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**Third ad hoc intergovernmental and multi-stakeholder
meeting on an intergovernmental science-policy platform
on biodiversity and ecosystem services**
Busan, Republic of Korea, 7–11 June 2010

**Analysis of the assessment landscape for biodiversity and ecosystem
services¹**

Note by the secretariat

Summary

The present information document is intended to facilitate further discussions on the proposed intergovernmental science-policy platform on biodiversity and ecosystem services and its potential role in producing or contributing to assessments for biodiversity and ecosystem services. It reviews a selection of assessments with the potential to provide lessons that may be relevant in the design and implementation of future assessments, which are taken here to include the entire social process by which relevant knowledge is presented in a way that helps to inform decision-making.

¹ The present note was prepared with the assistance of a consultant who undertook an independent review of the relevant information. The comments provided by relevant organizations have been incorporated as appropriate.

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I. Context

1. The United Nations Environment Programme (UNEP) has been facilitating intergovernmental and multi-stakeholder discussions over the past several years on the feasibility of an intergovernmental science-policy platform on biodiversity and ecosystem services. Such a platform would seek to strengthen the contribution of scientific and technical advice to policymaking. At the first ad hoc intergovernmental and multi-stakeholder meeting on an intergovernmental science-policy platform on biodiversity and ecosystem services, held in Putrajaya, Malaysia, 10–12 November 2008, participants generally agreed on the need to strengthen the science-policy interface as it related to biodiversity and ecosystem services. They also requested UNEP to prepare a gap analysis to guide further discussion. The requested gap analysis was presented at the second meeting on the subject, held in Nairobi, 5-9 October 2009, as document UNEP/IPBES/2/INF/1. A majority of the participants at that meeting supported the need for a new intergovernmental mechanism to strengthen the science-policy interface on biodiversity and ecosystem services, and requested UNEP to prepare for a third meeting to agree on a way forward.

2. Participants also requested the preparation of documents on several key issues to facilitate further discussion and help to reach a decision on the most appropriate contributions that could be made by a potential platform. The purpose of the present document is to build on the gap analysis by expanding its section Q, on review of assessments and their role in the conservation and sustainable use of biodiversity and ecosystem services. This review can help to inform discussions on the appropriate structure and scope of assessment processes; the nomination and selection of authors and review editors; the peer review, approval, and outreach and communication processes; and the human resource needs for such assessments. A separate document will cover the current and future status of biodiversity and ecosystem service indicators, which should be integrated into future assessments.

II. Assessment landscape

3. By its resolution 64/204 of 21 December 2009, the General Assembly reiterated the need to build on the experiences gained from the preparation of global environmental assessments. Assessments are critical evaluations of information designed to guide decisions on complex issues. They are fundamentally communication processes and all share many important features irrespective of topic or discipline, making generalizations possible and helpful. Document UNEP/IPBES/2/INF/1 briefly reviewed assessments and their role in the conservation and sustainable use of biodiversity and ecosystem services, listing 13 global assessment initiatives relating to biodiversity and ecosystem services and summarizing some of their key characteristics, strengths and shortcomings. Many more assessments are available through the Prototype Environmental Assessment and Reporting Landscape system of UNEP.² This tool provides additional information on the assessments reviewed herein, in addition to the many regional and national assessment initiatives that have not been covered due to lack of time and space.

4. Effective assessments are conducted by credible groups of experts who bring a wide range of relevant experience to bear on the issues being assessed, synthesizing a broad diversity of information into useful summaries that indicate areas of general agreement (often specifying degrees of certainty) and areas in which further investigation is required. In today's complex world, assessments provide an important step in decision-making, especially for complex topics that affect much of the globe, such as climate change, oceans, forests, water resources and biodiversity. The present document builds on the UNEP gap analysis paper to present a more detailed review of several of the most significant biodiversity-relevant assessments conducted in recent years, at the global, regional and national levels. It will review the entire social process that organizes, evaluates, integrates and presents expert knowledge relevant to biodiversity and ecosystem services, in ways that inform decision-making, policies and actions. It builds on several papers discussed at the eleventh special session of the Governing Council of UNEP, Bali, Indonesia, 24–26 February 2010.³ Two papers of the Subsidiary

2 <http://www.unep.org/pearl>.

3 Documents UNEP/GC.24/4/Add.1 (Overview of the international environmental assessment landscape and options for a future global assessment on environmental change); UNEP/GC.25/INF/12 (Overview of the environmental assessment landscape at the global and regional levels); and UNEP/GC.25/INF/12/Add.1 (State of the environment reporting).

Body on Scientific, Technical and Technological Advice of the Convention on Biological Diversity are also relevant.⁴

5. It may also be useful to consider the International Panel for Sustainable Resource Management, hosted by UNEP, and how it might relate to the proposed platform. It was launched in November 2007 with the specific task of identifying the links between the many aspects of global resource management issues, and possible gaps that may remain. Comprising experts from various fields, serving voluntarily in their personal capacity, the Panel seeks to provide the scientific impetus for decoupling economic growth and resource use from environmental degradation. Its overall objective is to provide independent scientific assessment of the environmental impacts resulting from the use of resources, from biomass to minerals, over the full life cycle, and advise Governments and organizations on ways to reduce these impacts. With a steering committee comprising Governments and relevant organizations, the Panel will contribute to the Global Environment Outlook and the development of the 10-Year Framework of Programmes on Sustainable Consumption and Production (the Marrakech Process). It therefore has a more specific mandate than is envisioned for the proposed intergovernmental science-policy platform on biodiversity and ecosystem services, and will consider only some aspects of biodiversity and ecosystem services. Some of its products may be of use to the proposed platform, but to date its only publication has been on biofuels. Other products on metals and the principles of decoupling are expected in the fairly near future, but these may not be directly relevant to the proposed platform.

III. Review of some relevant assessments at the global, regional and national levels

6. Most assessments analysed herein have been designed to support international decision-making by providing a balanced perspective from the peer-reviewed literature as assessed by scientists from various disciplines and parts of the world. Several have incorporated other sources of knowledge, such as results from questionnaires, contributions from internet discussions, workshops and traditional knowledge. The global and regional assessments have covered broad and complex topics by drawing on expertise from many countries. The information provided is designed to be policy-relevant but not policy-prescriptive, and supported by quantified data wherever possible.

7. Many assessments have been prepared in recent years, with each process having lessons to teach (though these lessons are not always well communicated). The 16 assessments reviewed herein were selected from among hundreds of possibilities, to provide a wide range of topics, cover a range of timescales, be relatively recent (2002 onwards), come from a variety of sources and contain useful lessons for future assessments. Where assessments are periodic and repeated, such as those of the Intergovernmental Panel on Climate Change (IPCC) and the Food and Agriculture Organization of the United Nations (FAO),⁵ only the latest version was reviewed, because a detailed review of the entire series was beyond the scope of this study (although it would be useful to examine these in detail to assess how they have evolved and seek information on how they might develop in the future). Based on these reviews, lessons will be drawn that could be applied to a possible intergovernmental science-policy platform on biodiversity and ecosystem services.

8. For ease of comparison, each of the following reviews of assessments, and the lessons learned, will follow the same structure:

- (a) *Scales*: What variables are affected by scale, from subnational to global?
- (b) *Themes and focus*: How do the main themes and focus affect the way in which biodiversity and ecosystem services are treated in the assessment?
- (c) *Ecosystem services and biodiversity*: How were these parameters treated, especially in those assessments where they were not the main focus?

4 Documents UNEP/CBD/SBSTTA/6/9 (Scientific assessments: Development of methodologies and identification of pilot studies); and UNEP/CBD/SBSTTA/10/7 (Scientific assessments: Review of methods and modalities for assessments, and pilot assessments initiated by the Subsidiary Body on Scientific, Technical and Technological Advice).

5 FAO assessments currently under preparation include reports on the state of the world's forest genetic resources and aquatic genetic resources for food and agriculture; together with those requested by the FAO Commission on Genetic Resources for Food and Agriculture. Those include updates of existing reports and on the state of the world's biodiversity for food and agriculture.

- (d) *Periodicity and time frame*: How do assessments vary by timescale, including one-off, annual and multiannual?
- (e) *Authorizing environment and legitimacy of assessments*: How does the source of their mandate affect assessments' impact on policy?
- (f) *Scientific credibility*: How can the information, methods and procedures maintain high scientific quality in a balanced and transparent way?
- (g) *Policy impact and relevance*. What key factors enable an assessment to have a positive impact on policy and make it relevant to the key target audiences?
- (h) *Stakeholder involvement*. Who are the key stakeholders and how does their involvement affect the assessment's impact?
- (i) *Conceptual framework*. How do methodologies and indicators, transferability of data and methodologies vary across assessments, and what are the implications of this variability?
- (j) *Data used*. What are the sources of data and knowledge, and how do these affect the assessment's impact?

9. It should be noted that the above are parameters for the structure of the reviews. Answering the questions posed may require the assessments to be treated in different ways in the various reviews. The annex to the present document provides a brief comparison of the assessments reviewed, demonstrating their diversities and similarities.

A. Millennium Ecosystem Assessment

10. The Millennium Ecosystem Assessment was launched in 2001 to provide scientific information concerning the consequences of ecosystem change for human well-being and options for responding to those changes. Over the subsequent four years, the assessment team, with secretariat support from UNEP and other organizations, prepared volumes on current state and trends, scenarios, policy responses and multiscale assessments.

11. Synthesis reports were also prepared for specific audiences under the general title of *Ecosystems and Human Well-being*, including a general synthesis report and other reports on biodiversity, desertification, opportunities and challenges for business and industry, wetlands and water, and health. A separate statement of the Millennium Ecosystem Assessment Board was also prepared, entitled *Living beyond Our Means: Natural Assets and Human Well-being*.⁶

12. The *scale* of the assessment was global, but numerous subglobal assessments were also undertaken, some of which are continuing. These include 18 Board-approved assessments and 18 independent assessments. Assessments were undertaken at the regional level (for example, Altai-Sayan, Arafura and Timor seas, Caribbean Sea, Central Asia mountain ecosystems and Southern Africa), at the national level (for example, Fiji, Papua New Guinea and Portugal) and at the subnational level (for example, northern Australian floodplains, coastal British Columbia, Chile's Atacama Desert, western China, the Sinai of Egypt, local villages of India, the Glomma River basin of Norway, and Alaska and Wisconsin in the United States of America), in addition to two topical assessments (alternatives to slash-and-burn; and trade, poverty and environment). Section N below considers the Southern African assessment. The Millennium Ecosystem Assessment might have been stronger if the subglobal assessments had been completed before the global assessment, enabling the latter to build on the former.

13. The assessment's *focus* was on ecosystem services, of which 24 were assessed. Its major *themes* were the dependence of human well-being on healthy ecosystems, the consequences of ecosystem change for human well-being and the scientific basis for action needed to enhance the conservation and sustainable use of ecosystems.

14. The 24 *ecosystem services* were presented in four categories: provisioning services, such as food, water and genetic resources; regulating services, such as flood control, pollination and air quality; cultural services, such as tourism, recreation and cultural identity; and supporting services, such as nutrient cycling. The full list of the 24 ecosystem services is available on the assessment website. *Biodiversity* was not considered an ecosystem service in the assessment, as it was seen as an essential part of all the other services. Biodiversity did, however, have its own chapters in the volumes on state and trends and on policy responses and multiscale assessments, and a biodiversity synthesis volume was

6 Available from <http://www.millenniumassessment.org>.

published separately. The chapters and synthesis document contained relatively little quantification about biodiversity per se, concentrating rather on the impacts of biodiversity loss and options for reducing the rate of ecosystem degradation.

15. With regard to *periodicity and time frame*, as mentioned above, the assessment was carried out over a period of four years, with some continuing activities to promote its findings, provide training and capacity-building on the integrated ecosystem approach that it adopted, and give continued support to the outputs and reports from the subglobal assessments and to their coordination. It appears unlikely that the assessment will be repeated in the same way as some other assessments, but it has features that may help to inform future assessments on biodiversity and ecosystem services. The proposed intergovernmental science-policy platform on biodiversity and ecosystem services may be a specific result of the assessment follow-up process, although its possible future continues to be negotiated.

16. The *authorizing environment* (or legitimacy) of the assessment was based on a request by the United Nations Secretary-General in 2000. An extensive survey was undertaken as part of the assessment process to identify the needs of the relevant multilateral environmental agreements, which formed the basis for the design and scope of the working group assessments and reports. While the assessment was not specifically requested by any multilateral environmental agreement, its Board included representatives of the Convention on Biological Diversity, the United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa (Convention to Combat Desertification), the Convention on Wetlands of International Importance, Especially as Waterfowl Habitat (Ramsar Convention) and the Convention on the Conservation of Migratory Species of Wild Animals (Convention on Migratory Species), in addition to national Governments, United Nations agencies, civil society (including indigenous peoples) and the private sector. Furthermore, by its decision V/2 the Conference of the Parties to the Convention on Biological Diversity invited the assessment to work with its Subsidiary Body on Scientific, Technical and Technological Advice. By its decision VI/7, it welcomed the outline for the assessment, encouraged parties to support the involvement of experts in the assessment's work and encouraged its Subsidiary Body to review the assessment's findings and make recommendations to the Conference of the Parties on the basis of its review. By its decision VI/20, it also welcomed the assessment's further contribution to the Subsidiary Body's work.

17. The assessment's *scientific credibility* was based on the quality of the over 1,300 contributing scientists from 95 countries. These scientists drew on peer-reviewed literature; each chapter had a lead author or editor who worked with a team of co-authors to draft the chapter and conduct internal peer review. The four technical volumes then underwent two rounds of external review by experts and Governments. Some 44 Governments, 9 affiliated scientific organizations and over 600 individual reviewers from all parts of the world provided about 18,000 individual comments, each of which was answered by the respective chapter authors. The review process was overseen by an independent board of review editors, including a review editor for each chapter.

