Convention on Biological Diversity

Secretariat

Ref: SCBD/SEL/ML/GD/47681

27 May 2005

NOTIFICATION

Dear Sir/Madam,

Subject: Peer review of documents on the exploration of tools and methodologies for valuation of biodiversity and biodiversity resources and functions

I wish to draw your attention to decision VII/18 of the seventh meeting of the Conference of the Parties to the Convention on Biological Diversity, on incentive measures.

In paragraph 12 of this decision, the Conference of the Parties requested the Executive Secretary to *"explore, in cooperation with the Millennium Ecosystem Assessment, the Organisation for Economic Co-operation and Development and relevant international organizations, existing methodologies for valuation of biodiversity and biodiversity resources and functions, as well as other tools for prioritization in decision-making, by preparing a compilation of existing valuation tools that provides an overview of the discussion on their methodological status, if appropriate, as well as an assessment of their applicability in terms of effectiveness and capacity preconditions, and to prepare proposals for the application of such tools. These proposals should include the identification of options to strengthen international collaborative partnerships for assessing biodiversity values, especially for the refinement and advancement of valuation tools, and shall be submitted to the Subsidiary Body on Scientific, Technical and Technological Advice for its consideration at a meeting prior to the eighth meeting of the Conference of the Parties."*

Pursuant to that request, the Secretariat has prepared the attached documents that provide the requested analysis as well as the proposals on the application of tools for valuation of biodiversity and biodiversity resources and functions. The documents are now open for peer review. The purpose of the peer review process is to receive comments on the overall balance and soundness of the arguments covered by the documents, as well as on the identification of opportunities for further research.

To: CBD National Focal Points and relevant organizations

Attachment: Documents "An exploration of tools and methodologies for valuation of biodiversity and biodiversity resources and functions" and "Proposals on the application of tools for valuation of biodiversity and biodiversity resources and functions"

United Nations Environment Programme
UNEP
Tel.: (514) 288-2220
Fax: (514) 288-6588
website: www.biodiv.org
e-mail: secretariat@biodiv.org
World Trade Centre Building
413 Saint-Jacques Street, Suite 800
Montréal, Québec, Canada H2Y 1N9

I have the pleasure to invite you to take part in the peer review of the attached document. I would be grateful to receive your comments as soon as possible but not later than **4 July 2005**.

I wish to thank you in advance for your cooperation in this matter and for your continued support of the work of the Convention.

Yours sincerely,

Hamdallah Zedan
Executive Secretary

UNEP

CBD

CONVENTION ON BIOLOGICAL DIVERSITY

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Eleventh meeting
Montreal, 28 November – 2 December 2005
Item 5.3 (b) of the provisional agenda*

INCENTIVE MEASURES

AN EXPLORATION OF TOOLS AND METHODOLOGIES FOR VALUATION OF BIODIVERSITY AND BIODIVERSITY RESOURCES AND FUNCTIONS

Note by the Executive Secretary

DRAFT FOR PEER REVIEW – DO NOT QUOTE

1. Introduction

1. In paragraph 12 of decision VII/18, on incentive measures, the Conference of the Parties requested the Executive Secretary to *"explore, in cooperation with the Millennium Ecosystem Assessment, the Organisation for Economic Co-operation and Development and relevant international organizations, existing methodologies for valuation of biodiversity and biodiversity resources and functions, as well as other tools for prioritization in decision-making, by preparing a compilation of existing valuation tools that provides an overview of the discussion on their methodological status, if appropriate, as well as an assessment of their applicability in terms of effectiveness and capacity preconditions, and to prepare proposals for the application of such tools. These proposals should include the identification of options to strengthen international collaborative partnerships for assessing biodiversity values, especially for the refinement and advancement of valuation tools, and shall be submitted to the Subsidiary Body on Scientific, Technical and Technological Advice for its consideration at a meeting prior to the eighth meeting of the Conference of the Parties."*

2. In paragraph 8 of the same decision, the Conference of the Parties invited Parties, Governments and international organizations to submit case-studies, best practices and other information *inter alia* on the application of methodologies for the assessment of values of biodiversity and its functions, as well as other tools for prioritization in decision-making, to the Executive Secretary. The Executive Secretary communicated this invitation to Parties, governments and relevant organizations by notifications 076/2004 and 077/2004 as well as 026/2005 and 028/2005. Pertinent submissions received further to this invitation were taken into consideration in the preparation of the present note.

* UNEP/CBD/SBSTTA/11/1.

3. In accordance, with the request of the Conference of the Parties, the present note provides an exploration of existing methodologies for valuation of biodiversity and biodiversity resources and functions, as well as other tools for prioritization in decision-making, by providing an overview on existing valuation tools and their methodological status as well as an assessment of their applicability in terms of effectiveness and capacity preconditions.

2. Methodological issues in valuation

2.1 Defining value

4. Biodiversity and biological resources and functions are intuitively valuable. Few would contest the fact that the decline of biodiversity and related losses of ecosystem services would be costly to mankind, in particular with regard to those functions that cannot be replicated. But this general truth does not shed much light on how to identify, describe and measures the specific values that are held in respect of biodiversity and biological resources and functions.

5. The term value is used in different ways amongst a range of academic disciplines. According to the Oxford Dictionary, there are three main types of uses of the term "value": (i) *exchange value*, that is, the (relative) price of a good or service in the market; (ii) *utility*, that is, the use value of a good or service, which can be very different from the market price (e.g. the market price of water is very low, but its use value very high; the reverse is the case for, for example, diamonds or other luxury goods); and (iii) *importance*, that is, the appreciation or emotional value attached to a given good or service (e.g. the emotional or spiritual experience some people have when viewing wildlife or natural scenery, or our ethical considerations regarding the existence value of wildlife).

6. Different disciplines define and use these terms in different ways. For example, in economics, value and utility are unambiguously anthropogenic. It is humans who reveal value, in terms of their so-called willingness-to-pay, by the process of exchange. Similarly utility is derived by humans from resource use. Even the concept of importance is only meaningful if assigned by, and inferred from, human choices or decisions on behalf of other living organisms. But other disciplines may assign different interpretations to value or importance, which may or may not be linked to values ascribed by human beings. For example, anthropology may infer value from cultural norms and practices that are in some sense non-negotiable (e.g. sacred groves). Theologians and ethicists may base importance on moral or spiritual criteria that are neither observed nor measurable (but nevertheless strong motives), and may also point out that the predominant role of humans in utilitarian thinking displaces intrinsic value and the right of other species to exist. And last but not least, ecologists will be interested in the importance of attributes or functions of a system to maintain ecosystem resilience and health. . This is an objective criterion, that is, irrespective of its relevance to humans.

7. In what follows it is important to bear in mind these disciplinary distinctions and the fact that different perspectives on value lead to differing views on the practicality of measurement and, by extension, use in policy making.

2.2 Valuation

8. Valuation does normally not entail measuring the economic value of bio*diversity* as such. [1] While there is growing awareness of the value and importance of diversity *per se*, there is a lack of consensus on how diversity can be defined and measured. For example, species richness is frequently the only accessible indicator of species diversity, although it is well known that a head count of the number of apparently different species in an area may not be a good proxy for the portfolio effect of genetic distance between them. Some index or set of indices of biodiversity change would be fundamental to any

1/ Pearce and Moran, 1994.

economic valuation. In theory this could be based on phylogenetic data. In practice this data is not readily available as a basis for prioritization. However, other prioritisation devices, discussed below, employ non-monetary measures of value that may encompass genetic distance.

9. Instead, valuation typically focuses on the economic values of the goods and services generated by biodiversity resources and functions. It is noteworthy however that under the standard concept of **total economic value** (see next sub-section), the term "economic" is to be understood in a broad sense. Based on welfare economics, this concept recognizes that individuals may assign value for different reasons or motives, and not only for the immediate benefits of commercial exploitations of biodiversity resources (as a narrow interpretation of the term "economic" may suggest).

10. A comprehensive assessment of the values of global ecosystem services 2/ has recently been undertaken by the Global Ecosystem Assessment. The Millennium Ecosystem Assessment was carried out between 2001 and 2005 to assess the consequences of ecosystem change for human well-being and to analyze options available to enhance the conservation and sustainable use of ecosystems and their contributions to human well-being. Responding to requests for information including through the Convention on Biological Diversity, it was carried out by approximately 1,360 experts from 95 countries, and has been extensively peer reviewed by governments and experts. Table 1 presents a classification of ecosystem services developed by the Millennium Ecosystem Assessment.

11. Economics generally assigns value on the basis of direct or indirect monetary tradeoffs, that is, actions that show people making financial sacrifices in favour of specific goods and services, thus revealing their willingness-to-pay for these goods and services by exchanging them on markets. These actions can be explained by a robust theory of demand that posits specific axioms or rules about the consistency in which these choices are made. It is the consistency of the predictions of this theory that enables economists to infer what people value based on what they actually do.

12. Environmental economics has extended demand theory to goods and services that are not traded on markets, such as many biodiversity resources and the services generated by biodiversity functions. Hence, the value of these resources is again inferred from the aforementioned sacrifice or willingness to pay, based on actual or hypothetical behavior. There are many reasons why people are indirectly observed to, or directly state that they are willing to, make tradeoffs between their endowment (in terms of time, labour effort, monetary income or wealth) and biological resources. 3/. The framework commonly used for describing the different types of economic value ascribed to natural resources is known as the Total Economic Value (TEV) and will be presented below. These different types of value can be elicited by the different valuation tools at hand.

13. Hence, valuation usually attempts to measures the value of ecosystem services in monetary terms, in order to provide a common metric in which to express the benefits of the variety of services provided by ecosystems. This explicitly does not mean that only services that generate monetary benefits are taken into consideration.

14. The economic profession is divided on whether this approach is adequate or sufficient to deal with the more complex issues that are also involved in biodiversity conservation. It is in particular suggested that some biodiversity functions are key to the survival of global ecosystems including humans (the so-called life support function) and should therefore be treated as a fundamental constraint and not as an element of the set of possible economic choices. Put another way, all economic choices must be made within some

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2/ The Millennium Ecosystem Assessment adopted a wide definition of ecosystem services, which includes goods under the heading "provisioning services." See Millennium Ecosystem Assessment (2003), 57, and table 1.

3 Note the nature of these tradeoffs may be manifested in different ways. Oonly some of which ~~only~~ imply a monetary sacrifice. For example giving up time to harvest resources rather than undertaking some other activity such as childcare or collecting water. However, these activities can also be translated into monetary equivalents in order to have a common metric.

ecological constraints otherwise the global system may collapse. The standard economic toolbox is said to be of limited if any use for the identification of these global constraints.

