

# Options for the Application of TOOLS FOR VALUATION OF BIODIVERSITY and Biodiversity Resources and Functions

Biodiversity and its resources and functions generate substantial ecosystem services many of which are not traded on markets and whose value is therefore not reflected in market prices. Consequently, private and public decision-making and the allocation of funds will be distorted if the repercussions of activities on biodiversity resources and functions, and the associated ecosystem services, are not adequately taken into account. This distortion is an important underlying cause of biodiversity decline. Undertaking valuation of biodiversity resources and functions and the associated non-marketed ecosystem services has the potential of improving private and public decision-making, thereby contributing to the target of the Convention to significantly reduce by 2010 the current rate of biodiversity loss.

The options of valuation tools provided in the accompanying table should not be taken as a closed set of tools, considering the evolutionary character of this field.

**TOTAL ECONOMIC VALUE (TEV)** Most public and private resource management and investment decisions are strongly influenced by considerations of the monetary costs and benefits of alternative policy choices. Undertaking valuation should seek to address the relevant components of the Total Economic Value of non-marketed ecosystem services, bearing in mind that the concept of Total Economic Value includes both the direct and indirect use value as well as non-use value of ecosystem services and hence goes beyond the immediate benefits of commercial exploitations of biodiversity resources. Decisions can be improved if they are informed by the economic value of alternative management options and involve mechanisms that bring to bear non-economic considerations as well.

## Foreword



Over the last decades, human beings have changed global ecosystems faster and more extensively than in any comparable period of time in human history, leading to an unprecedented and ongoing loss of biodiversity. Ecosystems such as tropical forests and wetlands have already shrunk dramatically or become increasingly fragmented, with disastrous results for biodiversity. Species are becoming extinct at 1,000 times the typical background rate – leading scientists speak about the sixth wave of extinction taking place in Earth's history. This is the main message of the Millennium Ecosystem Assessment, an assessment of the world's ecosystems which was prepared by 1,395 experts from 95 countries.

According to the Assessment, the loss of biodiversity constitutes a concern for human well-being, especially for the well-being of the poorest. Biodiverse ecosystems provide essential resources and goods, such as food, fibre, and medicines. The ecosystem functions that support these provide other vital services, such as the regulation of water flows and levels, protection against extreme weather, the purification of air and water, the prevention of soil erosion, and opportunities for recreation and spiritual reflection. In its evaluation of these ecosystem services, the Assessment found that 15 out of the 24 examined are in decline.

Most of these ecosystem services are not traded on markets and thus do not bear a price tag, making it difficult to make informed choices about their conservation and sustainable use. Absence of a price does not mean the absence of economic value, however. Revealing the hidden value of ecosystem services through valuation techniques, in particular techniques for non-market valuation, is an important mechanism for integrating biodiversity considerations in economic decision-making. The application of improved valuation techniques can lead to interesting observations. For example, valuation techniques tell us that although many individuals benefit from

the activities that lead to biodiversity decline and the associated loss in ecosystem services, the costs borne by society of these activities are often higher.

Since the inception of the Convention on Biological Diversity, the Parties have expressed considerable interest in work on valuation, including the review of valuation information and research into appropriate and cost-effective valuation methodologies. Options for the Application of Tools for Valuation of Biodiversity and Biodiversity Resources and Functions is the latest result of this work. These options were identified by the Convention's Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) at its eleventh meeting, in November 2005. The Conference of the Parties to the Convention at its eighth meeting, which took place in Curitiba, Brazil, from 20 to 31 March 2006, invited Parties and other Governments to take these options into consideration as possible inputs for analysis when considering, on a voluntary basis, the application of methods for assessing the changes in the value of biodiversity resources and functions, and associated ecosystem services, that result from their decision-making. Such consideration is to be in accordance with their national policies and legislation, their capacity and taking into account other international instruments.

The Conference of the Parties underlined that the application of practical valuation methods can contribute to meeting the target agreed by Parties of achieving, by 2010, a significant reduction of the current rate of biodiversity loss at the global, regional and national level. Achieving this target is ambitious, but vital. It is my hope that the publication of the options developed by SBSTTA in an accessible format will help to apply such valuation methods, and hence to achieve the 2010 biodiversity target, as a contribution to poverty alleviation and for the greater benefit of all life on Earth.



