HABITATS IN THE CONTEXT OF UNEP/GEF PROJECT: "REVERSING ENVIRONMENTAL DEGRADATION TRENDS IN THE SOUTH CHINA SEA AND GULF OF THAILAND			

Ecosystem services covered	Values per area (i.e. per hectare) monetary unit used (year)
Moderation of extreme events (coastal protection) Climate regulation Maintenance of life cycles of migratory species (including nursery service for commercially valuable fish species)	**Moderation of extreme events:** *Mangroves: US$ 8,966-10,821/ha value for storm protection (Thailand) (US$, 2007) **Climate regulation:** *Mangroves: US$ 30.50/ha/yr (US$, 2000) **Maintenance of life cycles of migratory species:** *Mangroves: US$ 708-987/ha capitalized value of increased offshore fishery production, Thailand (US$, 2007)
Maintenance of life cycles of migratory species (including nursery service for commercially valuable fish species) Moderation of extreme events (e.g. floods, storms) Climate regulation (carbon sequestration) Sewage treatment (pollution treatment)	**Maintenance of life cycles of migratory species (Thailand):** Fish nursery for Ban Naca: US$ 995-1,975/ha/yr Fish nursery for Ban Bangman: US$ 2,462-4,887/ha/yr Total average value: US$ 1,946/ha/yr **Moderation of extreme events:** Sri Lanka (mangroves): US$ 76.8/ha/yr **Climate regulation:** US$ 75.5/ha/yr **Sewage treatment:** US$ 4,494/ha/yr **Opportunities for tourism/recreation:** US$ 933/ha/yr
Erosion prevention (shoreline stabilization and erosion control) Moderation of extreme events Water/Sewage treatment (wastewater processing, sediment trapping) Climate regulation Maintenance of life cycles of migratory species (nursery service)	**Erosion prevention:** *Mangroves: US$ 2,706/ha (total 4,273 million) **Moderation of extreme events:** *Mangroves: US$ 690/ha (total 1,089 million) **Water/Sewage treatment:** *Protection against saline intrusion: US$ 554/ha (total 859 million) *Wastewater processing and sediment trapping: US$ 1,220/ha (total 1,926 million) **Maintenance of life cycles of migratory species:** *Mangrove dependent species: US$ 16,259 million (US$ 10,295/ha/yr)
Maintenance of life cycles of migratory species (nursery service) Erosion prevention Opportunities for tourism/recreation Research and education	**Maintenance of life cycles of migratory species:** *Mangroves: US$ 243/ha/yr **Erosion protection:** *Mangrove: US$ 672/ha/yr **Opportunities for tourism/recreation:** *Coral reefs: US$ 405-1,625/ha/yr **Research and education:** US$ 32-111/ha/yr
Moderation of extreme events (coastal protection)	**Moderation of extreme events:** *Mangroves: US$ 145,349/km^2/yr
Erosion prevention (coastal protection) Opportunities for tourism/recreation Nutrient cycling	*Mangroves: **Erosion prevention:** US$ 1,839/ha/yr **Nutrient cycling:** US$ 6,696/ha/yr **Opportunities for tourism/recreation:** US$ 9,990/ha/yr
Opportunities for tourism/recreation Erosion prevention (coastal protection) Climate regulation (carbon sequestration) Nutrient cycling (sediment retention)	*Mangroves: **Opportunities for tourism/recreation:** US$ 43.3/ha/yr **Erosion prevention (coastal protection):** US$ 444/ha/yr **Climate regulation:** US$ 89.3/ha/yr **Nutrient cycling:** US$ 66.5/ha/yr

Examples of values from the repository of EV studies - beaches/dunes

Authors/name of the study/year	Marine or freshwater ecosystems	Specific ecosystems covered
Barbier / Hacker / Kennedy / Koch / Stier / Silliman (2011): THE VALUE OF ESTUARINE AND COASTAL ECOSYSTEM SERVICES	Marine	Beaches/dunes
Samonte-Tan / White / Tercero / Diviva / Tabara / Caballes (2007): ECONOMIC VALUATION OF COASTAL AND MARINE RESOURCES: BOHOL MARINE TRIANGLE, PHILIPPINES		

Examples of values from the repository of EV studies - estuaries/marshes and coastal wetlands

Authors/name of the study/year	Marine or freshwater ecosystems	Specific ecosystems covered
UNEP (2007): PROCEDURE FOR DETERMINATION OF NATIONAL REGIONAL ECONOMIC VALUES FOR GOODS AND SERVICES AND TOTAL ECONOMIC VALUES OF COASTAL HABITATS IN THE CONTEXT OF UNEP/GEF PROJECT: "REVERSING ENVIRONMENTAL DEGRADATION TRENDS IN THE SOUTH CHINA SEA AND GULF OF THAILAND	Marine	Coastal wetlands
Schuyt / Brander (2004): THE ECONOMIC VALUES OF THE WORLD'S WETLANDS	Marine Freshwater	Wetlands

Examples of values from the repository of EV studies - open sea

Authors/name of the study/year	Marine or freshwater ecosystems	Specific ecosystems covered
Emerton (2014): ASSESSING, DEMONSTRATING AND CAPTURING THE ECONOMIC VALUE OF MARINE COASTAL ECOSYSTEM SERVICES IN THE BAY OF BENGAL LARGE MARINE ECOSYSTEM	Marine	Marine (open sea) Mangroves Coral reefs
Samonte-Tan / White / Tercero / Diviva / Tabara / Caballes (2007): ECONOMIC VALUATION OF COASTAL AND MARINE RESOURCES: BOHOL MARINE TRIANGLE, PHILIPPINES	Marine	Marine (open sea)

	Ecosystem services covered	Values per area (i.e. per hectare) monetary unit used (year)
	Opportunities for tourism/recreation	**Opportunities for tourism/recreation:** *Beaches/dunes: US$ 166/trip or US$ 1,574/visiting household/year for North Carolina beaches, USA (US$, 2009)
		Opportunities for tourism/recreation: *Beaches: US$ 1,004,222/yr

	Ecosystem services covered	Values per area (i.e. per hectare) monetary unit used (year)
	Opportunities for tourism/recreation Maintenance of life cycles of migratory species Research and education	*Coastal Wetlands: **Opportunities for tourism/recreation:** US$ 8.84/ha/yr **Research and education:** US$ 4.61/ha/yr **Maintenance of life cycles of migratory species:** US$ 1.80/ha/yr
	Moderation of extreme events (floods) Water/Sewage treatment Opportunities for tourism/recreation	*Median wetland economic values worldwide: **Moderation of extreme events:** US$ 464/ha/yr **Water/Sewage treatment:** US$ 288/ha/yr **Opportunities for tourism/recreation:** US$ 492/ha/yr

	Ecosystem services covered	Values per area (i.e. per hectare) monetary unit used (year)
	Climate regulation	**Climate regulation:** *Sequestration: US$ 290/ha/yr *Avoided emissions: US$ 201/ha/yr
	Research and education	**Research and education:** US$ 32-111/ha/yr

Examples of values from the repository of EV studies - rivers

Authors/name of the study/year	Marine or freshwater ecosystems	Specific ecosystems covered	
Feeley / Bruen / Bullock/ Christie / Kelly / Remundou / Siwicka / Kelly-Quinn (2014): ECOSYSTEM SERVICES IN FRESHWATERS	Freshwater	Lakes Rivers	
Bateman / Day / Georgiou / Lake (2006): THE AGGREGATION OF ENVIRONMENTAL BENEFIT VALUES: WELFARE MEASURES, DISTANCE DECAY AND TOTAL WTP	Freshwater	Other inland wetlands Rivers	

Examples of values from the repository of EV studies - lakes

Authors/name of the study/year	Marine or freshwater ecosystems	Specific ecosystems covered	
Feeley / Bruen / Bullock / Christie / Kelly / Remundou / Siwicka / Kelly-Quinn (2014): ECOSYSTEM SERVICES IN FRESHWATERS	Freshwater	Lakes Rivers	
De la Hera / Fornes / Bernues (2011): ECOSYSTEM SERVICES OF INLAND WETLANDS FROM THE PERSPECTIVE OF THE EU NETWORK DIRECTIVE IMPLEMENTATION IN SPAIN	Freshwater	Lakes Other inland wetlands	

	Ecosystem services covered	Values per area (i.e. per hectare) monetary unit used (year)
	Water treatment Opportunities for tourism/recreation	**Total value of lakes and rivers:** US$ 1,779-13,488/ha/yr **Water treatment:** US$ 305-4,978/ha/yr **Opportunities for tourism/recreation:** US$ 305-2,733/ha/yr
	Aesthetic value	**Aesthetic value Norfolk Broads National Park preservation WTP:** £ 159.7 million/yr (£ 3,247-5,270/ha/yr)

	Ecosystem services covered	Values per area (i.e. per hectare) monetary unit used (year)
	Water treatment Opportunities for tourism/recreation	**Total value of lakes and rivers:** US$ 1,779-13,488/ha/yr **Water treatment:** US$ 305-4,978/ha/yr **Opportunities for tourism/recreation:** US$ 305-2,733/ha/yr
	Opportunities for tourism/recreation	**Opportunities for tourism/recreation:** € 80/person/yr for the recreational infrastructure that is actually used € 12.42/person/yr WTP for the use of the landscape Tablas de Daimiel National Park: € 5.67/visit

Examples of values from the repository of EV studies – other inland wetlands

Authors/name of the study/year	Marine or freshwater ecosystems	Specific ecosystems covered	
Millennium Ecosystem Assessment (2005): ECOSYSTEMS AND HUMAN WELL-BEING: WETLANDS	Marine Freshwater	Other inland wetlands	
Turpie / Smith / Emerton / Barnes (1999): ECONOMIC EVALUATION OF THE ZAMBEZI BASIN WETLANDS	Freshwater	Other inland wetlands	
IUCN (2003): WAZA LOGONE FLOODPLAIN CAMEROON: ECONOMIC BENEFITS OF WETLANDS RESTORATION	Freshwater	Other inland wetlands	
Emerton / Lyango / Luwum / Malinga (1998): THE PRESENT ECONOMIC VALUE OF NAKIVUBO URBAN WETLAND, UGANDA	Freshwater	Other inland wetlands	
Emerton / Kekulandala (2003): ASSESSMENT OF THE ECONOMIC VALUE OF MUTHURAJAWELA WETLAND	Freshwater	Other inland wetlands	
Gerrard (2004): INTEGRATING WETLAND ECSYSTEM VALUES INTO URBAN PLANNING: THE CASE STUDY OF THAT LUANG MARSH, VIENTIANE, LAO PDR	Freshwater	Other inland wetlands	

	Ecosystem services covered	Values per area (i.e. per hectare) monetary unit used (year)
	Moderation of extreme events	**Moderation of extreme events:** Thailand: US$ 1,000-36,000/ha (US$, 2005) Canada: (marshes) US$ 5,800/ha
	Moderation of extreme events Climate regulation Water/Sewage treatment	**Moderation of extreme events:** *Barotse floodplains: Flood attenuation value of wetland: US$ 1,350,000 (US$ 2.45/ha/event) (US$, 1999) *Lower Shire: Flood attenuation value of wetland: US$ 2.7 million (US$, 1999) (US$ 11.11/ha/yr) **Climate regulation:** US$ 1,300/ha (US$, 1990) **Water/Sewage treatment:** Two wetlands: US$ 15,208-58,982/ha/yr (US$, 1995)
	Moderation of extreme events	Incremental net benefit of floodplain re-inundation: € 871,500/yr (109 €/km^2)
	Water/Sewage treatment Nutrient cycling	**Water/Sewage treatment:** Costs of improving sewerage and sanitation facilities: USh 97.59 million/yr (Ugandan Shilling, 1991) or US$ 130,000/yr (US$ 24,575/km^2/yr) Investment and recurrent costs of sewage treatment plant: USh 1,500.29 million/yr (Ugandan Shilling, 1989) or US$ 6.72 million/yr (US$ 1.27 million/km^2/yr) Investment and recurrent costs of water treatment plant: USh 2,664.13 million/yr (Ugandan Shilling, 1989) or US$ 11.94 million/yr (US$ 2.26 million/km^2/yr) Costs of reticulating Nakivubo Channel outflow: USh 350.10 million/yr (Ugandan Shilling, 1998) or US$ 280,000 (US$ 52,930/km^2/yr)
	Maintenance of life cycles of migratory species Moderation of extreme events Climate regulation Opportunities for tourism/recreation Water/Sewage treatment	**Maintenance of life cycles of migratory species:** Rs 20 million or US$ 72/ha/yr **Moderation of extreme events:** US$ 1,758/ha/yr Flood attenuation: Rs 485.51 million/yr or US$ 17.66/ha/yr **Water/Sewage treatment:** Industrial sewage treatment: Rs 162.31 million/yr or US$ 5-16/ha/yr Domestic sewage treatment: Rs 4.32 million/yr or US$ 0.16/ha/yr **Opportunities for tourism/recreation:** Rs 5.28 million/yr or US$ 0.19/ha/yr **Climate regulation:** Rs 0.78 million/yr or US$ 87.06/yr
	Moderation of extreme events Water/Sewage treatment	**Moderation of extreme events (for the whole Vientiane area):** US$ 531,280 in 1989 US$ 18,566,305 in 2020 (US$, 2004) US$ 2,842,000/yr by 2020 **Water/Sewage treatment:** US$ 70,088/yr (for an area of 1,933 ha, value per ha: US$ 36/yr)

Emerton / Bos (2004): COUNTING ECOSYSTEMS AS AN ECONOMIC PART OF DEVELOPMENT INFRASTRUCTURE	Freshwater	Other inland wetlands
Schuyt / Brander (2004): THE ECONOMIC VALUES OF THE WORLD'S WETLANDS	Marine Freshwater	Wetlands
De la Hera / Fornés / Bernués (2011): ECOSYSTEM SERVICES OF INLAND WETLANDS FROM THE PERSPECTIVE OF THE EU WATER FRAMEWORK DIRECTIVE IMPLEMENTATION IN SPAIN	Freshwater	Other inland wetlands
Seyam / Hoekstra / Ngabirano/ Savenije (2001): THE VALUE OF FRESHWATER WETLANDS IN THE ZAMBEZI BASIN	Freshwater	Other inland wetlands
De la Hera / Fornes / Bernues (2011): ECOSYSTEM SERVICES OF INLAND WETLANDS FROM THE PERSPECTIVE OF THE EU NETWORK DIRECTIVE IMPLEMENTATION IN SPAIN	Freshwater	Lakes Other inland wetlands
Chen Z.M. / Chen G.Q. / Chen B. /Zhou J.B. / Yang / Zhou Y. (2007): NET ECOSYSTEM SERVICES VALUE OF WETLAND: ENVIRONMENTAL ECONOMIC ACCOUNT	Freshwater	Other inland wetlands

Moderation of extreme events Erosion prevention	**Moderation of extreme events:** Thailand: US$ 3,000/ha/yr South of Vietnam: US$ 50/ha/yr **Erosion prevention:** US$ 600/household/yr
Moderation of extreme events (floods) Water/Sewage treatment Opportunities for tourism/recreation	Median wetland economic values worldwide: **Moderation of extreme events:** US$ 464/ha/yr **Water/Sewage treatment:** US$ 288/ha/yr **Opportunities for tourism/recreation:** US$ 492/ha/yr
Opportunities for tourism/recreation	**Opportunities for tourism/recreation:** € 228.1-279.3/ha/yr
Opportunities for tourism/recreation Non-use values (biodiversity)	**Opportunities for tourism/recreation** (protected areas of Kafueflats and Banguelu): US$ 0.66/ha/yr (US$, 1990) **Non-use values (Biodiversity):** US$ 65.6/ha/yr (US$, 1994)
Opportunities for tourism/recreation	**Opportunities for tourism/recreation:** € 80/person/yr for the recreational infrastructure that is actually used € 12.42/person/yr WTP for the use of the landscape Tablas de Daimiel National Park: € 5.67/visit
Sewage treatment Climate regulation Moderation of extreme events (floods) Non-use values (biodiversity)	**Sewage treatment:** *Beijing wetland: US$ 131,948/ha/yr *Mean wetland: US$ 4,902/ha/yr *Sanyang wetland: US$ 854/ha/yr **Climate regulation:** *Beijing wetland: US$ 238/ha/yr (GHG emissions) *Mean wetland: US$ 156/ha/yr *Sanyang wetland: US$ 48/ha/yr **Moderation of extreme events:** *Beijing wetland: US$ 249/ha/yr *Mean wetland: US$ 5,344/ha/yr *Sanyang wetland: US$ 278/ha/yr **Non-use values:** *Beijing wetland: US$ 35/ha/yr *Mean wetland: US$ 357/ha/yr *Sanyang wetland: US$ 128/ha/yr

II.Annex IV

ToR-Template for recruiting an Expert/Experts to conduct a Tier 1 Evaluation

This template is also provided as Word document at the URL: *http://iwlearn.net/learning/manuals/economic-valuation/accompanying-documents-and-training-materials*

[AGENCY´S/ORGANISATION´S NAME]

Terms of Reference for Consultant

Name:	[name of the consultant]		
Job Title:	Economic Valuation of the [LME/river basin] Ecosystem Services		
Division/Department:	[name of the supervising organisation´s department directly responsible]		
Programme/ Project Number:	[internal programme/project number]		
Division/Department:	[name of the supervising]		
Location:	[location of the work to be done: mainly home-based, or in the region]		
Expected start date of assignment:	XX/XX/XXXX	**Duration:**	XXX
Reports to:	[name and title of the direct supervisor]		

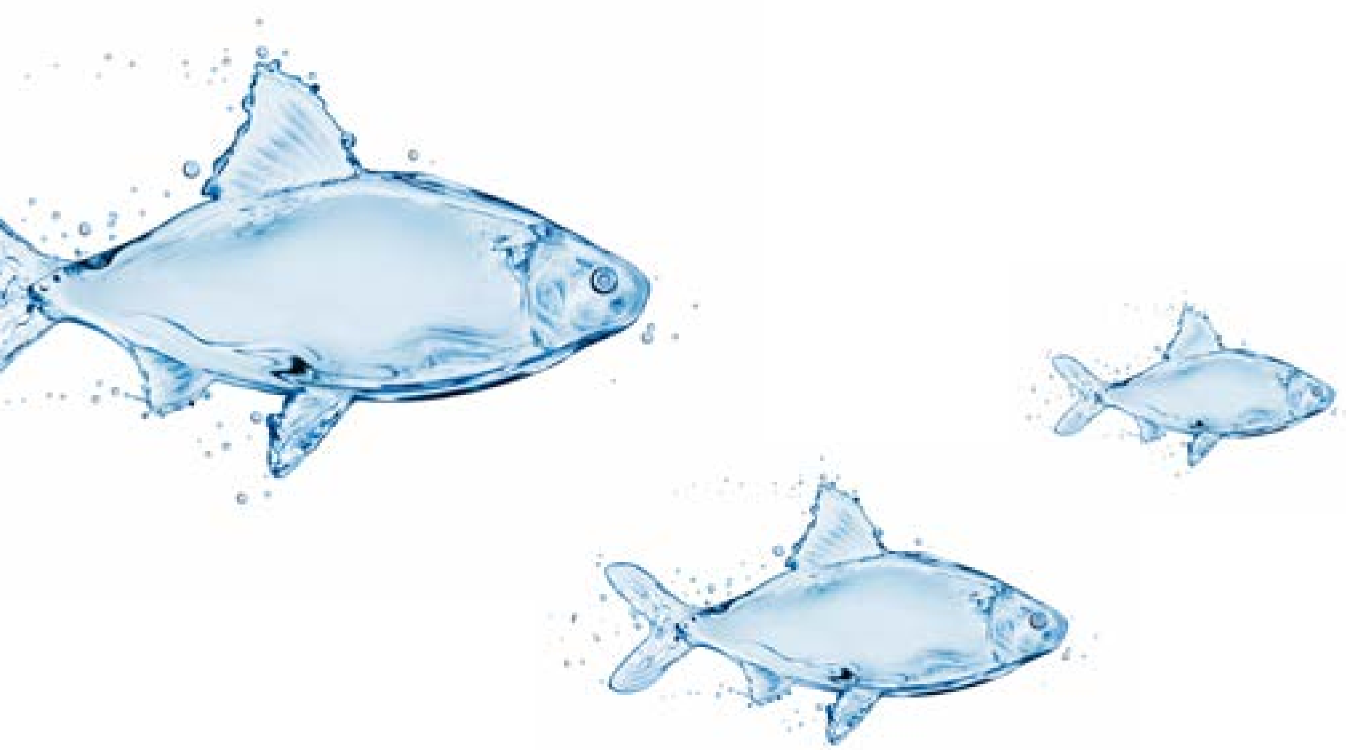
Under the general supervision of the [title of supervising agency], the guidance and direct supervision of the [name/title of the direct supervisor of the IW project] and in close cooperation with members of the [any other agencies/working groups taking part], the consultant is expected to prepare a report on approximating the Economic Value of the [name of the region/area] ecosystem goods and services. This approximation will use the methodology as described in the "Guidance to Tier 1 First Approximation to Economic Valuation", developed under the GEF International Waters: Learning Exchange And Resources Network - Subcomponent 4.1 Systematic consideration of the economic valuation of natural resources into the TDA/SAP process (to be found at: http://iwlearn.net/learning/manuals/economic-valuation).

Only minor adjustments to this methodology will be done if deemed necessary. Specific activities include [for example; to be adapted if necessary]:

1. Based on information available prepare an initial annotated outline report on ecosystem goods and services for discussion with [name of IW project/agency]. Available information will be made available by the [IW project/working groups].
2. Liaise with [national focal points/working groups/stakeholders] to obtain additional information. The [IW project manager/supervisor] will facilitate this liaison and support in case of delays the provision of information.
3. Compile relevant valuation information on the [region/area] and its ecosystem services using the above mentioned methodology.
4. Prepare an approximation of the Economic Value of the ecosystem goods and services of the [region/area], including a short chapter on the current versus potential values and the use of these values in support of decision-making.
5. Present the draft report to the [project manager/working groups/involved stakeholders] for discussion.
6. Finalise and submit the report taking into account the comments and recommendations of the [project manager/working groups/involved stakeholders].

All documents shall be prepared and submitted electronically in English using Word (A4 size paper, all margins 2.54 cm, Times New Roman 12 cpi font, inter-linea minimum 15pt). Original tables and figures should be submitted in Excel 2007 or successive versions.

Expected Outputs:	Required Completion Date:
1. Initial annotated outline of report for discussion with [project manager/working groups].	XX/XX/XXXX
2. An approximation of the Economic Value of the [region/area] ecosystem goods and services, including a short chapter on current versus potential values and the use of these values in support of decision-making.	XX/XX/XXXX
3. Present draft report to the [project manager/working groups/involved stakeholders] (duration of mission at least 3 days) and finalization based on feedback from the group.	XX/XX/XXXX
4. Provide final report.	XX/XX/XXXX



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METHODOLOGY FOR IN-DEPTH ASSESSMENTS OF ECOSYSTEM SERVICES

III.1 Introduction: Aim and Scope of an in-depth Economic Valuation

This is the second part of the GEF IW Guidance to Economic Valuation of Ecosystem Services. It presents an introduction to economic valuations in tier 2 IW projects (see introduction to the Guidance Documents for more details), a step-by-step guidance for conducting an economic valuation in an IW project area, an accompanying toolbox/fiches depicting various EV-methods and a proposal for a general outline of a tier 2 economic valuation report. In addition, a ToR-template for an economic expert to conduct such a valuation is included.

Depending on the specific situation and circumstances in the IW project area, a tier 2 economic valuation will be embedded in an individual "policy appraisal context", all of which could also form part of a TDA/SAP process[1], in which an economic valuation can play a crucial part (see chapter I.2.4 above). The most common policy appraisal contexts for tier 2 economic valuations are:

1. An in-depth analysis, assessing the overall value of all or some ecosystem services in the LME/river basin (can also be conducted as part of a TDA or as a follow-up to the screening based on the tier 1 methodology).

2. A "hotspot analysis", i.e. an in-depth analysis of very biodiversity rich and important ecosystems or areas (e.g. the Great Barrier Reef in Australia, or the Stoeng Treng Ramsar site, as in the example in box III.1 below).

3. An analysis of the impacts on ecosystems and ecosystem services of a planned, concrete project, i.e. an in-depth assessment of the values of ecosystem services in a specific area that will be impacted by the project - positively or negatively. Thus, while some development/infrastructure projects may lead to the deterioration of important ecosystem services, a conservation project such as division of a new Marine Protected Area (MPA) could result in maintained or improved provision of ecosystem services by the ecosystem in question. Consequently, such an analysis could have the objective of demonstrating the economic values at risk or the economic values that can be maintained/increased by the project to be analyzed, with the aim of influencing policy decisions. Such an analysis could also support the identification of options and alternatives in a TDA/SAP process.

[1] The TDA/SAP Manuals are under revision at the moment.

4. An economic valuation focusing on a single ecosystem type of special interest (e.g. mangroves in the Niger basin or urban wetlands) and the ecosystem services it provides (as in box III.3 below).