15. In fact, valuation usually focuses on the value of comparatively small (incremental) *changes* in ecosystem services that result (or would result) from management decisions or from other human activities. Some recent efforts have been made to derive the global (as opposed to incremental) value of ecosystems at a given time 4/ and to simulate the value of ecosystem services in an integrated Earth system model. 5/ However, the methodologies underlying these efforts, and the figures they produced, remain controversial; 6/ moreover, as the Millennium Ecosystem Assessment notes, their usefulness for policy is limited, as it is rare for all ecosystem services to be completely lost and even then, such a complete loss would usually happen only over time. 7/ For these reasons, and consistent with the approach chosen by the Millennium Ecosystem Assessment, 8 this note focuses on methods for assessing the value of *changes* in ecosystem resources and the services they yield.

2.3 Total Economic Value

16. The framework commonly used for describing the different *types* of economic value ascribed to natural resources is known as Total Economic Value (TEV). The framework comprises use values (direct, indirect and option value) and non-use values. These values as they apply to different biological resources are summarised in Figure 1. 9/

17. **Direct use value** is the value derived from direct use or interaction with environmental resources and services (e.g., timber, fuelwood, tourism are direct use values of a tropical forest). They involve commercial, subsistence, leisure, or other activities associated with a resource. In developing country contexts subsistence activities are often crucially important to rural populations and a range of studies has concentrated on the links between poverty alleviation and the sustainable exploitation of naturally occurring products. 10/

18. **Indirect use value** relates to the indirect support and protection provided to economic activity and property by the ecosystem's natural functions. For example, carbon sequestration is a function of forest ecosystems whose value can be derived from the avoided costs of having to sequester by other means, or from avoiding the actual effects of warming. Similarly, the watershed protection function of a tropical forest may have indirect use value through controlling water quality and flood drainage that affect downstream agriculture, fishing, water supplies and other economic activities. While these functions have in principle long been recognized, precise field experimentation has often been lacking in order to show more precisely the relationships between ecosystem functions and values. Once they are demonstrated though these values have provided the basis for a number of transactions and a general research theme to structure and realise market opportunities for ecosystem services. 11

4/ See Costanza et al. 1997.

5/ See Boumans et al. 2002.

6/ For instance, Dasgupta states that "the value of an incremental change to the natural environment is meaningful because it assumes that humanity will survive the change to experience it. The reason (that) estimates of the total value (of the environment) should cause us to balk is that if environmental services were to cease, life would not exist.".See P. Dasgupta (2000): Human Well-Being and the Natural Environment.

7/ Millennium Ecosystem Assessment, volume one, chapter 2.3.3.

8/ ibid.

9/ It is important to not confound this concept with the attempts, explained in paragraph 15 above, to quantify the global (as opposed to incremental) value of ecosystem services worldwide.

10/ See, e.g., Cavendish 1999.

11/ Landell-Mills and Porras 2004; Eftec 2005.

19. **Option value** is a type of use value in that it relates to future use of the environment or biodiversity resources. Option value arises because individuals may value the option to be able to use the biological resource some time in the future. For example, there may be an additional premium placed on preserving a forest system and its resources and functions for future use, particularly if prospects of future value are high and if current exploitation or conversion is irreversible. The logic of the option motive is to maintain a diverse portfolio of resources, including biological resources, as a means to reducing the risk of large fluctuations in value. Quantification of option value is complex, but several attempts have been made in the context of the values that could eventually be derived from wild plants and the chemical compounds of naturally occurring wild plants and organisms, which provide compelling reasons for maintaining a portfolio of genetic material.

20. **Non-use values** such as existence value (sometimes also dubbed passive value) are derived neither from current direct or indirect use of the environment. For example, there are individuals who do not use the tropical forest but nevertheless wish to see it preserved because they simply derive utility from the ongoing existence of the ecosystem. The concrete reasons why they derive utility may vary and may be based on, for instance, religious, spiritual, or ethical motives. In particular, a non-use motive may coincide with the recognition of an intrinsic right of existence of a biodiversity resource. In this sense, valuation that is based on the concept of total economic value will also capture, at least to some extent, non-utilitarian values. 12/

21. Of all the value categories, existence or passive value is most complex in terms of quantification and its role in decision-making. Yet it is a type of economic value that is significant in defining both national and global conservation priorities.

3. Valuation methods

22. In the last decades, valuation methods have reached a considerable degree of sophistication as well as a certain degree of canonization, which is reflected by the fact that recent handbooks and manuals on the topic provide very similar overviews and assessments of the individual tools, with differences remaining essentially only on the level of terminology and classifications. 13/

23. Valuation studies are increasingly applied not only in developed countries, but also in developing countries and countries with economies with transition. Rietbergen-McCracken and Abaza (2000) explain that *"up to recently, there was considerable skepticism, particularly among international development organizations and developing country governments (as end users of the valuation results) about the possibilities of using valuation methods outside the relatively resource-rich and data-rich environments of developed countries. It was generally felt that developing countries and countries with economies in transition presented too many difficulties (including a scarcity of statistical information; the presence of price distortions or undeveloped markets; and in some cases largely illiterate communities) to allow valuation methods to produce meaningful results. However, over the last five to ten years a growing body of evidence has emerged to refute these claims."* 14/ Rietbergen-McCracken and Abaza (2000) present a number of case studies of valuation studies undertaken in Africa, Asia, Latin America and Central and Eastern Europe, some of which also deal with biodiversity resources and functions and related ecosystem services. The IUCN guidelines for protected areas managers on economic values of protected areas also provide summaries of a number of valuation studies in developing countries. 15/

12/ Millennium Ecosystem Assessment (2003), 133.

13/ For recent handbooks and manuals, see e.g. Ramsar Convention (1997), IUCN (1998), OECD (2002), , and World Bank (2005).

14/ Rietbergen-McCracken and Abaza (2000), 2.

15/ IUCN (1998).

24. The Millennium Ecosystem Assessment has also reviewed and assessed the different valuation methods at hand. The purpose of the assessment is *inter alia* to provide an authoritative source of information and to clarify where there are areas of broad consensus within the scientific community and where important controversies remain. Except for the renumbering of paragraphs and headings, the remainder of this sub-section therefore provides a verbatim reproduction of the review and assessment of valuation tools provided in chapter 2.3.3.1 of volume 1 of the Millennium Ecosystem Assessment.

25. Many methods for measuring the utilitarian values of ecosystem services are found in the resource and environmental economics literature (Mäler and Wyzga 1976; Freeman 1979; Hufschmidt et al. 1983; Mitchell and Carson 1989; Pearce and Markandya 1989; Braden and Kolstad 1991; Hanemann 1992; Freeman 1993; Pearce 1993; Dixon et al. 1994; Johansson 1994; Pearce and Moran 1994; Barbier et al. 1995; Willis and Corkindale 1995; Seroa da Motta 1998; Garrod and Willis 1999; Seroa da Motta 2001; Pearce et al. 2002; Turner et al. 2002; Pagiola et al. in review). Table 3 summarizes the main economic valuation techniques.

26. Some techniques are based on actual observed behavior data, including some methods that deduce values indirectly from behavior in surrogate markets, which are hypothesized to have a direct relationship with the ecosystem service of interest. Other techniques are based on hypothetical rather than actual behavior data, where people's responses to questions describing hypothetical markets or situations are used to infer value. These are generally known as "stated preference" techniques, in contrast to those based on behavior, which are known as "revealed preference" techniques. Some techniques are broadly applicable, some are applicable to specific issues, and some are tailored to particular data sources. As in the case of private market goods, a common feature of all methods of economic valuation of ecosystem services is that they are founded in the theoretical axioms and principles of welfare economics. These measures of change in well-being are reflected in people's willingness to pay or willingness to accept compensation for changes in their level of use of a particular service or bundle of services (Hanemann 1991; Shogren and Hayes 1997). These approaches have been used extensively in recent years, in a wide range of policy-relevant contexts.

27. A number of factors and conditions determine the choice of specific measurement methods. For instance, when the ecosystem service in question is privately owned and traded in the market, its users have the opportunity to reveal their preferences for that service compared with other substitutes or complementary commodities through their actual market choices, given relative prices and other economic factors. For this group of ecosystem services a demand curve can be derived from observed market behavior, and this allows changes in well-being to be estimated. However, many ecosystem services are not privately owned and not traded, and hence their demand curves cannot be directly observed and measured. Alternative methods have been used to derive values for such ecosystem services.

28. Valuation is a two-step process. First, the services being valued have to be identified. This includes understanding the nature of the services and their magnitude, and how they would change if the ecosystem changed; knowing who makes use of the services, in what way and for what purpose, and what alternatives they have; and establishing what trade-offs might exist between different kinds of services an ecosystem might provide. The bulk of the work involved in valuation actually concerns quantifying the biophysical relationships. In many cases, this requires tracing through and quantifying a chain of causality. (See Figure 2.3.) Valuation in the narrow sense only enters in the second step in the process, in which the value of the impacts is estimated in monetary terms.

3.1 Overview

(i) Changes in productivity

29. The most widely used technique, thanks to its broad applicability and its flexibility in using a variety of data sources, is known as the change in productivity technique. It consists of tracing through chains of causality (such as those illustrated in Figure 2) so that the impact of changes in the condition of an ecosystem can be related to various measures of human well-being. Such impacts are often reflected in goods or services that contribute directly to human well-being (such as production of crops or of clean water), and as such are often relatively easily valued. The valuation step itself depends on the type of impact but is often straightforward:

- The net value in reductions in irrigated crop production resulting from reduced water availability is easy to estimate, for example, as crops are often sold. (Even so, it is a very common error to use the reduction in the gross value of crop production rather than the net value. Using gross value omits the costs of production and so overestimates the impact.)

- Where the impact is on a good or service that is not marketed or where observed prices are unreliable indicators of value, the valuation can become more complex. The impact of hydrological changes on use of water for human consumption, for example, once again begins by tracing through chains of causality to estimate the changes in the quantity and quality of water available to consumers. This is itself often difficult. The prices typically charged to consumers for this water, moreover, are not reliable measures of the value of the water to consumers, as they are set administratively, with no regard for supply and demand (indeed, in most cases water fees do not even cover the cost of delivering the water to consumers, let alone the value of the water itself). The value of an additional unit of water can be estimated in various ways, such as the cost of alternative sources of supply (cost-based measures are described later) or asking consumers directly how much they would be willing to pay for it (contingent valuation, described later). Note that it is very important to use the value of an additional unit of water, since some amount of water is, of course, vital for survival. Thus an additional unit of water will be very valuable when water is scarce, but much less so when water is plentiful. In this case, as in many others, averages can be misleading.