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## A. Valuation tools

A number of valuation tools are available that, when applied carefully and according to best practice, can provide useful and reliable information on the changes in the value of non-marketed ecosystem services that result (or would result) from management decisions or from other human activities (see the accompanying table). Data requirements may be quite demanding for a number of tools, as are the preconditions in terms of technical expertise. Moreover, conducting primary valuation studies is typically time-consuming and costly. Therefore, other approaches, including deliberative mechanisms that bring to bear non-economic considerations, will often be needed to support final decision-making.

### EFFICIENCY

A cost/benefit criterion should be applied, as appropriate, to the valuation study itself. In principle, valuation techniques or tools should be used when the anticipated incremental (including long-term) improvements in the decision are commensurate with the costs of undertaking the valuation.

### CHOICE OF VALUATION TOOLS

The choice of the valuation tool or valuation tools in any given instance will be informed by the characteristics of the case, including the scale of the problem and the types of value deemed to be most relevant, and by data availability. Several techniques have been specifically developed to cater to the characteristics of particular problems, while others are very broadly applicable but may have other limitations that should be taken fully into account when choosing the appropriate tool or set of tools. Different approaches can be used in a complementary manner. In general, tools based on observed behaviour (the so-called revealed-preference techniques) are preferred to tools based on hypothetical behaviour (the so-called stated-preference techniques).

### STATED-PREFERENCE TECHNIQUES

Stated-preference techniques are, however the only techniques that are able to capture non-use (or passive use) values, which tend to be important in certain biodiversity contexts, and can provide useful and reliable information when used carefully and in accordance with authoritative best practice. Limitations of stated-preference techniques include: (i) the detail of information needed by respondents in order to value complex processes or unfamiliar species or ecosystem functions; (ii) difficult external validation of the results; and (iii) the need for extensive pre-testing and survey work, implying that this technique can be expensive and time-consuming. Their application could therefore be considered if all of the following conditions are met: (i) non-

use values are expected to be an important component of the value of the ecosystem service under consideration; (ii) it can be ensured that the sample group of respondents is representative and has an adequate understanding of the issue in question; and (iii) capacity requirements for an application in accordance with best practice, including adequate skills in survey design, are met.

### COST-BASED APPROACHES

Cost-based approaches can provide useful guidance, if the nature and extent of physical damage expected is predictable and if the cost to replace or restore damaged assets, and the resulting ecosystem services, can be estimated with a reasonable degree of accuracy, and does not exceed the value of the ecosystem services in the first place. These approaches can in particular be used when the specific decision-making problem calls for a comparison of the costs resulting from different replacement or restoration options to meet a specific objective, and there is a general view that the benefits associated with meeting the objective outweigh the costs.

### BENEFITS TRANSFER

Benefits transfer can provide valid and reliable estimates under certain conditions, including: (i) that the commodity or service being valued be very similar at the site where the estimates were made and the site where they are applied; (ii) that the populations affected have very similar characteristics; and (iii) that the original estimates being transferred must themselves be reliable. When used cautiously, it has the potential to alleviate the problems of deficient primary data sets and limited funds often encountered in valuation. However, benefits transfer is still a developing subject. More work needs to be undertaken to assess its validity in studies where it has been used to value biodiversity. Cautious application and further development of this method needs to be undertaken.

## B. Institutional considerations

### DEVELOPMENT OR IMPROVEMENT OF INSTITUTIONS

Adequate institutional arrangements can generally be identified as an important precondition to the further promotion of valuation as a tool in biodiversity management and the generation of reliable valuation studies. These arrangements should, inter alia, provide a clear assignment of responsibilities for conducting appraisal processes and auditing for quality control.