5. Similarly, an economic valuation can be dedicated to one specific ecosystem service of relevance (e.g. carbon sequestration or water, as in box III.2 below) in the project area of interest (e.g. river basin/LME).

6. In certain cases it may be of interest to consider an important singular pressure or an impact resulting from a pressure. Examples of pressure are e.g. climate change, high levels of nitrates in the water body, whereas sea level rise, increased flood risks and eutrophication could be the resulting impacts (as in box III.4 below).

7. An economic valuation of ecosystem services to determine the value or the price of ecosystem services provided for a market-based financing scheme to protect ecosystems/ecosystem services or to finance conservation measures, i.e. for developing payment schemes. Examples of such schemes include Payments for Ecosystem (or Watershed) Services (PES/PWS; see Box III.5 for an example), compensation schemes, water banks, and liability schemes.

It is important to mention that in certain cases, there may be overlaps between different policy appraisal contexts or the project in question may be embedded in more than one policy appraisal context. However, the guidance presented here can also be applied in these particular/specific cases.

Box III.1: Example of Policy Appraisal Context 2 – A "Hotspot" Ecosystem Valuation

For the 12,000 people living in the Stoeng Treng Ramsar site, the wetland is a critical source of food, fuel, medicines and building materials. It is the main source of water, and the river is the primary means of transportation. The deep pools and flooded forests provide dry-season refuges and spawning habitats for many important species of fish. The wetlands also play a key role in maintaining water quality and regulating floods. Chong (2005) carried out an economic valuation study of the site as part of the Mekong River Basin Wetland Biodiversity Conservation and Sustainable Use Programme (MWBP), a UNDP/GEF funded project which IUCN implemented in conjunction with the Mekong River Commission.

The study found that the Stoeng Treng wetland resources are essential to the livelihoods of the villages from Veun Sean. They are worth an average of approximately US$ 750 per capita per annum, with the assumption of 4 persons in each household surveyed. The absolute value of wetland resource use is high in a country with an estimated GDP of about US$ 300 per capita. Out of this total value, approximately 13% are accounted for by fisheries resources, and rest by other products and services that are mostly self-consumed by the households but nevertheless very critical in terms of maintaining livelihoods of the rural community. Quantitative estimates also reveal that in Veun Sean village, the fisheries resource is more valuable to poorer households than wealthier households — partly because larger household sizes of poor households mean that they consume more fish per household, and partly because a greater proportion of a poorer household's fish catch is sold for income. This is why conventional, price-based ecosystem valuation methods are almost impossible to apply. Factoring these values into management planning and practice also requires a much broader understanding of the role of wetlands in food security and health, their importance in coping with stresses and shocks, and the way in which they underpin livelihoods.

The results revealed that at-the-time proposed zoning plans, if enforced, would adversely affect the poorest members of communities within the Ramsar Site, including migrant settlers, the landless, and those depending on income and food security from fishing. A follow-up 2007 study through the IUCN-Darwin project (Allen et al. 2008) conducted an integrated assessment to evaluate the potential impacts of the proposed zoning on biodiversity, local economies but also livelihoods. Some of those conclusions were that, for example, Preah Sakhon should be a semi-restricted zone with access permitted during a specific fishing period as there would be minimal impacts to other biodiversity at that time of year.

Beyond this, a broad range of benefits can be generated by transboundary cooperation in the management of International Waters (all of which have an economic value). The identification and assessment of these benefits of transboundary water cooperation (both past benefits and potential future benefits) in the elaboration of a TDA can strengthen the basis for prioritization of environmental problems by providing a fuller picture of the links of water management to economic, social and environmental outcomes. It can also help to engage in the elaboration of the SAP relevant economic actors (such as ministries of agriculture, tourism or economic development) that are usually reluctant to engage in what they often perceive as a technical study for water and environmental experts. Chapter III.2.6 of this Guidance Document provides an overview on such benefits, assessment approaches and ways to communicate the benefits.

Box III.2: Example of Policy Appraisal Context 5 - A Valuation of a specific Ecosystem Service

The need for achieving efficient, equitable and sustainable use of water resources to meet water demands of different sectors is pressing, particularly in areas where water resources are scarce or dwindling. Along with this goes the quest for having a good understanding of the value of water in its different uses. Using a simplified model derived from the residual method, Kadigi et al. (2008) assessed the value of water in irrigated paddy and in hydropower generation in the Great Ruaha River Catchment (GRRC) in Tanzania. The residual method calculates the value of water as the remainder or net income after all other relevant costs are accounted for. Water resources in the Usangu area of the GRCC support local livelihoods through irrigation of about 40,000 ha of rice, grass production in the wetlands for livestock, and fishing in the rivers and wetlands. The Mtera and Kidatu hydropower plants have a total installed capacity of 284 MW (the largest in Tanzania), the system providing more than 50% of the 559 MW available in the national hydropower grid.

The model defines the average value of water as the ratio of the difference of net output values between the situation with water and the situation without water, and the volume of water used. This is to avoid underestimating the real value of the resource, the social value of which can be very high. Is it for example better to use water resources to generate electricity that may enable small entrepreneurs to start businesses and children to see to do their homework in the evening or to irrigate agriculture that will make a greater contribution to reducing rural poverty? Ideally, the value of water for both irrigated paddy and hydropower generation should account for the operating and capital costs of investments (irrigation systems, power plants and reservoirs) but data on the latter type of costs were not readily available. Demand for irrigation water, particularly for rice production, is greatest from October through July. For hydropower generation water is normally stored during the wet season (from December to May in the case of Mtera reservoir) while water for running the turbines is needed throughout the year. In monetary terms the value of water in irrigated paddy is estimated at 15.3 Tanzanian shilling (TSh)/m^3 (for water withdrawn) and 0.19 TSh/m^3 (for water consumed). The values of water for hydropower generation are relatively higher than for irrigated paddy, ranging from 59 to 226 TSh/m^3. Yet, irrigated paddy also supports livelihoods of about 30,000 agrarian families in the GRRC, with gross revenue of about TSh 15.9 million per annum. Also, GRCC paddy contributes about 14–24% of national rice production.

In summary, both irrigated agriculture and hydropower generation in the GRRC are important sectors of the Tanzanian economy. Rice produced in the Usangu area contributes a significant share of national paddy production. The backward and forward linkages in the agricultural supply chain increase the importance of GRRC rice in the national economy. The Mtera–Kidatu hydropower system also generates significant revenues and provides 59–65% of the total electricity production in Tanzania. Public officials must determine the optimal allocation of scarce water resources among these sectors, one of which generates notable pro-poor returns (in agriculture), and one of which generates notable economic returns (in the hydropower/industrial sector). This can be viewed as the challenge of achieving a balanced allocation of water resources between competing uses.

As stated in the chapter I.3 of the introduction to the Guidance Documents, an economic valuation of ecosystem services conducted according to this guidance specifically excludes several economic uses/activities:

- The extraction of mineral resources (sand, oil, gravel, etc.).
- Water for shipping.
- Hydropower plants not built according to the strategic recommendations of the World Commission on Dams (WCD) or the HSA Protocol.
- Irrigation water not provided on a sustainable basis.

The Guidance Document will guide the user through a step-by-step process that will enable her or him to independently conduct an economic valuation of ecosystem services using different EV approaches, such as e.g. contingent valuation or replacement cost method. As far as possible, each step is accompanied by an illustrative example.

Box III.3: Example of Policy Appraisal Context 4 - Economic Valuation of a specific Ecosystem

In 1997, Mahan and the U.S. Army Corps of Engineers performed a study to specifically value wetland amenity services in the Portland, Oregon metropolitan. Wetlands provide recreation and cultural values including scenic views, aesthetics, open-spaces, and leisure opportunities to surrounding residents. In an urban setting where wetland resources are extremely limited, wetlands have significant positive amenity effects compared to e.g. sub-urban or rural areas.

The study, like others highlighted in its literature review, used the hedonic property pricing method, the principal measure of interest being proximity value, i.e. the willingness to pay to live closer to a wetland of a given type. The study results indicate that wetlands positively influence the value of residential property and that the degree of influence varies by wetland type. The results also clearly show that wetlands influence property values differently than other amenity-generating features such as parks, lakes, rivers, and streams. Later studies conducted in non-urban settings, however, found that wetland amenity values also vary with the characteristics of study location. In a rural setting where wetland resources are ample and sufficient, wetland amenities have negative impacts on the sales price of nearby single family homes. The amenity value of wetlands therefore appears to depend at least as much on the characteristics of the area being considered as it does on the characteristics of the wetlands. For example, the larger size of the nearest wetland is associated with lower residential property values in a rural area.

It is also important to recognize that the hedonic approach only provides a limited measure of total benefits. While urban wetlands provide many other services to society, such as water quality improvements, biodiversity, groundwater recharge and discharge, and recreation, these are not valued unless perceived by residents and reflected in the wetland variables. Nor does the approach measure the benefits received by other people in the area such as renters and visitors. Further, because the benefits are partial and site specific, the approach does not readily address the issue of how a wetland project in Portland benefits society relative to a wetland project in some other location.

Farmers Training Day, Jamaica/Demo Project

III.2 Tier 2 in-depth Economic Valuation - Step-by-Step

As already explained above, tier 2 projects can be embedded in different policy appraisal contexts. However, regardless of the individual policy context, the steps needed to conduct the economic valuation will be in general the same. A step-by-step summary of the tier 2 methodology is presented in the flow diagram below:

A. Decide on the policy appraisal context (chapter III.2.1)

B. Spatial scoping (chapter III.2.2)

B1. Spatial scoping: setting the Boundaries	B2. Identification of ecosystems present within the spatial boundaries and selection of those to be analyzed/valuated	B3. Determining the size of the ecosystems to be valuated

RESULT 1
Selection of ecosystems present within the spatial boundaries and determination of their size

C. Temporal scoping (chapter III.2.3)

D. Identification and selection of ecosystem services to be valuated (chapter III.2.4)

D1. Exclude ecosystem services not present in the ecosystems	D2. Exclude ecosystem services only marginally present in the ecosystems	D3. Possibly exclude ecosystem services where monetary information is already available	D4. Possibly exclude ecosystem services where not enough information is available	D5. Possibly exclude/select remaining ecosystem services based on the policy appraisal context

RESULT 2
Final selection of ecosystem services to be valuated

E. Selection of methodologies for the valuation of the selected ecosystem services (chapter III.2.5 and Annex II)

Figure III.1: Flow Diagram for the In-depth Economic Valuation - Step-by-Step

III.2.1 Decide on Policy Appraisal Context

First of all, you should decide which policy appraisal context of the ones described in chapter III.1 above is best applicable to your individual project context. As explained in the general introduction part, the tier 2 Guidance Document provides guidance for IW managers how to carry out an EV in projects which can dedicate sufficient funds for an original valuation of ecosystem services. Possible policy appraisal contexts from chapter III.1 provide the basis for such a decision. In addition, you might want to consider the following:

- Clarify what the expectations are from the policy/relevant decision-makers.
- Find out what projects are planned/ongoing and relevant (e.g. due to their size and impacts) in your context.
- Find out what is the current environmental situation/status on site.
- In cases concerning a pressure/impact-related policy appraisal context (# 6), specify which one you want to consider (i.e. pressure or impact) and determine them concretely.

At the end of this step, you should be clear about what you actually want to consider: is it an overall estimation of several (or even all) ecosystem services present in the region/project area? Or do you specify the assessment, either on a spatial level (e.g. for a hotspot ecosystem), a topic-related level (e.g. for a concrete project), or on another level (e.g. by focusing on pressures or impacts, or specific ecosystems or ecosystem services)?

Box III.4: Example of Policy Appraisal Context 6 - Valuation of Pressures and Impacts

Sea level rise (SLR) and related erosion are some of the most serious long-term threats of global climate change with negative impacts to population, coastal ecosystems and economies. Simpson et al. (2010) provided an in-depth assessment for all CARICOM Member States of the risks from climate change and SLR.

Small island countries, countries with low-lying coastal areas and countries with areas prone to natural disasters are more exposed to the impacts of SLR and storm surge. Concerns include landslides, beach erosion, damage to agriculture, saltwater penetration into groundwater reservoirs, as well as disruption to industry and infrastructure. There was an urgent need, therefore, to identify the risks posed by climate change impacts in the Caribbean and the adaptation options to cope with different levels of climate change (climate change projections and scenarios). Using a broad range of models running under a large number of simulations, scientists are able to provide a quantitative basis for estimating likelihoods for many aspects of future climate change. The report focused on four aspects: a) climate change projections for the Caribbean region under +2.0°C and +2.5°C global warming scenarios, b) the implications of ice sheet melt for global sea level rise (SLR); c) the projections and implications of SLR for the Caribbean region under 1 and 2 meter scenarios; and d) using an actuarial approach, the quantification and magnitude of the losses and damages resulting from sea level rise and related coastal erosion. This comprehensive report combines detailed geospatial data on land use and physical coastal characteristics with an assessment of the economic implications of climate change for the region.

The results of the study indicate the magnitude of the threats imposed by climate change; people would be displaced from their homes, agricultural lands be lost, and tourism severely affected among others. The costs of damages resulting from unprotected coastlines and the costs of protecting high-value urban coastlines and strategic infrastructure will have a major impact on both communities and national economies.

Of course, it is possible that the policy appraisal context is determined from the very beginning, i.e. that the economic valuation is motivated by a certain policy context, for example in the frame of a TDA/SAP. In these cases, this step is less important - nevertheless, it helps to write down the guiding question and the policy context, in order to always be clear about the overall objectives of the analysis.

Practical Recommendation

In the following steps, you will be constantly reminded of where it would be possible to involve stakeholders - this will be determined by the policy context and the overall strategy chosen.

During meetings for planning, brainstorming or discussing about the economic valuation, always write the guiding question(s) and the policy appraisal context on a flipchart/board, to be clearly visible for all participants at all times.

It is of special importance to consider all the stakeholders concerned, and especially the ones who are often not consulted properly (local actors, communities, CSOs, etc.). The involvement of such stakeholder groups through a well implemented and monitored participation process is a very good opportunity to empower often underrepresented groups.

Settaphan Rummanee/Shutterstock.com

III.2.2 Identification/Selection of Ecosystems present within the spatial Boundaries and Determination of their Size

After deciding on the relevant policy appraisal context as the aim/focus of the economic valuation, you will have to take the following three steps:

Step 1: Determine the spatial boundaries in which you will later conduct the EV.

Step 2: Identify ecosystems which exist within these spatial boundaries and select those to be analysed/evaluated.

Step 3: Determine the size of these selected ecosystems.

III.2.2.1 Spatial scoping: setting the Boundaries

Under Step 1, you have to determine the spatial boundaries of the area under scrutiny. This may seem logical and not necessary, and can well enough be the case, for example in Large Marine Ecosystems (LMEs), where it might be obvious that the boundaries of the study area are the same as the boundaries of the LME. In other cases, however, it can be more complex. It thus can make sense to first pre-screen the ecosystem boundaries in the project context, taking into account inter alia the following factors: Because of administrative or policy reasons, some parts of the project area might be excluded from the analysis despite being part of the ecosystem - e.g. in case a neighboring country is not part of the funding agreement etc. Vice versa, it can also be the case that relevant spatial scales better fit with more geographic boundaries, such as watersheds or mangrove forest areas that include parts of several political entities. In some river basins, for example, the question might arise whether to exclude urban areas, or areas under intensive agriculture, to avoid “watering down” the results of the whole exercise. Also, an IW manager might want to exclude small tributaries of major rivers, to reduce the complexity of the analysis. It further can be necessary to decide what size/characteristics an ecosystem must fulfill in order to be included in the analysis (e.g. when analyzing “mangroves in the Niger basin” in the context of flood protection you could decide to analyze all mangroves, or only those which e.g. have a minimum size of 1 km^2 and similar).

Box III.5: Example of Policy Appraisal Context 7 - An EV for PWS: Sustainable Water Management in the Catskill and Delaware Watersheds, USA

The Catskills and Delaware watersheds provide New York City's 9 million residents with 90% of their drinking water supply. The watersheds have a population of 77,000 and cover an area of 4,000 km^2. Historically, these watersheds have supplied high quality water, but in the 1980s concerns about pollution increased. In 1989, the US Environmental Protection Agency (EPA) initiated a requirement that all surface drinking water supplies had to be filtered. This could be waived if there were existing treatment processes or natural watershed services that provided safe water. In 1992, the City of New York decided to invest in protecting watersheds rather than new water filtration facilities, which would have cost US$ 6 to 8 billion to build and US$ 300 million annually to operate. The costs of investing in watersheds to maintain and restore natural filtration are much lower.

Diverse mechanisms for investment in the watersheds were used. The investment of US$ 1 to 1.5 billion over 10 years was financed by a 9% tax increase on New York City water bills. In comparison, a new filtration plant would have required a two-fold increase in water bills. Funds have been used to finance a US$ 60 million trust fund for environmentally sustainable projects in the Catskill watershed. The City has provided US$ 40 million in compensation to cover the additional costs of dairy farmers and foresters who adopted best management practices. Foresters who adopted improved forest management, such as low impact logging, received additional logging permits for new areas. Forest landowners with 20 ha of land or more that agree to commit to a 10-year forest management plan are entitled to an 80% reduction in local property tax. The City is also purchasing development rights for sensitive land near reservoirs, wetlands and rivers at market price. Farmers and forest landowners are able to enter into 10 to 15-year contracts with US Department of Agriculture to remove environmentally sensitive land from production.

In conclusion, this watershed protection programme was successful to the extent that NYC received two Filtration Avoidance Determination (FAD) from the US EPA for the period 1997-2017. It is also presented as a good example of inclusive bottom-up approach that built understanding and trust among stakeholders. Understanding the economic value of watershed services enables more informed decision-making on investment and development in watersheds based on payment schemes economically beneficial to stakeholders. But at the same time, for this development to be sustainable, it is necessary to go beyond the economic valuation work itself and ensure the following key steps:

- Link upstream land and water use and downstream benefits (identification of the watershed services, trade-offs going with the changes, location for the best intervention...)
- Use indicators to define baselines and track progress (definition of the indicators, good data for planning, negotiation and management of the payment scheme...)
- Understand the needs and capacities of stakeholders (identification of the stakeholders, socio-economic and scale analysis...)
- Build a case for investment in watershed management (value of watershed services, awareness raising processes...)
- Plan what needs to be done to develop a payment scheme (design, planning, negotiation, legal & institutional framework, public awareness building processes...) (Smith et al. 2006).

Drawing the spatial boundaries, hence, depends on the area under investigation, the policy appraisal context, and the specific aims and objectives you as an IW manager might have. The following guiding questions should help you to decide whether it is necessary to exclude or include certain areas from/in the analysis:

- Do you want to demonstrate the value of the natural and undisturbed ecosystems in your project area? If yes, urban/heavily used areas should be excluded.
- Are there significant urban agglomerations in the study area providing ecosystem services (e.g. recreation benefits of an urban park)? If yes, these areas should be included in the valuation, or treated separately.
- Are the other areas that are very strongly affected by human activities (such as intensive agriculture, military bases, etc.)? If yes, these areas should be excluded, or treated separately.
- How big are the relations between natural ecosystems and heavily impacted areas, i.e. is the size of strongly impacted regions significant? If yes, this fact should be communicated clearly, and the respective areas should be excluded or treated separately.

Practical Recommendation

In this step, it is fundamental to include stakeholders (especially the ones who are often not consulted properly and who rely heavily on ecosystem services) to ensure that all the ecosystem services are correctly included.

As a result of this exercise, you should be able to produce a map of the whole project area, clearly showing where the boundaries of the analyzed area are located, and which parts are possibly excluded from the economic valuation. Alternatively, a textual description detailing the decisions taken with regard to spatial boundaries will work equally well.

EXAMPLES of different policy appraisal contexts and the respective spatial boundaries:

- **For # 1 (in-depth analysis):** An IW manager of a transboundary freshwater ecosystem/river basin decides to limit the economic evaluation to the areas stretching 50m to the left and right of the river and its main tributaries, the major lakes and the delta region. He/she also decides to exclude the part of the river under the jurisdiction of a certain country, as the latter is not part of the funding agreement and hence not enough data is available to conduct the EV. He/she furthermore decides to exclude heavily used areas, to simplify the analysis.
- **For # 2 (hotspot analysis):** An IW manager decides to conduct an EV of a very biodiversity-rich area, e.g. Chupi Wetland in West Bengal, Eastern India (a "hotspot" ecosystem). Here the boundaries are quite easy to determine, based on the policy appraisal context and readily available information on the hotspot area in question.
- **For # 3 (concrete project analysis):** The government of a country considers an infrastructural development project as a result of which a big harbor would be built. This project would result in the deterioration or destruction of coastal ecosystems which are currently situated close to the proposed location. The IW manager would like to conduct the EV of these ecosystems, to demonstrate their importance for the local and national economy. Drawing the spatial boundaries in this case will involve several ecosystems, i.e. besides establishing the boundaries of the ecosystems in question, the manager needs to decide whether to include areas that lie in between these ecosystems (if they are scattered over a larger area), or if any "buffer strips" should be considered also etc.
- **For # 4 (economic valuation focusing on a single ecosystem type):** In this case, the IW manager decides to focus on a single ecosystem type – e.g. mangrove forests - in his/her project area and thus sets the spatial boundaries at the boundaries of the mangrove forests themselves.

▸ For # 5 (economic valuation focusing on a single ecosystem service): The IW manager wishes to evaluate only one ES, in this case e.g. the climate regulation/carbon sequestration service from different ecosystem types located in his/her project area. In this case, the boundaries will most likely coincide with the project area in question itself, i.e. the project manager can exclude the areas/ecosystem which do not provide significant carbon sequestration services. At the same time, he/she may decide to exclude agricultural areas (or treat them separately), due to the complex calculations involved in determining the emissions of agricultural landscapes.

▸ For # 6 (an assessment focusing on a pressure or impact): The IW manager wants to examine the impact of nutrient emissions into a lake and the economic effects of the resulting eutrophication. He/she decides to limit the economic valuation to the lake itself and the delta of the main river flowing into the lake, where the effects of eutrophication are particularly strong.

III.2.2.2 Identification of Ecosystems present within the spatial boundaries and selection of those to be analysed/valuated

In Step 2, you will have to identify which ecosystems are present within the spatial boundaries set above and select those which shall be evaluated later. Here, you will need to use Part 1 of the checklist presented in Annex I (best used in Word format, available under: *http://iwlearn.net/learning/manuals/economic-valuation/accompanying-documents-and-training-materials)* and the information below. This step plays an important role in various policy appraisal contexts (except those, where it is clear from the onset that the EV will focus on a single ecosystem).

Practical Recommendation

This step is very well suited for stakeholder participation.

The relevant ecosystems are grouped into freshwater and marine ecosystems, which is intended to serve as an additional assistance to the IW manager when identifying/selecting relevant ecosystems:

A. Freshwater ecosystems

The ecosystems/habitats in this category are selected according to the MAES typology (European Commission 2013; see also chapter I.2.1 in the introduction to the Guidance Documents), distinguishing between rivers and lakes. Beside the open water bodies themselves, closely linked riparian ecosystems are also considered (e.g. riparian wetlands and groundwater-dependent ecosystems, listed as "other inland wetlands") that can be partly vegetated.

Please note that only the ecosystems functionally linked to the river and/or its tributaries in terms of flows should be considered, e.g. forests or other significant ecosystems for water-related services like water storage also present in the watershed are excluded from this analysis (otherwise, basically all ecosystems would need to be analyzed). Groundwater bodies are included as part of groundwater-dependent ecosystems (i.e. wetlands).

B. Marine ecosystems

The ecosystems/habitats in the category "marine ecosystems" are selected according to the Millennium Ecosystem Assessment (MAE 2005) and Naber / Lange / Hatziolos (2008): open water marine ecosystems/habitats (deeper than 50 meters below sea level), coastal ecosystems/habitats and brackish/transitional waters (the area between 50 meters below mean sea level and 50 meters above the high tide level or extending landward to a distance 100 kilometers from shore: estuaries, marshes, salt ponds, and lagoons; mangroves; beaches/dunes; seagrass beds/meadows; coral reefs and atolls).

RESULT
At the end of Step 2, you will have a checklist/matrix which lists the ecosystems present in the area under investigation. However, please note that this checklist/matrix will not be ready, since it needs to be completed with the selection of ecosystem services to be analyzed (see chapter III.2.4 for this step).

III.2.2.3 Determining the size of the Ecosystems to be valuated

In this Step 3 you need to determine the size (area) of the ecosystems present in your area of investigation (which are selected in the checklist/matrix). You as the IW manager/expert working with the IW manager and his team of your project area are uniquely positioned to have access to the kind of information needed here. It should be easy to find it in e.g. TDA/SAP documents (if available), national statistical reports, scientific literature, environment reports. If there are data gaps, you should consider to consult scientists or local stakeholders (e.g. environmental NGOs). As each project is individual, we do not provide more concrete guidance on how to obtain the basic information. If there is no information available at all for an ecosystem type in your project area, you will probably have to exclude this ecosystem from the economic valuation, or use the best estimates available.

