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TERMS OF REFERENCE FOR A STUDY ON HOW MONITORING CAN SUPPORT THE IMPLEMENTATION OF VALUATION TOOLS AND POSITIVE INCENTIVE MEASURES

Note by the Executive Secretary

I. INTRODUCTION

1. In paragraph 10 (d) of decision VIII/25, on the application of tools for valuation of biodiversity and biodiversity resources and functions, the Conference of the Parties requested the Executive Secretary to *"prepare, in cooperation with relevant organizations and initiatives, terms of reference for a study on how monitoring can support the implementation of valuation tools and positive incentive measures. The study would propose a framework to capture the relationship between the monitoring of, and the valuation of, biodiversity resources and functions, and would aim to provide Parties with a practical tool to facilitate in-country studies."* The present note has been prepared pursuant to this request.

2. In the context of the 2010 biodiversity target – the commitment by Parties to the Convention to significantly reduce the current rate of loss of biodiversity by 2010 – there is increased interest in the costs of inaction with regard to biodiversity loss 1/ and, consequently, in practical and reliable valuation methodologies for quantifying the costs of inaction based, in part, on the valuation of ecosystem services that are being lost through inaction. 2/ In March 2007, the 13 environment ministers of the G8 and the five major newly industrializing countries (G8+5) established the "Potsdam Initiative on Biological Diversity 2010" and, as part of this initiative, agreed to initiate an analysis of the economics of biodiversity and ecosystems.

* UNEP/CBD/COP/9/1.

1/ Work had been undertaken for instance by the OECD and its Environmental Policy Committee (EPOC). An EPOC high-level special session considered in 2005 the cost of inaction with respect to key environmental challenges including biodiversity loss. See for thr results of this work OECD (2008): *Environmental Outlook to 2030*. Paris.

2/ See decision VIII/25, on the application of tools for valuation of biodiversity and biodiversity resources and functions. The promotion of the valuation of ecosystem services and supporting the use of market-based market-based mechanisms and economic instruments were among the actions, to be undertaken by national Governments, identified during the ministerial discussions on globalization and environment at the 24th session of the UNEP Governing Council/Global Ministerial Environment Forum, on 5-9 February 2007. See the president's summary, available under http://www.unep.org/GC/GC24/docs/GCPresSummary.pdf .

3. Many biodiversity components 3/ and their functions bear characteristics of "public goods", including the key characteristic that nobody can be excluded from their use. Consequently, markets cannot spontaneously develop for those components, which remain then unpriced. This absence of assigned value prevents existing market prices from signalling their scarcity, and hence to operate as adequate incentives for their conservation and sustainable use. Absence of a price does not mean absence of an economic value, however, as biodiversity components and functions provide many ecosystem services which are important to human well-being. 4/ This market failure can be remedied, at least partly, by eliciting the value of these biodiversity components, through the application of appropriate valuation tools, and by ensuring that this value comes into play in resource-use decision-making, through incorporation in decision-making tools such as cost-benefit or cost-effectiveness-analysis, Stategic or Environmental Impact Assessment, 5/ and/or through the calibration of adequate incentive measures. 6/ Decision-making both by Governments and by private actors would be improved by such 'internalization' of the costs associated with the loss of biodiversity components and functions, and economic development would be shifted towards a (more) sustainable path.

4. In general terms, a sound monitoring capability is a crucial prerequisite for designing and implementing effective biodiversity policies and improving decision-making at all levels. Monitoring ideally provides an understanding of what biodiversity is present, its current status and its conservation trajectory. While the issue of prioritization of biodiversity conservation continues to be debated in scientific literature, 7/ agencies charged with putting biodiversity policies in place need a sound scientific basis for understanding where the needs for action are most pressing, and for evaluating the effectiveness of policies. 8/

5. There is in particular a critical linkage between monitoring and the use of valuation tools and incentive measures, in that the former is typically required as a basis for undertaking the latter. However, in many instances, monitoring activities, and associated datasets, are not explicitly geared towards servicing valuation exercises or the design of incentive measures. Monitoring and valuation is typically undertaken by different communities, with frequently different academic background, and only sporadic interaction. This may consequently lead to, *inter alia*: (i) an insufficient knowledge of existing monitoring tools and associated datasets, and the opportunities they offer for undertaking valuation and for the design and/or improvement of positive incentive measures, as well as (ii) an insufficient awareness and knowledge of what monitoring information is needed for valuation purposes and for the design and implementation of incentive measures.

6. Consistent with the request expressed in decision VIII/25, the present report aims to sketch a *general* framework for an analysis of how existing monitoring tools, and associated datasets, can be used

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3/ Components of biodiversity as defined under the Convention are for instance: genes; species and populations; and ecosystems. See Article 7 (a) and annex I of the Convention, as well as the definition of biodiversity loss of decision VII/30, paragraph 2.

4/ Decision VIII/25 annex; SCBD (2007), at pages 7-8. A comprehensive assessment of the values of such ecosystem services has been undertaken by the Millennium Ecosystem Assessment. This assessment was based on a wide understanding of ecosystem services, which includes goods under the concept of "provisioning services". For a recent overview article prepared in the context of the DIVERSITAS EcoServices project, see Perrings et al. (under preparation): *The valuation of ecosystem services*. Mimeo.

5/ For instance, a recent study undertaken in the Netherlands showed that valuation of ecosystem services within SEA has contributed to enhanced decision making, and that the availability of good monitoroing data enhances valuation studies. See Beukering, P. van and R. Slootweg (2008). Valuation of ecosystem services in strategic environmental assessment and strategic decision-making. Netherlands Commission for Environmental Assessment (www.eia.nl).

6/ Even without explicit valuation however, it is possible to design policies that can provide incentives to be resource saving, which can have direct and indirect benefits for biodiversity conservation.

7/ See for a recent discussion Marris, E. (2007): "Conservation priorities: What to let go." *Nature* 450, 152-155.

8/ It is noteworthy that this general perspective may already require additional and/or shifting monitoring focus. For instance, from a biodiversity perspective, forest inventories which focus on timber quality and quantity would provide only a partial picture, and would need to be complemented by biodiversity inventories of forests.

to promote and reinforce the role of valuation and positive incentive measures. In light of largely varying national circumstances as regards relevant biodiversity components and functions, and associated ecosystem services, the variety of data sources available, and the varying needs to build or enhance required capacity, such an analysis would need to be undertaken on the national and/or sub-regional level. Given the currently limited interaction between the monitoring and the valuation communities, explained above, an important role of the study would be to raise awareness, for instance, about data availability and data demands, and the effective involvement of both the monitoring and the valuation communities during the preparation of the study would be useful.