- When the impact is on water quality rather than quantity, the impact on well-being might be reflected in increased morbidity or even mortality. Again, the process begins by tracing through chains of causality, for example by using dose-response functions that tie concentrations of pollutants to human health. Valuing the impact on health itself can then be done in a number of ways (see cost of illness and human capital, in the next section).

- In some cases, the impact is on relatively intangible aspects of well-being, such as aesthetic benefits or existence value. Particular efforts have been made in recent years to develop techniques to value such impacts, including hedonic price, travel cost, and contingent valuation methods.

(ii) Cost of illness and human capital

30. The economic costs of an increase in morbidity due to increased pollution levels can be estimated using information on various costs associated with the increase: any loss of earnings resulting from illness; medical costs such as for doctors, hospital visits or stays, and medication; and other related out-of-pocket expenses. The estimates obtained in this manner are interpreted as lower-bound estimates of the presumed costs or benefits of actions that result in changes in the level of morbidity, since this method disregards the affected individuals' preference for health versus illness and restrictions on non-work activities. Also, the method assumes that individuals treat health as exogenous and does not recognize that

individuals may undertake defensive actions (such as using special air or water filtration systems to reduce exposure to pollution) and incur costs to reduce health risks.

31. When this approach is extended to estimate the costs associated with pollution-related mortality (death), it is referred to as the human-capital approach. It is similar to the change-in-productivity approach in that it is based on a damage function relating pollution to productivity, except that in this case the loss in productivity is that of human beings, measured in terms of expected lifetime earnings. Because it reduces the value of life to the present value of an individual's future income stream, the human-capital approach is extremely controversial when applied to mortality. Many economists prefer, therefore, not to use this approach and to simply measure the changes in the number of deaths (without monetary values) or measures such as disability-adjusted life years.

(iii) Cost-based approaches

32. The cost of replacing the services provided by the environmental resource can provide an order of magnitude estimate of the value of that resource. For example, if ecosystem change reduces the water filtration services, the cost of treating water to make it meet the required quality standards could be used. The major underlying assumptions of these approaches are that the nature and extent of physical damage expected is predictable (there is an accurate damage function available) and that the costs to replace or restore damaged assets can be estimated with a reasonable degree of accuracy. It is further assumed that the replacement or restoration costs do not to exceed the economic value of the service. This assumption may not be valid in all cases. It simply may cost more to replace or restore a service than it was worth in the first place—for example, because there are few users or because their use of the service was in low-value activities.

33. As there are often multiple ways that replacement costs could be estimated (for example, the value of lost water filtration services could be estimated based on the cost of restoring the wetland that had provided the service, the cost of treating water to meet quality standards, or the cost of obtaining suitable water from another source), the cheapest option should be considered as the replacement cost estimate. Because of these problems, cost-based approaches are generally thought to provide an upper-bound estimate of value.

(iv) Hedonic analysis

34. The prices paid for goods or services that have environmental attributes differ depending on those attributes. Thus, a house in a clean environment will sell for more than an otherwise identical house in a polluted neighborhood. Hedonic price analysis compares the prices of similar goods to extract the implicit value that buyers place on the environmental attributes. This method assumes that markets work reasonably well, and it would not be applicable where markets are distorted by policy or market failures. Moreover, this method requires a very large number of observations, so its applicability is limited.

(v) Travel cost

35. The travel cost method is an example of a technique that attempts to deduce value from observed behavior in a surrogate market. It uses information on visitors' total expenditure to visit a site to derive their demand curve for the site's services. The technique assumes that changes in total travel costs are equivalent to changes in admission fees. From this demand curve, the total benefit visitors obtain can be calculated. (It is important to note that the value of the site is not given by the total travel cost; this information is only used to derive the demand curve.) This method was designed for and has been used extensively to value the benefits of recreation, but it has limited utility in other settings.

(vi) Contingent valuation

36. Contingent valuation is an example of a stated preference technique. It is carried out by asking consumers directly about their willingness-to-pay to obtain an environmental service. A detailed description of the service involved is provided, along with details about how it will be provided. The actual valuation can be obtained in a number of ways, such as asking respondents to name a figure, having them choose from a number of options, or asking them whether they would pay a specific amount (in which case, follow-up questions with higher or lower amounts are often used).

37. CV can, in principle, be used to value any environmental benefit simply by phrasing the question appropriately. Moreover, since it is not limited to deducing preferences from available data, it can be targeted quite accurately to ask about the specific changes in benefits that the change in ecosystem condition would cause. Because of the need to describe in detail the good being valued, interviews in CV surveys are often quite time-consuming. It is also very important that the questionnaire be extensively pretested to avoid various sources of bias.

38. CV methods have been the subject of severe criticism by some analysts. A "blue-ribbon" panel was organized by the U.S. Department of Interior following controversy over the use of CV to value damages from the 1989 Exxon Valdez oil spill. The report of this panel (NOAA 1993) concluded that CV can provide useful and reliable information when used carefully, and it provided guidance on doing so. This report is generally regarded as authoritative on appropriate use of the technique.

(vii) Choice modeling

39. Choice modeling (also referred to as contingent choice, choice experiments, conjoint analysis, or attribute-based stated choice method) is a newer approach to obtaining stated preferences. It consists of asking respondents to choose their preferred option from a set of alternatives where the alternatives are defined by attributes (including the price or payment). The alternatives are designed so that the respondent choice reveals the marginal rate of substitution between the attributes and money. These approaches are useful in cases in which the investigator is interested in the valuation of the attributes of the situation or when the decision lends itself to respondents choosing from a set of alternatives described by attributes.

40. Choice modeling has several advantages: the control of the stimuli is in the experimenter's hand, as opposed to the low level of control generated by real market data; the control of the design yields greater statistical efficiency; the attribute range can be wider than found in market data; and the introduction or removal of products, services and attributes is easily accomplished (Louviere et al. 2000; Holmes and Adamowicz 2003; Bateman et al. 2004). The disadvantages associated with the technique are that the responses are hypothetical and therefore suffer from problems of hypothetical bias (similar to contingent valuation) and that the choices can be quite complex when there are many attributes and alternatives. The econometric analysis of the data generated by choice modeling is also fairly complex.

(viii) Benefits transfer

41. A final category of approach is known as benefits transfer. This is not a methodology per se but rather refers to the use of estimates obtained (by whatever method) in one context to estimate values in a different context. For example, an estimate of the benefit obtained by tourists viewing wildlife in one park might be used to estimate the benefit obtained from viewing wildlife in a different park. Alternatively, the relationship used to estimate the benefits in one case might be applied in another, in conjunction with some data from the site of interest ("benefit function transfer"). For example, a relationship that estimates tourist benefits in one park, based in part on their attributes such as income or national origin, could be used in another park, but with data on income and national origin of that park's visitors.

42. Benefits transfer has been the subject of considerable controversy in the economics literature, as it has often been used inappropriately. A consensus seems to be emerging that benefit transfer can provide valid and reliable estimates under certain conditions. These conditions include the requirement 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 and that the populations affected have very similar characteristics. Of course, the original estimates being transferred must themselves be reliable in order for any attempt at transfer to be meaningful.

3.2 Summary assessment of valuation methods

43. Each of these approaches has seen extensive use in recent years, and considerable literature exists on their application. These techniques can and have been applied to a very wide range of issues (Rietbergen-McCracken and Abaza 2001), including the benefits of ecosystems such as forests (Bishop 1999; Kumari 1995; Pearce et al. 2002; Merlo and Croitoru in press), wetlands (Barbier et al. 1997; Heimlich et al. 1998), watersheds (Aylward 2004; Kaiser and Roumasset 2002). Other studies have focused on the value of particular ecosystems services such as water (Young and Haveman 1985), non-timber forest benefits (Lampietti and Dixon 1995; Bishop 1998), recreation (Bockstael et al. 1991; Mantua at al. 2001; Herriges and Kling 1999), landscape (Garrod and Willis 1992; Powe et al. 1995), biodiversity for medicinal or industrial uses (Simpson et al. 1994; Barbier and Aylward 1996), natural crop pollination (Ricketts in press), and cultural benefits (Pagiola 1996; Navrud and Ready 2002). Many valuation studies are cataloged in the Environmental Valuation Reference Inventory Web site maintained by Environment Canada (EVRI 2004).

44. In general, measures based on observed behavior are preferred to measures based on hypothetical behavior, and more direct measures are preferred to indirect measures. However, the choice of valuation technique in any given instance will be dictated by the characteristics of the case and by data availability. Several techniques have been specifically developed to cater to the characteristics of particular problems. The travel cost method, for example, was specifically developed to measure the utility derived by visitors to sites such as protected areas and is of limited applicability outside that particular case. The change in productivity approach, on the other hand, is very broadly applicable to a wide range of issues. Contingent valuation is potentially applicable to any issue, simply by phrasing the questions appropriately and as such has become very widely used – probably excessively so, as it is easy to misapply and, being based on hypothetical behavior, is inherently less reliable than measures based on observed behavior. For some types of value, however, stated preference methods may be the only alternative. Thus, existence value can only be measured by stated preference techniques.

45. In some cases, the value of a given benefit can be estimated in several ways. For example, the value of water purification might be estimated by the avoided health impacts (an application of change in productivity), by the avoided costs of treating water (an application of replacement costs), or by asking consumers for their willingness to pay for clean water (an application of contingent valuation). In such cases, it is appropriate to take the lowest figure as the estimate of the value of the benefit. It would make little sense to consider water purification to be worth 100 based (for example) on willingness to pay if treating the water to achieve the same result would only cost 10.

4. Valuation and decision-making

46. As explained earlier, most of the different values ascribed to ecosystem services are not captured in market prices, because most ecosystem services are not traded on markets. The reason is that many ecosystem services bear characteristics of "public goods", including the key characteristic of public goods that nobody can be excluded from their use. For this reason, markets cannot spontaneously develop for public goods, and the value of these services will therefore not be reflected in a market price. This has also the consequence that the prices of many marketed goods and services will not adequately reflect the essential role of biodiversity in their production, which, in turn, will lead to distorted decisions by

consumers and producers. Moreover, public decision-making and its allocation of public funds will also be distorted if the repercussions of governmental activities on biodiversity resources and the related ecosystem services are not adequately factored in.