At this point, you also should decide on the most feasible unit of measurement, based on available information/data, be it hectares, square miles, acres etc. We recommend to use hectares, as it is the most widely used unit of measurement. As such, it allows better comparability of results. Of course all other spatial units of management can be easily transformed into hectares.

Also the decision has to be taken to either:

- Assume for simplicity that every hectare of a certain ecosystem equals all other hectares, hereby neglecting social and ecologic region-specific factors that would certainly influence the values of ecosystem services (see the introduction, chapter I.2.5 on uncertainties).
- Take the differences between each area/hectare into account by trying to exactly measure the ecosystem services provision of each different area/hectare.

The first option is more pragmatic, but less exact. The second option is more accurate and represents the real-life situation (that no hectare of ecosystem equals the other), but needs also much more information, which might not be available.

RESULT
At the end of Step 3, you should have information on the size of the ecosystems selected in Step 2, e.g. that your "other inland wetlands" in the area have a total size of 1,500 hectares.

FINAL RESULT of Steps 1-3
At the end of Step 3, the spatial boundaries for the forthcoming EV should be determined, ecosystems present within these spatial boundaries should be identified, those to be evaluated should be selected and their size should be determined.

Squid drying on racks, Thailand/Timana Photography – Julie McGowan – Marine Photobank

III.2.3 Temporal Scoping

Besides spatial issues and relevant decisions that need to be taken (see chapter above), temporal issues also play an important role in economic valuations. This is due to the fact that impacts on ecosystems and ecosystem services may extend well beyond a standard time period. Imagine lost mangroves: the services they provide are lost for many decades, or forever. Hence, even a minimal ecosystem service value would be much higher than any economic value that could be generated by any economic undertaking, which always will have a limited lifetime.

It is therefore important to take into account the temporal dimension of ecosystem services, values and benefits. This is normally done by "discounting", using an appropriate "discount rate", which converts all costs and benefits to "present values", so that they can be compared. Discounting is essentially the inverse of applying a normal interest rate, and gives values relatively less weight the further into the future they accrue - i.e. the same value is less worth in 20 years than today. It accounts for the fact that people generally prefer to enjoy benefits now and not later, and that any funds invested in a project could be used productively to generate returns or profits elsewhere.

But choosing the "right" discount rate is a very difficult undertaking, and can strongly influence the overall outcomes of any economic valuations: a high discount rate (say 2 or 3%) gives much less weight to future values, while a low rate (zero or even negative values) may overestimate the future value, or at least make the study vulnerable to critique (for helpful information on discount rates see UNEP 2014, pages 56 to 59).

Box III.6: Temporal Scoping and Discount Rates - Example from El Salvador

Gammage (1997) carried out a study in the Gulf of Fonseca, El Salvador, with the twofold objective to capture and assign monetary values to as many of the production and environmental benefits of the mangrove ecosystem in this coastal region of El Tamarindo as possible, and to use these values to set up the framework for the comparison of different uses of the mangrove ecosystem. Approximately 112,000 Salvadoran families depend directly on the 26,772 hectares of mangroves and brackish forests for their livelihoods. The mangroves also secure the breeding grounds for industrial and artisanal shrimp production, an activity which contributes about 3.8% to export revenues annually.

This study explored the total economic value of the mangroves under three distinct management strategies: a) the do-nothing strategy, summarised by the current path of deforestation, land clearance and degradation: The mangroves that are cleared to make way for shrimp ponds are sold for timber and fuelwood. At the 1974-1989 rate, the mangrove forest in El Tamarindo would disappear in 26 years; b) partial conversion to semi-intensive shrimp farming and salt production: In the wild, the shrimp larvae develop in the estuary and move towards its mouth during their maturation, seeking different temperatures and levels of salinity and turbidity. The shrimp ponds, which operate as salt flats during the dry season, are created to mimic these complex conditions; and c) the sustainable management option where only mature trees would be felled. This scenario, that implies a non-depleting mangrove stock including through compensating reforestation, was developed in close consultation with an organisation comprising local fishermen and other community members, and incorporates their vision of a viable and equitable management strategy. Under this regime, the community participates actively in the control and allocation of access rights to forest resources.

Due to reasons specific to the study area and mangrove growth rates, a time horizon of 56 years was chosen. This valuation exercise yielded the result that the sustainable management strategy enables more timber and fisheries benefits to be captured over the chosen time horizon than do the other management options. It is particularly interesting that the greatest portion of value derives from industrial shrimping in the open sea. In all cases industrial shrimping generates greater benefits under sustainable mangrove management than under the other two management scenarios. The discount rate was chosen to be 7.08% – a figure given by the real return on long term government bonds. If the horizon over which these benefits are enumerated were longer, e.g. 100 years instead of 56, the benefits from the sustainable management option would far exceed those from the other proposed management strategies.

Luckily, in a "usual" tier 2 EV, no discount rates have to be applied, as the results are depicted in values per annum, i.e. as a fixed, present day determination of the value. Only when results are projected into the future, or if compared to the overall economic benefits of an infrastructure/economic project (e.g. a hydropower dam) - like in a #3 policy appraisal context - are a discount rate and future values needed.

Practical Recommendation

This step is very well suited for stakeholder participation.

In these cases, the main actions for an IW manager to take can be:

- Correct determination of the time scale of the economic valuation based on the concrete policy appraisal context and project-related factors (which will most likely be the lifetime of the project in a #3 policy appraisal context). Here, the IW manager has to make some assumptions on the period of the valuation (number of years), e.g. based on the project duration, life-time values of an asset and so on.

- Setting an "appropriate" discount rate, which reflects how we value the future. Here, it should be considered, that (1) the choice of discount rate can make a very significant difference in terms of the final outcomes of economic valuation and (2) there is no easy answer to the question about choosing the "right" discount rate. Rather, choosing the discount rate is complex undertaking depending on a variety of factors such as:
  - ethical considerations;
  - fundamental differences between different types of discount rate (e.g. individual at-a-point-in-time discount rate vs. the social discount rate; intergenerational discounting, lateral discounting based on different living standards[2] etc.

- Hence, it will be assumed here that it is possible and also necessary to use a variety of discount rates, including zero and negative rates, depending on the time period involved, the degree of uncertainty, the scope of project or policy being evaluated, the nature of the asset and so on. Which discount rates are being used has to be clearly and transparently communicated.

RESULT

As a result of this step, you have to be clear about the temporal scope of the EV. You should know whether this is a topic for your policy appraisal context or general objective, or not. If it is a topic, you should have chosen a range of discount rates to be applied (e.g. 0.1 and 2%).

Practical Recommendation

If you are not certain about the temporal scales at this stage, you can also just continue with the valuation, and clarify this at a later stage, e.g. after having obtained "values per annum" - applying the discount rate is in the end just a simple mathematical exercise.

[2] E.g. marginal utility for poor populations can be higher than for "normal" people in a "normal" context.

III.2.4 Identification and Selection of Ecosystem Services to be valuated

Under this step, you will first have to identify which ecosystem services are provided by your selected ecosystems[3]. Here again, you will need to use the checklist from Annex I (its Part 2), where examples of applying the checklist are also presented. After this, the identified ecosystem services can be either prioritized or excluded from the analysis by going through the sub-steps 1-5 below. These steps consider further factors such as special interests, data situation etc. Not all of them will necessarily be relevant for your project, however it is recommended to briefly go through all in order to make sure that relevant questions have been asked and important aspects have been considered. After this, you can skip those steps which seem irrelevant.

Box III.7: Selecting Ecosystem Services in a "Hotspot" Context - St. Maarten´s Coral Reefs

In 2010, the St. Maarten Nature Foundation conducted an economic valuation study in order to put a monetary estimate on the coral reefs surrounding St. Maarten and establish Marine Protected Areas. The areas in focus are home to a range of habitats, from globally threatened coral reefs and seagrass beds to open water, to many types of reef fish, sea turtles, numerous species of shark, lobsters and the rare Queen Conch, and also a migratory stopover point for many marine mammals, including whales and dolphins.

Coral reefs are one of the island's most valuable resources. They provide a livelihood through diving tourism and fisheries, and provide protection from large, damaging waves caused by hurricanes. Coral reefs also provide the sand, which makes St. Maarten's beaches famous in international tourism. However, there are numerous anthropogenic impacts that negatively affect coral reef ecosystems in the Caribbean. These range from overfishing to unrestrained coastal development, and sewage discharge into the marine ecosystems. Many of these activities occur because an individual or group seizes an immediate benefit, without considering the broader and longer-term consequences that these unsustainable practices may have on the communities, economy and ecosystem themselves. In order to properly manage the coral reef ecosystem of St. Maarten, an economic valuation was identified as a useful tool to determine what exactly the monetary value of a coral reef is. With an attached value, better management decisions can be made to adequately protect these precious resources. The study did not attempt to capture the total economic valuation of the coral reefs, but instead focused on two of the most important services, coral reef associated fisheries and coral reef associated tourism.

The study found that approximately 80% of all visitors to St. Maarten enjoy the goods and services provided by local coral reefs. In addition, the coral reefs inside a proposed marine park would contribute US$ 58 million per year to the local economy through tourism and fisheries. These findings helped convince the government to establish the Man of War Shoal Marine Park, the country's first national park.

The ecosystem services listed in the checklist are categorized according to the concept of the "Total Economic Value" (TEV), dividing ecosystem services into "use values" and "non-use values", and to the TEEB classification system, which distinguishes between provisioning, supporting, habitat and cultural services (of the latter, the four cultural services "aesthetic information/inspiration for culture, art and design/spiritual experience/information for cognitive development" were grouped into one single category, see the introduction to the Guidance Documents, chapter I.2.1).

[3] Please note however that this step is not relevant for the policy appraisal context # 5, where the focus is on a single specific ES from the beginning on.

III.2.4.1 Sub-step 1: Exclude ES not present in the Ecosystem(s)

Under this step, you must exclude ES which are not provided by the selected ecosystems. Please use Checklist Part 2, sub-step 1 for this purpose (Annex I). After this, if you have marked certain ES in the checklist with "U = unclear", i.e. you are still uncertain about the presence of certain ES or their relevance in your project area, you can use the following considerations to take respective decisions.

III.2.4.2 Sub-step 2: Exclude ES only marginally present in the Ecosystem(s)

The rationale behind this decision is that even when certain ES are provided by an ecosystem, their meaning/importance may be so marginal (in general and also in the specific project context) that it is feasible to exclude them from the EV analysis. So, for example, it can be the case that the marine ecosystem in question provides the ES "food", however for this or other reason the amounts are negligible. In such cases, you may want to exclude the respective ES from your analysis.

III.2.4.3 Sub-step 3: Possibly exclude ES where monetary Information is already available

Further, you may also want to exclude ES from your EV exercise where you assume/ /conclude that sufficient information is already available on the economic value of the ES in question. This will be usually the case when valuation studies have already been carried out for this region/ecosystem and/or reliable benefit transfer exercise has been conducted. In this case, you should consider excluding the ecosystem service from the analysis, and instead use the results from the existing study.

Hekla/Shutterstock.com

III.2.4.4 Sub-step 4: Possibly exclude ES where not enough Information is available

Next, you should check whether there is sufficient data/information available about the remaining ecosystem services to allow an evaluation. If there is not sufficient/information, how easily can it be obtained/within what time frames and resources? For ES where the answer is negative and or the efforts disproportionally high, you should consider excluding the ecosystem service from the analysis (see Checklist Part 2).

III.2.4.5 Sub-step 5: Possibly exclude/ select remaining ES based on the Policy Appraisal Context or special Interests

Finally, there are cases where you will need to exclude/ include ES based on the policy appraisal context or any individual interests. So, for example, when you as an IW manager are interested in analyzing only one specific ES of carbon sequestration, this particular policy appraisal context is the decisive factor for you. In this case, you can skip some of the "steps" or "decisions" as they are not relevant. Similarly, you may want to directly or additionally select ES which are directly linked to the major problems identified by the TDAs, or whose use/overexploitation aggravates these problems.

RESULT
At the end of chapter III.2.4, you will have a filled checklist/matrix which lists the ecosystems present in the area under investigation, and the ecosystem services selected for the analysis.

EXAMPLE
A filled checklist/matrix could, for example, look like this:

Ecosystem Services/Ecosystem	Rivers	Other inland wetlands
Food	Y	Y
Genetic resources	N	N
Medicinal resources	N	N
Fiber, timber, fuel	N	N
Water (drinking, irrigation, cooling)	Y	N
Air quality regulation	N	Y
Climate regulation	N	Y
Moderation of extreme events	N	Y
Water treatment	N	Y
Erosion prevention	N	Y
Nutrient cycling and maintenance of soil fertility	Y	Y
Maintenance of life cycles of migratory species	Y	Y
Maintenance of genetic diversity	Y	Y
Opportunities for tourism/recreation	N	N
Aesthetic information, Inspiration, Spiritual experience, Education	Y	Y

This matrix shows which ecosystem services of which ecosystems will be further analyzed ("Y"), and which not ("N"). In this case, the ecosystem category "lakes" is completely excluded from the analysis. The following steps will focus on the selected ecosystem services only.

III.2.5 Selection of Methodologies for the Valuation of the selected Ecosystem Services

In this chapter, you will be asked to identify and decide on most appropriate methods to conduct your EV. In order to simplify this task and provide some first orientation, below a classification of different common EV-methods is included (see also figure III.2).

III.2.5.1 Classification of EV Methods

Methods of economic valuation can be broadly attributed to three groups: revealed preference methods, stated preference methods and cost-based approaches. In addition, there is a fourth group, which encompasses deliberative or participatory approaches used to elicit non-economic values:

- **Revealed Preference (RP) Methods** rely on data regarding individuals' preferences for a marketable good which includes environmental attributes. These techniques rely on actual markets. Included in this approach are: market prices, averting behaviour, hedonic pricing, travel cost method, and random utility modelling.
- **Stated Preference (SP) Methods** use carefully structured questionnaires to elicit individuals' preferences for a given change in a natural resource or environmental attribute. In principle, SP methods can be applied in a wide range of contexts and are the only methods that can estimate non-use values which can be a significant component of overall TEV for some natural resources. The main options in this approach are: contingent valuation and choice modelling.
- **Cost-based Approaches** to valuing environmental goods and services consider the costs that arise in relation to the provision of environmental goods and services, which may be directly observed from markets. Included under this heading are: opportunity cost, cost of alternatives, damage cost avoided and replacement costs. However, as these methods are based on costs, they do not strictly measure utility, that is, they are non-demand curve methods and need to be used with care.
- **Deliberative or Participatory Approaches** of the fourth group are so called "soft" methods and are usually used to explore how opinions are formed or preferences expressed in units other than money. They can be e.g. used to analyse aesthetic and cultural values of ecosystem services or as complementary techniques together with methods of the first three groups.

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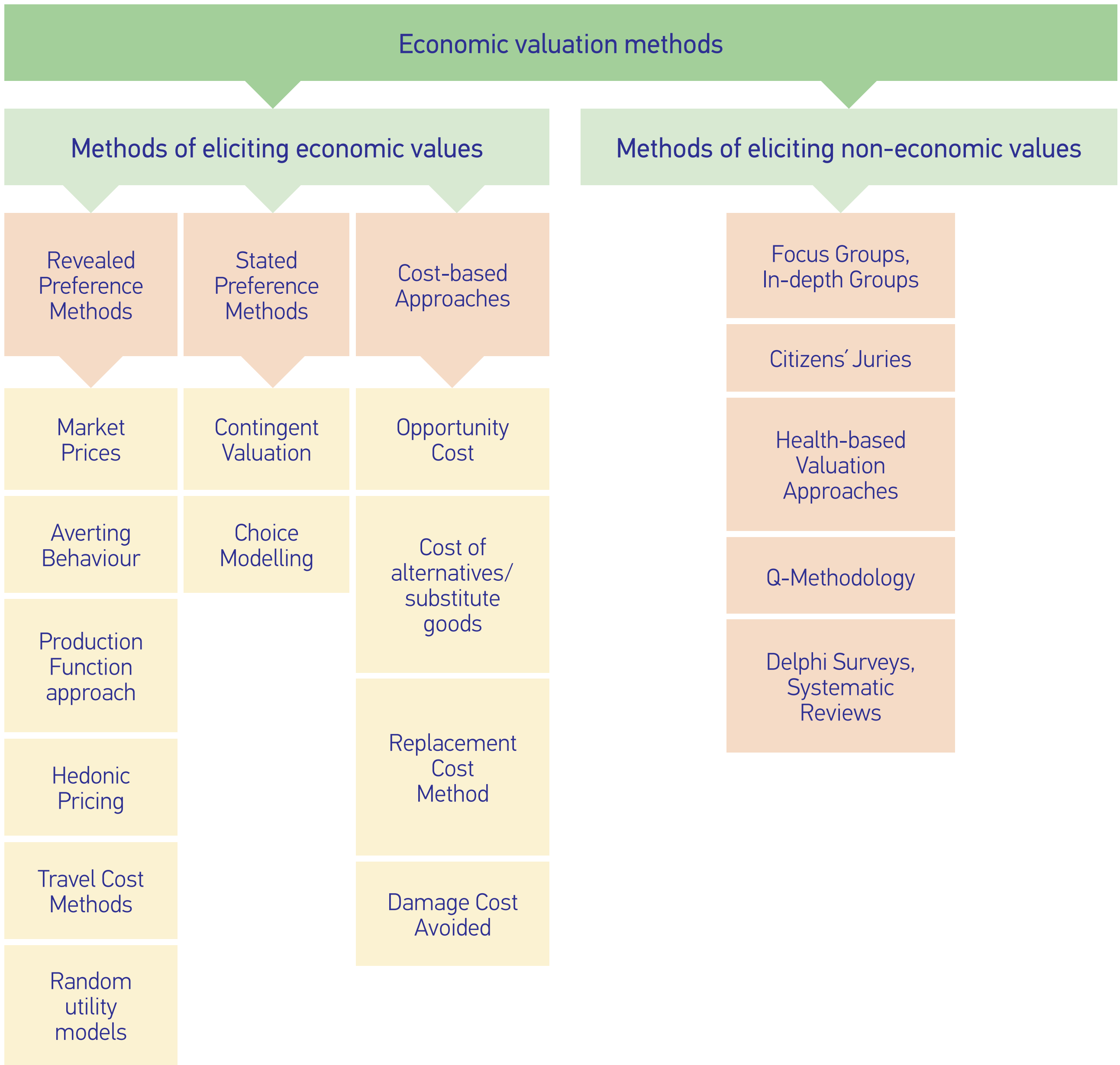

Figure III.2: Selection of suitable valuation methods based on the selected ES and the TEV category

III.2.5.2 Selection of suitable Valuation Methods based on the selected ES and the TEV Category

For identifying and deciding which EV methods to use in your EV exercise, the ecosystem services you selected in the previous chapters form an important basis, as different EV methods must be applied depending on the type of ecosystem services (e.g. whether they are "use values" or "non-use values"). For certain ecosystem services, only some valuation methods may be applicable. In addition, not all methods capture all elements of TEV and some valuation methods may be more suited to capturing the values of particular ecosystem services than others. For example, market prices are often used for valuing provisioning services, while stated preference studies are well suited to capturing non-use values (e.g. the existence value of a rare species).

The method selection can be done based on tables III.1 and III.2, which give a first orientation on which EV-methods are suited to evaluate different ecosystem services, while concrete guidance on application of individual methods is provided in methods' toolbox in Annex II. Please note that the tables III.1 and III.2 presented below follow the same categorization into freshwater ecosystems and marine ecosystems as used in chapter II.3.2 above:

Table III.1: Ecosystem services provided by marine and freshwater ecosystems and the methodology to be used for economic valuation

Type of Ecosystem Service (TEEB)	Ecosystem Service(s)	Category (TEV): (direct/indirect; use value / non-use value)	Methodology to be used for economic evaluation see fiches in Annex II)
Provisioning Services	Food: -Fish/Fisheries -Cultured products / Aquaculture	Direct use	Market Prices, Production Function Approach, Cost of alternatives/ substitute goods
	Other Food products		
	Genetic resources		
	Medicinal resources		
	Fiber, timber, fuel		
	Water (drinking, irrigation, cooling)		
Regulating Services	Air quality regulation (e.g. capturing dust)	Indirect use	Hedonic Pricing, Replacement Cost
	Climate regulation (carbon sequestration)		Damage Costs Avoided, Market Prices, Replacement Cost Method
	Moderation of extreme events (e.g. floods, storms)		Replacement Cost Method, Damage Cost Avoided
	Water treatment		Replacement Cost Method
	Erosion prevention		Replacement Cost Method, Damage Cost Avoided
	Nutrient cycling and maintenance of soil fertility		
Habitat Services	Maintenance of life cycles of migratory species (including nursery service for commercially valuable fish species)		Production Function Approach, Contingent Valuation

Habitat Services	Maintenance of genetic diversity (gene pool protection)	Indirect use	Production Function Approach, Contingent Valuation
Cultural Services	Opportunities for tourism/recreation	Direct use	Contingent Valuation, Travel Cost Method, Choice Modelling/ Experiments
	Aesthetic information, Inspiration, Spiritual experience, Education	Non-use	

III.2.5.3 Use and Combination of different EV Methods in a single Study/Valuation Process

In many policy appraisal valuation contexts, more than one EV method could and should to be employed (for example, the direct-use values of cultural services may be captured by revealed preference methods such as travel cost, while stated preference methods will capture the non-use values associated with cultural services). In other certain cases, it also could be advisable to use more than one EV method in the framework of your EV exercise, to make use of different strengths and take account of possible weaknesses of one or another method. In any case, it is up to you to decide whether to employ a single or several evaluation methods in your EV exercise. In the table below, the methods described in Annex II are listed with their specific advantages and limitations.

Table III.2: EV-methods, their advantages and disadvantages

Valuation method	Essence of the method	Benefits of the method	Limitations of the method
Revealed preference methods			
Market Price Method	Observes prices paid in markets and is used to estimate the value of mostly provisioning ES such as timber, fish and medicinal plants based on the prices they achieve in markets.	-Market data readily available and robust -Simple statistical analysis	-Limited to those ecosystem services for which a market exists -Danger of price distortion, e.g. by subsidies
Production Function Approach	Infers value by considering the changes in quality and/ or quantity of a marketed good that result from an ecosystem change (e.g. changes in fishermen's income resulting from improvements in coral reefs' health).	-Market data readily available and robust	-Data-intensive -Technically difficult -High scientific uncertainty regarding knowledge about ecosystems' functioning and biophysical relationships

Hedonic Pricing	Considers housing market and the extra amount paid for higher environmental quality.	-Based on market data, so relatively robust figures	-Very data-intensive and limited mainly to property-related services -Complex statistical analysis
Travel Cost Method	Estimates the value of an ecosystem based on time and money people spend getting to it.	-Based on actual/ observed behaviour -Relatively inexpensive	-Generally limited to recreational benefits -Technically rather difficult, complex statistical analysis required -High data requirements -Difficulties arise when trips are made to multiple destinations
Stated preference methods			
Contingent Valuation	Involves directly asking people how much they would be willing to pay to prevent loss of, or enhance an ecosystem service (e.g., willingness to pay to keep a local mangrove forest intact)	-Able to capture use and non-use values -Flexible	-Complex statistical analysis -Bias in responses, resource-intensive method -Hypothetical nature of the market; -Can be very expensive and time-consuming, because of the extensive pre-testing and survey work
Choice Modelling	Given a 'menu' of options with differing levels of ecosystem services and differing costs, which is preferred?	-Able to capture use and non-use values	-Very complex statistical analysis -Bias in responses, resource-intensive method -Hypothetical nature of the market -Analysis of the data generated is complex
Cost-based approaches			
Replacement Cost Method	Estimate cost of replacing ecosystem service with manmade equivalent.	-Simple statistical analysis	Often under-estimates value, as man-made equivalents generally don't provide same benefits as ecosystem
Damage Cost Avoided	Estimates damage avoided due to ecosystem service.	-Simple statistical analysis -Market data readily available and robust	-Difficult to relate damage levels to ecosystem quality

Methods of eliciting non-economic values			
Participatory Valuation	Asking members of a community to determine the importance of a non-marketed ES relative to goods or services that are marketed.	-Usually relatively low-cost to implement -Mostly do not require specific economic expertise or skills	-May be time consuming to carry out

Adapted from: Mumby et al. 2014, GiZ 2012, TEEB 2010, UNEP-WCMC 2011and DEFRA 2007.

RESULT

As a result of this step, you should be able to decide which EV method(s) you are going to use for your selected ecosystem services. After this, you can proceed to the method toolbox in Annex II to conduct your economic valuation.

III.2.6 Methodologies for determining and communicating Benefits of transboundary Water Cooperation and their Economic Value into Policy Processes for supporting the Development of TDA/SAP Processes

III.2.6.1 Introduction

The aim of this chapter is to offer to project managers and other experts and officials involved in International Waters an overview of methodologies that can be used to identify, assess and communicate the benefits of transboundary water cooperation.

This chapter complements the previous chapters in this Guidance to Tier 2 In-depth Economic Valuation. It broadens the scope of the guidance beyond economic valuation of water resources to illustrate how to identify the broad range of benefits that can be generated by cooperation in the management of International Waters (all of which have an economic value), provides an overview of how those different types of benefits can be assessed (indicating for which benefits the monetary valuation methodologies presented in previous chapters can be applied and for which ones other types of assessment would be needed), and highlights the importance of communicating the findings of benefit assessments (including but not restricted to monetary valuation).