7. Support by the UNEP World Conservation Monitoring Centre in preparing this report, including through a review by Ms. Katie Bolt, is gratefully acknowledged. A number of experts, acting in an individual capacity, also provided comments on an earlier version of the present note. Peer reviews are gratefully acknowledged from: Mr. Marcus Ballinger and Mr. Yves Bourassa (both Environment Canada); Ms. Sarah Hernandez (Ministère de l'Ecologie, du Développement et de l'Aménagement Durables, France), Ms. Emily McKenzie (formerly Joint Nature Conservation Committee, United Kingdom, now The Natural Capital Project, WWF-US), Mr. Roel Slootweg (Slootweg en van Schooten consultancy) and Prof. Charles Perrings (Arizona State University and chair, DIVERSITAS EcoSERVICES project). The collaboration of Dr. Dominic Moran (Scottish Agricultural College) in the preparation of the note is also gratefully acknowledged.

8. The structure of the present report is as follows. As the envisaged studies are of potential interest to both communities referred to above, and in light of the limited knowledge of each other's approaches and needs, the next sections provide, as part of the scoping exercise, brief overviews of valuation tools and incentive measures and their data needs (section III), as well as of the different monitoring tools available (section IV). Section V analyses how monitoring feeds into valuation exercises and the design and implementation of incentive measures. Section VI builds on the previous sections by deriving the terms of reference for national and/or sub-regional studies which would propose concrete, country or sub-region-specific frameworks to capture the relationship between the monitoring and the valuation of biodiversity resources/components and functions, and associated ecosystem services.

II. VALUATION TOOLS AND INCENTIVE MEASURES

A. General considerations

9. The importance of eliciting the economic value of biodiversity is widely recognised. In the Convention, the Conference of the Parties already at its fourth meeting, in 1998, recognized that *"economic valuation of biodiversity and biological resources is an important tool for well-targeted and calibrated economic incentive measures,"* and encouraged Parties, Governments and relevant organizations to *"take into account economic, social, cultural, and ethical valuation in the development of relevant incentive measures."*

10. As said above, the ultimate goal of undertaking valuation is to improve decision and policy-making. The policy relevance of valuation information is extensive, but might include: (i) demonstrating the value of biodiversity: awareness raising; (ii) land use decisions: for conservation or other uses; (iii) setting priorities for biodiversity conservation (within a limited budget); (iv) limiting biodiversity invasions; (v) assessing biodiversity impacts of non-biodiversity investments; (vi) determining damages for loss of biodiversity: liability regimes; (vii) limiting or banning trade in endangered species; (viii) revising and complementing the system of national economic accounts; and, of particular relevance in light of the request expressed by decision VIII/25, (ix) choosing and calibrating economic instruments for biodiversity conservation and sustainable use.

11. Valuation is a particular challenge if focus is given to damage to the *variability* among living organisms among all sources – the definition of biological diversity as provided in Article 2 of the Convention. Valuing variability as such would require an in-depth understanding of the interdependencies between the structure and diversity of biotic communities and the functioning of ecosystems. However,

this understanding is still limited and fragmented, which impedes the assignment of both ecological levels of importance (that is, of ecological value) to variability, as well as the assignment of economic values. 9/ It is for this reason that most valuation cases focus on specific components of biodiversity, in particular species or populations, as well as ecosystems, their functions, and their potential to provide critical ecosystem services.

12. All societies depend on biodiversity components and functions, and associated ecosystem services, either directly or indirectly but, except for those components that are directly marketed (e.g. commercially valuable species or other biodiversity resources), their economic value is not reflected in market prices. A lack of recognition of these economic values implies that they fail to compete on a level playing field with the economic forces that are driving their decline – that is, competing forces which have very real and measurable economic returns. The economic approach stresses the fact that any decision always has an opportunity cost – a benefit that is sacrificed because resources are used in a particular way.

13. Consider land-use change, an important driver of biodiversity loss, as an example. Measures of value denominated in monetary terms can be used to demonstrate the importance of biodiversity conservation relative to alternative uses of land. In this way, the need of a better balance between ‘developmental’ needs and conservation can be demonstrated. To date, that balance has tended to favour the conversion of land to industrial, residential and infrastructure use, simply because biodiversity components and functions, and associated ecosystem services, are not perceived as having a significant value. Economic approaches to valuation can help to elucidate this value. In a further stage, this value would have to be adequately reflected in decision-making, for instance by designing appropriate incentive measures, such as the creation of markets for biodiversity or the establishment of payments systems for ecosystem services, which is currently the subject of a number of pilot projects and much debate. 10/

14. Undertaking valuation should seek to address both direct and indirect use values, as well as their non-use value – reflecting the fact that many people hold non-use or passive use values over biodiversity components that they may never experience or use directly. Thus is reflected in the concept of ‘total economic value’. 11/

B. Valuation methods and their data requirements

15. There are many manuals on how to apply valuation tools and on their theoretical and practical merits and limitations. 12/ Some countries are also explicit about how valuation fits into project and regulatory appraisal. However, their use has been uneven across the signatories to the Convention. This disparity can be explained by in-country specific governance structures and institutional constraints, such as trained staff in relevant agencies, but also by the lack of monitoring capacity that provides the basic scientific input to the relevant valuation questions. 13/

16. Different biodiversity components and functions, and associated ecosystem services require different valuation approaches, and therefore feature different data requirements. It is often hard to generalize about what method works in which circumstance. Some techniques are broadly applicable, some are applicable to specific issues, and some are tailored to particular data sources. Any single valuation method is unlikely to be able to cover *all* of the different types of value given in the concept of total economic value. Different techniques may also be required for the same biodiversity components evaluated at different scales.

9/ See decision VIII/25, annex, section D; SCBD (2007), section V C.

10/ See COP-9 incentive measures documentation. See also FAO Sofa report 2007.

11/ See for a discussion SCBD (2007): *An exploration of tools and methodologies for valuation of biodiversity and biodiversity resources and functions.* CBD Technical Series No. 28, Montreal, at page 11.

12/ See for an overview SCBD (2007).

13/ Ibid, at pages 31-34.

17. Valuation approaches that have been used extensively in recent years, in a wide range of policy-relevant contexts, consist of three procedures:

(a) Techniques that are based on actual observed behaviour data, including some methods that deduce values indirectly from behaviour in surrogate markets and the price signals in these markets, which are hypothesized to have a direct relationship with the ecosystem service of interest. These approaches are termed *revealed preference* approaches;

(b) Techniques that are based on hypothetical rather than actual behaviour data, where willingness to pay estimates are derived from questionnaires – that is, replies of a representative sample of respondents to questions describing hypothetical markets or situations. These approaches are termed *stated preference* approaches;

(c) *Benefits transfer* (BT) is the term used to describe the process of "borrowing" existing monetary estimates and transferring them to other similar situations. Benefits transfer provides a potential solution for estimating environmental costs and benefits in situations where primary studies would be prohibitively expensive.