18. The assessment's *policy impact* has not yet been fully assessed, and indeed may not be known for many years. The assessment has, however, been presented at numerous meetings, including those of the conferences of the parties to the Convention on Biological Diversity and the Ramsar Convention. Its conceptual framework and its associated subglobal assessments – often with national or local funding – indicate that the approach has been widely welcomed. The attention paid to ecosystem services by the proposed intergovernmental science-policy platform on biodiversity and ecosystem services is another example of the assessment's influence. In addition, many countries have incorporated the concept of ecosystem services into their national policies, including developing systems of payments for ecosystem services (for example, China, Costa Rica and the United States).

19. *Stakeholder involvement* in the assessment began at the Board level, but the actual preparation of the global assessments included limited stakeholder input, depending instead on the peer-reviewed scientific literature and the perspectives of contributors from many countries. The subglobal assessments, however, were based much more on stakeholder contributions, especially the local-level assessments, for example those of Kristianstad in Sweden, the Glomma River basin in Norway and local villages in India (see also section N below for more details on the effective involvement of local stakeholders).

20. The assessment's *conceptual framework* was prepared in advance to guide the assessment's work. It was published as a stand-alone volume by Island Press in 2003, making the conceptual framework widely available. Its focus on ecosystem services has been widely accepted, leading to numerous publications in the scientific literature. It also has provided part of the framework for the project on the economics of ecosystems and biodiversity (TEEB), as discussed below. That at least 36 subglobal assessments have been carried out, including both Board-approved and associated subregional reviews, is a good indicator of the relevance of the approach taken by the assessment. One weakness was, however, that the data were not presented in a way that made them easily transferable to other assessments. Economic aspects were not fully addressed, leading to calls for a follow-up report, TEEB (mentioned above, with details in section H below).

21. The *data used* by the assessment came primarily from the peer-reviewed literature. Key definitions came from various sources, with the Convention on Biological Diversity providing those for "biodiversity", and "invasive alien species", among others. Biodiversity, as defined by the Convention on Biological Diversity, does not, however, lend itself to quantification, making data collection difficult, except for some components of biodiversity (see sections F and L below). Data at the species level are drawn from the scientific literature, which is fairly complete for vertebrates and some groups of plants and invertebrates; but no comprehensive list of species of plants has yet been agreed, and insects and micro-organisms remain poorly known. Data on responses, such as establishment of protected areas, are much better known and are included in the Global Biodiversity Outlook (see section D below) and other such documents.

B. International Assessment of Agricultural Science and Technology for Development

22. The International Assessment of Agricultural Science and Technology for Development (IAASTD) was initiated in 2002 by the World Bank and FAO. It was designed to assess the role of agricultural knowledge, science and technology in reducing hunger and poverty, improving rural livelihoods and facilitating equitable and environmentally, socially and economically sustainable development. It thus was expected to make a significant contribution to the Millennium Development Goals, but its targets were not clearly defined.

23. IAASTD published numerous reports in 2009, including a global report, a synthesis report, a global summary for decision makers, an executive summary of the synthesis report and summaries for decision makers for each major region of the world.⁷

24. The *scale* of IAASTD was global, but summaries for decision makers focus on major regions (North America and Europe; Central, West and North Africa; East and South Asia and the Pacific; Latin America and the Caribbean; and sub-Saharan Africa). These regional summaries enabled the diversity of agricultural challenges and practices to be made more relevant to each region.

25. Its *focus* was broadly on agriculture, but it recognized the multifunctionality of agricultural systems, going beyond the provision of food and fodder to consider also social security, ecosystem services, landscape values and other benefits to human well-being. It also recognized that the emphasis on increasing yields and productivity has in some cases had negative consequences for environmental sustainability, including for forests and freshwater. It called for broader adoption of agroecological sciences as a means of conserving ecosystem services and biodiversity. It considered wider issues such as food quality, sustainability, water use, land tenure and energy use as crucial elements in improving agriculture. The balance of the assessment was more on social and equity issues than on biodiversity and ecosystem services. It recognized that genetic improvement and sustaining biodiversity were late additions to the multifunctional perspective of agriculture (see figure GSDM-2 in the global summary for decision makers).

26. The *biodiversity* covered by IAASTD was primarily species and varieties of crops, livestock and trees used in agroforestry, with relatively little attention paid to wild relatives of domesticated species, soil micro-organisms and genetic diversity more broadly. *Ecosystem services* were recognized implicitly, especially the provisioning services, pollination and nutrient cycling. These were not presented within a framework of ecosystem services, but rather as part of the multifunctionality of agriculture and agroecosystems. That said, the three examples of policy approaches to advance development and sustainability goals in agriculture presented in the global summary for decision makers all related to ecosystem services: payment for ecosystem services, germplasm management and water management (see table GSDM-1 in the global summary for decision makers).

7 Full copies of all reports are available online at <http://www.agassessment.org>.

27. As regards *periodicity and time frame*, IAASTD was carried out over three years (2005–2007), with no apparent plans for it to be repeated. It recognized that many other similar assessments had been carried out in recent years, including the InterAcademy Council report, *Realizing the Promise and Potential of African Agriculture* (2004); the United Nations Millennium Project Task Force on Hunger (2005); *Comprehensive Assessment of Water Management in Agriculture: Guiding Policy Investments in Water, Food, Livelihoods and Environment* (2007); *World Development Report: Agriculture for Development* (2008); and the annual State of Food Insecurity in the World of FAO and Global Hunger Index of the International Food Policy Research Institute.
28. The *authorizing environment* (or legitimacy) of IAASTD began in 2002 at the World Summit on Sustainable Development, where the World Bank and FAO proposed such an assessment. In November 2002, relevant stakeholders met in Dublin and endorsed the guiding principles of transparency and inclusiveness in carrying out the assessment. Ten regional consultations were subsequently held in various parts of the world to discuss further the key elements of such an assessment. A steering committee with 55 members met in Cork, Ireland, and Budapest in 2003 to prepare recommendations to the President of the World Bank and the heads of FAO, the International Fund for Agricultural Development, the United Nations Development Programme (UNDP), UNEP, the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the World Health Organization. At the end of 2003, the Secretary-General of the United Nations wrote to the President of the World Bank expressing support for the initiative. Participating Governments and other stakeholders then met in Nairobi in September 2004 to agree on the objectives, goals, scope, key questions, design, outputs, timetable, budget and governance structure for IAASTD.
29. The *scientific credibility* of IAASTD, like many other assessments, was based on the quality of the 400 or so scientists selected by the Bureau (itself comprising 61 representatives of consumer groups, international organizations, non-governmental organizations, the private sector, producer groups and Governments, of which there were 28 representatives). The Consultative Group on International Agricultural Research (CGIAR) did not, however, put its full resources behind the effort and FAO was not a member of the Secretariat; this may have weakened the assessment's scientific credibility. An editorial in *Nature* (451: 223–224) considered the report “undoubtedly over-cautious and unbalanced” and an article in *Science* (319: 1474–1476) considered the report “biased”. The authors did, however, draw on a significant amount of peer-reviewed literature and on traditional forms of knowledge, thereby giving the reports a perspective that perhaps is unique among the global assessments being reviewed herein.
30. Its *policy impact* is difficult to assess, because the reports were issued only in 2009. The IAASTD Secretariat expects that all stakeholders will use the documents produced in ways that they find useful. That the Governments of three leading agricultural producers (Australia, Canada and the United States) did not fully approve the global summary for decision makers, and other Governments entered reservations on individual passages in the executive summary of the synthesis report and in some regional summaries for decision makers, may weaken the policy impact of IAASTD.
31. *Stakeholder involvement* in IAASTD was probably the broadest of any assessment reviewed herein, ranging from Greenpeace to Syngenta. This breadth of stakeholders led to active discussions and even fundamental disagreements. The global summary for decision makers concluded that “there are diverse and conflicting interpretations of past and current events, which need to be acknowledged and respected”. One member from the private sector (Syngenta) withdrew from the Bureau, contending that the debates had been taken over by extreme views from civil society. Governments also were far from unanimous in their support, underlining the difficulty in reaching consensus as the diversity of stakeholders increases. Civil society members from Greenpeace, Friends of the Earth and the Pesticide Action Network, on the other hand, may consider the report to be a much better reflection of the views of the small farmers whose interests they seek to represent.
32. The *conceptual framework* of IAASTD was specified in section 1.2 of the global report. It recognized the great diversity in agricultural systems, which vary with climate, topography, soils, political factors, and social and cultural contexts. It put agricultural knowledge, science and technology at the centre, surrounded by actors, rules and norms, processes, and networks, all influenced by direct drivers (such as food demand and consumption, land use and climate change); indirect drivers (such as the biophysical environment and demographics); food systems and agricultural products and services; and development and sustainability goals (including environmental sustainability). This conceptual framework led to more attention being paid to the interests of small farmers, food security and the rural poor. The conceptual framework includes the importance of capacity development, generation of knowledge and technology, exchange of information and technology, further development of science

and technology planning, and broad participation of all relevant parties in the development of science and technology policy.

33. The *data used* by IAASTD came from FAO, CGIAR, Governments and scientific literature, with additional information from traditional knowledge. Governments and university researchers will probably continue to be the main suppliers of data on most aspects of agriculture, though the private sector is also a major investor; one example provided by the assessment was that Monsanto and Syngenta each spend some \$800 million per year on agricultural research, compared to less than \$500 million for the 15 CGIAR centres (see figure GSDM-5 in the global summary for decision makers); expenditures by Governments are not provided, but are likely to be substantially larger.

C. Global Environment Outlook

34. Assessing and reporting on the state of the world's environment is a fundamental mandate of UNEP, and the Global Environment Outlook (GEO) is the main tool that it uses in doing so. The need to strengthen the links between science and policy has been repeatedly stressed since the United Nations Conference on the Human Environment (Stockholm, 1972), which saw the establishment of UNEP. Subsequent international conferences, such as the United Nations Conference on Environment and Development (the "Earth Summit", Rio de Janeiro, Brazil, 1992) and the World Summit on Sustainable Development (Johannesburg, South Africa, 2002), in addition to the 2004 consultative process on strengthening the scientific base of UNEP, have also highlighted the importance of environmental assessment and reporting to policymaking processes. Keeping the environment under review is based on a close relationship between science and policy.

35. The *scale* for the fourth Global Environment Outlook (GEO-4) report was both global and regional, with several national-level examples used to emphasize some challenges and opportunities. At the subglobal level, the GEO process has been replicated to undertake many regional, subregional, national and subnational assessments (see section M below for a regional example). South-South and North-South cooperation has been strengthened, with individual experts and institutions supporting processes in other regions.

36. The *focus* of GEO-4 was on two main questions: the current state of knowledge regarding the environmental challenges and emerging issues relating to biodiversity, freshwater, coastal and marine areas, forests, land, desertification, mountain areas, urban areas, polar areas, the atmosphere, disturbed biogeochemical cycles, chemicals, waste, and natural and human-induced hazards and conflicts, including issues of peace and security; and the drivers of environmental change and alterations in environmental services, how they affect human well-being and prosperity, and the groups, ecosystems and geographical areas that are vulnerable to change.

37. *Biodiversity and ecosystem services* were analysed in several sections, including a chapter on biodiversity and other chapters on water, land, regional dimensions, scenarios and policy options.

38. With regard to *periodicity and time frame*, four GEO reports were produced between 1997 and 2007. Each highlighted issues related to biodiversity and ecosystem services at both the global and regional levels. GEO-4 is the most recent in the series, having been published in October 2007, some 20 years after the report of the World Commission on Environment and Development. GEO has evolved in the decade that UNEP has been coordinating the assessment, from the initial period of about three years for the first three reports to five years for GEO-4 and subsequent reports. Work on the fifth report (GEO-5) is under way, with a target release year of 2012.

39. Considering the *authorizing environment*, the first GEO assessment report was initiated by the Governing Council of UNEP in its decision 18/27 of 26 May 1995, which called for a new comprehensive report to highlight the state and trends of the world environment, and potential future scenarios, including possible response measures to address the challenges identified. The GEO assessment is a practical tool to implement the mandate of UNEP to keep the global environment under review (General Assembly resolution 2997 (XXVII) of 15 December 1972). It responds to many subsequent General Assembly resolutions, and seven UNEP Governing Council decisions on GEO have been adopted since 1995. These successive decisions and resolutions have established GEO as the United Nations flagship report on the environment, providing for the analysis of diverse interlinked issues, including biodiversity and ecosystem services. In addition to the General Assembly and Governing Council processes, other governing bodies, such as conferences of the parties, have recognized the contribution of GEO-4 to enhancing knowledge on biodiversity and ecosystem services. For example, the Conference of the Parties to the Convention on Migratory Species at its eighth meeting requested parties to strengthen linkages with GEO, to explore opportunities to support the review process of the GEO-4 assessment and to explore synergies between the global register of migratory

species and the UNEP GEO data portal to enhance the mutual use of reliable data sets and information. The outcomes of GEO were acknowledged by the Conference of the Parties to the Convention on Biological Diversity at its eighth meeting (Curitiba, Brazil, March 2006).

40. *Scientific credibility* is central to the GEO assessment process, involving thousands of stakeholders within and outside government structures. Activities have included formal regional and global review consultation meetings, collaborating centre network meetings, and targeted expert review and input. The draft material is also reviewed during regional and global consultations to ensure high quality and accuracy. During the GEO-4 review process, six regional consultations were held and some 200 experts and organizations provided a total of about 2,000 review comments. The GEO-4 process also included a high-level consultative group, comprising 15 individuals from policy, science, business and civil society backgrounds, to provide guidance on the intergovernmental components of the GEO process and ensure high-level involvement and outreach, including for the launch of the report in 2007. The summary for decision makers was prepared by UNEP with technical inputs from the coordinating lead authors and inputs from the members of the high-level consultative group. It underwent two rounds of expert and government peer review before being subjected to in-depth consideration during the second global intergovernmental and multi-stakeholder consultation, in September 2007. The consultation, attended by representatives of some 70 Governments, lead authors of the main report, scientists and other stakeholders, endorsed the summary for decision makers. This was both an innovation for the GEO assessment and strengthened science-policy synergies.