47. Hence, undertaking valuation does not only raise awareness of the hidden benefits of biodiversity conservation in terms of maintaining critical ecosystem services. It has also the potential of improving public decision-making on projects or regulations as well as, under specific circumstances, of improving legal decision-making. In this connection, the synthesis report of the Millennium Ecosystem Assessment also notes that *"most resource management and investment decisions are strongly influenced by considerations of the monetary costs and benefits of alternative policy choices. Decisions can be improved if they are informed by the total economic value of alternative management options and involve deliberative mechanisms that bring to bear non-economic considerations as well."*

48. Existing decision-making frameworks use valuation information to a greater or lesser extent. Economic frameworks such as cost-benefit analysis (CBA) and cost-effectiveness analysis (CEA) involve explicit monetary valuation. An important advantage of the valuation tools reviewed in the last section is that they provide numbers in a common (monetary) metric, which can thus easily be incorporated into these standard appraisal methods. In contrast, multi criteria analysis (MCA) typically avoid using a monetary unit of account. Other non-economic approaches to prioritization include deliberative processes, scorecard approaches, expert judgment and satisficing. All of these methods can be combined in different ways to set conservation priorities.

4.1 Economic frameworks

(i) Cost-benefit-analysis and cost-effectiveness-analysis

49. Cost benefit analysis compares monetary costs and benefits in commensurate terms. This comparison is sometimes expressed as a cost-benefit ratio, with benefits as the numerator and costs as the denominator. Alternative options can then be ranked in accordance with their cost-benefit-ratio. Depending on the specific activities under investigation, the value associated with biodiversity resources and ecosystem services will be included as a cost or as a benefit. For instance, if the cost-benefit-ratios of different conservation projects were compared, the value of improved ecosystem services would be included as benefits of the individual projects. If, however, different development projects were considered, such as for instance different options to invest into public infrastructure with negative impacts on biodiversity, the value of the associated loss of ecosystem services would be included as a cost to the individual option.

50. Cost-effectiveness analysis (CEA) leaves the numerator in qualitative terms and simply compares the different costs of attaining some objective stated in the numerator. Different options *that deliver the same objective* are then compared and prioritized based on their cost-effectiveness-ratio. CEA, therefore, does not ask nor attempt to answer the question of whether the goal of the policy is justified, in the sense that the social benefits expected from this goal exceed the costs necessary to reach the goal. In fact none of the options may be economically efficient, in the sense of monetary economic costs outweighing economic benefits. Hence, while helping to set priorities, CEA may only be helping to select the least worst option among a list of (potentially) inefficient options. CEA is sometimes used as a second-best option when a full-blown CBA would be desirable, but many benefits cannot easily be monetised.

51. Both CBA and CEA are common governmental appraisal methods in OECD countries 16/ and among international organizations. 17/ While the methods were originally developed for appraising basic

16/ See Pearce 2005 xxx

17/ See, e.g., ADB 1999.

infrastructure, many government guidance documents now include advice on the inclusion of environmental and social costs and benefits. 18/

(ii) National income accounts

52. While CBA and CEA are decision-making tools relevant to projects and regulations, national income accounts are a key indicator framework for setting priorities in domestic macroeconomic policies. National income accounts are a long-standing economic convention by which national growth and economic performance are measured. In essence, the accounts measure national output from all sources (known as Gross National Product), and then deduct a measure of depreciation, which is the amount of (typically) man made capital that is used up in production. The result is a figure that depicts, in economic terms, how well off a country is year on year. While conventional accounts already include many biological products (e.g. production of timber and fish), in the last two decades there have been numerous attempts, at national and international levels, to include environmental externalities and, more importantly, some measure of environmental depreciation to reflect the environmental losses that occur as a result of economic activities. 19 For instance, recent work of the World Bank along these lines has shown that several countries that perform well on conventional grounds were actually performing less well once the new measure of depreciation was included. 20 Identification of this environmental drag on economic growth can serve as a basis for prioritizing national environmental policies and a focus on mitigation or reversal of environmentally damaging activities.

53. While valuation is central to the exercise of environmental adjustment, many theoretical and methodological challenges remain, in particular with regard to an adequate incorporation of biodiversity values in conventional macro economic indicators of growth. For instance, many of the valuation tools at hand are simply too costly and demanding to apply them on a scale that would be needed for a *comprehensive* valuation of the annual changes in domestic biodiversity resources. Nevertheless, national income accounts remain an important vehicle into which more information about biodiversity loss must be directed. Further research directed at the development of a biodiversity adjustment is an important means to have biodiversity losses more reflected in macroeconomic discourse.

(iii) Liability and redress

54. In some countries, the legal framework for liability and redress priorities has been an important driver for the analysis and refinement of valuation methods. For instance, in the United States, the ability to use valuation information as the basis for legal redress has been a significant impetus for considering the value of damaged biological resources. High damage costs, derived including through non-market valuation have given plaintiffs a large incentive to demonstrate the monetary value of any damaged resources. As a result, valuation methods, and contingent valuation in particular, has come under considerable scrutiny in high profile legal cases such as the Exxon Valdez oil spill. The European Union also explored the legal basis for using of non market values as evidence. However, it is currently unclear whether such values will form the basis of damages assessments in preference to say, remediation costs. In many other countries, weak legal systems, and/or poorly defined and enforced property rights over damaged resources mean that legal drivers for the application of valuation tools are currently weak to non-existent.

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18 See for example chapter 4 of the UK Treasury Green Book on public appraisal. http://greenbook.treasury.gov.uk/

19/ National satellite accounts, integrated accounting framework proposed by UNEP and UN Statistics Division.

20/ The World Bank has developed the concept of adjusted net savings, which measure the true rate of savings in an economy after taking into account investments in human capital, depletion of natural resources and damage caused by pollution. See http://lnweb18.worldbank.org/ESSD/envext.nsf/44ByDocName/AboutUs for further information.

4.2 Non-economic frameworks

55. The economics approaches mentioned so far are all potentially informed by the tools for the valuation of biodiversity resources presented in the next section. The following approaches are more qualitative in nature but may occasionally use valuation information in the decision process.

(iv) Multi criteria analysis

56. Multi-Criteria Analysis (MCA) is in fact a family of methods that use different scoring approaches to weight the different attributes of a decision. They are used to structure a policy problem in terms of possible policy alternatives and to assess each alternative under various criteria. Most of the variants of MCA are structured approaches used to determine overall preferences among alternative policy measures, where each policy measure may pursue several objectives. Participants in the analysis are typically given the criteria that define different options and are asked to score or weight these criteria using some pre determined points system.

57. Multi-Criteria Analysis is mainly applicable to cases where a single-criterion approach is insufficient. Instead, an MCA may accommodate a range of social, environmental, technical, economic, and financial criteria. MCA is therefore applicable especially where significant environmental and social impacts are present, which cannot (easily) be expressed in monetary terms. MCA are often integrated with deliberative and participatory approaches and are said to facilitate such input to a larger degree than the monetary assessment tools CBA and CEA. 21/

58. There are very few applications of MCA in developing countries. In general the method is less costly because sample sizes can be kept small. However, MCA is often difficult to use and understand for lay people. Most variants require an expert to explain how the method works, and to help users to define options, criteria and weights, as well as to choose the appropriate aggregation procedure. The method also makes no claim to be searching for economically efficient outcomes. Like CEA, all options under consideration may be inefficient.

(v) Deliberative and participatory approaches

59. Deliberative processes (sometimes also referred to as Deliberative and Inclusionary Processes or DIPs) include Participatory Appraisal, Focus Groups, Consensus Conferences and Citizen's Juries. These methods are aimed at creating better informed decisions that are owned by and have the broad consent of all relevant actors and stakeholders. They therefore contrast to the more technocratic approaches such as cost-benefit or cost-effectiveness analysis or even MCA. DIPs seek to build a process of defining and redefining interests that stakeholders introduce as the collective experience of participation evolves. As participants become more empowered, i.e. more respected and more self-confident, so it is assumed they may become more ready to adjust, to listen, to learn, and to accommodate to a greater consensus.

60. The adoption of such methods varies across countries, with some having formal processes for undertaking participation in the formulation of contentious area of public policy. The use of economic information in these methods is entirely at the group's discretion. Hence, valuation data may or may not consistently inform the outcome of such processes, and they cannot guarantee that outcomes are an efficient use of public resources. Moreover, in many countries, the relative weight that the outcome of these processes is given in final decisions is unclear.

21/ See Nichols et al. 2000 for further discussion.

(vi) Satisficing

61. A satisficing approach can be described as an assessment procedure to obtain an outcome that is good enough, rather than seeking the best solution. The approach can thus be contrasted with an optimising approach that seeks to identify the "best" solution, as is the case e.g. for Cost-Benefit Analysis or Multi-Criteria Analysis. For the implementation of a satisficing approach, one or more criteria need to be identified that the measure is expected to fulfil. The subsequent analysis can then either investigate all possible measures to achieve this objective(s), and list the successful options without ranking them. Alternatively, the analysis may also be terminated once the first option has been identified that fulfils the requirement(s).

62. In decision theory, the term satisficing is also used to refer to an optimisation process where *all* costs, including the cost of the optimisation calculations and the cost of getting information for use in those calculations, are considered. This takes account of the fact that, in some cases, the costs of gathering and processing information may not be justified by the subsequent improvements in decision-making that can be achieved through the improved information. This is likely to be the case in decision situations with a low level of complexity, where only few well-defined options are available, where the targets are clearly specified and where little or no trade-offs between targets are necessary.

One difficulty associated with such an approach is that the added value of better information for the decision making process may only be apparent if this information is available: if it is not available, it may be hard to assess in what way better information might have changed the results of the decision, and what impact this would have had.

4.3 Conclusions

63. The use of formal appraisal methods and the nature of decision-making processes generally vary across countries. Even when formally documented procedures are in place it is impossible to generalize how and when different methods are most appropriate. In general, methods such as cost-benefit-analysis seem to be less controversial, and are commonly applied, when financial costs and benefits are relatively clear to identify and when externalities, and the need to value them, are comparatively small. There seems to be a need for decision making tools to be more consensual and participation-oriented when external costs (social and environmental) are more significant.

64. Mirroring the research progress made in developing reliable tools and methodologies, valuation studies in many countries play an increasing role in contemporary environmental policies, as they provide additional knowledge to support better decision-making. It is important to apply and interpret valuation results in their appropriate context and to be aware of the pitfalls involved. However, this applies to most methods and techniques, whether in economics or in any other field. Many basic criticisms levelled at valuation can be avoided when best practice is followed while conducting valuation studies – for example, a contingent valuation study can well be integrated with and extended into a public participation exercise. The main question is rather – given their high costs and the expertise required – how their use can be targeted at those cases where valuation studies actually provide an added value in terms of improved decision making.