18. All these methods require bio-physical information and data as a crucial input. This is so, because valuation is a two-step process. First, the biodiversity components and functions and/or ecosystem services being valued have to be identified. This includes understanding their nature (bearing in mind that, under the Millennium Ecosystem Assessment understanding, services may also include goods) and their scale (being local, regional and/or global, on-site or off-site), and how they would change if the ecosystem changed; knowing who makes use of them, 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 these biophysical relationships. In many cases, this requires tracing through and quantifying a chain of causality. It is during this stage that biodiversity monitoring data and information will play an important role. 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.

C. Incentive measures

19. Incentive measures have been defined as a specific inducement designed and implemented to influence government bodies, business, non-governmental organizations, or local people to conserve biological diversity or to use its components in a sustainable manner. Incentive measures usually take the form of a new policy, law or economic or social programme. 14/ The basic aim of setting in place incentive measures for biodiversity conservation and sustainable use is to *influence* people's behaviour (rather than directly *prescribe* behaviour) by making it more desirable for them to conserve, rather than degrade or deplete, biodiversity components in the course of their economic activities. They would hence correct the lack of incentives resulting from the absence of markets for many of those components, as well as for those of the associated ecosystem services.

20. A range of incentive (and disincentive) measures is available to encourage the conservation or sustainable use of biological diversity. Among these, *positive incentive measures* are economic, legal or institutional measures designed to encourage beneficial activities. Positive incentive measures include for instance incentive payments for biodiversity-beneficial activities, agricultural land set-aside schemes as well as public or grant-aided land purchases or conservation easements. In addition, the *creation or strengthening of markets* for biodiversity-based products, for instance through certification and eco-labelling schemes, may also provide positive incentives for their conservation and sustainable use.

21. A related objective is addressing policies or practices that generate so-called *perverse incentives* , that is, incentives that were put in place for other objectives but as a by-product accelerate the loss of biodiversity. Examples include those public subsidies that support unsustainable farming, forestry or

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14/ See UNEP/CBD/COP/3/24, paragraph 8.

fishery activities. The Conference of the Parties to the Convention encouraged Parties and other Governments to identify such perverse incentives and consider their removal or the mitigation of their negative effects on biological diversity. 15/

22. Valuation, by raising awareness about the economic costs associated with the loss of biodiversity, can act as an incentive in its own right and, as has been noted by the Conference of the Parties, can also support the design and calibration of other incentive measures. 16/ Biophysical monitoring data will play an important role in the design and implementation of incentive measures: (i) by providing the basis for targeted measures; (ii) by ensuring compliance; and (iii) in evaluating the effectiveness of incentive measures.

III. MONITORING

23. Existing monitoring techniques are typically distinguished into remote sensing and field surveys. Both approaches have their strengths and limitations and most experts propose applying both methods in a complementary manner. This section provides a brief description of the main features of each method before proceeding to consider how these might be used to further valuation.

A. Field surveys

24. Current efforts to measure and monitor biodiversity at the regional and site levels tend to be undertaken by individual organizations or research scientists, each with their own species interests and ideas of how data should be gathered 17/. It would be a considerable undertaking to summarize the variety of data sources that certainly exist globally to account for species status. Moreover, it is often impossible to compare biodiversity data between sites because of incongruities in methodologies and databases. The need for standardized measures of biodiversity is now recognized, and researchers have made strides towards developing standardized protocols.

25. Typical methods include: point counts (e.g. surveying birds at 10 points over a specified time period); field surveys (a count of all animal or plant species in one field); line transacts of species counts across homogenous or heterogeneous plant transects; disturbance measurement transects; habitat characterisation; patch analysis; structured and unstructured interviews; participatory rural appraisal. All are common for terrestrial monitoring and can be applied to survey habitats, species or the health of any identifiable ecosystem function or process.

26. For marine environments, benthic studies methods that use quadrates (simple square method) or transects, as used in terrestrial environments, are feasible for estuarine, intertidal and hard bottom areas. These methods are not feasible for soft bottom substrates. Marine sampling operations other than in the intertidal zone is more complex and costly, as they require the use of some type of vessel, which will often influence survey procedures and choice of gear.

Measuring biodiversity on a regional or site level usually entails multi-taxa, species-based assessments using standardized techniques. Classification and description of all the species living even in a limited area is impracticable. A more efficient and effective system involves sampling of surrogate ‘indicators’ whose change in either time or space represents change in biological diversity as a whole. The selection of appropriate indicator species is a key element of this process.

27. Traditional methods for monitoring changes in distribution and abundance of species are labour-intensive and realistically can only be applied to small geographic areas and selected taxa at a time. More importantly, data gathering at this level can be combined with remotely sensed data (see below), to provide a more convenient way to understand how broader scale land cover changes, including

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15/ Decision IV/10 A, paragraph 1 (f).

16/ See decisions IV/10 A, VI/15 annex I, paragraph 22; and decision VIII/25 annex.

17/ For example, see the Important Bird Area (IBA) protocol used by Birdlife International http://www.birdlife.org/action/science/sites/african_ibas/monitoring_ibas_africa_2005_eng.pdf loss of vegetation that serves as habitat, are being played out at field scale. Indeed the combination of remote-sensing data and field data on species distribution may provide a tool to:

- measure biological diversity more efficiently through improved thematic mapping algorithms 18/;
- put ground-level surveys into a wider context;
- monitor particular areas in terms of disturbances (for instance the introduction of alien species);
- monitor changes over time (i.e. time series) in the most rapid, efficient way;
- input site/regional level information into a global surveillance system.

28. Field sampling and experimental surveys may also provide the basis for building a more complete understanding of the intricate ecosystem functions that are underpinning many ecosystem services. Time series (i.e. the comparison of two standardized surveys at the same locality at different times) of site-specific, detailed assessments of biodiversity can be used in designing monitoring programmes and in evaluating the effectiveness of conservation programs.

B. Remote sensing

29. Remote sensing uses aircraft observation or satellite imagery. The later uses analysis of spectral bands that generate digital maps of land-cover classes such as forests, disturbed areas, water, geological structures. This spectral imaging is broadly useful for categorising: (i) trends in extent of selected biomes, ecosystems and habitats; (ii) coverage of protected areas; (iii) threats to biodiversity; (iv) connectivity or fragmentation of ecosystems; (v) trends in populations of selected species; and (vi) potential human development indicators.

30. There are two general approaches to using remote sensing in assessing biodiversity. One is direct remote sensing, which maps individual organisms, species assemblages, or ecological communities by use of airborne or satellite sensors. The other approach, indirect remote sensing, facilitates assessments of biodiversity elements through analysis of such environmental parameters as general land cover, geology, elevation, landform, human disturbance, and other surrogates for the actual features of interest. When mapping the distribution of species of interest (focal species), a common approach is to map specific habitat types by use of a combination of remote sensing and environmental data themes.