41. The *policy impact* of GEO-4 has been significant, with both the General Assembly and the UNEP Governing Council taking decisions on the basis of its findings. The findings informed the development and subsequent adoption by the General Assembly and the Governing Council of the UNEP medium-term strategy 2010–2013. The report was also used extensively in the preparation of the official reports of the United Nations Secretary-General to the Commission on Sustainable Development at its sixteenth and seventeenth sessions. In addition, the GEO-4 summary for decision makers has been translated into at least 10 languages, including Czech, Japanese and Korean. In terms of public impact, GEO-4 recorded more than 1 million internet downloads in the first six months following its release in October 2007. It also spawned thousands of websites and links, including blogs. Some GEO-4 outreach materials, including television documentaries and interviews with prominent personalities, were available on the YouTube website. It has also been published as an e-book. GEO is now one of the most recognized global environmental assessments, establishing UNEP as a leader in integrated environmental assessment and reporting and highlighting both environment and development issues. The GEO process has also produced technical reports, manuals and GEO educational materials, the GEO data portal, meeting reports, capacity-building materials and associated products responding to specific user needs.⁸ Over the past decade, regional ministerial environmental forums and local councils have adopted decisions on environment outlook reports to meet their environmental policy objectives.

42. *Stakeholder involvement* in the GEO assessment process is at many levels, involving Governments, research organizations, academic institutions, civil society, the private sector, young people and individual experts. GEO is a consultative, participatory, capacity-building process for global environmental assessment and reporting on the state of the environment, trends and future outlook. A worldwide network of collaborating centres forms a strong assessment partnership at the core of the process and a focus for building capacity at various levels. More than 40 organizations take part in GEO assessments at the global level, and many more participate at the subglobal level. Advisory groups provide guidance on conceptual approaches and methodology development and capacity-building. At the subglobal level, the GEO process has been replicated to undertake many regional, subregional, national and subnational assessments. South-South and North-South cooperation has been strengthened, with individual experts and institutions supporting processes in other regions. By its resolution 64/204 of 21 December 2009, the General Assembly highlighted the importance of building on the experiences gained from the preparation of global environmental assessments.

43. Regarding *data used*, the development and use of data and information in the GEO assessment process is closely linked to the overall UNEP data and information strategy implementation. It also includes establishing and strengthening cooperation with new and existing data providers, and draws on the various assessments being produced throughout the United Nations system. Promoting the active participation of developing-country experts and expanding GEO data facilities in developing regions is an important component of the activity. This process is underpinned by a dedicated, interactive online data system, the GEO data portal.⁹ This participatory and consultative process gives GEO assessments

8 <http://www.unep.org/geo/>.

9 <http://geodata.grid.unep.ch/>.

scientific credibility, accuracy and authority, targeting a wide audience by providing information to support environmental management and policy development. The GEO data portal is upgraded continuously, and now also includes indicators on human well-being in relation to environmental change. The GEO Data Expert Working Group supports the GEO data component in the production of GEO-4 and other regional reports with the main focus on applicable data tools, strengthening data capacities in developing regions, filling existing and identifying emerging data gaps, and improving data quality assurance and control.

D. Global Biodiversity Outlook

44. The Global Biodiversity Outlook (GBO) was an early product of the Conference of the Parties to the Convention on Biological Diversity. At its second meeting, held in Jakarta in November 1995, the Conference of the Parties called for the preparation of a periodic report that would provide a summary of the status of biological diversity and an analysis of the steps being taken by the global community to ensure that biodiversity is conserved, that biological resources are used sustainably and that the benefits arising from the use of genetic resources are shared equitably (essentially reporting on the three objectives of the Convention). The first edition of GBO was published in November 2001.

45. The *scale* of GBO is global, but draws on at least 110 national reports submitted by parties to the Convention and other documents prepared for meetings of the Conference of the Parties.

46. Its *focus* is specifically on the three objectives of the Convention.

47. The *biodiversity* covered by GBO is comprehensive, including the full scope of the Convention. The genetic dimension is, however, relatively poorly covered, possibly reflecting the sources of information used. Most attention is paid to the ecosystem level and human impacts on ecosystems. Most of chapter 3, on the state of biodiversity, draws heavily on species information, much of it from the published literature. *Ecosystem services* are recognized in various parts of the publication, but are not a major focus as such, though the report does refer to various parts of the Millennium Ecosystem Assessment, for example discussing trade-offs between provisioning and regulating services under different scenarios.

48. Regarding *periodicity and time frame*, the first edition of GBO was published in November 2001. At its sixth meeting, held in The Hague, the Netherlands, in April 2002, the Conference of the Parties welcomed the publication of GBO and by its decision VI/25 decided that the second edition should be prepared for publication in 2004. The third edition (GBO-3) is now in an advanced stage of preparation, having been sent out for wide peer review; it is the version under review here. GBO is now considered the Convention's flagship publication, and GBO-3 will be published in 2010, indicating a periodicity of about four to five years. The regular production of GBO enables trends to be discerned and projected into the future, through the section on scenarios.

49. The *authorizing environment* (or legitimacy) of GBO comes from decisions of the Conference of the Parties, including decisions II/1, V/14, VI/19, VI/21 and VII/30. GBO is thus effectively owned by the Convention.

50. Its *scientific credibility* depends upon the quality of the national reports that it receives from parties, but it also draws heavily on other publications, including many assessments reviewed herein (such as the Millennium Ecosystem Assessment, IAASTD, the Intergovernmental Panel on Climate Change (IPCC) and the Red List of the International Union for Conservation of Nature and Natural Resources (IUCN)), in addition to the peer-reviewed literature. GBO is prepared under the supervision of the Executive Secretary of the Convention Secretariat, with an advisory group to help to guide the process of developing the report and to review drafts. GBO-3 draws on a broader base of expertise, including from the World Conservation Monitoring Centre of UNEP, the 2010 Biodiversity Indicators Partnership and Diversitas. An online survey on the use and effectiveness of the framework of the 2010 biodiversity indicators was conducted jointly by the Convention Secretariat and the World Conservation Monitoring Centre, enabling wide participation. The first draft of GBO-3 was made available electronically in August 2009, allowing broad participation in providing review comments. The scientific review panel met on 4 and 5 November 2009 to prepare a draft for consideration by the Subsidiary Body on Scientific, Technical and Technological Advice and the Bureau of the Conference of the Parties, which subsequently approved a draft synthesis of GBO-3 to be distributed for peer review.

51. The *policy impact* of GBO primarily relates to decisions of the Conference of the Parties to the Convention. Providing a solid background of information, drawn especially from parties' national reports, is designed to facilitate well-informed decisions being reached by the Conference of the Parties,

although the decisions remain subject to other considerations. The wide distribution of GBO, along with its web-based portal, presentations and brochures, are designed to enhance its policy impact.

52. *Stakeholder involvement* in GBO is primarily through the submission to the Secretariat of the Convention of national reports of parties to the Convention (who are the main stakeholders). Reaching out beyond the parties to general stakeholders in biodiversity (which includes the entire world) depends on how parties use GBO (which is expected to be available in numerous languages). The wide consultation during the review phase indicates that the scientific community can be involved.

53. Its *conceptual framework* is agreed by the Conference of the Parties and included in its decisions (especially II/1 and VII/30).

54. The *data used* by GBO come initially from parties' national reports, supplemented by other assessments, relevant peer-reviewed literature and data provided by the UNEP World Conservation Monitoring Centre.

E. Global Forest Resources Assessment

55. FAO has as part of its 1945 founding Constitution a mandate to collect, analyse, interpret and disseminate information relating to nutrition, food and agriculture. The term "agriculture" and its derivatives include fisheries, marine products, forestry and primary forestry products. One FAO flagship publication is the Global Forest Resources Assessment (FRA), which is supplemented by the annual State of the World's Forests report. These assessments guide the policy formation of FAO members and governing bodies. Recent issues of the annual State of Food and Agriculture report have also tackled matters of interest to this process, such as livestock (2010), biofuels (2008), paying farmers for ecosystem services (2006) and agricultural biotechnology (2004).

56. The *scale* of FRA is global, but is based on national reports; this enables the extraction of relevant information at the national level.

57. Its *focus* is on forest resources, their management and uses; it does not cover agroforests. Earlier editions have paid greatest attention to production forests, but the latest edition (2005) – being reviewed here – goes beyond conventional production and environmental dimensions to include parameters important to forest dwellers and rural poor people, such as the value of non-wood forest products and trends in fuelwood removals. By moving to consider these thematic elements of sustainable forest management, FRA has become a more valuable contributor to international negotiations involving forests and clarifies the relationship of forestry to sustainable development.

58. FRA 2005 has an entire chapter devoted to *biodiversity*, providing data on primary forests, forests that are designated for conservation of biodiversity, composition of forests, number of native tree species and threatened forest tree species. It does not discuss *ecosystem services* directly, but its chapters on the productive functions of forest resources, protective functions of forest resources and social and economic functions of forests provide the information necessary to assess at least some ecosystem services provided by forests.

59. FRA has a long *time frame*, reaching back to 1948. It is now produced on a *periodicity* of about five years. Its first production was *Forest Resources of the World* (1948), with world forest inventories following in 1953, 1958 and 1963. No global assessments were carried out in the 1970s, being replaced by a series of regional assessments. The first FRA published information relevant until 1980, drawing on forest inventory work in 76 countries; hence it was not global. After an interim assessment in 1988, the first global FRA was published in 1995, covering data until 1990; it was the first to use a deforestation model applied to the developing-country data for projecting the forest area statistics to a common reference year (1990) and based on an independent pan-tropical remote sensing survey of forest change using high-resolution remote-sensing data. An interim 1995 assessment was published in *State of the World's Forests 1997*. FRA 2000 (published in 2001) was the most comprehensive assessment, drawing on country data verified by remote sensing. FRA 2010 is in the final stages of preparation. The long time series enables trends in forest management, including deforestation, to be assessed.

60. The *authorizing environment* comes from article 1 of the FAO Constitution. The Conference of FAO members in 1951 recommended that FAO should maintain a permanent capability to provide information on the state of forest resources worldwide on a continuing basis. FRA has been regularly approved by the members of the FAO governing body. While discussions regarding a possible forest convention have continued for many years, no such convention has yet been agreed, so FRA is not directly linked to any multilateral environmental agreement. The United Nations Forum on Forests,

however, remains heavily dependent on FRA, and FRA is planning to work more closely with the Convention on Biological Diversity.

61. Its *scientific credibility* is based initially on the contributions of national experts from virtually all countries, with an FRA advisory group comprising 18 senior forest experts. Additional data are provided by FAO staff, consultants and volunteers, and by numerous international organizations and institutions. Over 800 people were directly involved in the process and 17 meetings and workshops were held in various parts of the world from 2002 to 2006 to ensure the quality of the document. Remote-sensing data have been used in previous FRA processes to help to confirm the national data, but a lack of resources prevented this for the 2005 FRA. In any case, all chapters were peer reviewed, although the scientific credibility ultimately depends on the sources of data.

62. Its *policy impact* is felt especially at the national level, enabling each country to see where it stands in relation to other countries. FRA is also used to inform debates at the United Nations Forum on Forests, IPCC, the International Tropical Timber Organization and the World Trade Organization. It also contributes to research on forest-related issues, much of which has policy relevance. FRA remains, however, essentially an assessment of data, with relatively little attention paid to direct policy implications. Other organizations, including multilateral environmental agreements and non-governmental organizations, are able to use FRA data in their own policy development.

63. *Stakeholder involvement* in FRA has tended to focus on professional foresters, though FRA 2005 sought information from countries on social and economic functions that ideally would involve working directly with forest-dwelling peoples as stakeholders in forest management. Only 66 countries and territories, representing a little over half of the world's forest area, reported having forest areas designated for social services, but it is impossible to determine from FRA whether forest-dwelling people were actually involved in data collection.

64. Its *conceptual framework* is fairly simple, focused on sustainable forest management, which in turn has seven thematic elements: extent of forest resources; biological diversity; forest health and vitality; productive functions of forest resources; protective functions of forest resources; social and economic functions for forests; and legal, policy and institutional framework. FRA did not, however, consider the legal, policy and institutional framework elements.

65. The *data used* in FRA 2005 were presented in 20 tables, with the data typically listed by country. These data come from the countries themselves, and are somewhat variable in quality (depending on the national investments made in forest management, monitoring and data collection). For FRA 2005, country reports were submitted for 229 countries and territories and were each issued as an FRA 2005 working paper. The FRA data are therefore highly transparent. Several FAO global databases are also relevant, including the Global Terrestrial Observing System, the Global Land Degradation Assessment and the Terrestrial Ecosystem Monitoring Sites.

F. State of the World's Plant Genetic Resources for Food and Agriculture

66. Biodiversity is commonly considered at the levels of genes, species and ecosystems. Most assessments reviewed herein focus on species and ecosystems, but FAO has been unique in the attention that it has paid to the genetic level of plants and animals relevant for food and agriculture. The first State of the World's Plant Genetic Resources for Food and Agriculture (SoW-Plants) report was presented at the fourth International Technical Conference on Plant Genetic Resources (Leipzig, Germany, 1996). The outcome of that meeting was welcomed by the FAO Conference and the Conference of the Parties to the Convention on Biological Diversity. The full version was published in 1998.

67. The FAO Commission on Genetic Resources for Food and Agriculture reaffirmed that FAO should periodically assess the state of the world's plant genetic resources for food and agriculture. The second report is an update of the first SoW-Plants report. A detailed proposal for its preparation was formulated in 2002, and guidelines for the preparation of country reports were designed in 2004.

68. The *scale* of SoW-Plants is intended to be global, but it depends on submissions from its member Governments. The first report was based on 151 country reports, and the second on 106 country reports and two regional syntheses.

69. With regard to *themes and focus*, in recognizing the essential importance of plant genetic resources for food and agriculture, in particular for the food security of present and future generations, FAO updated SoW-Plants as the basis for further action. It includes national, regional and global

analysis of the current status and trends of plant genetic resources conservation and use, and analysis of gaps and needs as a basis for global action plans. The themes include the state of plant diversity and its use, the state of in situ management and ex situ conservation, the state of national programmes, training needs and legislation, assessment of regional and international collaboration, access to plant genetic resources, and the sharing of benefits derived from their use and their contribution to food security, poverty alleviation and agricultural development within the sustainable management of the natural resource base.