Why is this relevant to TDA/SAP processes? A TDA has mostly been a technical exercise focused on identifying and analyzing environmental problems, while the SAP has been more of a political process (in the sense of different actors negotiating a common plan to solve those environmental problems) that builds on the findings of the TDA. The identification and assessment of the benefits of transboundary water cooperation (both past benefits and potential future benefits) in the elaboration of the TDA would strengthen the basis for prioritization of environmental problems by providing a fuller picture of the links of water management to economic, social and environmental outcomes. It would also help to engage in the elaboration of the SAP - besides the civil society as well as key stakeholders, of course - relevant economic actors (such as ministries of agriculture, tourism or economic development) that are usually reluctant to engage in what they often perceive as a technical study for water and environmental experts. The early engagement of those economic actors in the TDA/SAP process is often critical for the development of a successful SAP, since many of the actions in the SAP are likely to require policy reforms or investments in the sectors that they represent. The communication of the full range of the benefits that the implementation of the SAP will deliver, including those for which a monetary value cannot be calculated (such as peace and security benefits), would contribute to the approval of the SAP and its implementation.

This chapter builds primarily on the Policy Guidance on the Benefits of Transboundary Water Cooperation, developed by the United Nations Economic Commission for Europe in 2015 (UNECE 2015). It also builds on the experiences to apply the Policy Guidance carried out and on-going in the Okavango basin (shared by Angola, Namibia and Botswana), the Sio-Malaba-Malakisi basin (shared by Kenya and Uganda) and the Drina basin (shared by Montenegro, Bosnia-Herzegovina and Serbia).

III.2.6.2 Identifying the Benefits of transboundary Water Cooperation

Transboundary water cooperation can potentially generate many benefits, in terms of both development outcomes and process. There are at least two major "families" of benefits generated by transboundary water cooperation. The first "family" of benefits refers to development outcomes. Transboundary water cooperation allows the individual parties to improve the way they manage their water resources (for example by having better information). This will result in positive impacts in different economic sectors (for example in terms of agricultural productivity) as well as for the affected population (for example in terms of health impacts). A second "family" of benefits refers to the development process. For example, the demands of a transboundary water cooperation process in terms of information, analysis, establishment of cooperation mechanisms and stakeholder participation will have positive impacts for the domestic governance of water resources and it may have spill-over impacts to the broader domestic water governance agenda.

Transboundary water cooperation helps to pave the way for other forms of cooperation at all levels. There are a fair number of international conflicts revolving around transboundary water resources, in the same way that there are many domestic water conflicts. But in many settings, transboundary water management is actually an entry point to build trust between countries. Advances in transboundary water cooperation may facilitate advances in other policy areas – most notably regional economic interdependence as well as peace and security. More intense regional economic interdependence, for example through increased trade of goods and services or cross-border investments, would produce economic benefits for all countries involved. Advances in peace and security, although not easy to identify and measure, would also provide benefits to all countries involved – these may include from the avoided economic, social and environmental impacts of conflict to budget savings from lower military spending.

The UNECE Policy Guidance on the Benefits of Transboundary Water Cooperation offers a typology to help interested parties to identify the benefits of transboundary cooperation. Because transboundary water cooperation can generate many benefits and some of them are not very familiar to many audiences, a typology may be a useful tool to guide stakeholders in the identification of the benefits of transboundary water cooperation. Table III.3 presents the UNECE typology of benefits, building on previous work from Sadoff and Grey (2002). The typology highlights that there are two main avenues for the generation of benefits: improved water management and enhanced trust among cooperating parties. It also highlights that many of the benefits are relate to economic activities, but that there is also a range of benefits that go beyond the impact on economic activities. While this typology focuses on "outcome" benefits, transboundary water cooperation processes also generate important benefits in terms of improving domestic water governance at all levels.


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Table III.3: Typology of the potential benefits of transboundary basin cooperation (Source: UNECE 2015)

	On economic activities	Beyond economic activities
From improved management of basin resources	Economic benefits • Expanded activity and productivity in economic sectors (aquaculture, irrigated agriculture, mining, energy generation, industrial production, nature-based tourism) • Reduced cost of carrying out productive activities • Reduced economic impacts of water-related hazards (floods, droughts) • Increased value of property	Social and environmental benefits • Health impacts from improved water quality and reduced risk of water-related disasters. • Employment and reduced poverty impacts of the economic benefits • Improved access to services (such as electricity and water supply) • Improved satisfaction due to preservation of cultural resources or access to recreational opportunities. • Avoided/reduced habitat degradation and biodiversity loss
From enhanced trust	Regional economic cooperation benefits • Development of regional markets for goods, services and labour • Increase in cross-border investments • Development of transnational infrastructure networks	Peace and security benefits • Strengthening of international law • Increased geopolitical stability • New opportunities from increased trust • Reduced risk and avoided cost of conflict • Savings from reduced military spending

This typology is intended to support the identification of benefits and should not be seen as a straight-jacket. The list of examples is not exhaustive – some transboundary water cooperation processes may generate benefits that are not included above. At the same time, not all the transboundary water cooperation processes are expected to generate all the benefits listed. The individual benefits could be labelled, grouped and presented in different ways that may resonate better with the stakeholders in the basin. For example, Table III.4 presents the results of a rapid participatory exercise carried out in the Drina basin where there are references to the European Union that are not relevant to other basins. In the Sio-Malaba-Malakisi basin (see box III.8), stakeholders agreed that it was better to have two separate categories for social and environmental benefits to give more visibility to environmental benefits because they tend to be more easily forgotten.

Table III.4: Examples of benefits of transboundary water cooperation from the Drina basin (Source: UNECE's Nexus Assessment of the Drina Basin [forthcoming])

Economic benefits • Increase in electricity production (e.g. by raising awareness of opportunities) • Increase in agricultural production (e.g. by improving irrigation systems) • Reduced damage from floods and droughts (e.g. by better modelling of flood and drought risk, developing protective infrastructure and cooperating in flow regulation) • Development of the tourism sector	Social and environmental benefits • Reduced human costs of floods • Creation of jobs and reduced rural-urban migration (thanks to new economic opportunities) • Increased resilience of local communities to climate change (including through increased awareness) • Protection of water quality and ecosystems (including through improved wastewater treatment and solid waste disposal)
Regional economic integration benefits • Increased transboundary cooperation in all areas by making the Drina an item of connection and not division • Strengthened process of accession to the EU and better use of EU funds • Increased energy trade and integration, and energy security • Increased number of people employed thanks to cross-border economic activity	Geo-political benefits • Increased trust between countries from working together in flood protection • Facilitated compliance with international obligations to the EU targets (on renewables, water status,….) • Avoided conflicts and adoption of cheaper solutions, thanks to the development of connections between experts and officials and the sharing of information

Box III.8: Identifying the Benefits of transboundary Water Cooperation in the Sio-Malaba-Malakisi River Basin

The project "Strengthening transboundary water governance and cooperation in the IGAD region" (implemented by IUCN, UNECE, and IGAD and funded by the U.S State Department) was launched in December 2016 and includes a demonstration basin component that is supporting the development of transboundary water cooperation in the Sio-Malaba-Malakisi (SMM) river basin. The SMM is a sub-basin of the Nile river basin with an extension of about 5,200 km^2 and a population of about 4 million. The SMM basin includes part of Mt. Elgon national park (Uganda and Kenya) as well as forests, rivers and lakes that are home to a rich variety of fauna and flora. The basin is water-rich but poverty-stricken, 85% of the population relies on subsistence agriculture, and a combination of rapid demographic growth and poor agricultural practices is resulting in the degradation of land and water resources.

As part of the SMM demonstration basin component, the project produced in May 2017 a discussion paper that scopes the benefits of transboundary water cooperation in the SMM based on a literature review. The literature review showed that many past projects ideas did not identify benefits; that those that did would often include economic benefits but only to a lesser extent social and environmental benefits; and that overall there was a gap in terms of identifying beneficiaries, past benefits, or the cumulative regional economic cooperation and peace and security benefits of stronger cooperation. The findings of the discussion paper were presented at the first SMM stakeholders workshop in July 2017, which within a broad agenda included interactive sessions focused on identifying the benefits of transboundary cooperation in the SMM basin, both at basin level and at the level of the project for a handful of project ideas suggested and prioritised by the workshop participants. At the workshop the stakeholders quickly picked up the concept of the different types of benefits and were able to identify a range of them for the specific project ideas discussed. Additional work will be carried out in 2018 to characterize specific interventions, prioritize them based on a qualitative assessment of the expected benefits and their distribution across stakeholder groups, and define a roadmap for the development of a basin investment plan.

The SMM experience shows that significant work on identifying benefits can be done at a relatively modest cost by picky-backing on other activities that would typically be carried out anyway as part of a TDA/SAP process.

III.2.6.3 Assessing the Benefits of transboundary Water Cooperation

It is rarely possible, desirable, or necessary to provide a monetary value of all the benefits of transboundary water cooperation. The assessment of the benefits may include qualitative assessments, physical quantification, and monetary valuation (through market and non-market techniques). Despite progress made in recent decades in economic science, it is still difficult or impossible to value some of the potential beneficial impacts of transboundary water cooperation. There may be cases where monetary valuation of certain impacts would create controversies among stakeholders that undermine the process of transboundary water cooperation rather than support its progress.

The benefits of transboundary water cooperation are of very different nature and thus the assessment approaches will necessarily be different. For most of them it will be possible to at least undertake a qualitative assessment, possibly through a combination of expert and participatory assessments. For some of them, it will be possible to provide a quantitative assessment. And only for a reduced number of benefits it will be possible to provide a monetary valuation.

Assessing economic benefits

There is more scope to quantify and attach monetary values to economic benefits than to other benefits of transboundary water cooperation. However, that does not mean that it is an easy task. The benefits of TWC cooperation that results in infrastructure solutions can generally be quantitatively assess and monetarily valued. There is indeed a large literature providing technical guidance on how to assess the economic benefits of water projects. At the same time, the economic benefits of many "soft" solutions are often difficult or impossible to quantify. Table III.5 identifies assessment options. Box III.9 provides an example of monetary valuation of benefits that could be generated in the Drina basin.

Table III.5: Assessing economic benefits: options and methodological approaches

Sub-type of benefits	Assessment options	Comments on methodological approaches
Expanded activity and productivity in economic sectors (aquaculture, irrigated agriculture, mining, energy generation, industrial production, nature-based tourism)	Quantification and monetary valuation generally possible	These economic benefits are relatively straightforward to value by applying market prices to the estimated changes in production. If prices are regulated or distorted, shadow prices will need to be estimated. The main challenge may be estimating the changes in production. In most countries there will be economists familiar with the appropriate techniques.
Reduced cost of carrying out productive activities		These economic benefits are relatively straightforward to value by applying the expected changes in prices of inputs to the amount of inputs, or calculating estimates of the costs of alternative options to procure the inputs.
Reduced economic impacts of water-related hazards (floods, droughts)		These economic benefits are relatively straightforward to value by applying the replacement cost of goods and assets lost. The impact on human lives is included in the category of social and environmental benefits.
Increased value of property	Quantification and monetary valuation sometimes possible	The valuation of these economic benefits requires non-market approaches. The hedonic pricing method in particular will be appropriate. But it requires data and expertise that may not be readily available.
Additional economic impacts on the national economy, beyond the concerned basin	Quantification and monetary valuation rarely possible	The valuation of these economic benefits will require complex and data-hungry methodologies (such as input-output analysis or general equilibrium analysis) that are not generally justified in BA exercises, except may be for major infrastructure developments.

Box III.9: Assessing the Benefits of transboundary Water Cooperation in the Drina Basin

At the request of the Sava river commission, UNECE carried out in 2016-2017 an assessment of the water-energy-food-environment nexus in the Drina river basin. An innovation with respect to previous transboundary nexus assessments carried out by UNECE was the inclusion of a benefit assessment as part of the nexus assessment. The Drina river basin is shared by Montenegro, Bosnia-Herzegovina and Serbia. The Drina river is the main tributary of the Sava river, which in turn is the main tributary of the Danube river. It covers over 20,300 km^2 and is home to nearly 1 million people, of which 60% live in rural areas. It is a water-rich river basin characterized by untouched landscapes and high levels of biodiversity and that is often described in terms of unexploited potential.

The benefit assessment included qualitative and quantitative assessments. The nexus assessment identified and was structured around three key themes: co-optimising flow regulation, promoting rural development, and protecting water quality. During the second multi-stakeholder workshop of the nexus assessment the participants discussed in one session the past benefits of cooperation in the Drina basin from the perspective of each country. They also discussed in a different session the number of possible actions that could be adopted in each key theme (which had been previously identified by the experts carrying out the nexus assessment) and rated their benefits in a four-point qualitative scale ranging from very high to low. In addition, a modelling exercise was carried by the experts working on the co-optimizing flow regulation topic to illustrate some trade-offs around hydropower development. It showed that cooperative operation of hydropower dams could deliver above 600 GWh of electricity over the 2017-2030 period. Setting aside 30% of the dam capacity for flood control would have a cost, through a change in the energy mix, of about 4% of the operational cost of the whole electricity system in the three countries. Increasing energy efficiency would reduce pressure on hydropower generation – possibly indicatively by as much as 4.1 TWh in the combined Drina basin in the 2017-2030 period – and would also deliver significant reductions in greenhouse gas emissions (from 38 Mt in 2017 to about 28 Mt in 2030). Overall system savings for the three countries would amount to US$ 136 million over the period.

The Drina experience shows that a combination of qualitative and quantitative assessment approaches can be carried out building on the thematic analyses that would typically be done as part of a TDA/SAP process, and that it can enrich a traditional transboundary diagnostic analysis and pave the way for a smoother transition between the TDA and SAP phases of the process.

Assessing social and environmental benefits

Generally, there is less scope to quantify and attach monetary values to social and environmental benefits than to economic benefits. However, monetary values will be more contested for social and environmental benefits, and thus it should be considered whether it adds value to the transboundary cooperation process before carrying it out. Table III.6 identifies assessment options.

Table III.6: Assessing social and environmental benefits: options and methodological approaches

Sub-type of benefits	Assessment options	Comments on methodological approaches
Health benefits (morbidity and mortality effects)	-Quantification generally possible -Monetary valuation sometimes possible	These benefits can sometimes be quantified, using dose-response function approaches. It may also be possible to provide a monetary value on the averted loss of human life and illnesses (using value of a statistical life approaches), but this is not recommended unless the countries involved already use those approaches to value public policies and investments.
Employment and anti-poverty benefits	-Quantification generally possible -Monetary valuation rarely possible	The number of jobs created and the number of people lifted out of poverty can in principle be quantified. An approach to provide a monetary value is to estimate the cost of alternative measures that would generate the same benefits.
Improved access to services (water supply, electricity)	-Quantification generally possible -Monetary valuation sometimes possible	The number of beneficiaries can generally be quantified. The health impacts are included under the health benefits sub-type. Monetary values can be attached to convenience and other benefits by valuing time savings and eliciting willingness-to-pay (through survey- based methods such as contingent valuation or conjoint analysis).
Improved satisfaction due to preservation of cultural resources or access to recreational opportunities	-Quantification and monetary valuation sometimes possible	The number of beneficiaries of recreational opportunities can generally be quantified. Monetary values can sometimes be attached through non-market valuation methods (such as the travel cost method or contingent valuation). While in theory some of those non-market valuation methods can be used to elicit monetary values for the preservation of cultural resources, this can be contested and is thus not recommended.
Environmental benefits (avoided habitat degradation and biodiversity loss)		The total economic value (TEV) framework distinguishes use and non-use values of environmental preservation. Use values (such as flood control or recreational opportunities) are captured under other sub-types of benefits. Non-use values can be elicited through some non-market valuation methodologies, such as contingent valuation. Those monetary values, however, are sometimes contested by some stakeholders.

Assessing regional economic cooperation benefits

Assessing the regional economic cooperation benefits generated by transboundary cooperation will generally rely on qualitative assessments. This is largely due to the difficulty in attributing changes in trade or investments between countries to transboundary water cooperation. However, it will be possible to quantify some benefits – for example, the expansion of regional energy infrastructure networks facilitated by hydropower developments in transboundary basins.

The assessment of regional economic cooperation benefits should look at interdependencies in economic sectors, as well as opportunities to develop a regional water investment plan and mobilise investments for other types of regional infrastructure. Other considerations to be taken into account when approaching the assessment of regional economic cooperation benefits include the trend towards sub-basin agreements, the fact that these types of benefits will not be equally important in all basins, the framing of the outcomes of cooperation (moving away from water allocation, which is perceived as a zero sum game), and the opportunities to carry out these assessment as part of a nexus assessment.

Assessing peace and security benefits

The context for assessing peace and security benefits of transboundary water cooperation is evolving rapidly. While peace and security motivations for transboundary water cooperation still rank low in many basins, there is increasing awareness and interest among the foreign policy community about the opportunities and risks for peace and security generated by the management of transboundary waters. In many cases sovereignty concerns remain an obstacle to the promotion of transboundary water cooperation.

Efforts to try to provide monetary valuations or even quantification should generally be avoided and analytical resources focused on other types of benefits. Assessing peace and security benefits should rather focus on qualitative measures – for example, it may be possible to develop a "traffic-lights" indicator framework that identifies basin "stability" to suggest the potential for peace and security benefits. The assessment should highlight the cross-links to other policy benefits – both domestic and foreign policy objectives.

An option to carry out a qualitative assessment of peace and security benefits is to adopt a two-step approach. The first step would consist on gathering a factual information base focusing on physical variables of water resources and their impacts on economic sectors and other policy objectives. If an integrated assessment is being carried out, this step should not take much effort as it can make use of the results of the assessment of economic, social and environmental benefits. The second step would consist on organising an "expert group assessment" to assess the peace and security benefits, using the factual information base as a starting point. This "expert group assessment" can take two alternative forms: an open forum or a closed doors meeting. In any case, the involvement of respected think tanks (that carry weight with relevant national policymakers) is highly advisable.

III.2.6.4 Communicating the Benefits of transboundary Water Cooperation

Communicating the benefits of cooperation in the management of basin resources is often forgotten. Technical experts (on water, energy, agriculture or environment) are usually aware of the benefits of cooperation in their area of expertise. However, once some basin technical-level cooperation is in place, further deepening cooperation often requires the involvement of policymakers. Transboundary cooperation in the management of basin resources has costs as well as benefits. As transboundary basin cooperation processes deepen and their costs become more visible, policymakers are increasingly eager to understand why their countries should engage in deeper cooperation. When asked to report on their achievements, national agencies and transboundary organizations (such as river basin organizations) have traditionally reported on "activities" and "outputs" of the process of transboundary cooperation. These often include meetings organized, analyses carried out, and agreements signed. These activities and outputs may lead to improvements in the quality of information available to manage the transboundary basin and to the identification of actions that will help realize the potential benefits of transboundary cooperation. But policymakers generally require information about "outcomes" to support their decisions.

Communication efforts are essential to ensure that the findings of a benefit assessment effectively support the process of transboundary water cooperation. Poorly planned or executed communication efforts are likely to be counter-productive and damage the process of transboundary water cooperation. In developing a communications approach, however simple, it will be necessary to understand how the results of the benefit assessment will be fed into the transboundary water cooperation process. This may need to start by identifying the opportunities to influence the transboundary water cooperation process through the types of information that can be generated by a benefit assessment, and by creating multi-level partnerships/cooperation at all levels.

A strategy for communicating the findings of a benefit assessment should be carefully included in any existing communications plan supporting transboundary water cooperation in the basin. This will include issues such as who are the target audiences, which content needs to be developed for those specific target audiences (key messages and required supporting information), who will deliver the messages, how will the messages be delivered (communication products), and when will the messages be delivered. Effective communication efforts will require financial resources - in some settings, they may be provided by international organisations and the donor community. Communication efforts should be conceived as part of a communications cycle, they should communicate the benefits of the overall programme of cooperation, and take into account that upstream and downstream countries may have different perspectives. River basin organizations could also play a key role in communication efforts.

Box III.10: Communicating the Benefits of transboundary Water Cooperation in the Okavango Basin

The Okavango river basin, shared by Angola, Namibia and Botswana, comprises approximately 700,000 km^2 and is home to nearly 1 million people. Waters flowing from the Angolan highlands cross arid lands in the three countries before ending into the Okavango inland delta in Botswana, whose exceptional natural values have merited Ramsar and UNESCO World Heritage site recognition. The basin remains in nearly pristine status, but it is under threat from increasing water demand.

In 1994, the governments of Angola, Botswana and Namibia established the Permanent Okavango River Basin Commission (OKACOM). After a period of infancy that lasted over a decade, OKACOM focused on the development of a TDA, National Action Plans (NAPs), and a SAP. After 20 years of having patiently supported the difficult process of transboundary water cooperation, OKACOM members and partners were rightly asking what benefits OKACOM had generated, and the issues of notification and benefit sharing were about to take a central place in OKACOM's agenda. As a response, the OKACOM Secretariat decided to carry out a benefit assessment exercise to help OKACOM members and partners to gain a better understanding of the benefits of transboundary water cooperation in the basin and pave the way for stronger cooperation. In 2015, the OKACOM Secretariat commissioned a discussion paper scoping of the benefits of transboundary water cooperation, which was effectively used to attract financial and technical support from the World Bank and the UK-funded Climate Resilience Infrastructure Development Facility (CRIDF) to develop a benefit assessment in 2016-2017. The benefit assessment included the organization of three national multi-stakeholder workshops in towns located within the basin, carrying out a number of interviews with key national stakeholders, and a basin workshop where the preliminary findings were discussed with the members of the Okavango Basin Steering Committee (OBSC), a high-level technical body advising the Commissioners.

The experience of the Okavango shows that a benefit assessment is a valuable tool to engage actors that are key in the implementation of a SAP. OKACOM had paid particular attention to communicating the results from the TDA, developing different communication products aimed at different audiences (policy briefs, a consolidated technical report, over 70 technical specialist reports, a comic book etc.) as part of a communications strategy, but it found difficult to attract economic actors (such as the tourism sector) to events that discussed the findings of the TDA, because those were perceived as technical events for water and environment experts.

The findings of a benefit assessment can be used for multiple purposes. They include raising awareness (from national decision-makers to the general public), for policy development (involving not just decision-makers at national level but also stakeholders at the basin level), and for negotiation and deal-making (which mainly involves national decision-makers both with the water sector and outside). Whatever the purpose, it is important to use the results to clarify basic concepts, illustrating the trade-offs of the with/without cooperation alternatives.

NOTE

Potentially, there are several intended audiences for the communication efforts of a benefit assessment. They mainly include national decision-makers in the foreign policy, public finance and economic policy communities; the national water community in each country; local basin stakeholders (municipalities, businesses and the local populations), and the general public. Each intended audience will require different types of information and the use of different communication mechanisms.


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The messages should be meaningful for the intended audiences. They should be simple and fact-based, focusing on topics that stakeholders can relate to. Depending on the stage of the cooperation process, the messages will be only forward-looking (leading to cooperation) or may be backward-looking as well (building on the results already achieved). Attention should be paid to the framing of the messages. For example, for some audiences it may be more compelling to communicate the "avoided losses and risks" and the "costs of inaction" than the "new gains". Messages should be aligned to the political context. They should aim to develop success stories.

Box III.11: Communicating the Benefits of transboundary Water Cooperation in the Drina Basin

During the first Drina Nexus Assessment workshop a participatory exercise identified national governments at the highest level (including the premier) as the main target audience of efforts to communicate the benefits of stronger cooperation in the Drina basin. Other stakeholder groups identified as needing to receive (and provide) information about the benefits of cooperation in the Drina basin include majors, the local populations, high-level officials from competent ministries and other national experts, the ministry of finance, and project financiers. There are already a number of communication mechanisms used in the basin to promote cooperation, such as the Drina Day, but experts and ministerial representatives at the second Drina Nexus Assessment workshop identified a number of additional opportunities, yet unexploited. Examples include (i) providing information of the results of cooperation projects in national websites, (ii) organizing presentations and discussion as part of the planning processes of the Danube and Sava Commissions, (iii) lobbying at the ICPDR Inter-Ministerial Meeting (supported by a Policy Brief), (iv) informing the GEF-funded Strategic Action Plan, and (v) stronger involvement of media.

The experience of the Drina river basin shows that communicating the benefits of transboundary water cooperation should go hand in hand with communicating other findings that would be generated by a TDA/SAP process.

Communication efforts should focus on moving from perception to facts. To that end, it is necessary to understand the audiences. Successful tactics include: relating the benefits of transboundary water cooperation to national priorities and programmes, packaging benefits, and paying attention to timing (e.g. upcoming elections).

There are multiple mechanisms that can be used to communicate with the different audiences. The selection of mechanisms will depend on the intended audience and the intended purpose. Table III.7 maps out some of the possible mechanisms to be used.