31. Remotely sensed images do not represent biodiversity indicators per se. Rather, remote sensing data form the raw inputs from which indicators can be constructed. For example, the signal to remote sensors can be associated with a particular vegetation cover type (such as forests). A change in the signal from one time period to another might indicate a change in vegetation cover and the habitat that is associated with that cover. However, in many cases, ecosystem status (e.g. healthy vs. degraded grass lands, natural forest vs. tree plantations) cannot exclusively determined from remote-sensing studies alone but needs to be complemented by field surveys. 19/ Validation with ground truth or by high resolution data is necessary to confirm remote sensing observations. Data manipulation within a GIS environment can help produce the maps and statistics needed to create an indicator that can be understood by decision makers and the general public.

32. Remote-sensing data have the potential to be very useful in characterizing the distribution of biodiversity over a large geographic area. 20/ These data could potentially increase our ability to assess

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18/ Field observations are usually sampled at irregularly spaced points, but, in most cases, are representative of continuous phenomena; therefore, to restore the original information a continuous thematic map should be interpolated from the available observations.

19/ For further information see: American Museum of Natural History: *Myths and misconceptions in remote sensing,* available at http://cbc.rs-gis.amnh.org/remote_sensing/guides/basic_concepts/myths.html).

20/ A list of the data that can potentially generated using remote sensing is included in the Soucebook on Remote sensing and Biodiversity Iindicators prepared by the NASA-NGO Biodiversity Working Group and UNEP-WCMC. See SCBD (2007): *Sourcebook on remote sensing and biodiversity indicators.* CBD Technical Series No. 32, Montreal.

regional biodiversity rapidly and to monitor small- and large-scale changes in biodiversity over time. However, at the present time, thematic maps based on remote-sensing data do not adequately reflect patterns of biodiversity, i.e. different forest types or plant and animal communities. Nor can they be said to completely characterize the more fundamental complexity of ecosystem processes, which are not yet characterized at field scale. For instance, the currently available remote-sensing land-use classifications do reflect classes such as ‘forest’, and within forests even some subclasses 21/, but they do not adequately reflect their biological composition. It is however within this level, which includes the historically-known communities of organisms of a specific area, where the mechanisms for the maintenance of biodiversity need to be applied and where biodiversity has to be assessed.

33. Global scale remotely sensed data have historically been accessible to a limited community of researchers. Data such as Advanced Very High Resolution Radiometer (AVHRR), Thematic Mapper (TM), and Multi-spectral Scanner (MSS) have generally been unavailable to the broader conservation community due to many reasons such as the high cost of data, the expense of storing and processing the data, and the high level of expertise and facilities required to manage the data. These limitations are particularly severe for developing countries.

34. More generally, there seems to be a gap in linking this global information to local and regional data sets that contain specific information on habitat, communities, and species. This link would benefit both regional/site-level studies (e.g., what are the relationships between a temporal change in a species' distribution and deforestation?) and the global assessment (e.g., taken collectively, what is the distribution of certain species or genera, and how can they indicate the health or condition of the remaining habitat globally?).

35. Hence, three key concepts which must be considered whenever using remote sensing for monitoring are:

- *Importance of scale.* Different features can be identified successfully depending on the spatial, temporal, and spectral resolutions of data. Therefore, for any particular application, certain satellites are appropriate and others not.
- *Importance of field or ground truth data.* Such data are absolutely necessary to make the links between what can be detected from above and actual biodiversity phenomena.
- *Accuracy.* Accuracy increases with finer spectral and spatial resolution data, with better field data, and with coarser classification levels.

IV. LINKING MONITORING TO VALUATION AND INCENTIVE MEASURES

A. Using monitoring data in valuation

36. As was explained above, all valuation methods require bio-physical information and data as a crucial input. Different monitoring methods can be deployed to address different valuation questions. Hence, their application in valuation ultimately depends on the purpose of the valuation exercise, along the lines provided above. Moreover, valuation can address different types of value (direct and indirect use values or non-use values), different ecosystems and/or biodiversity components, and at different scales. Consequently, in order to develop a framework to capture the relationship between monitoring and valuation as a practical tool to facilitate in-country studies, as requested by the Conference of the Parties,

21/ Different spectral techniques to differentiate vegetation covers exist. See http://www.huegreencorridor.org/toolkit/English/documents/EOSTEM/7.EOSTEM_Enhanced_EO_Fragmentation_EN.pdf there seems to be a need to identify information needs at the national and/or regional level, as those will depend, amongst others, on the priorities and policy goals set at national level. 22/

37. This implies that the framework would appear to be most practical if it would 'work backward', in the sense of identifying first the relevant national priorities and associated key policy goals, which leads on to the type of valuation studies and/or incentive measures likely to be relevant 23/ to those priorities and goals, and at what scale, which in turn leads on to the data demands of these particular studies or measures, which in turn would shape what kind of monitoring information/schemes are required. The following paragraphs provide a number of concrete examples, along the concept of total economic value, presented above. These are not meant to be mutually exclusive – countries may decide to put differing degrees of emphasis in accordance with their national circumstances and priorities.

38. If *direct use values* are deemed to be important, countries may for instance wish to gain a clearer understanding of the overall market value of species or products occurring in the wild in their territory, and may therefore wish to establish inventories of marketed wild products and their associated values. This information would be useful for complementing existing systems of national accounting (see below for further discussion), but would also be useful for raising awareness. Field surveys, in conjunction with remote sensing, could be used to generate inventories of these products including not only their location, but also information on markets and prices at relevant scales, quantities collected, as well as time spent collecting.

39. More complicated monitoring tasks are associated with the valuation of indirect and non-use values. One revealed preference technique which is widely used to estimate *indirect use values* is the change in productivity technique. It consists of tracing through chains of causality so that the impact of changes in the condition of an ecosystem can be related to various measures of human well-being. The valuation step itself depends on the type of impact but is often straightforward, as 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.

40. For example , the impact of hydrological changes on use of water for human consumption begins by tracing chains of causality to estimate the changes in the quantity and quality of water available to consumers. This is itself often difficult, as the relationship between tree cover and water productivity in a watershed is complex and often not well understood. Further scientific research into this relationship and the chains of causality will in such cases be a key precondition for valuation, as will be the application of appropriate monitoring techniques, with a view to generate more refined data on 'ecological production functions', which are complex to measure and highly site and ecosystem-specific.

41. *Non-use values* such as existence value can only be measured by stated-preference techniques. Stated preference methods can be applied to one single species (for instance, in the context of a species conservation programme) but also at scales that are highly aggregate relative to the species level, for instance within studies considering whole landscapes and extents of vegetation or forest cover. Information and data requirements will depend on the scale considered as well as on the degree of biological complexity. An important precondition for the appropriate application of these methods is that respondents need to have a clear understanding of the issue in question in order to make informed

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22/ As an example for practical work on the regional level see the development of a regional empirical dataset relating to the values of the goods and services derived from habitats bordering the South China Sea, with emphasis on mangrove forests. This work was undertaken by the regional task force on economic valuation of the UNEP/GEF project 'Reversing Environmental Degradation Trends in the South China Sea and the Gulf of Thailand.' See for further information http://www.unepscs.org/ .