70. The SoW-Plant reports deal with biodiversity at the gene and species levels. They pertain to the conservation and sustainable use of plant genetic resources for food and agriculture in addition to access and benefit-sharing, in line with the three objectives of the Convention on Biological Diversity. The reports also look at the state of in situ conservation, including the conservation and management of plant genetic resources for food and agriculture in wild ecosystems, the farm management of plant genetic resources in agricultural production systems and global challenges to in situ conservation, such as climate and habitat change.

71. Regarding *periodicity and time frame*, the first SoW-Plants report was published in 1998. The second was carried out from 2006 to 2009. Within the multi-year programme of work of the Commission on Genetic Resources for Food and Agriculture of FAO, periodic updates of SoW-Plants are foreseen.

72. The *authorizing environment* dates from 1991, when, at its twenty-sixth session, the FAO Conference agreed that a first report on the state of the world's plant genetic resources should be developed. At its twenty-seventh session, the FAO Conference agreed that this should be done through a country-driven process under the guidance of the Commission on Genetic Resources for Food and Agriculture. The authorizing environment for the second report was based on a request from the Commission's member countries. The report on the state of the world's plant genetic resources and the Global Plan of Action are important supporting components of the FAO International Treaty on Plant Genetic Resources for Food and Agriculture.

73. The assessment's *scientific credibility* is based on its wide consideration of country reports, regional syntheses, thematic studies, published literature and technical publications. During the preparatory process, FAO received inputs from a range of partners, including Bioversity International, the Global Crop Diversity Trust and the Secretariat of the International Treaty on Plant Genetic Resources for Food and Agriculture. The assessment therefore drew on the best available knowledge from the major international organizations involved in plant genetic resources. The country reports were provided by national experts, giving the report credibility from the countries that contributed reports.

74. Concerning *policy impact and relevance*, the identification of the most significant gaps and needs provides a sound basis for updating a rolling global plan of action for the conservation and utilization of plant genetic resources for food and agriculture, containing priority actions for decision makers and policymakers in this field. The preparation of country reports, as a basis for SoW-Plants, is a country-driven process with positive effects on awareness-raising and on capacity-building.

75. During the report's preparation, *stakeholder involvement* was ensured through a participatory, country-driven process under the guidance of the FAO Commission on Genetic Resources for Food and Agriculture. Guidelines for the preparation of country reports were designed and support was provided where required. SoW-Plants involves primarily experts rather than farmers, although the latter are the intended beneficiaries.

76. With regard to the *conceptual framework*, in 2002, the FAO Commission on Genetic Resources for Food and Agriculture considered a detailed proposal for the preparation of the second SoW-Plants report, which contained a proposed outline for the report, focusing as far as possible on changes, including gaps and needs, that had arisen since the first report was produced. An intergovernmental working group on plant genetic resources, established under the Commission, guided the preparation of the second report. The working group met in 2003 and considered a multilevel process for the preparation. Guidelines were established for the preparation of the country reports, which would contain eight chapters with the option for other sections, providing a common framework to enable regional and global synthesis. The eight chapters covered the state of diversity, in situ management, ex situ management, use, national programmes, training and legislation, regional and international collaboration (including access to genetic resources, sharing benefits arising from their use and farmers' rights), and food security and sustainable development.

77. The *data used* were derived principally from country reports (106), which were the main source of information on the status and trends of conservation and use of plant genetic resources for food and agriculture.

G. State of the World's Animal Genetic Resources for Food and Agriculture

78. Domestic animals have long been an important source of food, fertilizer, clothing, labour and other resources for people. FAO has a long history of working with Governments to enhance the management of domestic animals, but the loss of many breeds has become of increasing concern. FAO thus began gathering information on the status of domestic animals, together with wild animals that might have potential for domestication. It now regularly produces a world watch list for domestic animal diversity, with the third edition produced in 2000. This report helped to encourage Governments to take animal genetic diversity more seriously, and in 2001 FAO invited 188 countries to submit country reports assessing the state of animal genetic resources at the national level.

79. The *scale* of the State of the World's Animal Genetic Resources for Food and Agriculture (SoW-Animals) report was intended to be global, prepared through a participatory, country-driven process under the guidance of the FAO Commission on Genetic Resources for Food and Agriculture. By 2005, 169 countries had submitted country reports that, combined with reports from international organizations and input from scientists and experts, provided the basis for an assessment that can be considered global. It also includes regional and national analyses.

80. With regard to *themes and focus*, FAO, recognizing the essential importance of animal genetic resources for food and agriculture, particularly for the food security of present and future generations, updated SoW-Animals as the global assessment and basis for further action. It includes national, regional and global analysis of the current status and trends of animal genetic resources conservation and use, and analysis of gaps and needs as a basis for global action plans. The report assessed, among other things, the state of agricultural biodiversity in the livestock sector, livestock-sector trends, the state of capacities in animal genetic resources management, the state of the art in the management of animal genetic resources, and needs and challenges in animal genetic resources management. It recognized that improved knowledge of breeds and production systems, better planning and greater awareness at the policy level were essential if genetic erosion was to be minimized.

81. Domestic animals and their wild relatives are critical components of the world's *biological diversity*, at both the species and genetic levels. SoW-Animals treats the diversity of the species and breeds that it reviews at both such levels, containing information on 7,616 livestock breeds, of which some 20 per cent are classified as at risk. Of even greater concern, almost one breed becomes extinct per month, underlining the importance of tackling biodiversity problems at the genetic level. The animals assessed in SoW-Animals also contribute to *ecosystem services*, including provisioning services, cultural services and supporting services, contributing to soil management, ecosystem functioning (for example through grazing), pest control (for example through poultry controlling insects) and soil enrichment (for example through providing manure). The assessment paid relatively little attention to these ecosystem services, however, with its major focus on the management of genetic diversity.

82. Regarding *periodicity and time frame*, in 1999 the Commission on Genetic Resources for Food and Agriculture agreed that FAO should coordinate the preparation of the report. In 2007, the final report was presented to the International Technical Conference on Animal Genetic Resources for Food and Agriculture, held in Interlaken, Switzerland. The Commission included in its multi-year programme of work the update of SoW-Animals for 2017.

83. The *authorizing environment* for SoW-Animals was based on a request from the member countries of the FAO Commission on Genetic Resources for Food and Agriculture in 1999.

84. The assessment's *scientific credibility* is based on its consideration of 169 country reports, regional syntheses, several thematic studies and published literature. During the preparatory process, FAO received inputs from a range of partners, including (international) research institutes, universities, international organizations and other specialized agencies, in addition to individual specialists.

85. Concerning *policy impact and relevance*, the identification of the most significant gaps and needs provides a sound basis for updating the Global Plan of Action for Animal Genetic Resources for Food and Agriculture, containing priority actions for decision makers and policymakers in this field. The Global Plan of Action is intended as a rolling plan, with an initial time horizon of 10 years, with provisions for the sustainable use, development and conservation of animal genetic resources at the

national, regional and global levels. This assessment provides FAO members with the information that they require to improve the management of animal genetic resources.

86. *Stakeholder involvement* in the preparation of the report was ensured through a participatory, country-driven process under the guidance of the FAO Commission on Genetic Resources for Food and Agriculture. Guidelines for the preparation of country reports were designed and a wide range of partners was involved in their preparation, including government officials, scientific researchers, local and traditional communities, non-governmental organizations, the private sector, farming communities, international research organizations and others interested in the diversity of domestic animals and their wild relatives.

87. The development of the methodology and *conceptual framework* behind SoW-Animals was explained in guidelines developed for the preparation of country reports, from which SoW-Animals drew its information. Production of SoW-Animals followed a series of steps, including the development and review of country report guidelines at the intergovernmental level with input from stakeholders; the establishment of a domestic animal diversity information system, which provides users with searchable databases of breed-related information and images, management tools, a library of references and links, and contact details of regional and national coordinators for the management of animal genetic resources; training in the use of the domestic animal diversity information system; the preparation of country reports guided by national and regional focal points; the development of a regional synthesis of country reports; and the development of the SoW-Animals report.

88. The *data used* were derived principally from the country reports (169), which were the main source of information on the status and trends of conservation and use of animal genetic resources for food and agriculture. Most detailed data used to prepare country reports have been stored in the domestic animal diversity information system, while the main developments that they show have been recorded in the country reports. The domestic animal diversity information system thus provides a wealth of accessible information that supports further work on the conservation of animal genetic resources.

H. The Economics of Ecosystems and Biodiversity

89. One main shortcoming of the Millennium Ecosystem Assessment was the relatively weak economic basis provided in support of conserving biodiversity and ecosystem services. Governments had agreed early in the twenty-first century to a target to significantly reduce the rate of loss of biodiversity by 2010 (and the Governments of the European Union member States went further, calling for a halt to the loss of biodiversity by that date). It is generally agreed, however, that this target will not be met, at least partly because the economic incentives that would be required to convince Governments to take the necessary steps were lacking. At a meeting in Potsdam, Germany, in May 2007, the environment ministers of the Group of Eight and five major newly industrializing countries decided to launch a joint initiative to draw attention to the global economic benefits of biodiversity, and the costs to human well-being of the continuing loss of biodiversity and ecosystem degradation. This initiative was stimulated in part by the effectiveness of the *Stern Review on the Economics of Climate Change*, which helped to add an important new dimension to the debates on the costs to society of climate change and the costs that would be avoided by reducing the rate of climate change. It also drew on the increasing literature on economic aspects of biodiversity and ecosystem services, but the important innovation was to provide a synthesis of the available information that went beyond the Millennium Ecosystem Assessment.

90. As a result of this initiative, a project on the economics of ecosystems and biodiversity (TEEB) was launched in 2007 and a first interim report presented to the Conference of the Parties to the Convention on Biological Diversity at its ninth meeting, held in Bonn, Germany, in 2008. As work on TEEB continues, this review should also be considered interim, but it nonetheless contains important lessons for biodiversity-related assessments.

91. The *scale* of TEEB is global, although most of its examples are national (such as payments for ecosystems services in Costa Rica) or local (such as the economic benefits of Panama Canal reforestation). The methodologies and data being developed by TEEB are, however, expected to be widely applicable at a variety of scales.

92. Its *focus* is primarily on the value of ecosystems and their services, drawing on the Millennium Ecosystem Assessment. Biodiversity per se has proven to be a more difficult concept to consider in economic terms, as its definition (under the Convention on Biological Diversity) does not lend itself easily to quantification and monetization. Some components and values of biodiversity, especially some

genes and species, are, however, relatively straightforward to measure and are incorporated into the TEEB reports being produced.

93. TEEB looks at *biodiversity* as a broad concept, on the assumption that any loss of biodiversity reduces ecological resilience and options for future use. Economic evidence is, however, generally limited to those components of biodiversity that lend themselves more easily to quantification, often using innovative approaches (such as the value of lions or whales to tourism). Far more attention is paid to *ecosystem services*, which often are easier to quantify. For example, the focus of the *TEEB Climate Issues Update* was on the impacts of climate change on coral reefs (and thus on fisheries and recreation), the importance of forests for carbon sequestration and mitigating climate change, and the positive cost-benefit ratio for public investment in ecological infrastructure as a means of adapting to climate change.

94. Regarding *periodicity and time frame*, TEEB is a continuing project, having presented an interim report to the Conference of the Parties to the Convention on Biological Diversity at its ninth meeting and an update on climate-related issues at the fifteenth session of the Conference of the Parties to the United Nations Framework Convention on Climate Change, in Copenhagen in December 2009. A report for national and international policymakers was released in November 2009. A core science report and additional reports for other stakeholder groups (business, local government and citizens) will be released during 2010. The intention is to deliver a final synthesis report at the tenth meeting of the Conference of the Parties to the Convention on Biological Diversity, in Nagoya, Japan, in October 2010, but much of the data collection has gained significant momentum and may well continue after that meeting. Much will depend on how the TEEB report is received by Governments in Nagoya.

95. Its *authorizing environment* comes from the environment ministers of the Group of Eight and five major newly industrializing countries. TEEB is hosted by UNEP and supported financially by the European Commission, the German Federal Environment Ministry, the British Department for Environment, Food and Rural Affairs and the Governments of the Netherlands, Norway and Sweden. TEEB is, however, an independent study.

96. Its *scientific credibility* hinges on the quality of the economists, ecologists and other experts involved in the preparation of the report. Background studies prepared to date have involved many leading figures in the field, from all parts of the world. TEEB has also used the internet to call for relevant economic evidence on the value of ecosystems and biodiversity, and economic solutions to biodiversity loss. The Advisory Board includes well-respected leaders, including the Executive Director of UNEP, the Director-General of IUCN and the Executive Director of the European Environment Agency. All TEEB reports are widely peer reviewed.

97. Its *policy impact* cannot yet be judged, but the interim report was well received by the Conference of the Parties to the Convention on Biological Diversity at its ninth meeting, and the *TEEB Climate Issues Update* was widely discussed in Copenhagen at the fifteenth session of the Conference of the Parties to the United Nations Framework Convention on Climate Change. Judging from the policy impact of the *Stern Review*, TEEB may have a substantial policy impact as a broader audience begins to understand the economic dimensions of ecosystem services and biodiversity.

98. *Stakeholder involvement* has been relatively modest, with most of the several hundred contributors being primarily part of the scientific and policy community. The case studies being collected, however, typically involve individuals directly benefiting from the economic dimensions of conserving biodiversity and ecosystem services, meaning that much stakeholder involvement is at one remove.

99. Its *conceptual framework* is based on the total economic value framework that is widely used in the economic literature, but also draws on the Millennium Ecosystem Assessment, the Convention on Biological Diversity and work by IPCC. It embraces all components of biodiversity (genes, species and ecosystems) and addresses all three objectives of the Convention on Biological Diversity (conservation, sustainable use and benefit-sharing). The links between biodiversity, ecosystems and poverty are a major focus. The recommendations emerging from TEEB are rooted in an economic diagnosis of the direct and underlying drivers of biodiversity loss, building on the latest knowledge of how to reform perverse incentives and create positive incentives for ecosystem restoration and biodiversity conservation, including economic valuation. It is hoped that TEEB will lead to biodiversity and ecosystem services being recognized for their values and benefits, much as the value of carbon is now recognized in the marketplace.