### BIODIVERSITY VALUES AND NATIONAL INCOME ACCOUNTS

In the last two decades there have been numerous attempts, at national and international levels, to include environmental externalities into national income accounts, including through satellite accounts, and to apply measures of environmental depreciation to reflect the environmental losses that occur as a result of economic activities. Such measures can serve as a basis for prioritizing national environmental policies and giving focus on mitigation or reversal of environmentally damaging activities. The development of a biodiversity adjustment for national accounting may be useful in reflecting biodiversity losses more adequately.

### DEVELOPMENT OF NATIONAL GUIDELINES

National valuation guidelines and protocols can be useful means to ensure that biodiversity values are adequately taken into account and/or integrated in domestic appraisal processes and income accounts. They can also ensure that valuation tools are applied in accordance with domestic conditions and can thereby contribute to increasing the credibility and acceptability of appraisal processes including the application of valuation methods.

### INVOLVEMENT OF STAKEHOLDERS AS WELL AS INDIGENOUS AND LOCAL COMMUNITIES

The full involvement of all relevant stakeholders as well as indigenous and local communities is another important means of increasing the credibility and acceptability of decision-making processes including the application of valuation methods. By ensuring that sample groups are representative, their full and effective involvement can also contribute to the quality of applying certain valuation tools. Institutions should therefore have mechanisms in place that ensure the full and effective involvement of relevant stakeholders as well as indigenous and local communities in appraisal processes including the application of valuation tools.

### AWARENESS-RAISING AND INCENTIVE MEASURES

Identifying and assessing the value of biodiversity resources and functions and of the associated ecosystem services can raise awareness, thus creating incentives for the conservation and sustainable use of biodiversity, and can also support the adequate design and calibration of other incentive measures for the conservation and sustainable use of biodiversity, bearing in mind that incentive measures should not negatively affect biodiversity and livelihoods of communities in other countries. Furthermore, raising awareness among all stakeholders of the value of biodiversity improves the chances for other incentive measures to be successful.

### AWARENESS-RAISING AND PILOT PROJECTS

Undertaking valuation studies as pilot projects on key domestic ecosystems can be another effective means to raise awareness of the value of biodiversity resources and functions and associated ecosystem services, and to advance the application of biodiversity valuation in domestic decision-making procedures.

## Main valuation techniques

(Source: Adapted from Millennium Ecosystem Assessment)

METHOD	DESCRIPTION	APPLICATIONS	DATA REQUIREMENTS	POTENTIAL CHALLENGES/LIMITATIONS	
REVEALED-PREFERENCE METHODS	Change in productivity	Trace impact of change in ecosystem services on produced goods	Any impact that affects produced goods	Change in service; impact on production; net value of produced goods	Lacking data on change in service and consequent impact on production
	Cost of illness, human capital	Trace impact of change in ecosystem services on morbidity and mortality	Any impact that affects health (e.g. air or water pollution)	Change in service; impact on health (dose-response functions); cost of illness or value of life	Lacking dose-response functions linking environmental conditions to health; value of life cannot be estimated
	Cost-based approaches (e.g., replacement, restoration costs)	Use cost of replacing or restoring the service	Any loss of goods or services; Identification of least cost option to meet given objective	Extent of loss of goods or services, cost of replacing or restoring them	Risk to over-estimate actual value if unknown benefits are higher than identified costs
	Travel cost (TCM)	Derive demand curve from data on actual travel costs	Site-specific recreation; site-seeing (e.g. protected areas)	Survey to collect monetary and time costs of travel to destination, distance travelled	Limited to described applications; difficult to use when trips are to multiple destinations
STATED-PREFERENCE METHODS	Hedonic prices	Extract effect of ecosystem service on price of goods that include those factors	Air quality, scenic beauty, cultural benefits	Prices and characteristics of goods	Requires transparent and well-working markets, and vast quantities of data; very sensitive to specification
	Contingent valuation (CV)	Ask respondents directly their willingness to pay for a specified service	In particular in cases where non-use values are deemed to be important	Survey that presents scenario and elicits willingness to pay for specified service	Ensuring sample representativeness important but large survey is time-consuming and costly; knowledge of respondents may be insufficient; potential sources of bias in responses; guidelines exist for reliable application
	Choice modelling	Ask respondents to choose their preferred option from a set of alternatives with particular attributes	In particular in cases where non-use values are deemed to be important	Survey of respondents	Similar to Contingent valuation, but minimizes some biases; analysis of the data generated is complex
OTHER METHODS	Benefits transfer	Use results obtained in one case in a different, but very similar case	Any for which suitable and high-quality comparison studies are available; applicable in cases where savings in time and costs outweigh certain loss of accuracy (e.g., rapid assessments)	High-quality valuation data from other, similar sites	Can be wildly inaccurate when not used cautiously, as many factors may still vary even when cases seem "similar"