23/ 'Relevant' should be understood in a broad sense. For instance, a country may put high priority to the development of its transportation infrastructure, and may put in place transportation policies accordingly. This may indicate a high need to undertake assessments of the environmental impacts of proposed transportation infrastructure projects, including the valuation of biodiversity components and functions, and associated ecosystem servies, which would be threatened by those projects. Importantly, the results of these assessments and valuation studies may well lead to changes in project design and/or in the policy itsself.

choices, and this is of particular relevance whenever an understanding of complex ecological biodiversity functions is required. Choosing the right approach for, and the adequate intensity of efforts in, improving the understanding of biological complexity of the sample group is a challenge for stated preference methods, and the adequate generation and representation of data will play an important role.

42. The precision of *benefits transfer* depends on the availability of studies corresponding to the relevant benefit categories identified as a result of environmental change. This means that, amongst others, there must be biophysical correspondence between the sites between which values are transferred, suggesting in turn that the quality of benefits transfer will depend on an appropriate monitoring of biophysical characteristics of sites, as well as of the valuation method used.

43. In all cases, temporal issues are important – repeated observations would be necessary in order to recalibrate value estimates and make inferences about changing values through time.

44. The identification of national policy goals and priorities could also include the identification of the relative importance of the different scales of valuation exercises. Arguably, the use of valuation in *national accounts* is the most systematic framework for conveying messages about the sustainable use of biological resources or ecosystem processes at a level relevant to national policy making. For example, the valuation of the change in national forest cover could be counted in a satellite physical stock account or included in an adjusted national accounts framework. 24/ The value can be derived from an initial estimate of the changing stock of timber; a good with a direct use value (see above). Such an assessment will most likely be informed primarily from top-down remotely sensed data, perhaps complemented by on the ground sampling to validate calculations. To undertake such assessments, it might prove to be useful to draw up an inventory of relevant existing or new monitoring data and analyse how the data can be fed into relevant valuation exercises.

45. In contrast, studies at smaller scales would seek for instance to understand and value the changing distribution of populations of bird or marine mammals, in order to evaluate and prioritize species action or recovery plans. Such studies will most likely be based on field surveys. However, it may be possible that this survey would also include favored habitat vegetation types, which in turn may allow broader extrapolation using remotely sensed information on the habitat.

46. As monitoring is expensive and national circumstances differ in particular across developing and developed countries, it would be useful if the framework would provide concrete country-specific guidance on what valuation could already been undertaken with the available data (with a view to 'pick the low-hanging fruit'), and on identifying and prioritizing further monitoring and data collection needs – which may possibly also include new monitoring techniques that may be more relevant to the specific information demands of valuation studies (e.g. monitoring of certain socio-economic information, or market surveys).

B. Linking monitoring to incentive measures

47. As explained above, valuation can support the design and calibration of incentive measures. However, explicit valuation is not always a necessary prerequisite. It has been noted by the OECD that calibration through valuation is of particular importance for those instruments that seek to directly correct prices, such as fees or direct payments for environmental services. In cases where property rights could be established on the relevant biodiversity assets, a market price would emerge endogenously, and valuation would not be needed for calibration. Even in the latter case however, valuation would still be useful to determine the magnitude of the policy problem and which policy instruments to choose. Whenever valuation is used as an input for the design and calibration of incentive measures, monitoring would have an indirect effect on the application of incentive measures – through the valuation exercise.

24/ See SCBD (2007), at page 25, for an overview of relevant work undertaken by the United Nations Statistics Division (on the System of Economic and Envrionmental Accounting – SEEA) and the World Bank (on adjusted net savings including investments in human capital, depletion of natural resources and damage caused by pollution).

48. However, monitoring may also have a direct effect. For instance, with regard to positive incentive measures, the Conference of the Parties recognized that they are important in achieving the objectives of the Convention and the 2010 biodiversity target when such positive incentive measures are, *inter alia*, *targeted and appropriately monitored.* 25/ Biodiversity monitoring data will play an important role in the appropriate targeting, in ensuring compliance, and in evaluating the effectiveness of incentive measures. This could imply basing the provision of incentives (or, conversely, the application of disincentives) directly on a comprehensive set of performance indicators that directly measure the state of biodiversity or biodiversity resources and functions. 26/ Using such performance indicators would avoid potential problems associated with proxy indicators, for instance, unexpected reactions from target actors ('you get what you pay for'). 27/ It is hence worthwhile to examine existing work on biodiversity indicators in select sectors and/or ecosystems as a basis for the application of incentive measures. 28/

49. Since valuation and incentives aim to change human behaviour, there is also a need to understand what behaviour needs to be changed and where. For instance, species-related information might need to be complemented with information and data on the human behaviours that are its main threats. This human drivers' angle is recognized in several of the indicators highlighted in the annex to the present document. For instance, countries may wish to consider how monitoring can capture information on the specific impacts on biodiversity of perverse sector subsidies, thus linking conservation considerations to policies for specific sectors, such as agriculture, energy, water and transportation.

50. The Conference of the Parties to the Convention, in its work on global headline indicators for assessing progress towards the 2010 target, identified potential measures under the respective headline indicator as well as the availability of methodologies and data, and the potential sources of data. A tentative analysis of this survey of existing data indicates potential for their application in valuation studies and the design of incentive measures, and may provide one useful starting point for conducting the national studies (see table provided in the annex and the analysis summarized in the last two columns of the table).

V. TERMS OF REFERENCE

51. The considerations in the previous sections suggest the following terms of reference for a study on how monitoring can support the implementation of valuation tools and positive incentive measures. The study would propose a framework to capture the relationship between the monitoring and the valuation of biodiversity resources and functions, as a practical tool to facilitate in-country valuation studies. In light of largely varying national circumstances as regards relevant biodiversity resources and functions, and associated ecosystems, as well as the variety of data sources available, the study on how monitoring can support the implementation of valuation tools and positive incentive measures would need to be undertaken on the national and/or sub-regional level, and would hence provide a framework to capture this relationship which would explicitly reflect the specific situation in the country of sub-region.

52. The terms of reference provided below provide a *general* framework for analysis for undertaking such national studies. Depending on their national priorities and circumstances, countries may wish to put more emphasis on some of the elements provided below, and/or decide to de-emphasize (or delete) others.

25/ Decision VIII/26, sub-section on positive incentive measures, preamble. Emphasis added.

26/ This could include the development of composite indicators such as an Environmental Benefit Index (EBI), which would quantify the significance of the habitat biodiversity and could also be used to characterize most promising biodiversity conservation/management measures.

27/ For a discussion in the context of agri-environmental payments, see SCBD (2005): *The impact of trade liberalization on agricultural biodiversity. Domestic support measures and their effects on agricultural biodiversity.* CBD Technical Series No. 16, Montreal.

28/ For instance, OECD work on agri-environmental indicators covers the agricultural impacts on soil, water, air, biodiversity, habitats and landscapes, and is aimed at policy makers and the wider public interested in the development, trends and the use of agri-environmental indicators for policy purposes.