100. The *data used* by TEEB come from case studies from around the world, mostly from peer-reviewed literature. Additional data come from Convention on Biological Diversity documents and networks of expertise. A database is being compiled from the widely dispersed economic studies of ecosystems and biodiversity, including some from grey literature. These data will be freely available for further research. It is expected that TEEB will also generate new research, particularly as the concept of payment for ecosystem services becomes a broader reality. A key challenge will be to maintain and extend the TEEB database of values and case studies when the current project concludes in 2010.

I. Intergovernmental Panel on Climate Change

101. It is now widely recognized that climate change will have far-reaching effects on biodiversity and ecosystem services. To provide a solid scientific basis for providing advice to Governments on the dimensions of the threat, the World Meteorological Organization and UNEP established IPCC in 1988. Its task was to assess the scientific, technical and social and economic information relevant for the understanding of the risk of human-induced climate change. Its first assessment report, issued in 1990, played an important role in the work of the Intergovernmental Negotiating Committee for the United Nations Framework Convention on Climate Change, which led to the adoption of that instrument in 1992.

102. People will feel the impacts of climate change especially through impacts on ecosystems, including agroecosystems, coastal zones, polar regions, forests and coral reefs. Most negotiations at meetings under the auspices of the Framework Convention on Climate Change have, however, focused on mitigation, and especially on reducing emissions of greenhouse gases. While the Kyoto Protocol to the Convention did include the possibility of tackling some forest-related issues as part of the Clean Development Mechanism, ecosystems and biodiversity have to date been only minor players in IPCC. The present section will focus on the relationship between IPCC and biodiversity and lessons learned that may be relevant to a possible intergovernmental science-policy platform on biodiversity and ecosystem services.

103. The *scale* of IPCC is global, as the climate system is a global phenomenon (although of course with significant local impacts).

104. Its *focus* is primarily on the Framework Convention on Climate Change, although given the importance of the issues that it tackles, its reports have a much broader reach, including politicians, the private sector and the general public.

105. IPCC recognized fairly swiftly that its work was highly relevant to *biodiversity*. Its technical paper V, on climate change and biodiversity, issued in April 2002, came in response to a request from the Subsidiary Body on Scientific, Technical and Technological Advice of the Convention on Biological Diversity. That Convention established its own ad hoc technical expert group on biological diversity and climate change, which included some of the same experts who were involved in the IPCC technical paper; the Convention paper was presented at the ninth meeting of the Subsidiary Body, in November 2003 (UNEP/CBD/SBSTTA/9/INF/12). The IPCC fourth assessment report, issued in 2007, provided detailed information on the expected impacts of climate change on *ecosystems* and water resources. It concluded, with medium confidence, that approximately 20–30 per cent of species assessed to date were likely to be at increased risk of extinction if increases in global average warming exceeded 2.5° C (relative to 1980–1999), and that, as global average temperature increase exceeded about 3.5° C, model projections suggested significant extinctions (40–70 per cent of species assessed). These conclusions were drawn from the peer-reviewed literature, and their inclusion in the IPCC report gives them greater credibility. Subsequently, the Ad Hoc Technical Expert Group on Biological Diversity and Climate Change at its second meeting, convened in 2008–2009, prepared a report that was submitted to the Conference of the Parties to the United Nations Framework Convention on Climate Change at its fifteenth session (Convention on Biological Diversity Technical Series Paper 41).

106. Regarding the *periodicity and time frame*, IPCC produces an assessment report about every six years (1990, 1995, 2001 and 2007), in addition to numerous interim technical papers (the fifth of which pertained to biodiversity). By the time an assessment report is issued, it is already slightly out of date, as it draws on the peer-reviewed literature and data provided by Governments; for example, its 2007 fourth assessment report did not fully consider issues of the potential impacts of accelerated melting of the Greenland and West Antarctic ice sheets and ocean acidification that were in the 2007 scientific literature and have become major issues; they will not be covered until at least the fifth assessment report, due in 2014.

107. The *authorizing environment* (or legitimacy) of IPCC came originally from the United Nations General Assembly, which endorsed the establishment of IPCC by its resolution 43/53 of 6 December 1988. It maintains legitimacy by providing useful guidance to the Government parties to the Framework Convention on Climate Change, though IPCC does not report directly to the Conference of the Parties. Its summary for policymakers is approved by Governments before it is issued.

108. Its *scientific credibility* comes from the very high quality of the several thousand scientists who have contributed to its reports, the strong support that it receives from Governments (and especially their climate research units) and to some extent its secretariat within the World Meteorological Organization and UNEP. All reports go through a rigorous review process that involves experts from around the world and all Framework Convention on Climate Change member Governments. Scientific credibility is crucial, as the issues being considered are highly controversial and have significant economic implications. Controversies that arose in 2009–2010 on conflicts of interest, extreme weather events and the rate of melting of Himalayan glaciers have undermined public confidence in IPCC, leading to calls for significant reform by some IPCC leaders (*Nature* 463: 730–732). An important lesson for a potential intergovernmental science-policy platform on biodiversity and ecosystem services is that scientific credibility can be fragile, even on relatively minor matters, and especially when the assessments have significant economic impacts and powerful interests that may be threatened by their findings.

109. The *policy impact* of IPCC has been extensive, which has led to some of the controversy mentioned above. It provided the basis for the Framework Convention on Climate Change and remains the most respected source of information about the potential impacts of climate change on ecosystems. The decisions made by the Conference of the Parties to the Convention draw heavily on the reports of IPCC, making it arguably the world's most influential assessment process. The parties to the Convention, in turn, inform IPCC about the kinds of information that they require, thereby helping to ensure that the IPCC reports are relevant to them. Many observers continue to feel that the parties to the Convention generally accord relatively low priority to issues of biodiversity and ecosystem services in their deliberations. In Copenhagen, however, the Conference of the Parties paid considerable attention to a new initiative, reducing emissions from deforestation and forest degradation (REDD), which could contribute to issues of biodiversity and ecosystem services, if appropriately implemented.

110. *Stakeholder involvement* in IPCC has been fairly narrow, involving primarily Governments and climate-related scientists (including the full range of interests, from climatology to impacts on ecosystems and species). Like many other assessments, however, scientists are involved largely on a voluntary basis, which may restrict participation to those who can afford to devote their time to the work at hand, or who are assigned by their Governments or organizations to do so. The general public, the ultimate stakeholders in climate change, cannot practically be very involved in IPCC work and a disconcertingly large number of people remain unconvinced even about the reality of climate change. It is difficult to involve such a large stakeholder group in a highly technical assessment, even though experience has indicated that greater involvement can lead to greater understanding. Effective public communication remains a key challenge for IPCC and its champions.

111. Its *conceptual framework* was based originally on determining the rate of climate change and possible anthropogenic causes of any observed changes. The conceptual framework developed further as more sophisticated models of climate change were produced and the Framework Convention on Climate Change sought specific information. The data, theories and models supported one another, giving greater confidence that the major conclusions were valid. At least by implication, this includes paying appropriate attention to biodiversity and ecosystems, though Governments may feel that these issues are more appropriately dealt with by the Convention on Biological Diversity. The work of IPCC is organized around three working groups, on the physical science basis; impacts, adaptation and vulnerability (where biodiversity is considered to a modest extent); and mitigation of climate change. These work relatively independently, but come together in preparing the synthesis, a model that might be relevant to an intergovernmental science-policy platform on biodiversity and ecosystem services.

112. The *data* upon which IPCC bases its reports come from peer-reviewed literature (though some problems may arise, such as the Himalayan glacier issue mentioned above, which came from a secondary informal source and was not included in any of the summary documents) and data provided by the meteorological services of Governments and relevant research agencies (including the use of satellites, which are becoming increasingly sophisticated in assessing climate variables). A global system of weather stations, coordinated by the World Meteorological Organization, also provides solid quantified data. IPCC also works closely with the Global Climate Observing System and the World Climate Research Programme.

J. Global International Waters Assessment

113. Water is essential to all life and plays an important role in many ecosystem services, yet water resources are being widely abused as human demands for water continue to grow. Water is mainly a domestic resource, contained within a single country, and therefore most appropriately addressed by local or national assessments. International waters, shared by two or more countries, are also being abused, however, through dramatic changes in the flow regime of river basins, increasing pollution loads, eutrophication and overexploitation of commercial fisheries. To help direct international support to resolving these problems and to provide guidance to the Global Environment Facility, UNEP worked with numerous Governments and water-related organizations to develop a global international waters assessment.

114. The *scale* of the assessment included 66 subregions and 9 megaregions, giving it an international coverage but without providing global coverage. It is unique among the assessments reviewed here in providing a global perspective to a series of regional assessments.

115. Its *focus* was on waters shared by two or more countries, including both freshwaters (such as the Lake Chad basin, the Mekong River, East African Rift Valley lakes and the Amazon basin) and some oceans and seas (such as the Caribbean Sea, the Caspian Sea, the East China Sea, the Benguela Current and the Humboldt Current). Its intent was to provide relevant information to the Global Environment Facility component on international waters.

116. While the Global Environment Facility has its own *biodiversity* component, any assessment of international waters inevitably will include both biodiversity and *ecosystems*.

117. With regard to *periodicity and time frame*, the assessment was a one-off effort, with its final report issued in 2006 under the title *Challenge to International Waters: Regional Assessments in a Global Perspective*. It is unlikely to be repeated, at least partly because it may be seen to duplicate the periodic United Nations World Water Development Report (not reviewed here).

118. The *authorizing environment* (or legitimacy) of the assessment came from the Global Environment Facility and UNEP, and through the many Governments that supported its research or contributed to it.

119. Its *scientific credibility* came from its hundreds of scientists, its hosting by the University of Kalmar (Sweden) and a steering group that included representatives from UNEP, the Global Environment Facility, the Group of Experts on Scientific Aspects of Marine Environmental Protection, the Global Water Partnership, the Ministry for Foreign Affairs of Finland, the Norwegian Ministry of the Environment, the National Oceanic and Atmospheric Administration, the Scientific Committee on Problems of the Environment, UNDP and the World Bank.

120. Its *policy impact* was primarily through its influence on the international waters projects supported by the Global Environment Facility. The regional reports were expected to be relevant to policymakers in the countries involved, but no assessment was available on the policy impacts of these reports.

121. *Stakeholder involvement* in the assessment was primarily at the subregional level and involved mostly the scientific community.

122. Its *conceptual framework* was prepared in 2002, with a detailed document on methodology for the assessment, including components of the subregional assessments framework (scaling, scoping, detailed assessment, causal chain analysis and policy option analysis). Report sheets were prepared to ensure that information collected from each subregion was comparable. The conceptual model included social and economic impacts, environmental impacts, immediate causes, sector activities and root causes. This was a very systematic approach that provided detailed guidance to those collecting the information in each subregion. This degree of structure may be more than would be required by a potential intergovernmental science-policy platform on biodiversity and ecosystem services, but undoubtedly was helpful to the Global Environment Facility.

123. The *data* upon which the assessment based its reports were collected in the field through interviews and literature. The assessment is perhaps unique among those reviewed here in the amount of original research conducted.

K. Assessment of Assessments (marine)

124. At the 2002 World Summit on Sustainable Development, Governments agreed to address the significant gaps in the understanding and management of the complex processes and trends at work on the high seas by deciding to keep the oceans under permanent review. An important first step was to assess the assessments by building on the work of existing global, regional and national institutions and processes while integrating all available information, including social and economic data, on how the oceans are actually being used. The ensuing Assessment of Assessments has considerable relevance for the contribution that a potential intergovernmental science-policy platform on biodiversity and ecosystem services could make in the future. It is intended to lead to a regular process under the United Nations for global reporting and assessment of the state of the marine environment, much as the intergovernmental science-policy platform on biodiversity and ecosystem services is proposed to do for biodiversity and ecosystem services.

125. Its *scale* is multiple, from the entire 71 per cent of the planet that is covered by oceans to relatively smaller assessments at the regional level.

126. Its *focus* is on all aspects of the state of the marine environment, including economic and social conditions (though it recognizes that few assessments have been undertaken on these parameters). It seeks to adopt an interdisciplinary methodology for integrated assessment, while recognizing that this approach is not yet well developed.

127. It deals with *biodiversity and ecosystem services*, though neither term is included in its list of “use of terms”. Instead it assesses “living marine resources”, especially fishery status and trends, but also seeks to incorporate assessments of species not exploited commercially and assessments of lower trophic levels, including primary productivity; it will thus cover all aspects of biodiversity. It adopts the ecosystem approach elaborated under the Convention on Biological Diversity, but recognizes that assessments have tended to pertain to specialized and high-risk environments such as coral reefs, seagrass beds, mangroves, marshes and estuaries (many of which are also of interest to the Ramsar Convention).

128. Regarding *periodicity and time frame*, the Assessment of Assessments issued its first findings of the Group of Experts in 2009 and is expected to produce a first global integrated ocean assessment by 2014. It is therefore too early to comment on periodicity and time frame, but the summary for decision makers is sufficiently informative to make it worth including in this review.

129. *The authorizing environment* came originally from the Plan of Implementation of the World Summit on Sustainable Development, which agreed to “establish by 2004 a regular process under the United Nations for global reporting and assessment of the state of the marine environment, including socio-economic aspects, both current and foreseeable, building on existing regional assessments”. This was endorsed by the United Nations General Assembly by its resolution 57/141 of 12 December 2002. In its resolution 60/30 of 29 November 2005, the General Assembly called for the establishment of an ad hoc steering group to oversee the execution of the Assessment of Assessments and a group of experts to undertake the actual work. It invited UNEP and the Intergovernmental Oceanographic Commission of UNESCO to serve as lead agencies for the process, provide secretariat services and coordinate the work.

130. Its *scientific credibility* comes from the Ad Hoc Steering Group of 17 experts nominated by States and six nominated by international organizations (FAO, the International Maritime Organization, UNEP, the Intergovernmental Oceanographic Commission, the World Meteorological Organization and the International Seabed Authority) and the Group of Experts (22 experts), who in turn could call upon other scientists to contribute. Its work undergoes stringent peer review, including by 36 experts, representatives of 16 institutions that deal with marine issues and representatives of 30 Governments. It intends to stimulate the further development of the information base, improve knowledge and methods of analysis, facilitate priority-setting at various levels and link potential solutions to identified problems.