Table III.7: Examples of mechanisms to communicate the benefits of transboundary water cooperation

Target audience	Awareness-raising	Policy-development	Negotiation and deal-making
National decision-makers (ministries of foreign affairs, economic development and finance)	• Policy briefs	• Trusted persons and think-tanks • Analytical reports making the economic case	• Joint analytical reports • Independent panel of experts
National water community (ministries of environment or water, basin organisations, large water users/ beneficiaries such as energy and agriculture)	• Policy briefs • Joint multi-language website • Platforms of joint bodies • Study tours	• Joint-bodies' platforms • Process of preparation of basin plans • Study tours and workshops (tailored to stakeholders and themes)	• Joint analytical reports • Independent panel of experts
Local stakeholders and general public (local governments, local communities, local water users/ beneficiaries, academia, NGOs, CSOs)	• Articles and op-eds in mass media • Training of journalists and teachers • Joint multi-language websites • Basin day events • Videos/infographics	• Trusted grass-roots organisations	• Public consultation mechanisms

III.3 Summing up

Finally, after completing the scoping steps of chapter III.2, and applying the individual methodologies to the selected ecosystem services, you are about to finalize the economic valuation you initially planned.

The last task remaining is now to sum up the results, calculate the total value (per year), and choose a form of presenting the results. Of course, these results vary considerably on a case- by-case basis, depending on the policy appraisal context and other factors, so in the end it will be up to you to decide on the best communication and dissemination strategy.

For the final report on your economic valuation, you should also write a very clear and concise presentation of the overall aims and objectives of the EV - what was it that you set out to demonstrate? Also, in the report, be very clear about the methodologies used, and the uncertainties involved and assumptions that you had to take to be able to valuate eco system services properly. Such clarity and transparency will increase the overall credibility of your economic valuation, both for the general public as well as for policy and decision makers.

But first, you should summarize the results in a way that can be easily presented to "the outside world",

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so that everybody can easily understand what has been valuated, why, and what the results have been. In this Guidance, a factsheet format is proposed for the summary, containing text fields for short and important information on the valuation itself (e.g. the time, the place, the methodologies etc.), as well as an overview table for presenting and summing up the results.

This "factsheet" can be found in Annex V, and should be regarded as a suggestion: feel free to adapt it, use some elements in a completely different format, or simply ignore it and use another, more appropriate form. The factsheet is also included as a "summary document" in the proposed outline for the detailed description of the economic valuation that can be found in Annex III.

III.Annex I

Checklist for the Identification of Ecosystems and Ecosystem Services to be assessed

This checklist is relevant should be applied at two critical steps in the economic valuation. First, you will need to make use of it when identifying ecosystems present within the spatial boundaries and selecting those to be analysed/evaluated (sub-chapter III.2.2.2 above). Second, it will help you to identify which ecosystem services are provided by these ecosystems, and which of these might not be relevant (chapter III.2.4).

You start by taking a closer look at the pre-filled matrices below (table C1 for freshwater ecosystems, and table C2 for marine ecosystems): this matrices show the ecosystems that can be present in transboundary freshwater or marine ecosystems, and the ecosystem services that are usually provided by these ecosystems (according to the MAES typology (European Commission 2013) for freshwater, and to the Millennium Ecosystem Assessment (MAE 2005) and Naber / Lange / Hatziolos (2008) for marine ecosystems).

NOTE

The information necessary to fill the checklist should be easily available to you as the IW project manager. It should be easy to find it in e.g. TDA/SAP documents (if available), scientific literature, environment reports, or via local stakeholders and experts. As each project is individual, we do not provide more concrete guidance on how to obtain the basic information.
The Checklist is also provided as Word-Document (*http://iwlearn.net/learning/manuals/economic-valuation/accompanying-documents-and-training-materials*). We recommend to use the Word-version of the Checklist, to directly work in the matrices and tables below.

Checklist Part 1: Identification of ecosystems present within the spatial boundaries and selection of those to be analysed/evaluated (to be used with sub-chapter III.2.2.2)

Your task here is to eliminate all ecosystems, which are not present within the spatial boundaries set in sub-chapter III.2.2.1 from the respective table C1 or C2, by simply deleting/eliminating the whole column(s). For some reasons, also ecosystems present in the spatial boundaries can be eliminated, e.g. if the ecosystem in question is too small, only marginally present in your area or there is no/not enough information available on its functioning. Please note that only the ecosystems functionally linked to the river and/or its tributaries should be considered, e.g. forests or other significant ecosystems also present in the watershed are excluded from this analysis.

EXAMPLE

Under the appraisal context #3 the IW manager decides to evaluate the wetland ecosystem, which will be destroyed if the harbour development project in question is implemented. He/she also decides to include a delta of a major river present in the project area, which also will be affected through the project and is located in the project area. He/she however excludes lakes from the analysis, as no such are present within the determined spatial boundaries, by deleting the whole columns "lakes" in table C1:

Ecosystem Services/Ecosystem	Rivers	~~Lakes~~	Other inland wetlands
Food	Y	~~Y~~	Y

Checklist Part 2: Identification and selection of ecosystem services to be evaluated (to be used with chapter III.2.4)

This process can be divided in two sub-steps:

Sub-step 1: to be applied in all cases

In sub-step 1, you select the ecosystem services which are similarly not present or not relevant in the ecosystems left, and change the “Y” to a “N”. In case this is unclear, mark the respective cell with a “U”, and proceed to sub-step 2 below.

EXAMPLE

In the above example, tourism and recreation play no role in the river basin/wetland, as it is very remote. It also is not a source of timber/fuel. The IW manager therefore decides to exclude the rows “opportunities for tourism/recreation” and “fiber, timber, fuel” from the analysis, by changing the “Y” to a “N” in the respective cells.

Ecosystem Services/Ecosystem	Rivers	~~Lakes~~	Other inland wetlands
Food	Y	~~Y~~	Y
Genetic resources	Y	~~Y~~	Y
Medicinal resources	Y	~~Y~~	Y
Fiber, timber, fuel	N	~~N~~	~~Y~~N
Water (drinking, irrigation, cooling)	Y	~~Y~~	N
Air quality regulation	N	~~N~~	Y
Climate regulation	N	~~N~~	Y
Moderation of extreme events	N	~~N~~	Y
Water treatment	N	~~N~~	Y
Erosion prevention	N	~~N~~	Y
Nutrient cycling and maintenance of soil fertility	Y	~~Y~~	Y
Maintenance of life cycles of migratory species	Y	~~Y~~	Y
Maintenance of genetic diversity	Y	~~Y~~	Y
Opportunities for tourism/recreation	~~Y~~N	~~Y~~	~~Y~~N
Aesthetic information, Inspiration, Spiritual experience, Education	Y	~~Y~~	Y

Sub-step 2: only to be applied when uncertain about ecosystem services' presence/relevance

In this sub-step, which is reserved for ecosystem services where you are uncertain about their presence or relevance in the project area´s ecosystems, you should reflect about the following guiding questions to come to a conclusion about whether to include or exclude the respective ecosystem service:

• Is there another study evaluating this ecosystem service in your project area?
→ In case the answer is YES, you should consider excluding the ecosystem service from the analysis, and instead use the results from the existing study; if the answer is NO, answer the next question.
• Is there sufficient data/information about the ecosystem service to allow an evaluation (e.g. is there information on the size of the ecosystem providing the service, on the amount provided in case of food or non-food products)?
→ In case the answer is YES, you should consider including the ecosystem service; if the answer is NO, you should consider excluding the ecosystem service from the analysis.

As a result, you should fill the respective answer (Y/N) in the matrix C1 or C2.


AMP Sierra Leone

EXAMPLE

Again using the same example, the IW manager is uncertain whether the provision of medicinal and genetic resources in rivers and other inland wetlands is relevant for the economic valuation or not. After searching without positive results for other studies evaluating these (question 1 above), and not being able to find any information on whether medicinal and genetic resources are provided by her ecosystems (question 2 above), she decides to exclude these two provisioning services from the analysis, by changing the "Y" to a "N" in the respective cells.

Ecosystem Services/Ecosystem	Rivers	~~Lakes~~	Other inland wetlands
Food	Y	~~Y~~	Y
Genetic resources	~~Y~~N	~~Y~~	~~Y~~N
Medicinal resources	~~Y~~N	~~Y~~	~~Y~~N
Fiber, timber, fuel	N	~~N~~	~~Y~~N
Water (drinking, irrigation, cooling)	Y	~~Y~~	N
Air quality regulation	N	~~N~~	Y
Climate regulation	N	~~N~~	Y
Moderation of extreme events	N	~~N~~	Y
Water treatment	N	~~N~~	Y
Erosion prevention	N	~~N~~	Y
Nutrient cycling and maintenance of soil fertility	Y	~~Y~~	Y
Maintenance of life cycles of migratory species	Y	~~Y~~	Y
Maintenance of genetic diversity	Y	~~Y~~	Y
Opportunities for tourism/recreation	~~Y~~N	~~Y~~	~~Y~~N
Aesthetic information, Inspiration, Spiritual experience, Education	Y	~~Y~~	Y

After completing these steps, you have a filled matrix which shows which ecosystems and corresponding ecosystem services are to be included in your economic valuation.

The following main steps of the guidance will focus on these ecosystem services only.

What to do with the filled-in matrix?

After the matrix has been filled, the Checklist is used to keep track of the steps that follow the identification of ecosystems and ecosystem services to be assessed – the selection of methodologies for the evaluation of the selected ecosystem services and the evaluation itself, using the toolbox provided in Annex II.

MATRIX C1 - Freshwater Ecosystems

Ecosystem Services/Ecosystem	Rivers	Lakes	Other inland wetlands
Food	Y	Y	Y
Genetic resources	Y	Y	Y
Medicinal resources	Y	Y	Y
Fiber, timber, fuel	N	N	Y
Water (drinking, irrigation, cooling)	Y	Y	N
Air quality regulation	N	N	Y
Climate regulation	N	N	Y
Moderation of extreme events	N	N	Y
Water treatment	N	N	Y
Erosion prevention	N	N	Y
Nutrient cycling and maintenance of soil fertility	Y	Y	Y
Maintenance of life cycles of migratory species	Y	Y	Y
Maintenance of genetic diversity	Y	Y	Y
Opportunities for tourism/recreation	Y	Y	Y
Aesthetic information, Inspiration, Spiritual experience, Education	Y	Y	Y

Note: brackish/transitional waters are listed under marine ecosystems.

MATRIX C2 - Marine Ecosystems

Ecosystem Services/Ecosystem	Marine/ open sea	Estuaries/ marshes	Salt ponds/ lagoons	Mangroves	Beaches/ dunes	Seagrass beds/ meadows	Coral reefs/ atolls
Food	Y	Y	Y	Y	Y	Y	Y
Genetic resources	Y	Y	Y	Y	Y	Y	Y
Medicinal resources	Y	Y	Y	Y	Y	Y	Y
Fiber, timber, fuel	N	Y	Y	Y	N	N	N
Water (drinking, irrigation, cooling)	N	Y	Y	N	N	N	N
Climate regulation	Y	Y	N	Y	N	Y	Y
Moderation of extreme events	Y	Y	Y	Y	Y	Y	Y
Water treatment	Y	Y	Y	Y	N	Y	Y
Erosion prevention	N	Y	Y	Y	Y	Y	Y
Nutrient cycling and maintenance of soil fertility	Y	Y	Y	Y	N	Y	Y
Maintenance of life cycles of migratory species	Y	Y	Y	Y	Y	Y	Y
Maintenance of genetic diversity	Y	Y	Y	Y	Y	Y	Y
Opportunities for tourism/ recreation	Y	Y	Y	Y	Y	N	Y
Aesthetic information, Inspiration, Spiritual experience, Education	Y	Y	Y	Y	Y	Y	Y

Local fish catch, Sierra Leone/Sub Regional Fisheries Commission

TABLE OF CONTENTS


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The present toolbox on EV methodologies includes 9 methodology fiches, containing a description of each method according to a predefined structure. Each methodology is described on 3-5 pages, covering the same categories. The aim of the toolbox is to provide the user with concrete guidance on the application of the methods selected in chapter III.2.5 above. Some fiches are further complemented by a case study example, illustrating successful application of the method in question.

In more detail, each method fiche contains:

- A brief description of the essence and main characteristics of the method.
- An explanation of which ES the method is (best) applicable to (e.g. marketed provisioning services) and which element of TEV it can capture (e.g. only direct use value or also non-use values).
- An orientation to key contexts/cases in which this method is usually used in combination with its main advantages.
- Details on which steps and actions to take for carrying out an EV with to the described method, including also main outputs/results and a specification of data needs.
- A description of main challenges in application and intrinsic limitations to the method.
- An explanation whether it is feasible to use the method in question in combination with other EV methods and which conflicts and/or advantages may emerge.
- 3-5 main literature sources used in the methodology fiche. They can also be used as key references for further/more in-depth reading on the specific methods.

A. Revealed Preference Methods

As already explained in sub-chapter III.2.5.1 above, revealed preference methods use market based information to infer a non-marketed value.

Fiche 1 - Market Price Assessment

a) Introduction and brief description of the method

The market price method is based on the observation of market prices. It is used to estimate the value of mostly provisioning ES such as timber, fish and medicinal plants based on the prices they achieve in markets.

The method can be used to value changes in either the quantity or quality of a good or service. It applies standard economic techniques for measuring the economic benefits from marketed goods, based on the quantity people purchase at different prices, and the quantity supplied at different prices.

Please note, however, that even where market prices are available, they may need to be adjusted to take account of distortions such as subsidies, taxes, etc.

b) Which ecosystem services can be valued by the method?

The market price method is only suitable for the valuation of ES which are traded on markets and, therefore, have market prices. This implies that applications focus on provisioning ES such as timber, fish, medicinal plants, etc. If markets emerge for other ES (e.g. carbon sequestration) then the valuation of these ES should also become possible using this method (UNEP-WCMC 2011; ValuES).

c) Element of TEV captured

The method can capture direct and indirect use values, as long as the respective ecosystem services are traded on markets.

d) Main application/uses and advantages

Results of a market price valuation take the form of monetary estimates of the value of the ES chosen for assessment. These estimates of the value can be used in assessments or processes that rely on or use monetary estimates of environmental values. So, for example, the method can be used to show a component of the value of a Marine Protected Area (MPA) in terms of increased fish production.

The main advantages of the market price method are:

- Price, quantity and cost data are relatively easy to obtain for established markets.
- It uses observed data of actual consumer preferences.
- It uses standard, accepted economic techniques.
- It reflects an individual's WTP for costs and benefits of goods that are bought and sold in markets, such as fish, timber, or fuel wood. Thus, people's values are likely to be well-defined.

e) Step-by-step application/implementation

The market price of an ecosystem good or service can be estimated by the following steps:

Step 1: Collect the necessary data.

There are three main sub-steps involved in collecting the data required to use the market price method to value ecosystem goods and services:

- Find out the existing levels of supply of the resource or changes in its supply depending on the reason for valuation (i.e. will the supply levels drop or increase due to e.g. a planned infrastructure project).
- Collect data on its commonly achieved market price. E.g., if the value of a forest for timber is being assessed then you will need to establish the local market price for timber (in cubic meters, for example).
- Conduct interviews with local resource users in order to better understand and be able to quantify the resource use can be beneficial, although it is not always necessary.

Such data is generally easy to collect. Market information, including historical trends, can usually be obtained from a wide variety of sources such as government statistics, income and expenditure surveys, or market research studies. In most cases it will be necessary to supplement these secondary sources with original data, for example through performing market checks or conducting some form of socio-economic survey.

Step 2: Examine whether adjustment of the market price is necessary.

Market prices might be affected by a monopoly, government intervention, taxes, subsidies etc. In this case, this should be noted and, if possible, the prices should be corrected for any distortions.

Step 3: Assess the costs of producing the marketed resource/goods, if necessary.

The sources you´ll assess in step 1 will not always be transparent about the methodologies applied for calculating the value. One major issue here is whether the costs of production are included in the stated value, or not. This issue is important, but also very complex to solve. If possible, obtaining costs of production will help you to estimate the "actual market value" of the resource (i.e. market price = value of resource + costs of production).

Step 4: Estimate the value of your biodiversity resource based on the market price.

For this, you need to multiply the quantity of sold resource by the unit price and, if possible, subtract the costs related to production.

Data needs

When applying the market price method it is important to ensure that the data collected covers an adequate period of time and samples of consumers and/or producers. Factors to bear in mind include the possibility that prices, consumption and production may vary between seasons, for different socio-economic groups, at different stages of the marketing or value-added chain, and in different locations (IUCN 2004).

f) Main challenges and limitations

The main limitations of the market price method are the following:

- Market data may only be available for a limited number of goods and services provided by an ecological resource and may not reflect the value of all productive uses of a resource.
- The true economic value of goods or services may not be fully reflected in market transactions, due to market imperfections and/or policy failures.
- Seasonal variations and other effects on price must be considered.
- The method cannot be easily used to measure the value of larger scale changes that are likely to affect the supply of or demand for a good or service.
- Usually, the market price method does not deduct the market value of other resources used to bring ecosystem products to market, and thus may overstate benefits.

g) Use in combination with other methods/possible conflicts and synergies

The estimated potential market value could be higher than the current selling price on the market. Therefore, assessing consumer's willingness to pay (WTP) for a good could be used to explore potential markets for new ES, such as e.g. sustainably produced and eco-labelled timber or fish. Estimating WTP could also be done based on contingent valuation methods.

h) Literature overview/list

Emerton, L. and Bos, E. (2004). Value - Counting Ecosystems as an Economic Part of Water Infrastructure. IUCN, Gland, Switzerland and Cambridge, UK.

Kettunen, M., Bassi, S., Gantioler, S. & ten Brink, P. (2009). Assessing Socio-economic Benefits of Natura 2000 – a Toolkit for Practitioners (September 2009 Edition). Output of the European Commission project Financing Natura 2000: Cost estimate and benefits of Natura 2000 (Contract No.: 070307/2007/484403/MAR/B2). Institute for European Environmental Policy (IEEP), Brussels, Belgium. 191 pp. + Annexes.

More information on the application of the market price method available at: *http://www.ecosystemvaluation.org/market_price.htm*

ValuES method profile on market price method, available at: *http://www.aboutvalues.net/data/method_navigator/values_method_profile_direct_market_prices.pdf*

Fiche 2 - Production Function Approach

a) Introduction and brief description of the method

Even when ecosystem goods and services do not themselves have a market price, other marketed products often rely on them as basic inputs. For example, fisheries depend on breeding habitats, many agricultural crops are dependent on insect pollination, and forest and grassland ecosystems in the upper catchment of a river greatly contribute to downstream water supplies. Before this background, the production function approach (PFA) measures "how much" an ES contributes to the enhancement of income or productivity of another (usually marketed) good or service. In simple words, production function is the functional relationship between the quantity of a good produced (output) and factors of production (inputs). Hence, it observes physical changes in environmental quality and estimates what differences these changes will make to the value of goods and services that are marketed, e.g. agricultural and forestry products, fish etc. (IUCN 2004, UNEP 2000, ValuES). Resorting to the example of interdependence between agricultural crops and insect pollination mentioned above, the value of increased pollination can be estimated from the increased revenues from higher yields or improved crop quality associated with higher level of pollination by insects.

b) Which ecosystem services can be valued by the method?

In principle, PFA can be used for any production or consumption process that uses ecosystem services as an input or depends on them for output. In practice, it is most commonly applied to regulating and supporting services, such as pollination, erosion control and soil fertility, water flow regulation, fisheries breeding habitats etc. The method may also be used to value non-marketed provisioning services, although this is less common (TEEB 2010b, ValuES).

c) Element of TEV captured

The PFA is used to capture indirect use values within the TEV framework.

d) Main application/uses and advantages

In the production function method, information is generated on the change in production that results from a shift in ecosystem status or integrity. This is of particular relevance to the producers and consumers of the goods that depend on ES, and to planners, policy-makers and decision-makers which are responsible for these sectors. The PFA is widely used to estimate the impact of wetland and reef destruction, deforestation and water pollution on sectors/activities such as fishing, tourism, agriculture, water supply etc. The method is furthermore well suited for providing guidance on appropriate levels of environmental damage liabilities and compensation, and for setting the level of ecosystem service payments, because it directly looks at the monetary effects of ES on production. (TEEB 2010a, ValuES).

The main advantages of the production function approach are:

- It observes people's actions in markets that are specifically related to biodiversity values.

- It is relatively straightforward and when the relevant data is readily available, it is inexpensive to apply.

- It relies on a simple and straightforward logic linking economic production to ecosystem services.

- It offers a way of clearly and concretely linking ES to outputs and income in other sites and sectors of the economy (ValuES; ecosystemvaluation.org; Australian Gov. 2005).

e) Step-by-step application/implementation

There may be some variance in the way the method is applied, but in general you will have to take 3 main steps. To make the description more straightforward and less abstract, these steps are explained below based on a hypothetical situation. Thus, imagine that a reservoir that provides water for a city's drinking water system is being polluted by agricultural runoff. You are a representative of the responsible agency and would like to determine the economic effects of applying measures to eliminate the runoff using the PFA:

Step 1: Specify the production function, relating inputs and outputs.

In our case, you will need to specify the production function for purified drinking water. This is the functional relationship between the inputs - water of a particular quality from the reservoir, chemicals, and filtration, and the output "pure drinking water".

Step 2: Specify the relationship between changes in the quality or quantity of a particular ecosystem good or service and output.

This means that you need to estimate how the cost of purification changes when reservoir water quality changes, using the production function estimated in the first step. For this, you must calculate the quantities of purification chemicals and filters needed for different levels of reservoir water quality, by relating different levels of water quality to the production function. These quantities must then be multiplied by their costs.

Step 3: Estimate the market value of the change in production.

Here, this would mean estimating the economic benefits of protecting the reservoir from runoff, in terms of reduced purification costs. For example, if all runoff is eliminated, the reservoir water will need very little treatment and the purification costs for drinking water will be minimal. This can be compared to the cost of purifying water where runoff is not controlled. The difference in purification costs is an estimate of the benefits of eliminating runoff. Similarly, the benefits for different levels of runoff reduction can be estimated. This requires information about the projected success of actions to reduce runoff, in terms of the decrease in runoff and the resulting changes in reservoir water quality.

Data needs

A defining characteristic of PFA is that it combines biophysical and socioeconomic aspects. It is usually relatively easy to collect and analyse the market information that is required to value changes in the production of ecosystem-dependent products. The more difficult aspect is determining and quantifying the biophysical relationship that links changes in the supply or quality of ecosystem goods and services with changes in production or income. For example, detailed data are required to relate catchment deforestation to a particular rate of soil erosion, consequent siltation of a hydropower dam and reduced power outputs, or to assess exactly the impacts of the loss of wetland habitat and water purification services on local fisheries production. Also interpretation of this data can be very demanding and will usually make it necessary to involve natural scientists. In most cases, the larger the spatial scale being considered, the more complex the calculations and data requirements will be.

f) Main challenges and limitations

The main limitations of the PFA are:

- The method is only applicable to ES that have a clear link to human production processes.

- It is often difficult or costly to collect sufficient data to be able to accurately predict the production-ecosystem linkages and responses.

- It may be difficult to apply in practice due to scientific uncertainty and lacks of data associated with our understanding of how ES are provided and interact with each other. For example, although there is progress in understanding and defining ecological production functions for certain ES, such as carbon sequestration, the understanding of production functions for many important ecosystem services is still very basic.

- An additional concern is the large number of possible influences on product markets and prices. In some cases changes in the provision of an ecosystem good or service may lead not just to a change in related production, but also to a change in the price of its outputs. That product may become scarcer, or more costly to produce. In other cases consumers and producers may switch to other products or technologies in response to ecosystem change or to a scarcity of ecosystem goods and services (eftec 2006; Perrings et al. 2009; IUCN 2004).

In general it must be said that implementing the PFA requires a strong expertise both in economy and natural sciences. The economic expertise is important as the method is technically difficult to apply and usually requires a good knowledge of statistical methods, econometrics and economic modelling. Involvement of a natural scientist (e.g. hydrologist, ecologist, biologist, agronomist etc.) is necessary to provide an understanding of (a) the biological processes at work (e.g. the role that mangrove forests play in the life cycle of relevant fish species) and (b) how and to what extent different services contribute to the final output (eftec 2006, ValuES).

g) Use in combination with other methods/possible conflicts and synergies

It is possible to link PFA to a stated preference method to estimate the economic value of e.g. cultural services offered by totemic species. For example, Allen and Loomis (2006) used such an approach to derive the value of species at lower trophic levels from the results of surveys of willingness to pay for the conservation of species at higher trophic levels. Specifically, they derived the implicit WTP for the conservation of prey species from direct estimates of WTP for top predators (TEEB 2010a). Furthermore, where production function is used to estimate the physical change, market price approach can be incorporated to estimate the economic value of the change (eftec 2006).

h) Literature overview/list

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Fiche 3 - Hedonic Pricing

a) Introduction and brief description of the method

The hedonic pricing method is based on the assumption that environmental values are reflected in property prices. Accordingly, amenities such as clean air, presence of water and aesthetic views will increase the price of surrounding real estate, while disamenities such as a nearby landfill site will decrease it. The value of the environmental component can therefore be captured by modelling the impact of all possible influencing factors on the price of the property (UNEP 2000; DEFRA 2007). An example of a study which used Hedonic Pricing is included in Box III.3 above.

b) Which ecosystem services can be valued by the method?