53. Those countries that do not yet apply environmental valuation within their decision-making processes could consider using the framework to initiate a limited number of pilot valuation studies, with a view to raise awareness of biodiversity values, gain familiarity with, and build capacity on, valuation methodologies, and assess the usefulness of the framework proposed by the study.

54. The relationship between monitoring and valuation is currently poorly understood due to the limited interaction between the communities involved in these two areas (biodiversity scientists and data custodians on the monitoring side, economists and interested policy-oriented ecologists on the valuation side). One important role of the study would hence to raise awareness, for instance, about: (i) the opportunities which existing monitoring tools and associated datasets may already offer for undertaking valuation and for the design and/or improvement of positive incentive measures, and (ii) of what monitoring information is needed for valuation purposes and for the design and implementation of incentive measures. It would therefore be useful if the process of preparing the study would involve consultations of relevant stakeholders and the effective involvement of both the monitoring and the valuation communities, for instance, by convening 'science and economics' workshops which could assist in the delivery of the action items enumerated below.

A. Taking stock

1. Define biodiversity for the purpose of the national study and identify, in a *qualitative* manner, key biodiversity components and functions, and associated ecosystem services, of national importance.
2. Catalogue current drivers and pressures on those biodiversity components and functions, and associated ecosystem services. Identify key national policy priorities, and key policy goals.
3. Specify whether any ecosystem services are transboundary in nature, including for instance cross-border watershed services, as well as emerging information linking habitats (e.g. forests) and rain formation.
4. Take stock of relevant national and international initiatives for biodiversity monitoring, and compile an inventory of relevant national field survey data as well as remotely sensed data, and GIS maps.

This work could possibly build on existing work undertaken within NBSAP development processes and earlier biodiversity country studies.

B. Valuation

5. Based on the work above, identify prioritized valuation needs and the extent to which they can be addressed by using existing datasets and ongoing monitoring activities. Identify opportunities for 'picking low-hanging fruit': important (but not yet fulfilled) valuation needs which could be implemented with existing monitoring. Specifically, dependent on the priorities and policy goals identified above, countries may wish to assign varying degrees of emphasis to the individual sub-sections below.

a. Direct use values

6. Analyse opportunities for producing a national direct use values inventory, possibly in a GIS framework, for instance: species occurring in the wild that are used (location, price information at relevant scales, quantities harvested, and harvesting effort); overview of use (number of visitors, average time visited, annual revenues) of ecosystems of high and direct economic importance (e.g. for tourism, recreation).
7. Consider how to develop a periodic survey methodology to track quantities and prices relative to a measurable sustainable yield.

b. *Indirect use values*

8. As far as possible identify chains of causality or production function linkages so that the impact of changes in the condition of key ecosystems can be related to various measures of human well-being. This could include both national and international well-being endpoints.

9. Using the general analysis provided in the annex for orientation, analyze whether and to what extent existing data sets and ongoing monitoring activities could be used to specify the ecologic production functions of key ecosystem services.

10. Consider how a time series of quantities and values may be developed and represented in a GIS framework.

c. *Non-use values*

11. Catalogue species and/or ecosystems with potentially high non-use value, for instance, landscapes of national importance, endemic, endangered, charismatic and/or keystone species. Identify the relevant populations that hold value over these biodiversity components.

12. Using the general analysis provided in the annex for orientation, analyze whether and to what extent existing data sets and ongoing monitoring activities could be used to improve the understanding of biological complexity of relevant sample groups.

13. For all sub-sections above, identify critical gaps in data availability and associated prioritized needs for new monitoring tools and activities.

14. For all sub-sections above, identify critical needs to build or enhance capacity.

C. **Incentive measures**

15. Identify relevant existing incentive measures for the conservation and sustainable use of relevant components of biodiversity.

16. Analyse opportunities for ‘picking low-hanging fruit’: whether and to what extent the design and implementation of existing incentive measures could be enhanced by better using existing datasets and ongoing monitoring activities, and subsequent valuation exercises.

17. Based on the work under B above, identify opportunities for new incentive measures based on existing datasets and monitoring activities.

18. Catalogue currently applied subsidies in relevant sectors and analyse how existing datasets and ongoing monitoring activities could be used for assessments of adverse effects on biodiversity.

19. Identify critical gaps in data availability and associated prioritized needs for new monitoring tools and activities, including for monitoring the effectiveness of incentive measures in changing behaviour over time.

20. Identify critical needs to build or enhance capacity.

D. **Addressing scale**

21. Identify the spatial scale of values derived in previous stages. Investigate potential to map values and the development of a GIS overlay system that can be linked to a database of location-specific values for direct, indirect and/or non use values, in accordance with national priorities and policy goals.

22. Consider options for the development of spatially referenced national accounts for relevant and prioritized biodiversity resources and functions, and associated ecosystem services, including biophysical changes and their implications for the depreciation/appreciation of the value of natural assets.

E. Conclusions and recommendations

23. Synthesize relevant conclusions and recommendations from the previous work into a national action plan on valuation, incentive measures, and monitoring, which includes:

    - Opportunities for undertaking priority valuation work by making use of existing datasets and ongoing monitoring activities.
    - Opportunities for improving existing incentive measures, including the removal of perverse incentives, by making better use of existing datasets and monitoring activities.
    - Gaps in existing datasets and ongoing monitoring activities for undertaking priority valuation work, and concrete proposals for prioritized action on how to close or narrow these gaps.
    - Gaps in existing datasets and ongoing monitoring activities for improving the application of incentive measures for conservation and sustainable use of biodiversity, including the removal of perverse incentives, and concrete proposals for prioritized action to close or narrow these these gaps.
    - With regard to all of the above: prioritized needs and opportunities for transboundary/regional/international cooperation.
    - With regard to all of the above: prioritized needs for the building or enhancement of capacity.

Annex

SUMMARY OF INDICATOR STATUS AND POTENTIAL APPLICATIONS TO VALUATION AND INCENTIVE MEASURES

Headline Indicator 2 /	Status3 /	Potential Measures	Data available now?	Method-ology available now?	Possible sources of data	Organizations to coordinate delivery of indicator	Potential application to valuation/ incentive measures	Data requirements for application
Trends in extent of selected biomes, ecosystems, and habitats 4/	B	Forests, and forest types (e.g. mangroves)	Yes	Yes	FRA (FAO); EU-JRC, NASA Modland; Corine land cover (see appendix 2 to the AHTEG report 5/)	UNEP-WCMC (with FAO, NASA-NGO Conservation Working Group and other relevant partners)	Direct use valuation of timber and non timber forest products Application of stated or revealed preference methods Valuation of forest carbon Production function impacts related to forest ecosystem services Allocation of property rights Harvest quotas Information provision for sustainable management and off take.	Harvested volumes and market prices Public willingness to pay for national forest conservation or afforestation Record of carbon biomass combined with shadow cost of carbon Hydrological data for water cycle in watersheds and basins in vicinity Biological data for key species using mangroves as habitat- e.g. offshore fish catch data for relevant speciesLand use/ownership surveys Maximum sustainable yield and numbers of users and quantity of use demanded Percapita or household maximum sustainable yield by year or season depending on species