131. Its *policy impact* will derive from its scientific credibility and its governing structure, which involves virtually all the relevant marine-oriented organizations in addition to Governments. It has the potential to provide policy advice to the Framework Convention on Climate Change on topics such as ocean acidification and the impact of climate change on ocean currents; to the Convention on Biological Diversity on marine aspects of biodiversity; and to the various fisheries agreements on the status of fisheries.

132. *Stakeholder involvement* is confined primarily to experts on the marine environment, with all the relevant United Nations agencies and most relevant research institutes involved.

133. Its *conceptual framework* comes from General Assembly resolution 61/222 of 20 December 2006, which indicates that ecosystem approaches to ocean management should be focused on managing human activities to maintain and, where needed, restore ecosystem health to sustain goods and environmental services, provide social and economic benefits for food security, sustain livelihoods in support of international development goals and conserve marine biodiversity. The Assessment of Assessments is expected to be a means of structuring existing information from various disciplines to enable new patterns and new understandings to emerge. Its initial report has set out an analytical framework to examine existing assessments and identify best practices for assessment, highlighting the criteria of relevance, legitimacy and credibility. It recognizes that marine monitoring and research are the basic tools for understanding what is happening to the oceans, why it is happening and how effective response measures have been.

134. The *data used* will come from contributing partners, many of whom are collecting primary data. Partners will be significant providers of data, including the FAO worldwide summaries of fishery catch and effort statistics; the International Oceanographic Data and Information Exchange of the Intergovernmental Oceanographic Commission; and the Ocean Biogeographic Information System of the Census of Marine Life.

L. IUCN Red List assessment

135. While species are only one component of biodiversity, they are the best known and recognized by the public. They have long provided multiple benefits to people, including as food, draft animals and cultural symbols. Most Governments have legislation for protecting and managing species, and species are covered by numerous international agreements, ranging from the Convention on International Trade in Endangered Species of Wild Fauna and Flora to various taxon-based agreements (for example, on tuna, polar bears and turtles). Some groups of species, especially vertebrates and some groups of plants, are reasonably well known, but most invertebrates and micro-organisms remain poorly known and new discoveries are reported regularly.

136. Recognizing that many species were being threatened by various kinds of human activities, many conservation organizations have joined government efforts to conserve species. The most comprehensive inventory of the global conservation status of plant and animal species is the IUCN Red List of Threatened Species, which involves the assessment of many known taxa. While only about 48,000 species have been assessed, the taxonomic coverage is growing continually and the Red List is becoming increasingly useful because of the depth of supporting documentation on habitats, threats and uses; many species now also have distribution maps.

137. The *scale* of the Red List is global, though hundreds of national red lists have been compiled. IUCN provides standards that seek to ensure greater compatibility between these national red lists, but this review will focus on the global level. This does pose some problems. For example, a species common in some countries may be extremely rare in countries at the edge of its range, and treated there as highly threatened.

138. Its *focus* was originally on threatened species, but over the past 10 years it has begun to cover the status of all species, at least within certain taxa (such as birds, amphibians, mammals, sharks, cycads and conifers). The Red List process assigns the species that it assesses to one of seven categories, based on a rigorous set of criteria.¹⁰ These categories range from “extinct” (no individuals remaining) to “least concern” (lowest risk, may be widespread and abundant). It also classifies other species as “data deficient” (lacking sufficient data to make an assessment of risk of extinction). The vast majority of species that have not yet been assessed are treated as “not evaluated” (has not yet been evaluated against the established criteria), but these are not included on the Red List.

139. The Red List addresses species and, in some cases, subspecies, varieties and even subpopulations, as part of *biodiversity* as defined by the Convention on Biological Diversity. It does not address *ecosystems* directly, although of course all species are parts of ecosystems and the actions that are indicated by the level of threat identified by the Red List will often lead to action at the ecosystem level.

140. Regarding *periodicity and time frame*, work on the Red List is continuous, with a unit of the Species Programme of IUCN specifically devoted to maintaining up-to-date information to the extent possible. Additional units are increasing the taxonomic coverage of the Red List by assessing freshwater or marine species or by focusing on regional assessments (the Mediterranean, Europe, the Caribbean

¹⁰ See <http://www.iucnredlist.org> for details.

and Oceania). Since 2000, annual updates have been produced, but IUCN is now moving to a system of more frequent updates (for example, two were produced in 2009 and four are expected in 2010). Assessments of major taxa, such as mammals or amphibians, are published in the full Red List of Threatened Species as part of the normal updates, but these are usually accompanied by the publication of an analysis of the results in a peer-reviewed scientific journal. The Red List, because it is now so large and so frequently updated, can no longer be published in hard copy (the last hard copy list appeared in 1998) and hence is only available as an online searchable database.¹¹ In-depth analyses of the data contained in the Red List are published periodically, usually once every four years. The Red List for birds is maintained by BirdLife International, which publishes a variety of assessments at the regional, national and global levels. BirdLife International submits its global assessments to IUCN for inclusion in the Red List. The overall aim is to reassess the major taxonomic groups included on the Red List once every four to five years, and every species must be reassessed at least once every 10 years. In cases in which that does not happen, the listings are given a caveat that they are in need of updating and hence the information should be treated with caution in making conservation decisions.

141. Its *authorizing environment* (or legitimacy) comes from IUCN, which has 80 State members, 116 government agency members, 752 national members of non-governmental organizations and 92 international members of non-governmental organizations. By its decision VI/20, the Conference of the Parties to the Convention on Biological Diversity welcomed the Red List's further contribution to the work of its Subsidiary Body on Scientific, Technical and Technological Advice.

142. The *scientific credibility* of the Red List comes from the 7,000 or so members of the IUCN Species Survival Commission who contribute to it. The massive expansion of the Red List coverage cannot be achieved by the Commission alone, so a Red List partnership has been formed to help to broaden the coverage and further bolster the process' scientific integrity. The current partnership includes IUCN (the Species Programme and Species Survival Commission), BirdLife International, Conservation International (in particular its Centre for Applied Biodiversity Science), NatureServe and the Institute of Zoology at the Zoological Society of London. Negotiations are currently under way to expand the partnership to include other organizations, including some major botanical partners and universities. A Red List committee with various working groups and subcommittees oversees the entire process. This includes regular review of the criteria for assigning species to categories and ensuring that the criteria are applied correctly. The listing of the species assessed goes through a rigorous peer review process, and the list is open to petitions against the recommended category. In addition, contributors to the Red List provide an expert-driven compendium of information on the ecological requirements of species, geographic distribution, threats and advice on conservation action. The Red List has been the subject of numerous scientific articles and the data that it provides are widely cited, giving it greater scientific credibility.

143. Its *policy impact* is reflected by its authority as the most reputable source of data on threatened species, by the hundreds of national red lists that have been prepared by Governments and expert groups, and by the publications that frequently draw on information in the Red List. Many donors determine priorities for project investments at least partly on the basis of the assessments provided by the Red List. The Red List Index has been selected as an official indicator to track progress towards attaining Millennium Development Goal 7. The latest iteration of the Red List reported 37 mammals, two birds and one amphibian whose status has genuinely improved due to conservation action (although far more have deteriorated due to the lack of such action).

144. *Stakeholder involvement* in the Red List's preparation is confined largely to the individuals who are experts in the species being assessed. Most are field scientists, and many work closely with local people who have knowledge of the species being assessed. To tackle the threats assessed by the Red List, however, local stakeholders are essential in the design and implementation of any recommended actions.

145. The *conceptual framework* of the Red List has evolved considerably since it was launched in the 1960s, with the criteria becoming increasingly sophisticated, quantitative and objective. This evolution has been driven by the significant increase in research, improved data management technology, improved approaches to assessing the status of species and greater public support for species conservation. The Red List criteria were designed to be applied at the scale of the entire range of the species being assessed, but they can be applied at the national level if the recommended guidelines are followed. The criteria may not be appropriate at very small scales.

146. The *data* upon which the Red List is based come from its network of contributors, guided by the Red List authorities (the institutions, usually specialist groups of the Species Survival Commission, that are responsible for given species or groups of species). Because some of these data are sensitive (potentially guiding poachers to rare species), the raw data are not always made freely available (at the request of those fieldworkers who provide the data). This has led to some criticisms of a lack of full transparency and legitimacy, but detailed information on threatened or scarce species can sometimes lead to illegal uses.

M. Africa Environment Outlook

147. Numerous regional assessments have been conducted in recent years, including environment outlooks prepared under the auspices of UNEP in Latin America and the Caribbean, Asia and the Pacific, Africa, North America and, most recently, West Asia. At least 10 other major assessment processes have been carried out in Asia and the Pacific, at least as many in Latin America and the Caribbean, a few in West Asia and many in Europe. Some are broad environmental assessments, while others focus on health, chemicals, pollution, water or climate. Earlier sections have also mentioned the regional components of global assessments, such as the fourth Global Environment Outlook report, the Global International Waters Assessment and the Millennium Ecosystem Assessment.

148. Here, the focus will be on regional environment outlooks. Only Latin America and the Caribbean and Africa have carried out a regular process of assessments, both following generally the same pattern. The present section will review the second Africa Environment Outlook report (AEO-2).

149. The *scale* of AEO-2 was the entire African continent, with information included from each individual country. On biodiversity, subregional reviews are provided for Central Africa, Eastern Africa, Northern Africa, Southern Africa, Western Africa and the Western Indian Ocean islands.

150. The *theme* was that economic development in Africa depends on the quality and integrity of its natural resource base. The *focus* was on environment for development, including land, freshwater, coastal and marine environments, forests and woodlands, and agriculture. It also reports on potential threats, such as invasive alien species, chemicals, civil unrest, overharvesting of wild resources and genetically modified organisms.

151. *Biodiversity* has an entire chapter devoted to it (chapter 7), covering genetic variation, species and *ecosystems*. The patterns of diversity, including biodiversity hot spots, are explored and ecosystem change and conservation are assessed in some detail. Ecosystem services are covered by implication, regarded as “environmental goods” and “environmental services”. The economic benefits of these goods and services are covered under nature-based tourism and adding value to genetic resources, although the entire chapter is devoted to linking biodiversity to economic development and the challenges being faced in realizing these opportunities for development.

152. AEO was first published in 2002, with the second volume appearing in 2006, implying a *periodicity* of about four years. The *time frame* seeks to be current, though AEO-1 also reached back over the previous 30 years. Work on the third report) is under way.

153. AEO is given *legitimacy* through its support by the African Ministerial Conference on the Environment, which first called for AEO at its eighth session, in 2000 in Abuja. The Conference considers AEO to be a flagship report that tracks regional environmental status and trends in addition to emerging issues, thereby providing a strong *authorizing environment*.

154. Its *scientific credibility* comes from the several hundred scientists and other experts from virtually all African countries, and some from other countries, who have extensive experience of working in Africa. Each chapter has lead authors and contributing authors, and others who contribute information from the various countries. The biodiversity chapter has contributors with a wide range of expertise, including wildlife, forestry, social issues and protected areas. Each chapter is also supported by up-to-date peer-reviewed literature. As with other assessments, serious peer review is also undertaken for each chapter, and the document as a whole.

155. Its *policy impact* derives from the strong support of the African Ministerial Conference on the Environment, the apex body for the environment in Africa. At least 22 individual countries and five subregions have adopted the AEO assessment framework in preparing their own environment outlook reports. AEO was used in the development of the Environment Initiative of the New Partnership for Africa’s Development, which provides the framework for environmental programmes in the region. AEO-2 is also expected to contribute to implementing the Millennium Development Goals. Collaborating organizations include the Agence internationale pour le développement de l’information environnementale, the Centre for Environment and Development for the Arab Region and Europe, the

Indian Ocean Commission, the Network for Environment and Sustainable Development in Africa and the Southern African Research and Documentation Centre. They also help to enhance the policy impact and relevance of AEO-2.

156. *Stakeholder involvement* was a result of the wide consultations undertaken by the hundreds of contributors to AEO-2. A companion volume, *Human Vulnerability to Environmental Change*, contains a series of case studies that involved stakeholders in their preparation. Governments were fully involved in the preparation of AEO-2, providing data and other information.

157. The *conceptual framework* of AEO-2 was based explicitly on the GEO approach, with UNEP providing technical and other support in its preparation. This enabled the data and indicators to be easily transferred to GEO.

158. The *data used* came from Governments, international agencies, collaborating centres, peer-reviewed literature and consultations with stakeholders.

N. Southern African Millennium Ecosystem Assessment

159. As mentioned in section A above, the Millennium Ecosystem Assessment included subglobal assessments at a variety of scales. Of the several dozen possibilities, the Southern African example was selected because of its many unique features, as discussed below.

160. The assessment's *scale* was regional, covering Southern Africa, but it actually consisted of underlying assessments of the Zambezi basin, the Gorongosa-Marrromeu region of Sofala province, Mozambique, and the Gariiep basin in South Africa, in addition to a Gariiep livelihoods assessment. It therefore assessed three spatial scales simultaneously, an approach unique among the assessments reviewed here. By considering these scales, it was able to demonstrate that scales of management need to be matched to ecosystem processes. It also tackled transboundary issues, a topic that most national-level assessments avoid.

161. The assessment's *focus* was on human well-being and how healthy ecosystems can support sustainable development. It promoted integrated resource management, using South Africa's Working for Water Programme as an example that creates a synergy between social development (through job creation and poverty relief) and ecosystem rehabilitation.

162. Drawing on the Millennium Ecosystem Assessment, the assessment concentrated on *ecosystem services*, laying particular emphasis on water-related services, provisioning services (including food, biofuel and livestock) and cultural services (including a report on the cosmology of the Xhosa people). *Biodiversity* is considered to underpin all ecosystem services, often influenced by land use and the trade-offs among the services. Unlike the Millennium Ecosystem Assessment, however, this assessment considered biodiversity to be an ecosystem service, and explained its economic values for local people. It also expanded upon the relevance of biodiversity at each of its three levels in terms of composition (for example the genes of different crop cultivars), structure (such as the mix of tall and short trees in different types of ecosystems) and function (for example primary productivity). Its use of biodiversity as a concept was therefore more sophisticated than that adopted by most other assessments reviewed here.