The hedonic pricing method considers attributes that can be appreciated by potential buyers, i.e. air quality, visual amenity, landscape/scenic beauty etc. The majority of applications of the method thus focus on cultural ES such as aesthetic and recreational values. Some regulating (e.g. air pollution and natural hazard regulation) and provisioning services can also be measured, if their value is captured in property prices (DEFRA 2007; eftec 2006; ValuES).

c) Element of TEV captured

The hedonic pricing method estimates the environmental costs and benefits that property buyers and sellers are aware of and hence can reflect in their selling and buying behaviour. Therefore, the value components that can be measured are limited to direct and indirect use values, e.g. air quality regulation, leisure etc. (GiZ 2012; eftec 2006).

d) Main application/uses and advantages

The scope of hedonic pricing studies is typically limited to environmental characteristics which can be found near residential areas, are observable to buyers and are likely to have an impact over the period of occupancy. The method is less applicable to environmental factors which are not typically perceived by the buyer, such as chemical hazard, radiation, etc. The method is usually used to estimate economic benefits or costs associated with environmental quality, including air and water pollution, or noise and/or environmental amenities, such as aesthetic views or proximity to recreational sites. Hedonic pricing has also the potential to value certain wetland/marine ecosystem functions (e.g. storm protection, groundwater recharge) in terms of their impact on land values, assuming that these functions are fully reflected in land prices (TEEB 2010a).

Main advantages of the hedonic pricing method are:

- It is relatively straightforward and uncontroversial to apply, because it is based on actual market prices and fairly easily measured data.
- It is potentially compatible with national accounting standards.
- Property markets are relatively efficient in responding to information and hence can be good indications of value.
- Data on property sales and characteristics is readily available through many sources, and can be related to other secondary data sources to obtain descriptive variables for the analysis.
- The method is versatile, and can be adapted to consider several possible interactions between market goods and environmental quality.

e) Step-by-step application/implementation

The main steps for undertaking a hedonic pricing valuation are the following:

Step 1: Conduct so called Reconnaissance and Pilot surveys.

This means that you need to identify the site, the environmental service in question, and the new variable that influences the property rate.

Step 2: Collect data on residential property sales in the region for a specific time period (e.g. one year).

The required data includes, inter alia:

- Selling prices and locations of residential properties.
- Property characteristics that affect selling prices, such as lot size, number and size of rooms, and number of bathrooms.
- Neighbourhood characteristics that affect selling prices, such as property taxes, crime rates, and quality of schools.
- Accessibility characteristics that affect prices, such as distances to work and shopping centers, and availability of public transportation.
- Environmental characteristics that affect prices.

Step 3: Data Analysis & Conclusion. Once the data is collected and compiled, the next step is to statistically estimate a function that relates property values to the property characteristics. Typically, you will use Regression Analysis to estimate the influence of various property characteristics. The resulting function measures the portion of the property price that is attributable to each characteristic. Thus, you can estimate the value of the particular ES by looking at how the value of the average home changes when the amount ES nearby changes (TEEB 2010a; IUCN 2004; Kanojia et al. 2016).

Data needs

Hedonic pricing techniques require the collection of a large amount of data, which must be subject to a detailed and complex analysis. Data are usually gathered through market observation, questionnaires and interviews, which aim to represent a wide variety of situations and time periods (IUCN 2004).

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f) Main challenges and limitations

The hedonic pricing method has the following main constraints and limitations:

- The method will only capture people's WTP for perceived differences in environmental attributes, and their direct consequences. Thus, if people aren't aware of the linkages between the environmental attribute and benefits to them or their property, the value will not be reflected in home prices.
- The method assumes that people have the opportunity to select the combination of features they prefer, given their income. However, the housing market may be affected by outside influences, like taxes, interest rates, or other factors and ecosystem quality may not be a defining characteristic of where people buy property.
- The method is relatively complex to implement and interpret, requiring a high degree of statistical expertise.
- Large amounts of data must be gathered and manipulated (IUCN 2004; ValuES).

g) Use in combination with other methods/possible conflicts and synergies

The hedonic pricing method is principally a stand-alone method with relatively small scope for combination with other methods. There is a conflict potential in situations where the presence of an environmental good actually has a tendency to reduce property prices, thus implying a negative value for the environmental good. So for example, Garrod and Willis (1992) report a case where marshland, which provides ample ES, was shown to decrease house prices in rural Gloucestershire.

h) Literature overview/list

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Fiche 4 - Travel Cost Method

a) Introduction and brief description of the method

The travel cost method (TCM) uses the money spent by visitors to an area to estimate the area's recreational or tourism use value. In other words, TCM assumes that the value of a site or its recreational services is reflected in how much people are willing to pay to travel to visit this site. Costs considered are travel expenditures (e.g. petrol, fares, accommodation, food etc.), entrance fees, and the value/opportunity cost of time.

The time and travel cost expenses that people incur to visit a site represent the "price" of access to the site. Thus, peoples' willingness to pay (WTP) to visit the site can be estimated based on the number of trips that people make at different travel costs. This is analogous to estimating peoples' WTP for a marketed good based on the quantity demanded at different prices.

b) Which ecosystem services can be valued by the method?

The travel cost method can be applied to all ES that contribute to recreational activities.

c) Element of TEV captured

The TCM can capture the direct and indirect use value elements of TEV, as well as the non-use elements of recreation and tourism (like scenic beauty).

d) Main application/uses and advantages

TCM can be applied to estimate, inter alia, the economic benefits or costs resulting from:

- Changes in access costs for a recreational site.
- Destruction of an existing recreational site or establishment of a new site.
- Changes in environmental quality at a recreational site.

It can thus be used for entry pricing for any environmental site open to recreation (e.g. when countries are facing difficulties in mobilising public money for nature conservation), or demonstration of the importance of a site. Also charging special fees for specific activities in protected areas is quite common (e.g. fees added to diving costs in marine reserves).

Main advantages of the TCM are:

- The method closely mimics the more conventional empirical techniques used by economists to estimate economic values based on market prices.
- The method is based on actual behaviour (what people actually do) rather than stated WTP (what people say they would do in a hypothetical situation).
- The method is relatively inexpensive to apply.
- On-site surveys provide opportunities for large sample sizes, as visitors tend to be interested in participating.
- The results are relatively easy to interpret and explain.

e) Step-by-step application/implementation

In practice, 3 variations of TCM are common. The simplest of all is the Zonal Travel Cost Method (ZTCM), followed by the Individual Travel Cost Method (ITCM) and Random Utility Approach.

Hypothetical example: Imagine that a coral reef site supporting recreational fishing and diving is threatened by development in the surrounding area. Siltation and other impacts from this development could destroy the fish habitat at the site, resulting in a serious decline in, or total loss of, the site's ability to provide recreational fishing services/diving grounds. You as a representative of a state tourism agency want to determine the value of programmes or actions to protect fish habitat at the site.

Application of the Zonal Travel Cost Method (ZTCM): The ZTCM uses mostly secondary data, with some simple data collected from visitors, and estimates a value for recreational services of the site as a whole. It cannot easily be used to value a change in quality of recreation for a site, and may not consider some of the factors that may be important determinants of value. To carry out a ZTCM, you need to take the following steps:

Step 1: Define a set of zones surrounding the site.
These may be defined by concentric circles around the site, or by geographic divisions that make sense, such as metropolitan areas or counties surrounding the site at different distances.

Step 2: Collect information on the number of visitors from each zone, and the number of visits made in the last year.
Because the travel and time costs will increase with distance, this information will allow you to calculate the number of visits "purchased" at different "prices". For example, if you have access to the records of the number of visitors and their zip codes, these can be used to calculate total visits per zone over the last year.

Step 3: Calculate the visitation rates per X population (e.g. 1.000) in each zone.
For this, divide the total visits per year from the zone by the zone's population in thousands.

Step 4: Calculate the average round-trip travel distance and travel time to the site for each zone.
In order to do so, you must assume that people in zone 0 have zero travel distance and time. Each other zone will have an increased travel time and distance. Next, using average cost per distance unit (e.g. mile, km) and per time unit (e.g. hour of travel time), you can calculate the travel cost per trip. The cost per mile/km is generally easier to specify than the cost of time. Here, one of the simplest approaches is to use the average hourly wage.

Step 5: Apply statistical regression analysis to get the equation relating visits per capita to travel costs and other important variables.
In a simple model, this analysis could include demographic variables such as age, income, gender, and education levels, using the average values for each zone.

Step 6: Construct the demand curve for visits to the site.
Use the results of the regression analysis. Remember that the quantity demanded is expected to decrease as price increases. The first point on the demand curve will be the total visitors to the

site at current access costs (assuming there is no entry fee for the site). You will now need to find the other points by estimating the number of visitors with different hypothetical entrance fees (assuming that an entrance fee is viewed in the same way as travel costs).

Step 7: Estimate the total economic benefit of the site to visitors by calculating the consumer surplus[1] , or the area under the demand curve.

In the hypothetical case of your coral reef site you might, for example, find out that the total economic benefits from recreational uses of the site equal $x per year. Remembering that your objective as the agency staff was to decide whether it is worthwhile to spend money on programs and actions to protect this site: If the actions cost less than the amount $x per year, the cost will be less than the benefits provided by the site. If the costs are greater than this, you will have to decide whether other factors make them worthwhile.

Application of the Individual Travel Cost Method (ITCM): ITCM differs from ZTCM by using survey data from individual visitors in the statistical analysis, rather than data from each zone. This method thus requires more data collection and a slightly more complicated analysis, but will give more precise results.

For the hypothetical example of the recreational fishing site, rather than simply collecting information on number of visitors and their zip codes, you will need to create a questionnaire/ conduct a survey, to determine inter alia who the visitors are (how old they are, where they come from); how much they spend (to get to the site, to get into the site, while they are there); what their motivation for visiting are; how often they visit; the person's income or other information on the value of their time; substitute sites that the person might visit instead of this site etc. (TEEB 2010b).

Using the survey data, you can now proceed, in a similar way to the zonal model, by estimating, using regression analysis, the relationship between number of visits and travel costs and other relevant variables. This time, you must use individual data, rather than data for each zone.

The regression equation will provide you with the demand function for the "average" visitor to the site, and the area below this demand curve will show the average consumer surplus. Multiply this by the total relevant population (the population in the region where visitors come from) to estimate the total consumer surplus for your site.

Because additional data about visitors, substitute sites, and quality of the site has been collected, the value estimates can be "fine-tuned" by adding these other factors to the statistical model. Including information about the quality of the site will also allow you to estimate the change in value of the site if its quality changes. To do so, you would need to estimate two different demand curves - one for each level of quality. The area between these two curves is the estimate of the change in consumer surplus when quality changes.

[1] The satisfaction/utility consumers receive for which they do not have to pay for. Or, in other words, amount of money by which consumers value a good or service over and above its purchase price.

Box A1: Example of the (Individual) Travel Cost Method - Chilika, India

Chilika is one of the most important natural asset endowments of the State of Odisha in India. It is a highly complex ecosystem influenced by a diverse range of factors within its river basin and coastal zone. During 1950 - 2000, Chilika rapidly degraded due to increasing siltation from catchments and a variety of anthropogenic activities, which choked the lagoon's connection with the Bay of Bengal. Wetlands International-South Asia with the Chilika Development Authority (2012) have produced a comprehensive report presenting 'An Integrated Management Planning Framework for Conservation and Wise Use' of this site, which includes an economic valuation of the Lake's ecosystems services.

The range of services provided plays a critical role in sustaining life and livelihoods of communities living in and around Lake Chilika The economic value of tourism related to Chilika, in particular, was estimated using the Individual Travel Cost Method (ITCM). Information was collected on the number of visits to the site from different distances through a survey of 433 tourists carried during the months of October 2006 – January 2007. Because the travel and time costs will increase with distance, this information allowed to calculate the number of visits "purchased" at different "prices". This information was then used to construct the demand function (or curve) for Chilika Lake, and estimate consumer surplus, i.e. the difference between the price actually paid for the recreational services of the site through the costs of the visit, and the maximum amount that an individual is willing to pay for it. Demand curves were developed separately for the domestic and foreign tourists as they related the annual site visitation rate to the visit costs, income, and other socioeconomic characteristics. The average "consumer surplus" for the domestic and international tourists was estimated to be Rs. 5,806 and Rs 120,480 respectively. The annual economic value of wetland tourism, derived using individual travel cost method, was estimated to be Rs. 3,379 million. Other ecosystem services like fisheries, inland navigation and use of aquatic vegetation were valued using available market prices. The annual flows of benefits from these key provisioning services these were assessed to be worth Rs. 1,463 million, Rs. 34 million and Rs. 14 million respectively. Non-use benefits were estimated to be Rs. 167 million per annum.

To sustain these benefits, since its inception in 1991, the Chilika Development Authority (CDA) has incurred programmatic expenses of Rs. 1,608 million. Using a select set of ecosystem services, namely increase in fish landings and recreational benefits, the benefit-cost ratio was assessed to 15.44. Also, the fishers of Manglajodi, once deriving livelihood from illegal water bird hunting, presently sustain themselves on community managed wetland ecotourism. As the number of tourists visiting Chilika soared after a hydrological restoration, so did the number in Manglajodi (which consistently supports large water bird congregation numbers). The community has since been making much higher and steady income from tourists interested in bird watching than the income levels and risks associated with illegal water bird hunting. Presently, the area is visited by 5,000 tourists each year and stands out as one of the popular destinations for watching migratory water birds.

Application of the Random Utility Approach: This is the most complex of all 3 variations. It uses survey and other data and more complicated statistical techniques. It is also the "state of the art" approach, because it allows for much more flexibility in calculating benefits. It is the best approach to use to estimate benefits for specific characteristics, or quality changes, of sites, rather than for the site as a whole. It is also the most appropriate approach when there are many substitute sites.

In our hypothetical example from above, you might want to value the economic losses from a decrease in fish populations, rather than from loss of the entire fish stock. The random utility approach would be the best way to do so, because it focuses on choices among alternative sites, which have different quality characteristics.

It assumes that individuals will pick the site that they prefer, out of all possible fishing sites. Individuals make trade-offs between site quality and the price of travel to the site. Hence, this model requires information on all possible sites that a visitor might select, their quality characteristics, and the travel costs to each site. To get this information, you can e.g. conduct a telephone survey of randomly selected residents of the state, first asking them if they go fishing or not. If they do, ask a series of questions about how many fishing trips they took over the last year (or season), where they went, the distance to each site, and other information similar to the information asked in the ITCM survey. You can also ask questions about fish species targeted on each trip, and how many fish were caught.

Using this information, you can estimate a statistical model that can predict both the choice to go fishing or not, and the factors that determine which site is selected. If quality characteristics of sites are included, the model can easily estimate values for changes in site quality, for example the economic losses caused by a decrease in catch rates at the site.

Data needs

The main type of data you will need from survey respondents to conduct a TCM includes information on: travel time, mode of travel, travel costs, origin of trip, socio-economic status (e.g. income), place of residence, relevant preferences etc. In order to increase the confidence in survey results, it is advisable to include a test survey and/or to use larger survey samples designed under the guidance of a professional economist with knowledge of statistics and sampling.

f) Main challenges and limitations

Main weaknesses of the TCM include:

- Those who value certain sites may choose to live nearby. If this is the case, they will have low travel costs, but high values for the site that are not captured by the method.

- It assumes that people perceive and respond to changes in travel costs the same way that they would respond to changes in admission price.

- The availability of substitute sites will affect values. For example, if two people travel the same distance, they are assumed to have the same value. However, if one person has several substitutes available but travels to this site because it is preferred, this person's value is actually higher.

- Interviewing visitors on site can introduce sampling biases to the analysis.

- In order to estimate the demand function, there needs to be enough difference between distances travelled to affect travel costs and for differences in travel costs to affect the number of trips made. Thus, it is not well suited for sites near major population centers where many visitations may be from "origin zones" that are quite close to one another.

- It is limited in its scope of application because it requires user participation. It cannot be used to assign values to on-site environmental features and functions that users of the site do not find valuable. It cannot be used to value off-site values supported by the site and to measure non-use values (ecosystemsvaluation.org).

g) Use in combination with other methods/possible conflicts and synergies

The survey aspect of TCM implies that it can be combined with stated preference methods, where it is possible to elicit information on travel costs and values for a simulated market involving the environmental good/service of interest. In some cases, CVM or CM/CE can also be used instead of the TCM. While they might produce more precise estimates of values for specific characteristics of the site in question, and also can capture non-use values, they are usually considerably more complicated and expensive to apply.

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B. Stated Preference Methods

Stated preference (SP) methods use carefully structured questionnaires to elicit individuals' preferences for a given change in a natural resource or environmental attribute. In principle, SP methods can be applied in a wide range of contexts and are the only methods that can estimate non-use values which can be a significant component of overall TEV for some natural resources. The main options in this approach are: contingent valuation and choice modelling.

Fiche 5 - Contingent Valuation

a) Introduction and brief description of the method

The contingent valuation method (CVM) was the first stated preference technique to be developed. CVM uses the stated preferences of respondents to a survey in order to analyse and express people's values and preferences. The approach entails the construction of a hypothetical, or 'simulated', market via questionnaires, asking people how much they would be willing to pay (the so-called "Willingness-to-pay"/WTP) 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 (the so-called "Willingness-to-accept"/WTA) (TEEB 2010a; eftec 2006). It is called "contingent" valuation, because people are asked to state their willingness to pay, contingent on a specific hypothetical scenario and description of the environmental service (Australian Gov. 2005).

b) Which ecosystem services can be valued by the method?

CVM can be applied for all types of ecosystem services (TEEB 2010b; DEFRA 2007). It is often used for biodiversity, cultural and heritage values (UNEP-WCMC 2011).

Box A2: Example of the Contingent Valuation Method - Jamaica

For a small island developing state like Jamaica, the coastal tourism industry is an important economic activity, and this is largely dependent on healthy coastal ecosystems. Edwards (2008) conducted a study with the aim to gauge the willingness to pay of tourists for a range of variables (beach cleanliness, coral reef quality, water quality) and to determine an appropriate tax level for tourists to finance environmental management activities in coastal areas.

The study used Contingent Behaviour, a modification of the Contingent Valuation method. The tourists had to choose between two different scenarios; a) the local government deciding to increase the tourism tax, or b) the local government deciding to add the environmental tax. In both scenarios, this additional tax resulted in an increase to tourists' current travel expenses, and full justification of what this extra revenue would contribute to was given. The surveys were distributed to tourists randomly at the departure terminal of the international airport. In addition, an statistical estimation using the survey data and the number of visitors in Jamaica in the given year, were used to predict the likely impact of the imposition of different tax amounts would have on tourist visitation rates.

The study found that tourists are willing to pay more for an "environmental tax" instead of a general "tourism tax". Also, a small tax could completely finance coastal zone management and effects of this tax on the visitation rate would be negligible. However, if there are any potential negative impacts from the imposition of additional taxes on the annual tourist visitation rates, the study suggests that these can be minimised by providing information on how the revenues from the tax will be utilised.

c) Element of TEV captured

The CVM can capture both use and non-use elements of TEV, and it is the most widely used method for estimating non-use values. Taking into account the Total Economic Value framework, CVM is capable of capturing direct use values, option values, bequest values and existence values. It is limited in its ability to provide ecological values and values for the intrinsic value of nature (DEFRA 2007; OpenNESS).

d) Main application/uses and advantages

The results of a CVM assessment take the form of monetary estimates of the value of the ES or environmental changes chosen for the assessment. CVM is generally used for detailed assessments. It is difficult to apply it at scoping level given the need for a survey sample that is large enough to ensure statistical validity. The method can be applied at all spatial scales and target population sizes due to the flexibility associated with the use of surveys.

The main advantages of the CVM are:

- Contingent valuation is very flexible, because it does not rely on actual markets or observed behaviour. It is applicable to a wide range of environmental goods and services - including the changes that are yet to be experienced. However, it is best able to estimate values for goods and services that are easily identified and understood by users and that are consumed in discrete units (e.g., user days of recreation).
- CVM can estimate use values, as well as existence values, option values, and bequest values.
- Though the technique requires competent survey analysts to achieve reliable estimates, the nature of CVM studies and the results of CVM studies are not difficult to analyse and describe. Monetary values can be presented in terms of a mean or median value per capita or per household, or as an aggregate value for the affected population.
- CVM has been widely used, and a great deal of research is being conducted to improve the methodology, make results more valid and reliable, and better understand its strengths and limitations (eftec 2006; ValuES; ecosystemvaluation.org; IUCN 2004).

e) Step-by-step application/implementation

Although there may be some variance in the way this method is applied, in general you will have to take at least the following steps:[2]

Step 1: Define the valuation problem.
This includes determining exactly which ES need to be valued and why, and who the relevant population is. The latter is important because you will need to survey an appropriate sample of this population. While you already determined the relevant ES in chapter III.2.4 of the Tier 2 Guidance, here the focus will be on defining the relevant respondents for the survey.

Step 2: Make preliminary decisions about the survey itself, including whether it will be conducted by mail, phone or in person, how large the sample size will be, who will be surveyed, and other related questions. The answers will depend, among other things, on the importance of the valuation issue, the complexity of the question being asked, and the size of the budget.

In-person interviews are generally the most effective for complex questions, because it is often easier to explain the required background information to respondents in person, and people are more likely to complete a long survey when they are interviewed in person. At the same time, in-person interviews are generally the most expensive type of survey. However, mail surveys that follow procedures that aim to obtain high response rates can also be quite expensive. Mail and telephone surveys must be kept fairly short, or response rates are likely to drop dramatically. Telephone surveys may be less expensive, but it is often difficult to ask contingent valuation questions over the telephone, because of the amount of background information required.

[2] For a more detailed description please consult the ecosystemsvaluation.org-Website and the approach proposed by Kontoleon and Pascual 2006 in TEEB 2010a, Chapter 5, p. 21.

Step 3: Survey design and testing. This is the most important and difficult part of the process, which is accomplished in several sub-steps. It may take six months or more to complete, and needs some experience or expert´s knowledge:

- Start with focus group sessions and consultations with stakeholders of the sought profile. The objective is to examine peoples' knowledge and understanding of the issues that are being researched and potential sources of bias.
- Decide the nature of the market, i.e., determine the ES being traded, the status quo, and the improvement or deterioration level of the ES that will be valued.
- Determine the quantity and quality of information provided over the traded good or service, who will pay for it, and who will benefit from it.
- Set allocation of property rights (determines whether a WTP or a WTA scenario is presented).
- Determine credible scenario and payment vehicle (e.g. tax, donation, price)[3].
- Choose elicitation method (e.g. dichotomous choice (yes-no) type questions vs. open-ended questions).
- In addition to the valuation scenario and other questions mentioned above, it is common practice to include a 'debriefing' section in which respondents state why they answered certain questions in the way they did.

Based on the insights from this step, you should create informed questions for the survey; decide what kind of background information is needed and how willingness-to-pay responses could best be elicited.

Once it is clear how to provide background information, describe the hypothetical scenario, and ask the valuation questions, you should proceed with pre-testing the survey.

Step 4: As a next step, **implement the survey.** Here, a very important task is to select the survey sample. Ideally, this should be a randomly selected sample of the relevant population, using standard statistical sampling methods.

Step 5: The final step is **to compile, analyse and report the results.**
The data must be systemized and analysed using statistical techniques appropriate for the type of questions in the survey. In the data analysis, you should attempt to identify any responses that may not express the respondent's value for the ES in question. In addition, you should deal with possible non-response bias in a number of ways. The most conservative way is to assume that those who did not respond have zero value, but you could also eliminate these from the analysis

Furthermore, estimate the average value for an individual or household in the sample and extrapolate this to the relevant population in order to obtain the value likely to be placed on the ecosystem good or service by the whole population, or the entire group of users. So, for example, you can multiply the sample mean WTP of visitors to a site by the total number of visitors per annum. Past or current values can be extrapolated into the future using reasonable assumptions and scenarios (IUCN 2004; ValuES; TEEB 2010a; eftec 2006).

[3] For example, some payment vehicles, such as taxes, may lead to protest responses from people who do not want increased taxes. Others, such as a contribution or donation, may lead people to answer in terms of how much they think their "fair share" contribution is, rather than expressing their actual value for the good.

Box A3: Contents of a CVM questionnaire (based on Eftec 2006)

A CVM questionnaire should provide information on:

- An introduction to the general decision-making context;
- A detailed description of the good or service offered to the respondent;
- The institutional setting in which the good or service will be provided;
- The way in which the good or service will be paid for; and
- Reminders about respondents' budget constraint including other things they may wish to purchase.

Essentially, this information describes the hypothetical market which respondents are required to engage in. The questionnaire also collects information about tastes, attitudes, prior experience of using or knowing about the good or service in question and the socio-economic characteristics of the respondents.

The principal output from CVM studies are estimates of WTP/WTA for changes in the provision of non-market goods and services.