		Peatlands	Yes	Yes	Various national datasets and remote-sensing (see appendix 2 to the AHTEG report)		Valuation of carbon sequestration and/or release when converted to alternative land uses Allocation of property rights Land use zoning Participation in carbon/ greenhouse gas offset schemes Agri environemtnal schemes based on soil carbon	Record of carbon biomass combined with shadow cost of carbon Hydrological data for water cycle in watersheds and basins in vicinity Cadastral surveys of land Land class mapping Land class maps and soil composition Soil carbon inventories
		Coral reefs	Yes	Yes	GCRMN/Reefcheck		Direct use valuation of reef products Production function impacts Indirect (production function) valuation of fish stocks and other coral species Property rights to management and harvest User fees Identification/remonal of perverse incentives Support for sustainable use practices	Data on harvests commercially valuable corral species Market price data on coral species Areas of specific coral reef degradation – including bleaching Specific data on coral species (e.g. species-area relationships) User surveys / traitional use patterns and rights Data on detrirmental impacts from commercial uses (fisheries, tourism, ...)

		Croplands	Yes	Yes	National regional datasets and remote-sensing (see appendix 2 to the AHTEG report), MA		Relative value of native to non native crops Farm systems diversity Farm genetic diversity Identification of perverse incentives Design of agri-environmental schemes	Areas of native to non native crops Indicator of on farm crop species diversity – to be related to on farm productivity Data on impacts on agricultural production systems and their intensification on biodiversity
		(Natural) grasslands	Yes	Yes	Remote-sensing (see appendix 2 to the AHTEG report), MA		Grassland diversity Valuation of carbon sequestration and/or release when converted to alternative land uses Participation in carbon/ greenhouse gas offset schemes Identification/removal of perverse incentives	Grassland areas by variety Carbon sequestration by landraces. Carbon budgets and auditing tools Data on impacts on agricultural production systems and their intensification on biodiversity
		Polar/ice	Yes	Yes	Remote-sensing(see appendix 2 to the AHTEG report), MA		Direct use (hunting and subsistence values) Global existence value of charismatic polar species Establishment of property rights	Harvest quantities of specific species and market prices of thee or close substitutes Public willingness to pay of remote populations
		Inland wetlands	No	No	Remote-sensing (see appendix 2 to the AHTEG report), MA		Value of water use – domestic and irrigation Value of flood control Direct use value of wetland species Non use value of wetland species	Water volumes abstracted by different user populations Unit water values using either market data, willingness to pay or time spent on collection Crop production cost information to derive netback value of irrigation water

							Establishment of property rights Land use zoning Tradeable development rights Abstraction controls/licencing Abstractio and disharge limits or pricing Water pricing	Volumes and value of harvested species Data on land titling/ownership Data on historical abstraction volumes Willingness to pay for water
		Tidal flats/estuaries	No	No	Remote-sensing (see appendix 2 to the AHTEG report), MA		Direct use of value of harvestable species Indirect value of tidal functions of flood control and breeding grounds Extraction/harvest licencing Closed seasons on harvests	Volumes of harvested species Values of harvested species Coastal or offshore fishery catch data to construct a production function for relevant species dependent on flats and estuaries
		Seagrasses	No	No	Seagrass Atlas , MA		Extraction/harvest licemcing	Volumes harvested Market prices
		Dry and sub-humid lands	No	No	LADA, Remote-sensing (see appendix 2), MA		Direct use value of relevant plant and animal products	Harvest quantities of specific species and market prices of thee or close substitutes
		Urban	No	No	Remote-sensing (see appendix 2), MA		N/A	
Trends in abundance and distribution of selected species	B	Living Planet Index	Yes	Yes	WWF	UNEP-WCMC (WWF, Birdlife International and others, encouraged to review and refine methodology for calculation of index; These groups and IUCN encouraged to compare and share data with that used for the Red List Index.) Indices could be developed from data disaggregated (e.g.: migratory	Valuation of status of species (either direct use value or non use value)	Sustainable harvest volumes of marketable species; market prices and harvest costs

		Various species assemblage-trends indices	Yes	Yes	Birdlife International and partners, others	species, wetland species))	N/A	
Coverage of protected areas	B	Coverage according to World List of Protected areas.	Yes	Yes	WCMC/WCPA	UNEP-WCMC/IUCN-WCPA	Valuation of protected areas Use and non use value User/visitor fees Benefit sharing (local communities)	Recreational visitation rates Public willingness to pay for conservation of protected areas and new designations Price elasticities of demand in relation to tourist visitation Population data and identification of relevant stakeholders
		Ecological networks and corridors	Yes	Could be developed	MBC, PEEN etc.		Non use/existence value of area connectivity and resilience Benefit sharing and/compensation/userights for host communities	Public willingness to pay data Population data and identification of relevant stakeholders
		Overlays with areas of key importance to biodiversity	Yes	Yes	WCMC, WCPA, BirdLife International		N/A	
		Inclusion on community and private protected areas	No	No			Community direct and indirect value derived from relevant areas and resident species.	Use value information that discriminates between user groups.
		Management effectiveness	No	No			N/A	
Change in status of threatened species	B	Red List Index (IUCN-SSC)	Yes	Yes	Red List Consortium	Red List Consortium (Methodological refinements requested)	Cost-effectiveness of species action plans	Cost data corresponding to species action plans. Data needs to be on a consistent accounting basis
Trends in genetic diversity of domesticated animals, cultivated plants, and fish species of major socioeconomic	B	*Ex situ* crop collections	Yes	Could be developed	FAO (SOW, WIEWS); IPGRI (CGIAR-SINGER); Fishbase	FAO with IPGRI on behalf of CGIAR	Value of Global plant genetic diversity (portfolio theory?) Access and benefit-sharing provisions	Population data and identification of relevant stakeholders who contribute to diversity of collections