65. Conducting primary valuation studies is time-consuming and costly. Given the limited budget and manpower in many administrations, the need to conduct or manage primary research can pose a strain on the available resources. Capacity, both in conducting valuation studies and in overseeing their preparation and ensuring their quality, is often limited. Problems are exacerbated when the rationale for valuation is poorly conveyed to higher-level administrators. In many cases the people that matter can be left with an impression that new research will not produce added value for the quality of decision-making. More

commonly, poorly conducted studies, 22/ with limited follow up, can leave officials with an impression that valuation studies can only tell them what they already know. Resources that flow into the studies become harder to justify.

66. Resistance to the use of valuation in OECD countries has in recent years been addressed by attempts to produce both valuation guides and protocols as well as standard environmental values for use in benefits transfer. These efforts have revealed to be fruitful in terms of increasing the credibility and acceptability of valuation methods. More importantly, these resources have also simplified and reduced the cost of undertaking policy appraisal. Given the cost of undertaking primary valuation studies, the further use of benefits transfer is likely to be an increasingly effective means for extending the use of valuation in developing countries.

5. Strengthen international collaborative partnerships for assessing biodiversity values

67. Valuation is beginning to play a significant role in any conservation decisions in OECD countries. Many governments espouse its use, with the predominant framework being cost-benefit analysis, even if they acknowledge the technical difficulties of consistent implementation of valuation in decision-making. While it would be premature to suggest that biodiversity values are always consistently considered, the important thing to note about the experience is that there is a formally documented approach that should be followed in determining resource allocations and in setting priorities. 23/

68. International organizations such as the OECD, EU, The World Bank and GEF have all advocated greater use of valuation in policy making and project design. Other UN organizations such as UNDP, UNEP and FAO have, at various times, either sponsored meetings on the topic or undertaken projects, which have a strong biodiversity valuation component. Several governments have also facilitated greater use through the sponsorship of meetings and information databases sources such as EVRI (see below).

69. Similarly a number of non-governmental organizations such as IUCN, WWF and Conservation International have continued to sponsor research and wider application and dissemination about biodiversity valuation, and its role in creating incentives for conservation.

70. A combination of poor institutional capacity and a lack of trained staff can generally be identified as the main barriers to further promotion of valuation as a conservation tool, in particular in developing countries and countries with economies in transition. Overall, valuation can normally be advanced in most countries by the development of one or two high profile studies that help to raise the issue of biodiversity in national debates. 24/ Many countries have reached this stage, but many others have not. This critical phase requires international collaboration and enhancement of domestic capacity.

4.1 Institutional capacity

71. Poor institutional capacity is often an important impediment for consistent policy and regulatory appraisal. However, even where staff and infrastructure are relatively adequate, institutional weakness manifests in poorly defined lines of responsibility and the absence of clearly defined governmental practices for appraising basic policy changes such as projects and regulations.

22/ For instance, a problem frequently identified in the literature is high values derived though Contingent Valuation studies. For many observers excessive stated preferences defy intuition and apparently discredit the method. See section 2.2 for further discussion.

23/ In the UK for example, there is clear guidance on the importance of considering non-market values in central government project and regulatory appraisal. This guidance in nominally the responsibility of the Treasury (Ministry of Finance), which advocates good appraisal practice across a range of government ministries, including environment and transport. This model of appraisal practice is mirrored in several other countries.

24/ Typically one finds that an exercise such as a national accounts adjustment or one study of an endemic or charismatic species is sufficient to kick-start a national debate on the topic.

72. These institutional weaknesses can be summarized as a checklist, which can in turn provide a basis for the identification of needs:

(i) Does a single ministry or agency hold a clearly defined remit for biodiversity conservation?

(ii) Is there a formally documented procedure for conducting environmental impact assessments of new projects and regulations?

(iii) Is there a formally documented economics appraisal process for: a) new projects and b) new regulations?

(iv) Do the project or regulatory appraisal procedures include quantitative as opposed to qualitative assessments of costs and benefits?

(v) What role does cost-benefit analysis play in appraisal?

(vi) Do formal guidelines for CBA exist?

(vii) Do formal guidelines include guidance on how to deal with non-market costs and benefits and biodiversity in particular?

(viii) What is the legal status of the findings of government appraisals?

(ix) Who conducts any appraisal and how is the process audited for quality control?

4.2 Capacity building and training

73. The answers to many of the preceding questions are likely to be qualified by the issue of adequate capacity building and training. On the governmental level, capacity needs to be enhanced for conducting the actual valuation studies, 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. Moreover, training could also include staff of relevant non-governmental organizations. As regards valuation, two levels of training seem to be required: First, basic courses to provide non-economists with sufficient insights into the logic of valuation and environment economics. Second, more specialized training for those supervising the conduct of valuation studies and steering project implementation, which is likely to be best undertaken by economists equipped with prior knowledge in microeconomics. Well-planned modules can normally be sufficient to impart the basics of environmental valuation to trained economists.

(i) International cooperation in enhancing domestic capacities

74. Most expertise in valuation is arguably located in several OECD countries that have established research institutions specifically in the area, and it appears to be important to tap into this expertise as a basis for sponsoring training arrangements such as regional workshops on biodiversity valuation.

75. In non-OECD countries, notable centers of expertise are, for instance, the Environment and Economics Program for South East Asia (EEPSEA) 25/ and The Forum for Economics and the Environment located in South Africa. 26/ EEPSEA offers courses that are predominantly for post Masters level ability in economics. The South African initiative coordinates exchange of information and training between the countries of Southern Africa. In addition, in many developed countries, many university departments offer exchange opportunities that are normally supported by their own national development ministries (e.g., Swedish SIDA, Danish Ministry for Foreign Affairs). Short-term courses are offered by

25 http://www.idrc.ca/en/ev-7890-201-1-DO_TOPIC.html

26 http://www.econ4env.co.za/. This site actually includes a very comprehensive training manual

other agencies including the World Bank, which offers a course in Environmental Economics and Development Policy. 27/

76. Another means of extending training is for bilateral arrangements between agencies for temporary secondment. For instance, The Overseas Development Institute (ODI) in the UK has been running such a fellowship scheme for several decades. The scheme sends young postgraduate economists to work in the public sectors of developing countries in Africa, the Caribbean and the Pacific on two-year contracts. It has worked in over 30 countries concentrating on those most in need of trained staff. Currently, 20 developing country governments and three regional bodies are partners in the Scheme.

77. The demand-led nature of the Scheme means that it is an attractive way for governments to build capacity in their public sectors and improve the execution of economic policy. Its excellent reputation and unique form of technical assistance means that it is held in high regard by the development community. The costs of the Scheme are shared between the recipient government and ODI. ODI finances the Scheme primarily under grants provided by the Department for International Development (DFID) in the UK, the Commonwealth and AusAID. In recent years the scheme has been picking a number of graduates in environmental economics, who have gone to work in environment related agencies.

(ii) Web-based resources

78. Possibly the most cost-effective partnership arrangements can de developed using web access. The World Bank offers a range of E-Learning resources. Moreover, several sites provide good overviews of environmental valuation. A simple and accessible site is provided by Dennis King, of the University of Maryland, and Marisa Mazzotta, of the University of Rhode Island. 28/ This site sets out all the relevant issues in relation to valuation and contains some practical demonstrations of how to collect relevant data. The site provides an excellent introduction, but those who follow it probably need to be faced with more complex case studies to gain hands-on experience. In this regard, other web-based learning and training resources are also available, with varying levels of theory and applied examples. For instance:

(i) A UNEP sponsored training guide on the valuation of biological diversity for National Biodiversity Action Plans and Strategies line is available at the IUCN biodiversity economics site 29/,

(ii) The IUCN site also provides access to online guidelines for protected area managers on the economic values of protected areas; 30/

(iii) The site of the Ramsar Convention on Wetlands provides access to the Ramsar guide for policy makers and planners on the economic valuation of wetlands; 31/

(iv) A recent report prepared by the World Bank in cooperation with thew Nature Conservancy and IUCN, on assessing the economic value of ecosystem conservation, is also available online. 32/

27/ http://web.worldbank.org/WBSITE/EXTERNAL/WBI/WBIPROGRAMS/ENRLP/0,,contentMDK:20356396~pagePK:64156158~piPK:64152884~theSitePK:460957,00.html

28/ http://www.ecosystemvaluation.org/

29/ http://www.biodiversityeconomics.org/valuation/topics-612-00.htm .

30/ http://biodiversityeconomics.org/valuation/topics-34-00.htm .

31/ http://www.ramsar.org/lib_valuation_e.htm .

32/ http://www-wds.worldbank.org

(iii) Enhancing global capacities: benefits transfer databases

79. A number of other web sites contain valuation data for more advanced practitioners. Most noteworthy is a range of sites developed to facilitate benefits transfer, such as the Environment Valuation Reference Inventory 33/ database sponsored by number of countries and hosted by Environment Canada, and Envalue 34/ sponsored by the government of New South Wales in Australia. These databases are compilations of data from primary valuation studies conducted in different countries studies around the world. The basic idea is for the user to define a resource to be valued (e.g. a rare species or a water body), and to search the database for studies that have generated similar information. If the studies are suitably similar, then the database provides the basis of a transfer value that fills in an information gap at the site of interest.

80. Benefits transfer is still under development, with numerous academic research exercises focused on the validity of transferring benefit or willingness-to-pay unit values or the statistical functions that predict these values. Nevertheless the use of value transfer seems to be an appealing way to advance the use of valuation information in particular in resource poor countries where time and resource constraints will typically prevent extensive primary research.

81. Existing databases contain a variety of studies from different developing countries, but are not specifically tailored to developing country needs, either in terms of the likely valuation studies included, or in terms of the required modifications, for instance, exchange rates and currency deflators, needed to translate values for use. Therefore, a useful collaborative initiative could be to further develop existing transfer databases, or, alternatively, to design a new web-based database that is more specifically targeted at the needs of biodiversity assessment in low-income countries. One operational, it would be updated on a regular basis, *inter alia* by encouraging researchers to submit studies for inclusion to what is essentially a global library.