Data needs

The CVM is a quite resource and data intensive method. The following data inputs may be necessary:

- Information, maps and visual aids to clearly convey the reason for the survey and its contents/ questions to survey respondents.
- Data from the survey respondents including data on: willingness to pay/accept, socio-economic status (e.g. income), place of residence, and relevant preferences, among others.
- As with most surveys, confidence in results increases when survey instrument design is done carefully and includes a test survey that can be used to iron out problems. Confidence is also greater when larger survey samples are used and administered by people with experience in surveys. The guidance of a professional statistician with knowledge of sampling is often recommended in this regard.[4]

Box A4: Time requirements and costs

The amount of time spent on a CVM is highly variable and depends on difficulty of question/issues being addressed, level of detail required, availability of data, among other issues. Most assessments require moderate to long timeframes as they involve a pilot survey for testing, followed by the revision of the survey instrument and a full survey.

Costs relate primarily to time needed for assessment and analysis, which can range from short (for rough approximations with limited data) to long (for detailed estimates with analysis of extensive data).

[4] For more detailed information on data and resource/skill requirements please consult the OpenNESS method factsheet on stated preference methods and the ValuES method profile on CVM.

f) Main challenges and limitations

Despite being a valuable method for capturing the TEV of ES, the CVM also has several important limitations and weaknesses, inter alia:

- Although CVM has been widely used for the past two decades, there is considerable controversy over whether it adequately measures people's WTP for environmental quality.
- People have practice making choices with market goods, so their purchasing decisions in markets are likely to reflect their true WTP. CVM assumes that people understand the good in question and will reveal their preferences in the contingent market just as they would in a real market. However, most people are unfamiliar with placing monetary values on environmental goods and services. Therefore, they may not have an adequate basis for stating their true value.
- There is a number of potential sources of biases. These include "strategic bias" whereby respondents over- or understate their true willingness to pay because they believe their response may influence decision making. "Embedding bias" occurs when people do not see the question in the context of all their wants, needs and budgetary constraints. "Interviewer bias", "Information bias", "starting point bias" and "hypothetical bias" also must be taken into account.[5]
- Respondents may make associations among environmental goods that the researcher had not intended. For example, if asked for WTP for improved visibility (through reduced pollution), the respondent may actually answer based on the health risks that he or she associates with dirty air.
- Some researchers argue that there is a fundamental difference in the way that people make hypothetical decisions relative to the way they make actual decisions. For example, respondents may fail to take questions seriously because they will not actually be required to pay the stated amount.
- The payment question can either be phrased as the conventional WTP or in less usual WTA form. In theory, the results should be very close. However, when the two formats have been compared, WTA very significantly exceeds WTP.
- Respondents may give different WTP amounts, depending on the specific payment vehicle chosen. For example, some payment vehicles, such as taxes, may lead to protest responses from people who do not want increased taxes.
- It is sometimes challenging, yet crucial to ensure the representativeness of the sample of respondents etc. (CBD 2007, ecosystemvaluations.org, TEEB 2010b, Australian Gov. 2005).

g) Use in combination with other methods/possible conflicts and synergies

The CVM is flexible and is often used in combination with other valuation methods in order to supplement or cross-check their results (IUCN 2004). For instance, one-to-one in-depth interviews, focus groups and workshops could be used to investigate methodological issues such as consumer versus citizen preferences. CVM studies may also be carried out in conjunction with travel cost studies since data necessary for these studies could be collected through a CVM questionnaire (eftec 2006, IUCN 2004).

h) Literature overview/list

Arrow, K., Solow, R., Portney, P., Leamer, E., Radner, R., Shuman, H. (1993). "Report of the NOAA panel on Contingent Valuation" Resources for the Future, Washington.

OpenNESS method factsheet on stated preference valuation, available at: *http://oppla.eu/sites/default/files/uploads/methodfactsheeetstated-preference-valuation-methods_0.pdf*

Pearce, D., Özdemiroglu, E. et al. (2002). Economic Valuation with Stated Preference Techniques: Summary Guide; Department for Transport, Local Government and the Regions: London.

Secretariat of the Convention on Biological Diversity (2007). An exploration of tools and methodologies for valuation of biodiversity and biodiversity resources and functions, Technical Series no. 28, Montreal, Canada, 71 pages.

ValuES method profile on Contingent valuation method (CVM), available at: *http://www.aboutvalues.net/data/method_navigator/values_method_profile_contingent_valuation.pdf*

[5] For a detailed explanation of these biases see e.g. http://www.ecosystemvaluation.org/contingent_valuation.htm

Beach, Antigua & Barbuda/Patrick Debels

Fiche 6 - Choice Modelling/Choice Experiments

a) Introduction and brief description of the method

Choice modelling (CM) [also called choice experiments (CE)] is the most recently developed stated preference technique. Like CVM (see fiche 5), it is a survey-style approach that asks people to make choices based on a hypothetical scenario. However, it focuses on the individual attributes of the ecosystem in question. For example, a lake may be described in terms of water quality, number of species etc. Participants are presented with different sets/combinations of attributes and asked to choose their preferred combination or rank the alternative combinations. Each combination of attributes has a price associated with it and therefore the respondents reveal their wiliness to pay (WTP) or willingness to accept (WTA) for each attribute (TEEB 2010c, DEFRA 2007). Some sets may also have non-monetary values (social, cultural, spiritual). Implicitly, as respondents choose, they make trade-offs between the attributes of each set (Australian Gov. 2005, TEEB 2010b).

Box A5: Example of Choice Experiments - Barbados

With support from the Ministry of Tourism and the Caribbean Tourism Organization, Schuhmann (2012) led a research project in order to understand the preferences of tourists and their willingness to pay for "coastal attributes", such as beach width and beach cleanliness, in Barbados.

A survey was administered to departing tourists at the international airport, with non-national vacation travelers being the target group. The survey was comprised of a) questions regarding demographics, expenditures and recreational activities; b) questions that asked the respondents to rate the quality of several "coastal attributes" using a 5-point scale, where 1 represented the lowest and 5 the highest quality. The attributes included the cleanliness of beaches, the quality of the beach sand, beach width, the cleanliness and visibility of the seawater, the ease of access to the sea, and the overall quality of the beaches; and c) a choice experiment, where the respondents were asked to choose between two lodging options, or neither option. The price (US$/night), lodging type, beach width, distance to beach and beach litter were selected as attributes, each one of those having four levels. The attributes and their levels were combined to create alternative versions and then paired into alternative choices. For example, "Option A" included US$ 75, small hotel, 3-5 meters wide beach, 12-15 min walk from the beach, and 0 pieces of beach litter per 25 meters. On the other hand, "Option B" included US$ 225, apartment, 13-15 meters wide beach, 6-8 min walk from the beach, and 10 pieces of beach litter per 25 meters, with "I would not choose either of these options" as "Option C". The price was used to derive the value or willingness to pay for each level of the remaining attributes relative to the baseline "best case" scenario, staying at a beachfront villa on a very wide beach with no litter.

The survey was not designed to allow for an empirical examination of reservation prices. However, it used the relative values of willingness to pay in order to discuss trade-offs that tourists would be willing to make based on the attribute levels that they favoured. More specifically, the study found that tourists prefer wider and cleaner beaches, but once beaches reached a particular width, tourists were indifferent to additional width. Also, tourists strongly prefer beachfront lodging, but they would be equally satisfied with a short walk to a clean beach and beachfront lodging at a marginally dirty beach.

b) Which ecosystem services can be valued by the method?

CM/CE can be applied for all types of ecosystem services. It tends to be most commonly used to estimate cultural services and non-use values (e.g. existence and bequest values) (UNEP-WCMC 2011, TEEB 2010b).

c) Element of TEV captured

As with CVM, CM/CE can capture all elements of TEV. It is well suited to capture direct use values, option values, bequest values and existence values, but is limited in its ability to provide ecological values and values for the intrinsic value of nature (DEFRA 2007; OpenNESS).

d) Main application/uses and advantages

Because it focuses on trade-offs among scenarios with different characteristics, CM/CE is especially suited to policy decisions where a set of possible actions might result in different impacts on natural resources or environmental services. For example, improved water quality in a lake will improve the quality of several ES provided by the lake, such as drinking water supply, fishing, swimming, and biodiversity. In addition, while CM/CE can be used to estimate monetary values, the results can also be qualitative presenting relative rankings between alternative options. In policy design setting, CM/CE can thus be used to rank alternative solutions or approaches to environmental challenges.

The main advantages of the CM/CE approach are:

- The key strength of the method is its flexibility which allows for valuation of all types of ecosystem services. Choice experiments focus on analysing trade-offs and ranking alternatives which make them particularly useful in the valuation of measures for improving an ecosystem, where several service flows are simultaneously affected.
- It is more flexible than contingent valuation, as many more potential combinations of environmental change can be presented. This allows for a better incorporation of uncertainty surrounding environmental impacts than can be afforded by contingent valuation.
- Respondents are generally more comfortable providing qualitative rankings or ratings of attribute bundles that include prices, rather than monetary valuation of the same bundles without prices, by de-emphasizing price as simply another attribute.
- It is better at estimating relative values than absolute values. Thus, even if the absolute monetary values estimated are not precise, the relative values or priorities elicited by a contingent choice survey are likely to be valid and useful for policy decisions.
- Advantages also include the method's ability to involve the community in the planning process.
- The method minimizes many of the biases that can arise in open-ended contingent valuation studies where respondents are presented with the unfamiliar and often unrealistic task of putting prices on non-market (eftec 2006; Australian Gov. 2005; ValuES).

e) Step-by-step application/implementation

When conducting CM/CE, you will have to take the following steps:

Step 1: Define the valuation and choice problem. This includes determining exactly which ES need to be valued and why, who the relevant population is and an appropriate sample of whom needs to be surveyed. While you already determined the relevant ES in chapter III.2.4 of the Tier 2 Guidance, here the focus will be on defining the relevant respondents for the survey.

Step 2: Make preliminary decisions about the survey itself, including whether it will be conducted by mail, phone or in person, how large the sample size will be, who will be surveyed, and other related questions. The answers will depend, among other things, on the importance of the valuation issue, the complexity of the question(s) being asked, and the size of the budget.

In-person interviews are generally the most effective for complex questions, because it is often easier to explain the required background information to respondents in person, and people are more likely to complete a long survey when they are interviewed in person. In some cases, visual aids such as videos or colour photographs may be presented to help respondents understand the conditions of the scenario(s) that they are being asked to value. At the same time, this interview form is also the most expensive one. However, mail surveys that follow procedures that aim to obtain high response rates can also be quite expensive. Mail surveys must be kept fairly short, or response rates are likely to drop dramatically. Telephone surveys are generally not appropriate for contingent choice surveys, because of the difficulty of conveying the trade-off questions to people over the telephone.

Step 3: Design and test the survey.
This is the most important and difficult part of the process, which is accomplished in several sub-steps. It may take six months or more to complete:

- Start with focus group sessions and consultations with stakeholders of the sought profile. The objective is to examine peoples' knowledge and understanding of the issues that are being researched and potential sources of bias. Usually, several stages of interviews/focus groups will be needed, questions getting more detailed and specific as time passes. Responses help to develop questions for the survey, decide what kind of background information is needed and how to present it to respondents and decide on a preferred way of eliciting preferences between trade-offs presented.

▸ Once it is clear how to provide background information, describe the hypothetical scenario and ask the survey questions, you should pre-test the survey. So, for example, if the actual survey will be conducted by mail, it should be pretested with as little interaction with the researchers as possible. Thus, you can ask your test persons to assume that they've received the survey in the mail and to fill it out. Then ask respondents about how they filled it out, and let them ask questions about anything they found confusing. Eventually, you could think about conducting a mail pretest. This process must continue until you have a survey that people seem to understand and answer in a way that makes sense and reveals their values for the ecosystem services in question.

Step 4: As a next step, **implement the survey.** Here, a very important task is to select the survey sample. Ideally, this should be a randomly selected sample of the relevant population, using standard statistical sampling methods.

Step 5: The final step is **to compile, analyse and report the results.**
The data must be systemized and analysed using statistical techniques appropriate for the type of questions in the survey. The statistical analysis for CM/CE is often more complicated than that for CVM, requiring the use of discrete choice analysis methods to infer WTP from the trade-offs made by respondents. Furthermore, estimate the average value for each of the analysed services, for an individual or household in the sample. This can be extrapolated to the relevant population in order to calculate the total benefits from the site/ES under different policy scenarios. The average value for a specific action and its outcomes can also be estimated, or the different policy options can simply be ranked in terms of peoples' preferences.

Box A6: Different CM/CE formats

There are a variety of formats for applying contingent choice methods, e.g. contingent ranking, discrete choice and paired rating:

• **Contingent ranking** surveys ask individuals to compare and rank alternate program outcomes with various characteristics, including costs. For instance, people might be asked to compare and rank several mutually exclusive environmental improvement programs under consideration for a watershed, each of which has different outcomes and different costs. Respondents are asked to rank the alternatives in order of preference.

• In the **discrete choice approach,** respondents are simultaneously shown two or more different alternatives and their characteristics, and asked to identify the most preferred alternative in the choice.

• **Paired rating** is a variation on the discrete choice format, where respondents are asked to compare two alternate situations and are asked to rate them in terms of strength of preference. For instance, people might be asked to compare two environmental improvement programs and their outcomes, and state which is preferred, and whether it is strongly, moderately, or slightly preferred to the other program.
Whatever format is selected, the choices that respondents make are statistically analysed using discrete choice statistical techniques, to determine the relative values for the different characteristics or attributes. If one of the characteristics is a monetary price, then it is possible to compute the respondent's willingness to pay for the other characteristics.

Data needs

CM/CE is a quite resource- and data intensive method. The following data inputs may be necessary:

• Information, maps and visual aids to convey the reason for the survey and its contents/questions to respondents more clearly. Particularly important for survey success is the accurate and clear presentation and illustration of trade-offs that respondents need to consider.

• Data from the survey respondents including data on: WTP/WTA, socio-economic status (e.g. income), place of residence, and relevant preferences, among others.

• As with most surveys, confidence in results increases when survey instrument design is done carefully and includes a test survey that can be used to iron out problems. Confidence is also greater when larger survey samples are used and administered by people with experience in surveys. The guidance of a professional statistician with knowledge of sampling is often recommended in this regard[6].

Box A7: Example of Choice Experiments – Kilombero valley wetlands, Tanzania

Mombo et al. (2011) used a Choice Experiment (CE) to expose public preferences over the range of possible future landscape configurations for the Kilombero valley wetlands in Tanzania. As in other areas in Africa, wetlands play a significant role in the livelihoods of the rural communities of this region. The ability of wetlands to store water during the wet season and release it during the dry season provides farmers living in semiarid areas opportunities to grow crops all-year round. This improves their food security and incomes. Besides water for crop production, wetlands also provide other services that support human welfare such as livestock grazing and watering, drinking water supply, fishing and natural products. Degradation of wetlands can cause loss of these functions.

Distinct groups of stakeholders showing different concerns make it important to recognize that conflicting multiple objectives may exist within the same group. The CE method has the advantage to reveal these differences in preferences by combining theories that model the decision process of individuals. In the study, the utilities of different individuals who are primary and secondary users of wetland services were estimated and used to see how these are influenced by environmental and socioeconomics "attributes" and hence how households' willingness to pay for an improved status of the wetlands is. The various wetland attributes used to design wetland management options were identified and their levels defined through consultations: "floodplain area that remains unconverted into agriculture", "wetland area that is used for free range grazing", "wetland area that is used for free range grazing", the "number of different species of plants, wild animals and fish and their population levels" as well as a "one off payment to go to the wetland unit in the Wildlife department" in terms of percentage increase in the water bills. This payment attribute was included in the experiment in order to measure the willingness to pay for changes in other attributes.

In general, there was a preference among communities to improve management of the wetlands, which reveals that the inhabitants of the Kilombero Valley and Morogoro Municipality desire improvement of the wetland's conditions. This suggests that the ongoing degradation is socially not optimal. Secondly, looking at the attributes associated with the wetlands, the study shows that land ownership and cultivation type are very important factors. Farmers are more reluctant to shift their practice and to give up some of their land in order to enhance the conditions of the wetland because this would drastically affect their household income. This being the case, it is therefore important for the policy makers to have enough information of what are the really causes of the wetlands degradation in specific areas before they develop conservation strategies. Moreover, in the establishment of management plans the CE can also be used as a conflict avoidance tool or conflict resolution tool.

[6] For more detailed information on data and resource/skill requirements please consult the OpenNESS method factsheet on stated preference methods and the ValuES method profile on CM.


che supajit/Shutterstock.com

f) Main challenges and limitations

Many limitations of CM/CE are similar to those of contingent valuation. A problem more specific to CM/CE is the challenge of providing respondents with complex information in a manageable format. The more complex CM/CE designs may cause problems for respondents leading to an increased degree of random error in responses. Therefore, it should be expected that as the number of attributes (or rankings increase) the likelihood of inconsistent responses will also increase due to limits in cognitive ability unless sample sizes are increased to reduce number of choices each respondent is asked to make.

Further weaknesses of CM/CE include the following:

- Respondents may find some trade-offs difficult to evaluate, because they are unfamiliar.
- The respondents' behaviour underlying the results of a contingent choice study is not well understood. Respondents may resort to simplified decision rules if the choices are too complicated, which can bias the results of the statistical analysis.
- When presented with a large number of trade-off questions, respondents may lose interest or become frustrated.
- CM/CE may extract preferences in the form of attitudes instead of behaviour intentions.
- By only providing a limited number of options, it may force respondents to make choices that they would not voluntarily make.
- Contingent ranking requires more sophisticated statistical techniques to estimate WTP.
- Translating the answers into US$ values, may lead to greater uncertainty in the actual value that is placed on the good or service of interest.
- Although CM/CE has been widely used in the field of market research, its validity and reliability for valuing non-market commodities is largely untested (Australian Gov. 2005, ecoystemsvaluation.org).

g) Use in combination with other methods/possible conflicts and synergies

CM/CE is flexible and is often used in combination with other valuation methods in order to supplement or cross-check their results (IUCN 2004). For instance, one-to-one in-depth interviews, focus groups and workshops could be used to investigate methodological issues such as consumer versus citizen preferences. CM/CE studies may also be carried out in conjunction with travel cost studies since data necessary for these studies could be collected through a CM/CE questionnaire (eftec 2006, IUCN 2004).

h) Literature overview/list

Hensher, D.A., Rose, J.M., & Greene, W.H. (2005). Applied choice analysis: a primer. Cambridge University Press.

Kettunen, M., Bassi, S., Gantioler, S. & ten Brink, P. (2009). Assessing Socio-economic Benefits of Natura 2000 – a Toolkit for Practitioners (September 2009 Edition). Output of the European Commission project Financing Natura 2000: Cost estimate and benefits of Natura 2000 (Contract No.: 070307/2007/484403/MAR/B2). Institute for European Environmental Policy (IEEP), Brussels, Belgium. 191 pp. + Annexes.

OpenNESS method factsheet on stated preference valuation, available at: *http://oppla.eu/sites/default/files/uploads/methodfactsheeetstated-preference-valuation-methods_0.pdf*

ValuES method profile on Choice Experiments/Choice Modelling, available at: *http://www.aboutvalues.net/data/method_navigator/values_method_profile_choice_experiments.pdf*

C. Cost-based Approaches

Cost-based approaches the costs that arise in relation to the provision ecosystem services, which may be directly observed from markets. Included under this heading are: opportunity cost, cost of alternatives, damage cost avoided and replacement costs.

Fiche 7 - Replacement Cost Method

a) Introduction and brief description of the method

The replacement cost method is a cost-based approach for valuing ecosystem services. It assesses their values by determining the costs of man-made products, infrastructure or technologies that could replace them (or be replaced by ecosystem services). For example, constructed reservoirs can replace natural lakes, sewage treatment plants can replace wetland wastewater treatment services, and many natural products have artificial alternatives. The cost of replacing an ecosystem service with such an alternative or substitute can be taken as an indicator of its value in terms of expenditures saved (IUCN 2004).

b) Which ecosystem services can be valued by the method?

The replacement cost method is most commonly applied to regulating and supporting ecosystem services, but may also be applied to provisioning services. It is particularly useful for valuing services that have direct manufactured or artificial equivalents, such as coastal protection by coral reefs or water storage and purification by mangrove forests. It is generally inappropriate for valuing cultural services (Mumby, P. et al. 2014; DEFRA 2007).

Box A8: Example of the Replacement Cost Approach - Groundwater in Central Mexico

The annual amount of groundwater extracted in Central Mexico region represents twice the recharge volume of the area's aquifer system according to official statistics of the National Water Commission (CONAGUA, for its Spanish acronym). This results in a number of problems, including subsidence, lowering of the water table, loss of water quality, or increases in the cost of extraction. In particular, ten different aquifers provide about 70% of the water required by more than 28 million people in the metropolitan areas of Mexico City, Toluca, and Cuernavaca. López-Morales and Mesa-Jurado (2017) estimated the costs of replacing the groundwater that these three cities pump from the ten over-exploited aquifers with an alternative system.

For the replacement method cost to be applicable, certain conditions need to be met. Firstly, the alternative to the ecosystem service in question be provided in comparable magnitude and quality to the service or good it is replacing, i.e. the water extracted from the aquifer. Then, there must be a real need to build the manufactured system in the absence of the ecosystem service under study. Finally, by looking at the least costly alternative, the study found that replacing groundwater extraction would involve the construction of six inter-basin transfer systems for surface water as well as aquifer injection of treated water. If Mexico's central aquifer system collapsed, the demand for water would require the construction of this much infrastructure at an estimated cost of US$ 25 billion at present values since other local water sources are not sufficient. The costs for each of the six supply alternatives are comprised by four elements: capital costs, energy costs, opportunity costs of energy otherwise generated, and maintenance. Total construction costs were capitalized through an installation calendar of five years. Given the length of the construction period, it was deemed necessary to also compute the financial opportunity costs of construction expenditures and a 6% discount rate usually included in CONAGUA's financial plans was used for that purpose. The study also formulated four scenarios regarding different degrees of water leak control in the system. In the scenario with no leak control, the full volume of extraction of the aquifer system is to be substituted with the minimum cost combination of the six supply alternatives. It was found that every dollar invested in leak control reduces replacement costs by between US$ 1.9 and US$ 8.4.

The results therefore suggest the prioritization of leak control measures in order to reduce extraction from over-exploited aquifers. Furthermore, the present and future supply of groundwater in the region is not only threatened by the overexploitation of the aquifers, but also by the impact of land use changes in the aquifers' most important recharge zones, i.e. forested mountains. Despite these areas representing only 0.1% of Mexico's land area, they provide water to nearly 24% of the total country's population. Because of policy failures to recognize forests' water services, the region lacks measures for effective conservation. However, the economic value of the water contained in Central Mexico's aquifer system that share the same recharge zone is not to be interpreted as the economic value of the forest itself. Such an estimation would need to include the economic value of the provision of other ecosystem services, which was beyond the scope and objective of this study. That said, local authorities should be warned about the economics of losing ecosystem services that are crucial to sustaining the population and the economic activities in the region of study.

c) Element of TEV captured

The method is suitable to capture direct and indirect use values.

d) Main application/uses and advantages

Because it indicates the savings associated with ecosystem conservation (or, conversely the costs associated with ecosystem degradation and loss), the replacement cost method is often used to help to "make the case" for conservation budgets, investments or other contributions, to weigh up the cost-effectiveness or impact of different development options or projects, and to provide guidance on appropriate levels of environmental damage liabilities and compensation. It provides particularly useful information for the individuals, households and companies potentially affected by the loss of ES. The method is also useful for planners, policy-makers and decision-makers operating in sectors that benefit from the protective functions associated with ecosystems.

Main advantages of the replacement cost method are:

- It can be easily used as part of rapid assessments (to generate "quick and dirty" indications of values), as well as for more detailed analyses.
- It is relatively simple to apply and analyse.
- It does not usually require lengthy or complex primary data collection.
- It provides value estimates (of costs, losses and expenditures avoided as a result of ecosystem conservation, or incurred as a result of ecosystem degradation) which can be easily communicated, and tend to resonate with decision-makers (ValuES).

e) Step-by-step application/implementation

The basic steps in applying the replacement cost method are:

Step 1: Benefit allocation.
First of all, you must ascertain the benefits that are associated with a given ecosystem service and the magnitude and extent of these benefits. You also will need to identify the users of the ES and how the ES is used.

Step 2: Identification of alternatives.
As a next step, identify the most likely alternative source of product, infrastructure or technology that would provide an equivalent level of benefits to an equivalent population.

Step 3: Calculation of replacement costs.
Finally, you must calculate the costs of introducing and distributing, or installing and running, the replacement to the ecosystem service.