importance		Livestock genetic resources	Yes	Could be developed	FAO (DADIS)		Farm genetic diversity Agri environemtnal schemes (direct payment) to encourage sytem diversity (crops and livestock)	Genetic characterisation of traditional breeds Population data and identification of relevant stakeholders who contribute to diversity of collections
		Fish genetic resources	Yes	Could be developed	FAO; Fishbase		Farm genetic diversity Agri environmental schemes to encourage sytem diversity (crops and livestock)	Genetic characterisation of traditional species Population data and identification of relevant stakeholders who contribute to diversity of collections
		Tree genetic resources	Some	Could be developed	REFORGEN database of FAO; OECD		Farm genetic diversity Agri environemtnal schemes to encourage sytem diversity (crops and livestock)	Genetic characterisation of traditional species Population data and identification of relevant stakeholders who contribute to diversity of collections
		Varieties on-farm	Some	Could be developed	FAO, IPGRI, OECD		Farm genetic diversity Agri environemtnal schemes to encourage sytem diversity (crops and livestock)	Genetic characterisation of traditional breeds and plant species Population data and identification of relevant stakeholders who contribute to diversity of collections
Area of forest, agricultural and aquaculture ecosystems under sustainable management	B	Existing data sets for measuring sustainability of agriculture, aquaculture and forestry, including FAO reports, Certification, and Ecological corridors and community-based management areas, and wildlife sustainable management schemes	Yes	Yes	FAO reports; Certification bodies (e.g., FSC, MSC, ISO, PEFC, CSA, SFI, LEI); MBC; Parties	UNEP-WCMC with FAO	Cost benefit analysis of moving to sustainable management pathway – e.g. in the case of agricultural land use, the Universal Soil Loss Equation (USLE) Land use restrictions Development right restrictions Conservation easements applicable to land	USLE data[6] Other pollution externality data
Proportion of products derived	C		No	No	Equilibrium/WWF/World Bank/TNC intend to propose	SCBD	Valuation of status of species (either	Sustainable harvest volumes of marketable

from sustainable sources					some indicators		direct use value or non use value) Product labelling Pricing differnentials Selective procurment schemes	species; market prices and harvest costs Data on numbers of produers in labelling schemes or niche product cooperatives
Ecological footprint and related concepts	C	Ecological footprint	Yes	Yes,	FAO, IAE, IPCC, UNEP-WCMC	Ecological Footprint network		
		Other measures of the area of land and sea needed to support production of goods and deliver services	Some	Some		SCBD and UNEP-WCMC	Production function approach linking relevant ecosystem function to relevant valuable service	Field study data confirming production function links
Nitrogen deposition	B		Yes	Yes	Available (INI) models for 2010 could be developed with additional effort	INI with UNEP-WCMC	Damage cost analysis	Data on depositions and critical loads across different habitats
Trends in invasive alien species	B	Numbers and cost of alien invasive species	Yes – some areas	Yes	Various, particularly national data sets	GISP	Direct an indirect damage costs from invasive species Quarantine systems to implement relevant forms of the poluter pays principle	Yield losses in competing species Damage cost data – e.g. soil compaction, clearance costs Data on presence and prevelance of invasive species
		Other measures to be identified and developed	Some	No				
Marine Trophic Index	B		Yes	Yes	Available (UBC)	UBC	Value of marine species and associated ecosystem goods and services	Considerable data on marine species - url to Defra report to be supplied
Water quality of freshwater ecosystems	B	Indicator of biological oxygen demand (BOD), nitrates and sediments/ turbidity	Yes	Yes	UNEP-GEMS/Water Programme	UNEP-GEMS/Water Programme	Value of different water quality classes Water prcing; abstraction and discharge licencing	Data on water quality classes Data on current and historical water abstraction

								and uses
Trophic integrity of other ecosystems	C		No	No		SCBD to assemble available information		
Connectivity / fragmentation of ecosystems	B	Patch size distribution of terrestrial habitats (forests and possibly other habitat types)	Yes	Yes	NASA Consortium; CI; WWF-US based on remote sensing data	UNEP-WCMC (with FAO, CI, NASA-NGO Conservation Working Group and USDA-FS)	Value of area connectivity and resilience Community compensation for foregone production (opportunity cost)	Public willingness to pay data Data on displaced land uses – e.g. farming activities and returns
		Fragmentation of river systems	Yes	Yes	WRI			
Incidence of human-induced ecosystem failure	C	(see notes)	Some	No	SCBD to assemble available information for later consideration	SCBD/UNEP-WCMC		
Health and well-being of communities who depend directly on local ecosystem goods and services	C		No	No	To be identified	SCBD	Biodiversity related health impacts	Patterns of plant animal species use that can be linked to health and well being outcomes
Biodiversity for food and medicine	C		Some	No	FAO, IPGRI, WHO and others	SCBD	Market values of derivative food and pharmaceutical products Property rights Harvesting rights Access and benefit sharing deals.	Patterns of plant animal species use that can be linked to health and well being outcomes Date on stakeholder communities (e.g. numbers of households) Data on traditional uses.
Status and trends of linguistic diversity and numbers of speakers of indigenous languages	B		Yes	Under review	UNESCO World Atlas of Endangered Languages; Ethnologue: Languages of the World - Fifteenth Edition	UNESCO with UNEP-WCMC (Smithsonian Institution requested to explore possible application of Red List methodology)	N/A	
Other indicator of the status of indigenous and traditional knowledge	C		No	No	To be considered by the Working Group on Article 8(j) (possibly including land-tenure of indigenous and local communities)		N/A	
Indicator of access and benefit-sharing	C		No	No	To be considered by the Working Group on Access and Benefit-	SCBD		

					sharing			
Official development assistance provided in support of the Convention	B	Official development assistance as marked	Some	Yes	Donor countries encouraged to mark data	OECD (OECD is working on this for a trial period)	N/A	
Indicator of technology transfer	C		No	No	Countries invited to submit information. The Expert Group on Technology Transfer may wish to consider this matter.	SCBD	N/A	

1/ The numbering of the goals and targets incorporated into the programme of work on island biodiversity has been aligned with that used in the provisional framework for evaluating progress towards the 2010 framework.

2/ **Bold = Indicator considered ready for immediate testing and use (column B in decision VII/30)**; ***Bold italic = Indicator considered ready for immediate testing and use and therefore recommended for upgrading from column C to column B;*** Regular = Indicator confirmed as requiring more work (to remain in column C)

3/ B = Indicator is considered ready for immediate testing and use; C = Indicator requires further work

4/ Based on current and short-term future availability of trend information, the following major ecosystem types are recommended for immediate indicator implementation: (i) forests (including different forest types, notably mangroves), (ii) peatlands (probably for certain geographic areas only by 2010), (iii) coral reefs, (iv) croplands, (v) grasslands/savannahs, (vi) polar/ice. Efforts should also be made to apply the indicator to the following ecosystem types, for which suitable global datasets need to be gathered, to ensure coverage of all thematic areas recognized by the Convention: (i) inland wetlands, (ii) tidal flats/estuaries, (iii) seagrass beds, (iv) dry and sub-humid lands, and (v) urban.

5/ UNEP/CBD/SBSTTA/10/INF/7.

6/ Universal Soil Loss Equation (USLE) A =R x K x LS x C x P A represents the potential long term average annual soil loss in tons per acre per year. This is the amount, which is compared to the "tolerable soil loss" limits.
R is the rainfall and runoff factor by geographic location
K is the soil erodibility factor.
(i) LS is the slope length-gradient factor. C is the crop/vegetation and management factor.
(ii) P is the support practice factor. It reflects the effects of practices that will reduce the amount and rate of the water runoff and thus reduce the amount of erosion.
http://www.omafra.gov.on.ca/english/engineer/facts/00-001.htm

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