163. With regard to *periodicity and time frame*, this was probably a one-off exercise, although the results indicated that repeating the exercise in a decade or so would be worthwhile for assessing the extent to which the concepts promoted through the assessment were effective in improving human well-being.

164. The *authorizing environment* came from the Steering Committee of the Millennium Ecosystem Assessment, although all Governments in the region participated actively in the assessment (which can perhaps be considered an informal authorizing environment).

165. Its *scientific credibility* came from the participation of leading scientists and practitioners from all countries involved, together with scientists from outside the region. This assessment, however, sought broader credibility by paying considerable attention to other kinds of knowledge, such as information gained through the life experience of local residents. It also included a section on responding under uncertainty, recognizing that surprises in complex systems cannot always be foreseen by science.

166. The *policy impact* appears to have been reasonably effective, though no independent assessment was available at the time of writing. Each component study was published separately, along with the integrated report; the component studies were designed to have particular policy relevance to the region

or topic considered. For example, the assessments at the basin level (Gariep and Zambezi) were designed to contribute primarily to the needs of the catchment management authorities in the respective basins, in addition to relevant government bodies dealing with conservation, agriculture and development. At the regional level, the assessment sought to influence the Southern African Development Community, national Governments, non-governmental organizations working in the region, the media and the public.

167. *Stakeholder involvement* was an important element of the assessment, perhaps most dramatically in the Gariep livelihoods assessment, which derived its information directly from the people involved. A user advisory group was established for each component study, thereby giving a wide range of stakeholders a means of participating in the assessment.

168. The *conceptual framework* was derived directly from the Millennium Ecosystem Assessment conceptual framework, but adapted to local needs. The link between ecosystems and human well-being was explained clearly for decision makers.

169. The *data used* by the assessment came directly from the institutions involved and the peer-reviewed literature. In addition, other forms of knowledge were also involved, collected from direct interviews with individuals living in the ecosystems being assessed. Generally speaking, as the scale of assessment moved from regional to local, the balance of information shifted from more scientific sources towards more informal sources, with information often transmitted by oral tradition. This assessment is unique among those reviewed here in paying so much attention to participatory methods of data collection and analysis.

O. Nepalese biodiversity strategy and Kenyan national report to the Convention on Biological Diversity

1. Nepalese biodiversity strategy

170. Article 6 of the Convention on Biological Diversity calls upon parties to prepare national biodiversity strategies and action plans that indicate how the country plans to implement the Convention. Such strategies can also indicate whether external support is required and, if so, the priorities. To date, 170 countries have prepared such biodiversity strategies and action plans. The Convention Secretariat has provided considerable guidance to countries on preparation, although Governments remain free to prepare their document in a form that they find helpful. The following two reviews – Nepal and Kenya – have been selected to illustrate the range of approaches taken, although any other pair might have revealed other approaches. Nevertheless, this appears an adequate sample for the purposes of this review document.

171. The *scale* of the Nepalese biodiversity strategy is national. It does not cover relationships with surrounding countries, except incidentally. The problem of transboundary cooperation remained an issue in the 2009 national report to the Convention on Biological Diversity.

172. The *theme* is that Nepal commits its Government to the protection and management of biological resources and their diversity on a sustainable basis for the benefit of Nepal's present and future generations and for the global community as a whole, in accordance with the principles of the Convention on Biological Diversity.

173. *Biodiversity* is the focus of the entire volume, with sections devoted to ecosystems, species and genes. *Ecosystems* are described in general terms, with lists of species of plants for the various forest types. Species are described briefly, by class, with citations of the latest taxonomic list. Protected areas are listed specifically. Genetic diversity is mentioned only briefly, reflecting the level of information at this level. Ecosystem services are not mentioned specifically, perhaps because the strategy was produced in 2002, well before the Millennium Ecosystem Assessment was published and the Convention on Biological Diversity began paying more attention to the topic.

174. Concerning *periodicity and time frame*, the strategy was published in 2002 and has not been updated since. Nepal has, however, now submitted four national reports to the Convention on Biological Diversity, with the most recent coming in March 2009. The 2002 strategy laid the groundwork, but the quality of the national report shows considerable improvement in quality and sophistication, indicating that participation in the Convention has been helpful in building national capacity.

175. The *legitimacy* of the strategy and the subsequent national reports to the Convention come directly from the Government, which publishes them.

176. The strategy's *scientific credibility* came from the considerable research undertaken in Nepal, much of it by foreign scientists. By the time of the fourth national report, however, the vast majority of the work reported was carried out by Nepalese scientists.

177. The strategy's *policy impact* was on government agencies and donors. By 2006, a national implementation plan had identified 13 priority projects, linked to the Millennium Development Goals and the 2010 biodiversity targets agreed by the Conference of the Parties to the Convention on Biological Diversity. Biodiversity in Nepal has become more cross-sectoral, contributing to the work of the Poverty Alleviation Fund, climate change and the attainment of the Millennium Development Goals. Biodiversity coordination committees are also being formed at the district level (in 10 of the 75 districts to date).

178. *Stakeholder involvement* in the strategy was relatively modest, but the fourth national report involved extensive consultation with relevant stakeholders, including through mass media, publications, visits to relevant institutions, and workshops.

179. The strategy's *conceptual framework* came directly from the Convention on Biological Diversity and the guidance provided by the Convention Secretariat.

180. *Data used* in the strategy and subsequent national reports to the Convention come from the scientific literature on Nepalese biodiversity, which remains weak on genetic diversity. Relatively strong non-governmental organizations are carrying out new fieldwork, thereby enhancing the state of knowledge.

2. Kenyan national report to the Convention on Biological Diversity

181. The assessment's *scale* was national, covering the entire country. It also looked at issues pertaining to Lake Victoria, which are shared with Uganda and the United Republic of Tanzania.

182. Its *focus* was on the current status of the national biodiversity strategy and action plan, published in 2000 and the basis for Kenya's approach to biodiversity.

183. Drawing on the Convention on Biological Diversity, the national biodiversity strategy and action plan covered all aspects of the Convention. It therefore paid considerable attention to *biodiversity*, including ecosystems, but the fourth report did not deal in great detail with *ecosystem services* as such.

184. With regard to *periodicity and time frame*, this was the fourth national report that Kenya had submitted to the Conference of the Parties to the Convention, and was published in 2009. It followed previous national reports (in 1998, 1999 and 2005), all of which were based on the national biodiversity strategy and action plan, published in March 2000.

185. The *authorizing environment* came from the National Environment Management Authority.

186. The *scientific credibility* came from the same authority, but the report was prepared by two consultants from the University of Nairobi and Moi University, who sought information from key institutions involved in biodiversity management in the country. The report lists some 19 national institutions that deal with aspects of Kenya's biodiversity, and cites four international research centres that are based in Kenya and work on biodiversity; however, no indication is given about their contribution to the report. A draft of the report was subjected to peer review, with the comments received subsequently discussed at a stakeholders' workshop. No details of the peer review process are provided, nor are the stakeholders identified.

187. The *policy impact* is perhaps best considered in relation to the national biodiversity strategy and action plan, in that the report highlights progress toward the policies agreed upon in 2000, which sought to maintain a high-quality environment for sustainable livelihoods for all Kenyans; guarantee the intergenerational and intragenerational sustainable use of natural resources and services; maintain ecological and ecosystem processes; and preserve and benefit from genetic resources and biological diversity in the nation's ecosystems and preserve their cultural value. The fourth national report found that the national biodiversity strategy and action plan had not yet been fully endorsed and effectively mainstreamed into national programmes, but almost every sector made reference to it and incorporated appropriate measures into their activities wherever possible.

188. *Stakeholder involvement* was apparently confined to the workshop to review comments on the first draft report.

189. The *conceptual framework* was derived directly from the Convention on Biological Diversity and the guidelines for preparing a national biodiversity strategy and action plan.

190. The *data used* by the fourth national report were scanty, as the report was primarily descriptive. It mentions that the National Environment Secretariat had established a national biodiversity database, but reports that “information is hardly updated and rarely accessed by field biodiversity workers”.

IV. Key messages and conclusions

191. As the present document has indicated, the landscape of assessments is vast, covering a broad range of issues (many of them overlapping). All assessments have in common the need to communicate objectively with a broad range of audiences, especially decision makers; draw a fine line between being policy-prescriptive and policy-relevant; draw information from the most authoritative sources; deal with a variety of geographical scales, while providing advice or policy options that will be relevant to all; tackle issues that include various degrees of uncertainty; include countries or regions with varying degrees of capacity to contribute; ensure that all appropriate stakeholders are involved; and be responsible to sponsors yet maintain scientific independence. This is a daunting task, especially when carried out by contributors working on a largely voluntary basis.

192. Some Governments, and scientists, are beginning to complain of what they have termed “assessment fatigue” and it appears likely that few people actually read the full assessment documents, preferring the relatively brief and well-illustrated synthesis volumes. Nevertheless, these communications tools depend on the solid information contained in the more detailed (albeit perhaps less widely read) assessments.

193. The present review has indicated that assessments often use similar words with rather different definitions, or use different terms to mean approximately the same thing (for example, the second Africa Environment Outlook uses the term “environmental services” when the current term of choice is “ecosystem services”). This inconsistent use of key terms renders it difficult to weave coherent messages from such a multitude of threads. Greater effort in coordinating assessments, while maintaining their independence, could be worthwhile. A proposed intergovernmental science-policy platform on biodiversity and ecosystem services could help to ensure that those assessments that include discussions relevant to biodiversity and ecosystem services are better coordinated, thus helping to ensure that these issues are more effectively communicated to key audiences.

194. Considerable efforts notwithstanding, environmental challenges remain, and many are becoming more serious. While the assessments discussed herein have often been successful in raising awareness of biodiversity and ecosystem services, policy responses remain more often reactive (seeking to solve a problem that has arisen) rather than proactive (taking the steps necessary to prevent a problem from arising). The dynamic nature of environmental problems means that assessments will remain critical to inform policy processes and help to minimize or even pre-empt emerging challenges to healthy ecosystems.

195. The remainder of the present section provides key messages from each parameter reviewed for each assessment. Additional conclusions are added on communications, funding and institutions involved in managing assessments.

196. Biodiversity and ecosystem services are relevant at multiple *scales*, from the very local to the global, arguing against favouring any particular scale, but rather recognizing the advantages of working at multiple scales. No process has, however, yet been universally agreed to be appropriate for linking assessments at various scales, though the Global International Waters Assessment and the Southern African Millennium Ecosystem Assessment have demonstrated its feasibility. The subglobal assessments of the Millennium Ecosystem Assessment were completed too late to feed into its global assessment. This hampered the development of a logical transition from local to global in the Millennium Ecosystem Assessment, rendering it difficult to ensure consistency in results and policy recommendations. It may well be that such consistency is unrealistic, given the wide variability in the issues being tackled at the local level. Even so, the use of coupled global and subglobal assessments needs to be further explored, as illustrated by the Africa Environment Outlook (and the other regional environmental outlooks not reviewed herein), which uses both a continental and a regional approach, and GBO-3 draws heavily from national reports. A potential intergovernmental science-policy platform on biodiversity and ecosystem services will need to be able to work at multiple scales, or at least be relevant to them.

197. Another challenge posed by global assessments is that aggregation masks diversity. The global environmental assessments often mask the significant disparities at the national, regional and global levels. In at least some cases, such aggregation may present a challenge for appropriate policy

interventions, when these need to be tailored to suit subglobal or national needs where intervention is most urgent.

198. In terms of *themes and focus*, each of the seven main biodiversity and ecosystem service-related multilateral environmental agreements (the Convention on Biological Diversity, the Convention Concerning the Protection of the World Cultural and Natural Heritage, the Convention on International Trade in Endangered Species of Wild Fauna and Flora, the Convention on Migratory Species, the Convention to Combat Desertification, the Ramsar Convention and the International Treaty on Plant Genetic Resources for Food and Agriculture) has a legitimate need for its own assessments, considering issues specific to the respective agreement. All these agreements are, however, relevant to biodiversity and ecosystem services, and would benefit from using the same general themes, language and conceptual frameworks. Many assessments may have common objectives, or may be designed to do so; for example, the approach taken by the Framework Convention on Climate Change on REDD could easily incorporate a biodiversity conservation component that draws on the Global Forest Resources Assessment of FAO, and the Convention on Biological Diversity and the Ramsar Convention often work closely together.

199. Other multilateral agreements, such as those dealing with trade, health and security, may also prepare assessments that could and should include dimensions of biodiversity and ecosystem services. This argues for a role for a potential intergovernmental science-policy platform on biodiversity and ecosystem services to provide biodiversity and ecosystem services input to assessments on many topics and at multiple scales, while not assuming full responsibility for preparing the assessment.

200. With regard to *ecosystem services and biodiversity*, the term “biodiversity”, as defined by the Convention on Biological Diversity, is difficult to quantify and communicate to non-specialists. One result is that it is defined in many ways, often confined to simply its species dimensions. Some assessments, such as the IUCN Red List, explicitly confine themselves to this dimension, which is arguably the most easily communicated to the public. Others, such as the FAO assessments of plant and animal genetic resources, operate at the genetic level; but this remains the least well-addressed level in most assessments.

201. Ecosystem services, a concept that originated in the 1970s and popularized by the Millennium Ecosystem Assessment, have proven to be useful, having been adopted by the Framework Convention on Climate Change, TEEB and many national efforts. They are a good example of how a conceptual framework developed for an assessment can have wider impact.

202. The Millennium Ecosystem Assessment was the sole assessment that sought to cover the full range of ecosystem services and biodiversity, yet it did not always use those terms consistently, reflecting variability among scientists in their understanding of even these key terms. An intergovernmental science-policy platform on biodiversity and ecosystem services could help to ensure that these key terms are used more consistently.