82. An important first step in this exercise seems to be to undertake a comprehensive audit of all valuation studies conducted over the last ten years in the developing world, in the same way as those studies included in the EVRI database. This initial audit would enable the identification of cases where the same resource has been valued in one or more locations, possibly internationally. From here, a limited meta analysis of multiple studies would provide a mean value and confidence intervals for the particular resource. This value would be the standard transfer value for, say, a hectare of mangrove or a hectare of a specific forest type. More importantly, a systematic review would help to identify gaps in coverage of species or goods, and therefore provide the basis for any necessary primary research to fill gaps.

83. In order to be accessible to non-specialist users a basic transfer protocol could be developed using a spreadsheet front-end that allows the user to define the resource, its extent, location and quality. These queries will then locate a range of values that can be selected by the investigator. For maximum use of the database in particular by decision-makers and researchers in developing countries, access fees should be low or absent for them.

4.3 Fostering research

84. As explained above, considerable progress has been made in the last decades in developing reliable valuation tools and protocols for their application, in particular on stated preference techniques and benefit transfer. However, challenges for further research and development also remain, in particular with regard to the conditions for validity and robustness of the benefits transfer approach. Furthermore, further research directed at the development of a biodiversity adjustment for national accounting seems to be another important means to have biodiversity losses more reflected in macroeconomic discourse.

33/ www.evri.ca

34/ http://www2.epa.nsw.gov.au/envalue/

85. It was also explained earlier that valuation addresses the ecosystem services generated by biodiversity resources and functions, but not biodiversity as such. Despite recent progress made in understanding the links between biological diversity, biodiversity functions, and the ecosystem services that are subsequently generated, as summarized in the Millennium Ecosystem Assessment reports, this understanding is still limited and fragmented, with many unresolved questions remaining on the specific nature of interdependencies between the structure and diversity of biotic communities, the functioning of ecosystems, and the generation of ecosystem services. Further research in addressing these important questions, including research cooperation at the international level, is therefore crucial. Importantly, new insights on the relationship between changes in biodiversity, for example through sudden shifts in ecosystem equilibria, and the generation of ecosystem services may also lead to the development of new tools and methodologies for the valuation of biodiversity and biodiversity functions.

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ANNEX2

Applications of economic valuation techniques		
Context	Comment	Type of valuation likely to be relevant
Cost-benefit analysis: projects and programmes	Traditionally, this is the context in which CBA was developed. Usually used for public investment projects in public or quasi-public goods, but can include non-marketed private goods (e.g. patient care)	RP, SP, BT
Cost-benefit analysis: policies, incl. regulations	A more recent focus in the UK but RIA now required for all regulations. Traditional for many RIA requirements in the USA	RP, SP, BT
'Demonstration' of the importance of an issue	Usually used to estimate economic damage from some activity (e.g. ill-health from pollution)	Usually BT only
Setting priorities within a sector plan	Used for prioritising road investments	Usually BT only
Setting priorities across sectors	Rare, but has been used for this purpose by World Bank	Mainly BT
Establishing the basis for an environmental tax or charge	Recent UK experience appears to be unique, e.g. landfill tax, aggregates tax	Mainly BT (landfill tax) but can include original RP and SP (aggregates tax)
'Green' national income accounting	Only utilised in a limited way in the UK	Usually BT only
Corporate green accounting	A few studies exist, but even fewer are public	BT only
Sustainability indicators	World Bank uses 'genuine savings' and 'wealth' indicators, based on economic valuation, to determine if economies are sustainable or not	Tends to be BT only
Legal damage assessment (liability)	Not yet used in the UK but extensively used in the USA in context of liability for damage. Expected forthcoming in EU.	RP, SP and BT
Estimating discount rates	Used in health (and environmental) literature and for estimating discount rates in developing countries	SP

Note: CBA=cost benefit analysis; RIA=Regulatory Impact Assessment; RP=revealed preference; SP=stated preference, and BT=benefits transfer.

Source: Department for Transport, Local Government and the Regions, United Kingdom (2002): *Economic Valuation with Stated Preference Techniques: Summary Guide.*

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Eleventh meeting
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Item 5.3 (b) of the provisional agenda*

INCENTIVE MEASURES

PROPOSALS ON THE APPLICATION OF TOOLS FOR VALUATION OF BIODIVERSITY AND BIODIVERSITY RESOURCES AND FUNCTIONS

Note by the Executive Secretary

DRAFT FOR PEER REVIEW – DO NOT QUOTE

1. Introduction

1. In paragraph 12 of decision VII/18, on incentive measures, the Conference of the Parties requested the Executive Secretary to *"explore, in cooperation with the Millennium Ecosystem Assessment, the Organisation for Economic Co-operation and Development and relevant international organizations, existing methodologies for valuation of biodiversity and biodiversity resources and functions, as well as other tools for prioritization in decision-making, by preparing a compilation of existing valuation tools that provides an overview of the discussion on their methodological status, if appropriate, as well as an assessment of their applicability in terms of effectiveness and capacity preconditions, and to prepare proposals for the application of such tools. These proposals should include the identification of options to strengthen international collaborative partnerships for assessing biodiversity values, especially for the refinement and advancement of valuation tools, and shall be submitted to the Subsidiary Body on Scientific, Technical and Technological Advice for its consideration at a meeting prior to the eighth meeting of the Conference of the Parties."*

2. In paragraph 8 of the same decision, the Conference of the Parties invited Parties, Governments and international organizations to submit case-studies, best practices and other information *inter alia* on the application of methodologies for the assessment of values of biodiversity and its functions, as well as other tools for prioritization in decision-making, to the Executive Secretary. The Executive Secretary communicated this invitation to Parties, governments and relevant organizations by notifications

* UNEP/CBD/SBSTTA/11/1.

076/2004 and 077/2004 as well as 026/2005 and 028/2005. Pertinent submissions received further to this invitation were taken into consideration in the preparation of the present note.1

3. In accordance with the request of the Conference of the Parties, information document UNEP/CBD/SBSTTA/11/INF/xxx provides an exploration of existing methodologies for valuation of biodiversity and biodiversity resources and functions, as well as other tools for prioritization in decision-making, an overview on existing valuation tools and their methodological status as well as an assessment of their applicability in terms of effectiveness and capacity preconditions. The present document provides a synopsis of this analysis and presents, in an annex, proposals on the application of tools for the valuation of biodiversity and biodiversity resources and functions.

2. Synopsis of Exploration of Valuation Methodologies

2.1 General observations

4. Value is a term that is defined and used in different ways amongst a range of academic disciplines. For instance, in economics, value and utility are used in an anthropogenic manner. It is humans who reveal value, in terms of their so-called willingness-to-pay, by the process of exchange. Similarly utility is derived by humans from resource use.

5. It is noteworthy however that the term "economic" value is to be understood in a broad sense. Individuals may assign value for different reasons, and not only for the immediate benefits resulting from the commercial exploitation of biodiversity resources (as a narrow interpretation of the term "economic" may suggest). While valuation methods developed in economics attempt to measure the value of ecosystem services in monetary terms, in order to provide a common metric in which to express the benefits of the variety of services provided by ecosystems, this explicitly does *not* mean that only services which generate direct monetary benefits are taken into consideration.

6. Valuation does normally not directly address the value of bio*diversity* as such. Instead, valuation typically focuses on the values of the goods and services generated by biodiversity resources and functions, from which biodiversity values could be inferred in an indirect way. A comprehensive assessment of the values of ecosystem services 2/ has recently been undertaken by the Global Ecosystem Assessment. However, some tools for prioritisation in decision-making devices, discussed below, employ non-monetary measures of value that may encompass genetic distance as a diversity indicator.

7. The commonly used concept of **Total Economic Value** (TEV) provides a framework for describing different *types* of economic value ascribed to natural resources. The framework distinguishes use values (direct, indirect and option value) and non-use values:

- *Direct use value* is the value derived from direct use or interaction with environmental resources and services (e.g., timber, fuelwood, tourism are direct use values of a tropical forest). They involve commercial, subsistence, leisure, or other activities associated with a resource.

- *Indirect use value* relates to the indirect support and protection provided to economic activity and property by the ecosystem's natural functions.

1/ The valuable input by Dr. Dominic Moran in the preparation of this note is also acknowledged.

2/ The Millennium Ecosystem Assessment adopted a wide definition of ecosystem services, which includes goods under the heading "provisioning services." See Millennium Ecosystem Assessment (2003), 57, and table 1.

- *Option value* is a type of use value in that it relates to future use of the environment or biodiversity resources. Option value arises because individuals may value the option to be able to use the biological resource some time in the future.

- *Non-use value* such as existence value (sometimes also dubbed passive value) may be derived neither from current direct or indirect use of the natueral resource under consideration, but instead from its ongoing existence. The concrete reasons why utility is derived from mere existence may vary and may also be based on, for instance, religious, spiritual, or ethical motives. Of all the value categories, existence or passive value is most complex in terms of quantification and its role in decision-making.

8. Economics has developed methods to assign value to goods and services that are not traded on markets, such as many biodiversity resources and the ecosystem services they generate. The value of these resources is inferred from the direct or indirect tradeoffs or sacrifices (in terms of time, labour effort, monetary income or wealth) people are willing to make, thus revealing their willingness to pay.

9. These methods are of limited usefulness for the identification and assessment of those biodiversity functions that are key to the survival of global ecosystems including humans (the so-called life support function), and that, according to many voices, should therefore be treated as fundamental constraints and not as elements of the set of possible economic choices. Valuation therefore usually focuses on the value of comparatively small (incremental) *changes* in ecosystem services that result (or would result) from management decisions or from other human activities.

2.2 Valuation methods

10. In the last two decades, substantial progress has been made in the development and application of valuation methods. They have reached a considerable degree of sophistication and are now widely applied both in developed and in developing countries.3/ They have also reached some degree of canonization, which is reflected by the fact that recent handbooks and manuals on the topic provide very similar overviews and assessments of the individual tools, with differences remaining essentially only on terminology and classification.

11. A recent review and assessment of valuation methods was undertaken by the Millennium Ecosystem Assessment. The remainder of this sub-section largely follows this assessment.

12. Some techniques, the so-called “revealed preference” techniques, are based on actual observed behavior data, including methods that deduce values indirectly from behavior in surrogate markets, which are hypothesized to have a direct relationship with the ecosystem service of interest. Other techniques, the so-called “stated preference” techniques, are based on hypothetical rather than actual behavior data, where people’s responses to questions describing hypothetical markets or situations are used to infer value. Some techniques are broadly applicable, some are applicable to specific issues, and some are tailored to particular data sources.

3/ See Rietbergen-McCracken and Abaza (2000) for a number of case studies of valuation studies undertaken in Africa, Asia, Latin America and Central and Eastern Europe, some of which also deal with biodiversity resources and functions and related ecosystem services. See also IUCN (1998) for summaries of valuation studies undertaken in developing countries.