Data needs

Data collection is relatively straightforward, and usually relies on secondary information about the benefits associated with a particular ecosystem service and alternatives that are available to replace it. In most cases this can be ascertained through expert consultation and professional estimates, supplemented with direct observation (IUCN 2004; ValuES).

f) Main challenges and limitations

The main limitations of the replacement cost method are:

- It does not measure people's preferences, utility or benefits: it values avoided costs, losses and expenditures.
- It is usually impossible to find perfect replacements or substitutes for an ES.
- It requires information on the degree of substitution between the market good and the natural resource. Few environmental resources have such direct or indirect substitutes. Substitute goods are unlikely to provide the same types of benefits as the natural resource, e.g. stocked salmon may not be valued as highly by anglers as wild salmon.
- The goods or services being replaced probably represent only a portion of the full range of services provided by the natural resource. Thus, the benefits of an action to protect or restore the ecological resource would be understated.
- In some cases, the technique may lead to the over-valuation of ecosystem benefits, as sometimes the replacement product, infrastructure or technology may be associated with secondary benefits or additional positive impacts.
- Without evidence that the population would respond or react in a particular way to the effects of ecosystem service loss, it is not possible to ascertain whether the value estimates yielded via methods are in fact realistic (IUCN 2004; ValuES).

g) Use in combination with other methods/possible conflicts and synergies

Generally, the Replacement Cost approach is compatible with other valuation techniques.

h) Literature overview/list

Barton, D.N., N. Vägnes Traaholt, S. Blumentrath (2015) Materials and methods appendix for valuation of ecosystem services of green infrastructure in Oslo.– NINA Rapport [1115. 65 pp.].

TEEB (2010a). The Economics of Ecosystems and Biodiversity Ecological and Economic Foundations. Edited by Pushpam Kumar. Earthscan, London and Washington.

ValuES method profile on Cost-based methods, available at: *http://www.aboutvalues.net/data/method_navigator/values_method_profile_cost_based_methods.pdf*

Fiche 8 - Damage Cost Avoided

a) Introduction and brief description of the method

ES frequently protect other economically valuable assets. For example, the loss of catchment protection services may result in increased downstream siltation and flooding, which leads to the destruction of infrastructure, settlements and agriculture. When applying the damage cost avoided method, the value is based on the costs of actions taken to avoid damages if a specific ES did not exist. So, for example, a healthy mangrove forest protects against storm damage. The damage cost avoided method hence asks how high the damage of a storm would be damages if the mangrove didn't exist (IUCN 2004).

b) Which ecosystem services can be valued by the method?

The damage cost avoided method is most commonly applied to regulating and supporting ecosystem services, but may also be applied to provisioning services. It is well suited to value the protective functions of ecosystems, especially when this concerns property and infrastructure. Some good examples are: coastal protection by mangroves/reefs, erosion control, carbon sequestration, flood attenuation by mangroves etc. (Mumby, P. et al. 2014; DEFRA 2007). It is generally inappropriate for valuing cultural services.

c) Element of TEV captured

The method can capture both direct and indirect use values.

d) Main application/uses and advantages

Because it indicates the savings associated with ecosystem conservation (or, conversely the costs associated with ecosystem degradation and loss), the damage cost avoided method is often used to help to "make the case" for conservation budgets, investments or other contributions, to weigh up the cost-effectiveness or impact of different development options or projects, and to provide guidance on appropriate levels of environmental damage liabilities and compensation. It provides particularly useful information for the individuals, households and companies potentially affected by the loss of ES. The method is also useful for planners, policy-makers and decision-makers operating in sectors that benefit from the protective functions associated with ecosystems.

Main advantages of the damage cost avoided method are:

- It can be easily used as part of rapid assessments (to generate "quick and dirty" indications of values), as well as for more detailed analyses.
- It is relatively simple to apply and analyse.
- It does not usually require lengthy or complex primary data collection.
- It provides value estimates (of costs, losses and expenditures avoided as a result of ecosystem conservation, or incurred as a result of ecosystem degradation) which can be easily communicated, and tend to resonate with decision-makers (ValuES).

e) Step-by-step application/implementation

The basic steps in applying the damage cost avoided method are:

Step 1: Identification of the ecosystem's protective services.

First, you will need to identify the protective services of the ecosystem, in terms of the degree of protection afforded. Next, you also must determine the on- and offsite damages that would occur as a result of the loss of this protection.

Step 2: Location of affected objects.

For the specific change in ES provision that is being considered, locate the infrastructure, output or human population that would be affected by the loss of the ES.

Step 3: Information collection.
Obtain information on the likelihood and frequency of damaging events, occurring under different scenarios of ecosystem loss, as well as the spread of their impacts and the magnitude of damage caused.

Step 4: Damage cost calculation.
As a final step, calculate the costs of these damages and ascribe the contribution of the ES towards minimising or avoiding them.

Data needs

More specifically, the data required for the damage cost avoided method includes:

• The degree of protection provided by the ecosystem.
• The on- and off-site damages that would occur as a result of loss of this protection.
• The infrastructure, output or human population that would be affected by this damage.
• The likelihood and frequency of damaging events occurring under different scenarios of ecosystem change.
• The spread of impacts and the magnitude of damage caused.
• The cost of damages.
• The contribution of the ES towards minimising or avoiding damages.

For this method, data collection is rather complex. It usually relies on a combination of analysis of historical records, direct observation, interviews and professional estimates. The method also requires detailed data and modelling for predicting the likelihood of extreme events and the associated impacts under different scenarios.

f) Main challenges and limitations
The main limitations of the damage cost avoided method are:

- It does not measure people's preferences, utility or benefits: it values avoided costs, losses and expenditures.
- The estimates of damages avoided remain hypothetical, and thus may not be accurate. They are based on predictions usually calculated under considerable uncertainty.
- It depends on the existence of relevant markets for the ecosystem service in question. Examples include man-made defences being used as a surrogate for wetlands storm protection; expenditure on water filtration as a surrogate for value of water pollution damages etc.
- Without evidence that the population would respond or react in a particular way to the effects of ecosystem service loss, it is not possible to ascertain whether the value estimates yielded via methods are in fact realistic (IUCN 2004; ValuES; DEFRA 2007).

g) Use in combination with other methods/possible conflicts and synergies
There is often confusion between the application of damage costs avoided and production function approach (PFA) to valuation. Here it is important to underline that whereas this technique deals with damage avoided such as from pollution and natural hazards (which are typically external effects), PFA usually relates to changes in some input such as water (typically internalised) (IUCN 2004).

h) Literature overview/list
Barton, D.N., N. Vågnes Traaholt, S. Blumentrath (2015) Materials and methods appendix for valuation of ecosystem services of green infrastructure in Oslo.– NINA Rapport [1115. 65 pp.].

TEEB (2010a). The Economics of Ecosystems and Biodiversity Ecological and Economic Foundations. Edited by Pushpam Kumar. Earthscan, London and Washington.

ValuES method profile on Cost-based methods, available at: *http://www.aboutvalues.net/data/method_navigator/values_method_profile_cost_based_methods.pdf*


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D. Methods of eliciting non-economic Values

Deliberative or participatory approaches are so called "soft" methods and are usually used to explore how opinions are formed or preferences expressed in units other than money. They can be e.g. used to analyse aesthetic and cultural values of ecosystem services or as complementary techniques together with methods of the first three groups.

Fiche 9 - Overview of Participatory Valuation Methods (Focus Groups, In-Depth Groups, Citizens' Juries, Health-based Valuation Approaches, Q-Methodology, Delphi Surveys, Systematic Reviews)

There is no clear definition of Participatory Valuation Methods. Two common features, however, can be identified: a concern with reflecting stakeholders' own perceptions, preferences and categories of value, and efforts to ensure that ES users and beneficiaries are directly involved in the valuation process. Further, they apply more of a qualitative approach rather than focusing solely on assigning economic values. These can elicit values often by asking people to explain or discuss why they behave in a particular way or hold a particular view. The focus can be on what people think society should do, rather than on their personal behaviour. This method group includes, but is not limited to, focus groups, in-depth groups, Citizens' Juries, Health-based valuation approaches, Q-methodology, Delphi surveys and systematic reviews.

Method fiche # 9 presents an overview of the variety of Participatory Valuation Approaches in line with the format applied for all other fiches. Different methods are described here under the collective term of "Participatory Valuation Methods" (PVMs).

a) Introduction and brief description of the methods

Focus Groups/In-Depth Groups. Focus groups are a way of collecting qualitative data in the form of a planned discussion. It is a meeting of a small number of people convened by a facilitator, around a particular topic. This method aims at getting insights from enabling the exchange of diverse perceptions on a specific topic. Conducted in a relaxed and permissive environment, a focus group discussion fosters the expression of different points of view, with no pressure for consensus. Focus groups can be part of a process for determining the social value and importance of ecosystem services. They can contribute to interpreting data from biophysical analysis or from economic valuation by generating a rich description of stakeholder perspectives.

In-depth groups are similar in some respects, but they may meet on several occasions, and are much less closely facilitated, with the greater emphasis being on how the group creates discourse on the topic.

Citizens' Juries. Citizens' juries are designed to obtain carefully considered public opinion on a particular issue or set of social choices. A sample of citizens is given the opportunity to consider evidence from experts and other stakeholders and they then hold group discussion on the issue at hand.

Health-based Valuation Approaches. The approaches measure health-related outcomes in terms of the combined impact on the length and quality of life. For example, a quality-adjusted life year (QALY) combines two key dimensions of health outcomes: the degree of improvement/deterioration in health and the time interval over which this occurs, including any increase/decrease in the duration of life itself.

Q-Methodology. This methodology aims to identify typical ways in which people think about environmental (or other) issues. While Q-methodology can potentially capture any kind of value, the process is not explicitly focused on "quantifying" or distilling these values. Instead it is concerned with how individuals understand, think and feel about environmental problems and their possible solutions.

Delphi Surveys, Systematic Reviews. The intention of Delphi surveys and systematic reviews is to produce summaries of expert opinion or scientific evidence relating to particular questions. However, they both represent very different ways of achieving this. Delphi relies largely on expert opinion, while systematic review attempts to maximise reliance on objective data. Delphi and systematic review are not methods of valuation but, rather, means of summarising knowledge (which may be an important stage of other valuation methods). Note that these approaches can be applied to valuation directly, that is as a survey or review conducted to ascertain what is known about values for a given type of good (DEFRA 2007; TEEB 2010b).

b) Which ecosystem services can be valued by the method?

Participatory valuation can be applied to virtually all ES. Most often, however, PVMs are either used to analyse aesthetic and cultural values of ES or as complementary techniques together with methods of the first three groups (revealed preference methods, stated preference methods and cost based approaches) (TEEB 2010b).

c) Element of TEV captured

The method group can capture direct, indirect and non-use values.

d) Main application/uses and advantages

These methods are particularly useful in situations where money is not the most important medium of exchange or accurate indicator of value, and in relation to products which are not traded or for which the quantity of use is difficult to measure. Participatory methods are often used to emphasise the importance of local or subsistence-level use of wild resources, and to highlight non-material values and cultural services.

They are commonly used as a means of advocating for the participation of local communities in biodiversity and ecosystem management and benefit-sharing, especially the marginalised or vulnerable groups that often lack a strong "voice".

Main strengths of participatory valuation methods include:

- They directly reflect stakeholder preferences, perceptions and categories of value.
- They are flexible, and can be adapted to many different circumstances and needs.
- They can yield both qualitative and quantitative information about ecosystem dependencies and benefits.
- They pay attention to the broader social, institutional and cultural context in which ES are managed, used and perceived.
- They provide a means of representing the interests and needs of more marginalised or vulnerable groups that often lack a "voice" in decision-making.
- Data collection and analysis is usually relatively straightforward and cost-effective to undertake.

e) Step-by-step application/implementation

Participatory valuation is flexible in its approach, and can be applied in many different ways. It refers more to the adoption of stakeholder participation as a guiding principle in the design and process of ecosystem valuation than to the use of fixed steps or required methods. Most approaches share:

- a concern with reflecting stakeholders' own perceptions, preferences and categories of value, and
- efforts to ensure that ecosystem service users and beneficiaries are directly involved in the valuation process.

Various approaches to information gathering are often used to solicit stakeholder input. Emphasis is on understanding the institutional, social and cultural context in which ES are generated, received and used, as well as to what their worth is in economic terms. Economic values may or may not be expressed in monetary terms: often, other categories of value are used which are meaningful to stakeholders or at the local level, and have been devised by ES users and beneficiaries themselves.

Data needs

The exact data requirements depend on the scope, scale, aim and approach being followed. However, usually information collection is focused more on broad-based consultation with ES users and beneficiaries than on using surveys or models to generate and analyse quantitative and biophysical data.

f) Main challenges and limitations

The main challenges in this regard are:

- Lack of single method or accepted process means that studies are not always accepted or given credence by scientists and decision-makers.
- The methods may be time consuming to carry out, as they require building trust with ES users and beneficiaries, ensuring adequate levels of stakeholder participation, and generating a depth of understanding of context.
- Estimates generated for one stakeholder group or in one site cannot usually be extrapolated to, or compared with, other groups or areas.

g) Use in combination with other methods/possible conflicts and synergies

Methods of participatory valuation are often used as complementary techniques together with methods of the first three groups (revealed preference methods, stated preference methods and cost based approaches). Usually no conflicts are observed.

h) Literature overview/list

DEFRA (2007). An introductory guide to valuing ecosystem services.

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ValuES method profile on focus group discussion, available at: *http://www.aboutvalues.net/data/method_navigator/values_method_profile_focus_group_discussion.pdf*

ValuES method profile on participatory economic valuation methods, available at: *http://www.aboutvalues.net/data/method_navigator/values_method_profile_participatory_valuation.pdf*

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III. Annex III

General Outline of a Tier 2 Economic Valuation Report

The individual contents of your Tier 2 in-depth economic valuation report will strongly vary based on relevant policy appraisal context and the decisions you take in the framework of your concrete project. However, in general, your economic valuation report should/might have the following parts/ chapters:

Executive Summary

1. Introduction - Background and Rationale of the Analysis
   - Description of the Policy Appraisal Context
   - Integration into TDA/SAP processes (if relevant)
2. The Role of Economic Valuation of Ecosystem Services in IW projects
   - Importance and possible role of economic valuation in policy decisions
3. The Methodology for evaluating the Ecosystem Services in the Project Area
   - Rationale for the economic valuation (embedding into the policy appraisal context)
   - Reference to the Guidance Document
   - Analytical Framework: TEV and TEEB
   - Description of uncertainties
4. The main Ecosystems, Ecosystem Services and relevant Uses in the Project Area
   - Short overview on studies assessing ecosystem services in the project area (if relevant)
   - Short overview of literature/studies on the project area
   - Socio-Economics of the countries in the project area
   - Ecosystems in the project area (importance, quality, size)
   - Ecosystem services in the project area (socio-economic importance, functions)
5. The Valuation Approaches for the Project Area - Practical Considerations
   - Description of available data and information, as well as data gaps
   - Description of the assumptions and limitations of the chosen approaches (exclusion of certain ecosystems, exclusion of certain ecosystem services, specific approaches for certain ecosystem services due to data limitations etc.)
6. Valuation/Results
   - Sub-chapters per ecosystem and ecosystem service, or per methodology chosen
   - In the methodology chapters, description of the approach (e.g. to surveys, any assumptions takes etc.)
   - Summary of results, uncertainties and assumptions
7. Summary and Outlook
   - Summarizing the results, highlighting specific figures of importance (using the factsheet found in Annex V to this report, if it fits)
   - Description (again) of assumptions and underlying uncertainties
   - Reflection on current versus potential values of ecosystem services
   - Way ahead
8. References

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III.Annex IV

ToR-Template for recruiting an Expert/Experts to conduct an in-depth Valuation

This template is also provided as Word document at the URL: *http://iwlearn.net/learning/manuals/economic-valuation/accompanying-documents-and-training-materials*

[AGENCY´S/ORGANISATION´S NAME]

Terms of Reference for Consultant

Name:	[name of the consultant]		
Job Title:	In-depth Economic Valuation of Ecosystem Services in the [specify region/area/hotspot]		
Division/Department:	[name of the supervising organisation´s department directly responsible]		
Programme/ Project Number:	[internal programme/project number]		
Division/Department:	[name of the supervising]		
Location:	[location of the work to be done: mainly home-based, or in the region]		
Expected start date of assignment:	XX/XX/XXXX	**Duration:**	XXX
Reports to:	[name and title of the direct supervisor]		

Under the general supervision of the [title of supervising agency], the guidance and direct supervision of the [name/title of the direct supervisor of the IW project] and in close cooperation with members of the [any other agencies/working groups taking part], the consultant is expected to prepare a report on approximating the Economic Value of the [name of the region/area/hotspot] ecosystem goods and services. This approximation will use the methodology as described in the "Guidance to Tier 2 In-depth Economic Valuation", developed under the GEF International Waters: Learning Exchange And Resources Network - Subcomponent 4.1 Systematic consideration of the economic valuation of natural resources into the TDA/SAP process (to be found at: http://iwlearn.net/learning/manuals/economic-valuation).

Only minor adjustments to this methodology will be done if deemed necessary. Specific activities include [for example; to be adapted if necessary]:

1. Based on information available prepare an initial annotated outline report on ecosystem goods and services for discussion with [name of IW project/agency]. Available information will be made available by the [IW project/working groups].

2. Liaise with [national focal points/working groups/stakeholders] to obtain additional information. The [IW project manager/supervisor] will facilitate this liaison and support in case of delays the provision of information.

3. Compile relevant valuation information on the [region/area/hotspot] and its ecosystem services using the above mentioned methodology.

4. Prepare an approximation of the Economic Value of the ecosystem goods and services of the [region/area/hotspot], including a short chapter on the current versus potential values and the use of these values in support of decision-making.

5. Present the draft report to the [project manager/working groups/involved stakeholders] for discussion.

6. Finalise and submit the report taking into account the comments and recommendations of the [project manager/working groups/involved stakeholders].

All documents shall be prepared and submitted electronically in English using Word (A4 size paper, all margins 2.54 cm, Times New Roman 12 cpi font, inter-linea minimum 15pt). Original tables and figures should be submitted in Excel 2007 or successive versions.

Expected Outputs:	Required Completion Date:
1. Initial annotated outline of report for discussion with [project manager/working groups].	XX/XX/XXXX
2. An approximation of the Economic Value of the [region/area/hotspot] ecosystem goods and services, including a short chapter on current versus potential values and the use of these values in support of decision-making.	XX/XX/XXXX
3. Present draft report to the [project manager/working groups/involved stakeholders] (duration of mission at least 3 days) and finalization based on feedback from the group.	XX/XX/XXXX
4. Provide final report. Required Completion Date:	XX/XX/XXXX

III. Annex V

Factsheet for summing up and presenting the Results of the Economic Valuation

Title of the Economic Valuation exercise:

Leading Agency/Organisation and principal author´s name(s): Other involved agencies/authors:
Timing/duration:

WHAT has been valuated: name of the ecosystem(s) and short description of the policy appraisal context
Site characteristics: size/boundaries, temporal issues (lifetime, any discount rates)
Specifics: which ecosystem services (or pressures), and which were excluded (name also the reasons)
Methodologies: which methodologies were being used for which ecosystem services
Specifics: were any assumptions taken with regard to the methodologies - e.g. population size, boundaries of coastal ecosystems
Uncertainties resulting from the methodologies and the assumptions taken: clearly describe where the major uncertainties lie, and whether you generally used a more conservative approach (i.e. always assuming lower values), or not.

SUMMARY TABLE

Ecosystem(s)	Size of the ecosystem	Ecosystem Service(s)	Methodology used	Value determined per hectare per year**	Overall value per year**
#1		#1			
		#2			
#2		#1			
		#2			
TOTAL	-	-	-	SUM*	SUM*

*For these summary values, it is very important to check thoroughly for any double counting issues (see Introduction to the Guidance Document, chapter I.2.5).

**Or "damage per year per hectare" (policy appraisal context # 6) or "value until lifetime of project ends" (policy appraisal context # 3).

SUMMARY TEXT

Summarize the main findings of the valuation - the general results, any specific highlights (e.g. the especially high value of some ecosystems), any major uncertainties, and the conclusions that need to be drawn policy-wise from the valuation.

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V Summary and Partners of the GEF IW:LEARN Project

GEF IW:LEARN is a global project that promotes experience sharing, learning, information management and partnership-building among projects in the GEF International Waters (GEF IW) focal area. The IW:LEARN project was established to strengthen transboundary water management around the globe by collecting and sharing best practices, lessons learned, and innovative solutions to common problems across the GEF International Waters portfolio. It promotes learning among project managers, country official, implementing agencies, and other partners.

The GEF IW focal area targets transboundary water systems, such as shared river basins, lakes, groundwater and large marine ecosystems. GEF IW:LEARN aims to serve all GEF IW stakeholders including project managers, international and local project staff, government officials, implementing agency staff, non-governmental organizations, and others. The project also operates as a central hub for storing and sharing data and documents from past GEF IW projects, making it the focal area's sole repository for such information.

Over the last eighteen years, GEF IW:LEARN has grown from an informal network serving a few projects and agency staff focused on IW projects, to a large partnership working with community of individuals from a few hundred public and private sector organizations. GEF IW:LEARN has produced a number of noteworthy results across multiple service lines that foster this community from coordinating information management through the GEF IW:LEARN website and its applications to both virtual and face- to-face training events.

Global Environment Facility (GEF) was established on the eve of the 1992 Rio Earth Summit as a catalyst for action on the environment. Through its strategic investments, the GEF works with partners to tackle the planet's biggest environmental issues.

United Nations Development Program (UNDP)'s comparative advantage for the GEF lies in its global network of country offices, its experience in integrated policy development, human resources development, institutional strengthening, and non-governmental and community participation.

UN Environment is the leading global voice on the environment. It provides leadership and encourages partnership in caring for the environment by inspiring, informing, and enabling nations and peoples to improve their quality of life without compromising that of future generations.

Intergovernmental Oceanographic Commission of UNESCO (IOC-UNESCO) was established in 1960 as a body with functional autonomy within UNESCO, it promotes international cooperation and coordinates programmes in marine research, services, observation systems hazard mitigation and capacity development in order to understand and effectively manage ocean and coastal areas resources.

GRID-Arendal supports sustainable development by working with UN Environment and other partners. GRID Arendal communicates environmental knowledge that strengthens management capacity and motivates decision-makers to act. GRID is a key centre of geo-spatial know-how, with strengths in GIS, IP/remote sensing and statistical analyses, integrated through modern spatial data infrastructures and web applications.

Conservation International (CI) is a non-profit organization. Building upon a strong foundation of science, partnership and field demonstration, CI empowers societies to responsibly and sustainably care for nature, our global biodiversity, for the well-being of humanity.

Global Water Partnership (GWP) is a global action network with over 3,000 Partner organisations in 183 countries. The network has 86 Country Water Partnerships and 13 Regional Water Partnerships. GWP offers toolboxes and knowledge products, capacity building and knowledge network, dialogue activities with the private sector and online courses.

International Commission for the Protection of the Danube River (ICPDR) works to ensure the sustainable and equitable use of waters and freshwater resources in the Danube River Basin. ICPDR supports twinning and expertise on transboundary water management, as well as cooperation with private industry through its Green Danube Partnership and education material (the Danube Box) which can be up-scaled.

International Hydrological Programme (IHP) of UNESCO is an intergovernmental programme of the UN systemdevoted to water research, water resources management, and education and capacity building. It contributes its extensive groundwater program and networks to various activities, for example data and publications, global forums and intergovernmental processes.

International River Foundation (IRF) champions integrated river basin management for the restoration, protection and sustainable management of the world's rivers. IRF helps with dissemination, an extensive twinning program, global river symposium and network expertise.

The International Union for Conservation of Nature (IUCN) is composed of both government and civil society organisations. It provides public, private and nongovernmental organisations with the knowledge and tools that enable human progress, economic development and nature conservation to take place together.

The Nature Conservancy (TNC) is an international NGO active in over 35 countries, it offers a diverse body of experience, expertise, and vast partner network, including through its Global Water Program and Great Rivers strategies, focused on several of the world's large basins of Africa, Asia, Latin America and the USA. Its support will centre on thematic capacity building, trainings, and other knowledge sharing activities, project twinning support, private sector engagement activities, scientific publications and other knowledge products, support to global events and policy dialogues in various regions, and e-learning and online materials.

United Nations Economic Commission for Europe (UNECE) services the UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes (UNECE Water Convention) which is turning into a universally open legal framework for transboundary cooperation. UNECE offers lessons learnt from projects and guidance developed in the last 20 years to synthesis publications produced by GEF IW:LEARN.

United Nations Industrial Development Organization (UNIDO) is a specialised agency of the United Nations that promotes industrial development for poverty reduction, inclusive globalisation and environmental sustainability. It contributes a business partnership program as well as staff resources to support the economic valuation activity.

World Water Assessment Programme (WWAP) of UNESCO monitors freshwater issues in order to provide recommendations, develop case studies, enhance assessment capacity at a national level and inform the decision-making process. It has developed a unique role in fostering the definition and use of sex disaggregated indicators in water resources assessments and monitoring.

World Wildlife Fund-US (WWF-US) supports the project through its private sector engagement (e.g., significant partnerships with private sector companies, trainings on water footprints and water stewardship, water risk filter), gender and community-based conservation, and work on global legal conventions.

GEF International Waters:
Learning Exchange and Resources Network
(IW:LEARN)

United Nations
Educational, Scientific and
Cultural Organization

Intergovernmental
Oceanographic
Commission

Empowered lives.
Resilient nations.

https://iwlearn.net/valuation