## C. Capacity-building and training

### CAPACITY-BUILDING

The effective application of tools for the valuation of biodiversity resources and functions and associated ecosystem services requires considerable capacity and technical expertise. In many countries, capacity needs to be enhanced for putting adequate institutions in place, for conducting effective appraisal processes including the valuation of biodiversity and associated ecosystem services, for improved oversight and auditing for quality control, as well as for putting valuation results to good use in governmental decision-making by an effective and credible follow-up. Capacity would also be needed to, as appropriate: improve biophysical information to support biodiversity valuation; address ethical concerns about valuing environmental impacts in monetary terms; and address technical concerns surrounding the use of valuation tools for biodiversity.

### REGIONAL WORKSHOPS

Regional workshops on ecosystem valuation are an important means to exchange national experience on best practices in the valuation of biodiversity resources and functions and associated ecosystem services, and in the development of national guidelines and protocols, and to extend training.

### REGIONAL AND INTERNATIONAL COOPERATION AND TRAINING

Training is an important component in activities to build or enhance domestic capacities. A number of mechanisms exist that extend training on the valuation of biodiversity resources and functions and associated ecosystem services, and could be further strengthened. They include: (a) Regional centres of expertise which offer training activities; (b) Long-term and short-term academic exchange programmes; (c) Short-term courses offered by international organizations; (d) Bilateral arrangements between agencies for temporary secondment; (e) Web-based resources and training manuals.

### INTERNATIONAL DATABASES FOR BENEFITS TRANSFER

There exists web-based databases that collect valuation data for use in benefits transfer. As the use of this concept seems to be an increasingly appealing way to advance the use of valuation information in particular in light of the time and resource requirements for undertaking extensive primary research, fostering its further development and wider application should therefore be considered. This could also include increased cooperation among existing initiatives with a view to ensuring, in accordance with their mandates, a comprehensive coverage of cases of valuation of biodiversity resources and functions and associated ecosystem services, especially in developing countries, in particular the least developed and small island developing States among them, and countries with economies in transition.

## D. Further research

### INTERNATIONAL RESEARCH COOPERATION

Considerable progress has been made in the last decades in developing reliable tools, as well as the protocols for their application, for the valuation of biodiversity resources and functions and associated ecosystem services. However, important opportunities for further research and development remain. Research initiatives that address these opportunities and seek to establish regional or international cooperation and exchange should be supported.

### BIODIVERSITY VALUATION AND NATIONAL ACCOUNTING

Further research directed at the development of a biodiversity adjustment for national accounting seems to be an important means to have biodiversity losses more reflected in macro-economic policy-making.

### VALUATION TOOLS

Further research on the conditions for validity and robustness of valuation techniques, in particular of stated preference techniques, may contribute to further the reliability of valuation information of non-marketed ecosystem services, in particular with regard to non-use values.

### BENEFITS TRANSFER

Further research on the conditions for validity and robustness of benefits transfer may further advance the use of valuation information under tight time and resource constraints, which prevent extensive primary research.

### LINKS BETWEEN BIODIVERSITY, BIODIVERSITY FUNCTIONS, AND ASSOCIATED ECOSYSTEM SERVICES

Despite recent progress made in understanding the links between biological diversity, biodiversity functions, and the associated ecosystem services, many questions remain unresolved. Further research in addressing these important questions is therefore warranted and may also lead to the development of innovative tools and methodologies for the valuation of biodiversity and biodiversity resources and functions.

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Achieving the 2010  
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1. See decisions I/10 A and W/15, annex I, paragraph 22.