Revealed preference techniques

(i) Changes in productivity

13. This most widely used method (also called the derived value method) is used to estimate the value of ecosystem products or services that contribute to the production of marketed goods. The change in price of the marketed good allows deriving the value for the underlying ecosystem service.

14. The technique is broadly applicable and flexible in using a variety of data sources. However, its application is more complex if prices are unreliable indicators of value, such as is often the case for instance for water resources. The logic of the productivity method is relatively straightforward and the technical skill to estimate such values is not likely to be an important constraint in most cases.

15. As similar approach can be used to estimate the costs associated with pollution-related mortality (death) and is referred to as the human-capital approach. In this case the loss in productivity is that of human beings, measured in terms of expected lifetime earnings. Because it reduces the value of life to the present value of an individual's future income stream, the human-capital approach is extremely controversial when applied to mortality.

(ii) Cost-based approaches

16. The cost of replacing the services provided by the environmental resource can provide an order of magnitude estimate of the value of that resource. As there are often multiple ways that replacement costs could be estimated, the cheapest option should be considered as the replacement cost estimate.

17. These methods is comparatively easy to apply if the nature and extent of physical damage expected is predictable and if the (minimum) cost to replace or restore damaged assets can be estimated with a reasonable degree of accuracy, and does not exceed the value of the service in the first place. However, in many cases, these conditions may put limitations to this approach. Because of these problems, cost-based approaches are generally thought to provide an upper-bound estimate of value.

18. The economic costs of an increase in morbidity due to increased pollution levels can be estimated using information on various costs associated with the increase. The estimates obtained in this manner are interpreted as lower-bound estimates of the presumed costs or benefits of actions that result in changes in the level of morbidity.

(iii) Hedonic analysis

19. Hedonic price analysis compares the prices of similar goods, in particular real estate, to extract the implicit value that buyers place on the specific environmental attributes of the good.

20. This method assumes that markets work reasonably well, and would not be applicable where markets are distorted by policy or market failures. Moreover, hedonic methods are particularly data demanding, and were therefore rather scarcely applied. Accordingly they are of limited applicability in many developing countries where data sets are particularly limited.

(iv) Travel cost

21. The travel cost method uses information on visitors' total expenditure to visit a site to derive their demand curve for the site's services. From this demand curve, the total benefit visitors obtain can be calculated.

22. This method was designed for and has been used extensively to value the benefits of recreation. It has been applied in developing nations to model visitor choices to important natural assets such as national

parks and protected areas. The data requirements for travel costs methods are relatively straightforward, and applications have been conducted with national respondents and international visitors. However, the method has limited utility in other settings.

Stated preference techniques

23. Stated preference techniques rely on questionnaires to infer the assigned value to ecosystem services from a representative sample of relevant actors. They can, in principle, be used to value any environmental benefit, and can be targeted quite accurately since they are not limited to deducing preferences from available data. An important advantage of stated preference techniques is that they are the only techniques able to capture non-use values, which tend to be crucial in certain biodiversity contexts.

24. Stated preference methods have seen much methodological improvement over the last decade, in particular on the statistical design of studies, though extensive pre-testing, and on avoiding different statistical biases, such as the bias resulting from strategic respondent behaviour.

25. A potentially important limitation in terms of applying these methods to biological resources and functions is that respondents cannot typically make informed choices if they have a limited understanding of the issue in question. Choosing the right approach and the adequate intensity of efforts in improving the understanding of biological complexity of the sample group is a challenge for stated preference methods.

26. Most applications of stated preference techniques have been undertaken in developed countries. Applications in developing countries are increasing. It is noteworthy, however, that stated preference techniques were applied, in a number of cases, in fields such as water and sanitation where much can already be inferred much from actual behaviour.

27. A careful application of these techniques is fairly demanding in terms of capacity and time. Hence, the main constraints are likely to be costs of implementation and the lack of trained specialists. These constraints should not lead to shortcuts and lower sample sizes, as the associated savings can be counterproductive in terms of delivering less reliable results. Failure to reflect established best practice in commissioned studies will result in poor and non-credible output.

(i) Contingent valuation

28. Contingent valuation is carried out by asking consumers directly about their willingness-to-pay to obtain an environmental service. A detailed description of the service involved is provided, along with details about how it will be provided. The actual valuation can be obtained in a number of ways, such as asking respondents to name a figure, having them choose from a number of options, or asking them whether they would pay a specific amount.

29. Contingent valuation methods have been the subject of severe criticism by some analysts. A “blue-ribbon” panel was organized by the U.S. Department of Interior following controversy over the use of contingent valuation to value damages from the 1989 Exxon Valdez oil spill. The report of this panel (NOAA 1993) concluded that contingent valuation can provide useful and reliable information when used carefully, and it provided guidance on doing so. This report is generally regarded as authoritative on appropriate use of the technique.

(ii) Choice modeling

30. Choice modeling (also referred to as contingent choice, choice experiments, conjoint analysis, or attribute-based stated choice method) is a newer approach and consists of asking respondents to choose

their preferred option from a set of alternatives where the alternatives are defined by attributes (including the price or payment).

31. The disadvantages associated with the technique are that the responses are hypothetical and therefore suffer from problems of hypothetical bias (similar to contingent valuation), and that the choices can be quite complex when there are many attributes and alternatives. The econometric analysis of the data generated by choice modeling is also fairly complex.

Benefits transfer

32. Benefits transfer refers to the use of estimates obtained (by whatever method) in one context to estimate values in a different context. Alternatively, the relationship used to estimate the benefits in one case might be applied in another, in conjunction with some data from the site of interest ("benefit function transfer"). For example, a relationship that estimates tourist benefits in one park, based in part on their attributes such as income or national origin, could be used in another park, but with data on income and national origin of that park's visitors. In this connection, the term meta analysis refers to taking the data from individual studies and compiling a master database that can be analysed to explore why the studies produce different answers, i.e. to 'explain the variance'. Isolating factors that affect valuation then makes it easier to engage in benefits transfer.

33. Benefits transfer has been the subject of considerable controversy in the economics literature, as it has often been used inappropriately. A consensus seems to be emerging that benefit transfer can provide valid and reliable estimates under certain conditions.

34. Benefits transfer has the potential to alleviate the problems of deficient primary data sets and limited funds often encountered in valuation. As was shown above, considerable efforts in time and money are often needed to meet best practice standards and deliver credible results. By extension, high expenditure means that there will always be a limit to the number of quality studies that can be undertaken. Accordingly, the question becomes paramount on how new studies can be used more generally or, in the absence of new studies, how existing information can be borrowed for use in suitably similar policy contexts.

35. Databases containing the results of many different kinds of valuation study are now becoming available, such as the Environmental Valuation Reference Inventory Web site maintained by Environment Canada. 4/ These databases facilitate the task of researchers in providing off-the-shelf value estimates for a range of resources and environmental changes. These will also permit more extended meta-analysis of studies.

2.3 General assessment of valuation tools

36. In general, measures based on observed behavior are preferred to measures based on hypothetical behavior, and more direct measures are preferred to indirect measures. However, the choice of valuation technique in any given instance will be dictated by the characteristics of the case and by data availability. Several techniques have been specifically developed to cater to the characteristics of particular problems. The travel cost method, for example, was specifically developed to measure the utility derived by visitors to sites such as protected areas and is of limited applicability outside that particular case. The change in productivity approach, on the other hand, is very broadly applicable to a wide range of issues. Contingent valuation is potentially applicable to any issue, simply by phrasing the questions appropriately and as such has become very widely used – probably excessively so, as it is easy to misapply and, being based on hypothetical behavior, is inherently less reliable than measures based on observed behavior. For some types of value, however, stated preference methods may be the only alternative. Thus, existence value can

4/ www.evri.ca

only be measured by stated preference techniques. Benefits transfer has often been used inappropriately but can provide valid and reliable estimates under certain conditions. Given the cost of undertaking primary valuation studies, benefits transfer when used cautiously is likely to be an increasingly effective means for extending the use of valuation, including in developing countries.

2.4 Valuation and decision-making

37. Most of the different values ascribed to ecosystem services are not captured in market prices, because most ecosystem services are not traded on markets. This has also the consequence that the prices of many marketed goods and services will not adequately reflect the essential role of biodiversity in their production, which, in turn, will lead to distorted decisions by consumers and producers. Moreover, public decision-making and its allocation of public funds will also be distorted if the repercussions of governmental activities on biodiversity resources and the related ecosystem services are not adequately factored in. Hence, undertaking valuation has the potential of improving decision-making on projects or regulations as well as, under specific circumstances, of improving legal decision-making.

38. In this connection, the synthesis report of the Millennium Ecosystem Assessment also notes that *"most resource management and investment decisions are strongly influenced by considerations of the monetary costs and benefits of alternative policy choices. Decisions can be improved if they are informed by the total economic value of alternative management options and involve deliberative mechanisms that bring to bear non-economic considerations as well."*

39. Existing frameworks for prioritization in decision-making use valuation information to a greater or lesser extent. An important advantage of the valuation tools reviewed in the last section is that they provide numbers in a common (monetary) metric, which can thus easily be incorporated into the standard appraisal methods of **cost-benefit analysis** (CBA) and **cost-effectiveness analysis** (CEA). This incorporation has an important effect. It conveys the message that any loss of biodiversity that is associated with the activity under consideration generates *economic* costs, which are on a par with the other, financial costs and benefits associated with the activity.

40. Both CBA and CEA are common governmental appraisal methods in OECD countries and among international organizations. While the methods were originally developed for appraising basic infrastructure, many government guidance documents now include advice on the inclusion of environmental and social costs and benefits.

41. In the last two decades there have been numerous attempts, at national and international levels, to include environmental externalities into **national income accounts** and, more importantly, some measure of environmental depreciation to reflect the environmental losses that occur as a result of economic activities. For instance, recent work of the World Bank along these lines has shown that several countries that perform well on conventional grounds were actually performing less well once the new measure of depreciation was included. 5 Identification of this environmental drag on economic growth can serve as a basis for prioritizing national environmental policies and a focus on mitigation or reversal of environmentally damaging activities.

42. However, many theoretical and methodological challenges remain, in particular with regard to an adequate incorporation of biodiversity values in conventional macro economic indicators of growth. For instance, many of the valuation tools at hand are simply too costly and demanding to apply them on a scale that would be needed for a *comprehensive* valuation of the annual changes in domestic biodiversity resources. Further research directed at the development of a biodiversity adjustment for national

5/ The World Bank has developed the concept of adjusted net savings, which measure the true rate of savings in an economy after taking into account investments in human capital, depletion of natural resources and damage caused by pollution.

accounting seems to be an important means to have biodiversity losses more reflected in macroeconomic discourse.

43. In some countries, the legal framework for liability and redress priorities has also been an important driver for the analysis and refinement of valuation methods.

44. The economics approaches mentioned so far are all potentially informed by the tools for the valuation of biodiversity resources presented in the next section. In contrast, **multi-criteria analysis** (MCA) is more qualitative in nature but may occasionally use valuation information in the decision process. Multi-Criteria Analysis (MCA) is in fact a family of methods that use different scoring approaches to weight the different attributes of a decision. Participants in the analysis are typically given the criteria that define different options and are asked to score or weight these criteria using some pre determined points system. A Multi-Criteria Analysis may accommodate a range of social, environmental, technical, economic, and financial criteria. MCA is therefore applicable especially where significant environmental and social impacts are present, which cannot (easily) be expressed in monetary terms. MCA are often integrated with **deliberative and participatory approaches** and are said to facilitate such input to a larger degree than the monetary assessment tools CBA and CEA.

45. There are very few applications of MCA in developing countries. In general the method is less costly because sample sizes can be kept small. However, MCA is often difficult to use and understand for lay people. Most variants require an expert to explain how the method works, and to help users to define options, criteria and weights, as well as to choose the appropriate aggregation procedure. The method also makes no claim to be searching for economically efficient outcomes.

46. Furthermore, the method does *not* phrase environmental impacts as *economic* costs on a par with the other financial costs and benefits associated with the activity under investigation. In a situation where multiple criteria are involved confusion can arise if a logical, well-structured decision-making process does not follow the appraisal exercise. In particular when used in conjunction with deliberative and participatory approaches, the relative weight that the outcome of these processes is given in final decisions is sometimes unclear.

2.5 Conclusions

47. Valuation studies play an increasingly important role in contemporary environmental policies, as they provide additional knowledge to support better decision-making. It is important to apply and interpret valuation results in their appropriate context and to be aware of the pitfalls involved. Many criticisms levelled at valuation can be avoided when best practice is followed while conducting valuation studies. The main question is – given their high costs and the expertise required – how their use can be targeted at those cases where valuation studies provide an added value in terms of improved decision making.

48. Resistance to the use of valuation in OECD countries has in recent years been addressed by attempts to produce both valuation guides and protocols as well as standard environmental values for use in benefits transfer. These efforts have gone some way in terms of increasing the credibility and acceptability of valuation methods. More importantly, these resources have also simplified and reduced the cost of undertaking policy appraisal.

49. The use of formal appraisal methods and the nature of decision-making processes generally vary across countries. Even when formally documented procedures are in place it is impossible to generalize how and when different methods are most appropriate. In general, methods such as cost-benefit-analysis seem to be less controversial, and are commonly applied, when financial costs and benefits are relatively clear to identify and when externalities, and the need to value them, are comparatively small. There seems to be a need to amend appraisal processes with tools that are more consensual and participation-oriented when external costs (social and environmental) are more significant.

4. Strengthening international collaborative partnerships for assessing biodiversity values

50. Valuation is beginning to play a significant role in any conservation decisions in OECD countries. Many governments espouse its use by defining protocols for inclusion of environmental values into decision-making, adopting voluntary or mandatory guidelines, and assigning clear responsibilities. Moreover, international organizations have advocated greater use of valuation in policy making and project design, have sponsored meetings or undertaken projects with a strong biodiversity valuation component, have sponsored research and the wider application of, and dissemination of information on, biodiversity valuation and its role in creating incentives for conservation. Several governments have also facilitated greater use through the sponsorship of meetings and information databases sources.

51. A combination of poor institutional capacity and a lack of trained staff can generally be identified as the main barriers to further promotion of valuation as a conservation tool, in particular in developing countries and countries with economies in transition. Institutional weakness manifests in poorly defined lines of responsibility and the absence of clearly defined governmental practices for appraising policy decisions on projects or regulations.

52. Valuation can often be advanced by the development of one or two high profile studies as pilot projects that help to raise the issue of biodiversity in national debates. Many countries have reached this stage, but many others have not. This critical phase requires international collaboration and enhancement of domestic capacity.

4.2 Capacity building and training

53. On the governmental level, capacity needs to be enhanced for conducting the actual valuation studies, 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. Moreover, training could also include staff of relevant non-governmental organizations.

(i) International cooperation in enhancing domestic capacities

54. Most expertise in valuation is arguably located in several OECD countries that have established research institutions specifically in the area, and it appears to be important to tap into this expertise as a basis for sponsoring training arrangements such as, for instance, regional workshops on biodiversity valuation.

55. A number of existing mechanisms to extend training on ecosystem services valuation could be strengthened:

(i) In many non-OECD countries, notable centers of expertise also exist whose training activities should be supported;

(ii) In many developed countries, university departments offer exchange opportunities that are normally supported by their own national development ministries;

(iii) short-term courses are offered by other agencies and international organizations including the for instance the World Bank, which offers a course in Environmental Economics and Development Policy;

(iv) bilateral arrangements between agencies for temporary secondment is another means of extending training;

(v) a number of web-based resources and training manuals exist and should be put to wider application.

(ii) Enhancing global capacities: benefits transfer databases

56. Web-based databases exist which contain valuation data for use in benefits transfer (see above). While benefits transfer is still under development, the use of this concept seems to be an appealing way to advance the use of valuation information in particular in resource poor countries where time and resource constraints will typically prevent extensive primary research. Fostering the wider application of this concept should therefore be considered.

57. Existing databases contain a variety of studies from different developing countries, but are not specifically tailored to developing country needs on the valuation of ecosystem services. Therefore, a useful collaborative initiative could be to further develop existing transfer databases, or, alternatively, to design a new web-based database that is more specifically targeted at the needs of biodiversity assessment in low-income countries. An important first step in this exercise seems to be to undertake a comprehensive audit of all valuation studies conducted over the last ten years in the developing world, in the same way as those studies included in the EVRI database.

4.3 Fostering research

58. As explained above, considerable progress has been made in the last decades in developing reliable valuation tools and protocols for their application. However, opportunities for further research and development remain, in particular with regard to the conditions for validity and robustness of stated preference techniques and the benefits transfer approach. Furthermore, further research directed at the development of a biodiversity adjustment for national accounting seems to be an important means to have biodiversity losses reflected in macroeconomic decision-making.

59. It was also explained earlier that valuation addresses the ecosystem services generated by biodiversity resources and functions, but not biodiversity as such. Despite recent progress made in understanding the links between biological diversity, biodiversity functions, and the ecosystem services that are subsequently generated, as summarized in the Millennium Ecosystem Assessment reports, this understanding is still limited and fragmented, with many unresolved questions remaining. Further research in addressing these important questions, including research cooperation at the international level, is therefore crucial. Importantly, new insights on the relationship between changes in biodiversity, for example through sudden shifts in ecosystem equilibria, and the generation of ecosystem services may also lead to the development of new tools and methodologies for the valuation of biodiversity and biodiversity functions.

Annex

Proposals for the application of tools for valuation of biodiversity and biodiversity resources and functions

60. Biodiversity and its functions, as well as biodiversity resources, 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. Hence, undertaking valuation of biodiversity resources and functions and the associated non-marketed ecosystem services has the potential of improving private and public decision-making on projects or regulations.

61. **Total economic value.** 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 identify the total economic value of non-marketed ecosystem services, bearing in mind that the total economic value includes both the direct and direct use value and well as existence 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 total economic value of alternative management options and involve deliberative mechanisms that bring to bear non-economic considerations as well.

A. Valuation tools

62. 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 table 1 – to be added from Millennium Ecosystem Assessment).

63. **Choice of the valuation tool.** The choice of the valuation tool in any given instance will be dictated by the characteristics of the case 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.

64. **Stated and revealed preference techniques.** In general, tools based on observed behavior (the so-called revealed preference techniques) are preferred to tools based on hypothetical behavior (the so-called stated preference techniques). Stated preference techniques are however the only techniques that are able to capture non-use values, which tend to be crucial in certain biodiversity contexts, and can provide useful and reliable information when used carefully and in accordance with authoritative best practice. Their application should 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 has an adequate understanding of the issue in question; and (iii) capacity requirements for an application in accordance with best practice are met.

65. **Benefits transfer**. Benefits transfer can provide valid and reliable estimates under certain conditions and when used cautiously has the potential to alleviate the problems of deficient primary data sets and limited funds often encountered in valuation. Given the cost of undertaking primary valuation studies, the further use of benefits transfer is likely to be an increasingly effective means for extending the use of valuation, including in particular in developing countries. The cautious application and further development of this method should therefore be supported.

B. Institutional considerations

66. **Development or improvement of institutions**. Adequate institutional arrangements can generally be identified as an important precondition to the further promotion of valuation as a conservation tool 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.

67. **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 and 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 seems to be an important means to have biodiversity losses more adequately reflected in macroeconomic policy-making.

68. **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.

69. **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 appraisal and 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.

70. **Awareness raising and incentive measures.** Identifying and assessing the value of biodiversity and of the ecosystem services it provides 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. Furthermore, raising awareness among all stakeholders of the value of biodiversity improves the chances for other incentive measures to be successful.

71. **Awareness raising and pilot projects.** Undertaking a few high profile valuation studies as pilot projects on key domestic ecosystems can be another effective means to raise awareness of the value of biodiversity and associated ecosystem services, and to advance the application of biodiversity valuation in domestic decision-making procedures.

C. Capacity building and training

72. **Capacity building.** The effective application of tools for the valuation of biodiversity and associated non-marketed 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.

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

74. **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 and associated ecosystem services, and could be further strengthened. They include:

(i) Regional centers of expertise which offer training activities;

(ii) long-term and short-term academic exchange programmes;

(iii) short-term courses offered by international organizations;

(iv) bilateral arrangements between agencies for temporary secondment;

(v) web-based resources and training manuals.

75. **International databases for benefits transfer**. Web-based databases exist which collect valuation data for use in benefits transfer. As the use of this concept seems to be an appealing way to advance the use of valuation information in particular in resource poor countries where time and resource constraints will typically prevent extensive primary research, fostering its wider application, including through the further development of international online databases to more fully reflect biodiversity valuation in developing countries and countries with economies in transition, should therefore be considered.

C. Further research

76. **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.

77. **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 macroeconomic policy-making.

78. **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.

79. **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.

80. **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 functions.

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