203. In respect of *periodicity and time frame*, the most useful assessments generate a variety of quickly prepared but highly relevant products on a regular basis, with a major product once every four to five years. One-off assessments are less valuable than assessments that are repeated over time, with the latter enabling the assessment of trends and the effectiveness of policies; indeed, it may be that assessments become increasingly valuable as they build on experience and evolve as new knowledge and approaches become available (as indicated by IPCC, GEO-4, GBO-3 and the IUCN Red List).

204. The *authorizing environment and legitimacy* vary by assessment. Relatively few are specifically called for by the multilateral environmental agreement that they are seeking to influence: GBO is a notable exception, and IPCC has a close relationship with the Framework Convention on Climate Change. The Conference of the Parties to the Convention on Biological Diversity at its third meeting (Buenos Aires, 1996), however, called upon parties to cooperate on a voluntary project to demonstrate the use of successful assessment and indicator methodologies (decision III/10), which may have offered gentle persuasion to the Millennium Ecosystem Assessment. At the regional or continental levels, the Africa Environment Outlook enjoys very strong government support through the African Ministerial Conference on the Environment. Other assessments, such as the Millennium Ecosystem Assessment and IAASTD, sought support from the relevant multilateral environmental agreements or United Nations agencies by including representatives from them on their governing bodies or preparing chapters or separate publications directed specifically to their needs, as reflected in decisions of the conferences of the parties. While the Millennium Ecosystem Assessment Steering Committee included broad representation of the multilateral environmental agreements, United Nations agencies and Governments, strictly speaking it had no formal intergovernmental authorizing mechanism. This may have limited its policy impacts and has not led to periodic updating or review. The proposed intergovernmental

science-policy platform on biodiversity and ecosystem services may, however, itself be seen as a follow-up to the Millennium Ecosystem Assessment.

205. Other assessments, such as the IUCN Red List and the FAO assessments, have a weak authorizing environment in relation to the multilateral environmental agreements but seek legitimacy by providing useful information to a wide range of potential users of the data; and the FAO assessments have a strong authorization from its member Governments.

206. *Scientific credibility* varies by assessment. No standard criteria have been adopted, or even suggested, for the selection of scientists and peer review of outputs. Often, the scientists have been self-selected, and the voluntary nature of their contribution may have limited the pool of expertise available. This also applies to the peer review process. Enhancing the scientific credibility of assessments should be considered a high priority, involving capacity-building and a thoughtful approach to selecting the expertise to be involved in contributing to the assessment.

207. Many assessments represent a consensus perspective, and indeed seek such agreement, thereby excluding or downplaying more extreme possibilities that have been shown to be feasible. The uncertainties inherent in natural and social systems need to be recognized and not ignored in the drive for consensus; communicating uncertainty to decision makers (and often the public) who are seeking certainty will remain a significant challenge. The social and economic dimensions are especially subject to surprises. Assessments ideally should include advice on adapting rapidly to changing conditions or new research, and an intergovernmental science-policy platform on biodiversity and ecosystem services would be well advised to seek to be at the cutting edge of emerging issues relating to biodiversity and ecosystem services.

208. In terms of *policy impact and relevance*, the assessments prepared to date have had variable impacts on the decision-making processes of the various multilateral environmental agreements, with IPCC being the most influential in this regard. The Millennium Ecosystem Assessment, was tied to the Convention on Biological Diversity, the Convention to Combat Desertification, the Convention on Migratory Species and the Ramsar Convention through their participation on the Board. Converting problem definition to action on the ground has, however, proven difficult, and not only for the Millennium Ecosystem Assessment.

209. At the global level, IPCC undoubtedly has had the highest impact on policy among the assessments reviewed here, although judging from the recent controversies, some of its results have been called into question. Assessments with less direct relevance to issues of significant policy concern to Governments, or receive less government support, such as IAASTD, may have less policy impact. It is perhaps worth remembering that the most effective assessment in terms of actually affecting policy was initiated by independent scientists who identified the processes that led to the depletion of the ozone layer; this led to the 1989 Montreal Protocol on Substances that Deplete the Ozone Layer to the Vienna Convention for the Protection of the Ozone Layer. The then Secretary-General of the United Nations considered the Montreal Protocol “perhaps the single most successful international agreement to date”. It has now been ratified by 196 States, although they were not involved in the original assessment work. The reports on the state of the world’s plant genetic resources and on world animal genetic resources have led to the adoption of the Global Plan of Action. This Plan is implemented in many countries, in many cases with the active support of international organizations, including FAO, and donors.

210. Assessments that provide data that can be used in various ways, such as the IUCN Red List and the FAO Forest Resources Assessment, can have considerable indirect policy impact, especially when the data are presented in an objective way and packaged for multiple uses.

211. At the national level, some processes (especially the preparation of national biodiversity strategies and action plans) have proven to be highly influential, especially when the contributing scientists were of high reputation and included some nominated by Governments. In countries in which scientific bodies have been specifically established for this purpose or assigned responsibility for contributing to international assessments, the relevance of their advice to their Governments may be greatly enhanced. Outstanding examples are the National Commission for the Knowledge and Use of Biodiversity in Mexico and the South African National Biodiversity Institute.

212. A formal framework for assessing the policy impact and relevance should be included as part of any assessment, requiring that targets included in the assessment should be clearly defined and measurable.

213. *Stakeholder involvement* is highly variable and a significant challenge, as indicated by some of the problems of IAASTD. Defining stakeholders is itself a major issue, especially given the diversity of political and disciplinary perspectives and the more so when some are interested primarily in defending narrow special interests or preventing progress on the topic from being made. Even so, improving the involvement of appropriate stakeholders at all stages of the assessments would appear to be a valuable contribution in developing and communicating key messages and increasing a sense of ownership and understanding. Stakeholder involvement, however, needs careful management, beginning with the selection of participants in the assessment and a clear definition of their role. This also implies that effective assessment processes will involve expertise in social learning and facilitation.

214. Each assessment uses or develops its own *conceptual framework*, methodologies, indicators and databases. This variability may erect barriers to exchange of information and hamper the use of the results across the multilateral environmental agreements and relevant United Nations agencies. On the other hand, some conceptual frameworks have been a powerful foundation upon which the assessment was built, for example ecosystem services in the Millennium Ecosystem Assessment; indeed, in that case, its conceptual framework may have been the most influential part of the process.

215. In terms of *the data used*, most assessments draw from peer-reviewed literature, data provided by Governments or authoritative research institutions and expert opinion. The sheer volume of data makes synthesis more difficult, but all the more necessary. Relatively few of those assessments reviewed herein generate new data (with the Global International Waters Assessment and the IUCN Red List being exceptions). As indicated above, scientific data are not immune to attack; indeed, the scientific method is constantly seeking to improve the quality of data or their interpretation. That said, authoritative sources of data, such as the Global Terrestrial Observing System, the Group on Earth Observations (set up by GEO to implement the Global Earth Observation System of Systems), GEO and the IUCN Red List, can provide a consistent foundation of information, and an intergovernmental science-policy platform on biodiversity and ecosystem services should seek to have authoritative databases on biodiversity and ecosystem services on which to draw. The difficulty of defining biodiversity in a way that lends itself to quantification will be a challenge. The economic data being compiled by TEEB may prove useful to many other assessments and more local applications.

216. A challenge for many assessments is the use of qualitative information and alternative knowledge systems, much of which may come from non-scientists, for example local and indigenous peoples. If these stakeholders are to be involved, however, ways of using their knowledge will need to be found, including an appropriate vetting system comparable to peer review in the scientific literature. The Southern African Millennium Ecosystem Assessment has illustrated how this can be accomplished.

217. With regard to *communication to key audiences*, few assessments have built in a sufficient outreach capacity, enabling the assessment's results to reach the users whose decisions it seeks to inform. This communication needs to be based on strong scientific credibility, as indicated by the recent problems that IPCC has suffered due to relatively minor issues. While IPCC continues to be seen as highly credible by the expert community, the general public remains uncertain about climate change. While no assessment process can maintain its credibility if perceived to be advocating particular positions, effective outreach of scientific findings remains an important element of any assessment and will typically require support for several years following the publication of the main assessment report.

218. GEO-4 had a comprehensive outreach strategy that was far more effective than previous assessments and the investments made in reaching a broad public appear to have proved worthwhile.

219. Biodiversity and ecosystem services are relevant to virtually all human endeavours. Highly qualified expertise is, however, required to ensure that the best available information is provided to the various stakeholders who are likely to be affected by policies that improve the management of biodiversity and ecosystem services; trade-offs will often be involved, indicating the importance of building in the economic dimensions (as being developed by TEEB, building on the earlier work on trade-offs by the Millennium Ecosystem Assessment).

220. On the subject of *institutions for assessments*, the most effective assessments have tended to be those with an institutional home, such as IPCC (World Meteorological Organization and UNEP), the Global Biodiversity Outlook (Secretariat of the Convention on Biological Diversity), the various FAO assessments, the IUCN Red List and the various environment outlooks (UNEP and partners). Those lacking a permanent, or at least semi-permanent, home, such as the Millennium Ecosystem Assessment and IAASTD, are at a significant disadvantage, especially in outreach and continuity (though an intergovernmental science-policy platform on biodiversity and ecosystem services can be seen as a follow-up to the Millennium Ecosystem Assessment, which, if successful, would be an example of an institution being developed by an assessment).

221. Concerning *capacity-building*, given that the strength of assessments depends on the quality of the expertise involved in their preparation, efforts to build capacity for contributing to the preparation of assessments is often accorded high priority. By its resolution 63/220 of 19 December 2008 the General Assembly highlighted the importance of building scientific capacity in developing countries. The ideal would be to enable participation in global assessments by any country that wishes to contribute, and this may require a significant effort to build the capacity to do so. At the national level, most assessments already involve local experts, but some improvement is also necessary in at least some cases.

222. A more ambitious capacity-building goal would be to build the capacity to prepare responses to assessments that are linked directly to the findings of assessments of state, pressure and impact, as called for by the Assessment of Assessments.

223. Some assessments have paid particular attention to capacity-building. GEO-4, for example, has built capacity through the active participation of developing-country experts in the assessment. Such capacity-building is not only in the context of the main report but also applies to regional, subregional, national, ecosystems and city environment outlook reporting processes in various regions, much akin to the approach taken by the Millennium Ecosystem Assessment. UNEP has established a capacity-building expert working group to develop specific capacity-building manuals, guidelines and tools. For example, a new training manual was produced as part of the GEO-4 process.

224. *Funding* is an issue that has generally been avoided in the present document, primarily because so few assessments contain details on funding requirements (the Assessment of Assessments is a notable exception, presenting options for financing its regular process, while recognizing that it is too early to estimate costs of capacity-building, and that the costs of institutions supporting participants in the process are very difficult to estimate). While most assessments avoid the issue of costs, the Assessment of Assessments offers a useful model for a potential intergovernmental science-policy platform on biodiversity and ecosystem services.

225. Institutions that include assessments among their tasks will be more attractive to funding sources if they successfully tackle the challenges identified above.

Annex

Summary of key parameters of assessments reviewed

	Scale	Themes and focus	Ecosystem services and biodiversity	Periodicity and time frame	Authorizing environment	Scientific credibility	Policy impact	Stakeholder involvement	Conceptual framework	Data used
Millennium Ecosystem Assessment	Global, with associated subglobal elements	Broad, covering 24 ecosystem services, with volumes on state and trends, and policy responses	Main focus of the assessment	One-off, in this form	User needs survey, multilateral environmental agreements, Governments, international organizations on Millennium Ecosystem Assessment Board	Very high; 1,300+ scientists, rigorous peer review	Strong, judging from follow-up actions	Fairly narrow at global level, often strong at subglobal	Very strong, published as separate volume and widely followed	Considerable information, but data on biodiversity weak at detailed level
International Assessment of Agricultural Science and Technology for Development (IAASTD)	Global, with associated subglobal assessments	Agriculture in all dimensions. Broad focus within agriculture	Biodiversity at domestic level; ecosystem services addressed indirectly or implicitly	One-off	World Summit on Sustainable Development request, large Steering Committee with multiple stakeholders	Moderate, with 400+ scientists and strong peer review, but some key expertise not involved	Too early to tell, but may be strong in some regions	Very broad	Sound, but no innovations	Considerable information, but data on biodiversity fairly weak and not compiled in usable form
Global Environment Outlook (GEO)	Global	Broad, covering wide range of environmental issues	Addressed in several sections but not main focus	About every 3–5 years, with GEO-5 now in preparation	UNEP Governing Council	High, with wide consultation and peer review	Fairly strong at UNEP Governing Council level, variable among Governments. Strong outreach effort	Fairly broad, with stakeholder involvement used to help build capacity	Subject to broad consultation with UNEP members	Strong, with GEO Data Portal
Global Biodiversity Outlook (GBO)	Global, but based on national reports	The three objectives of the Convention on Biological Diversity	Main focus of the assessment	Every 4–5 years	Conference of the Parties to the Convention on Biological Diversity	High, drawing on other assessments and national reports	Influential in informing decisions at Conference of the Parties level	Primarily through national reports and review process	Agreed by Conference of the Parties, so consensus rather than innovative	Come from national reports, other sources; maps rather than data tables
Global Forest Resources Assessment (FRA)	Global, but based on national reports	Forest resources	Biodiversity has chapter in latest version; ecosystem services treated indirectly	About every 5 years	FAO Constitution Article 1, plus confirmation from FAO member Governments	Depends on the quality of national reports, but additional meetings and workshops plus remote sensing strengthened	Not a priority of FRA, but indirect impact may be strong in some countries	Mostly those professionally involved in forests	Simple, based on sustainable forest management	Come from national reports, but presented in very useful set of tables

	Scale	Themes and focus	Ecosystem services and biodiversity	Periodicity and time frame	Authorizing environment	Scientific credibility	Policy impact	Stakeholder involvement	Conceptual framework	Data used
State of the World's Plant Genetic Resources (SoW-Plants)	Global, but based on national reports	Plant genetic resources for food and agriculture	Focus on genetic level of biodiversity; recognizes ecosystem services but does not address	Now second report, more planned in future; every 10 years?	FAO Conference FAO International Treaty on Plant Genetic Resources for Food and Agriculture (Article 17.3)	Depends on the quality of national reports, plus additional literature and contributions from collaborating agencies	Affects FAO Global Plan of Action; may have impact at national level	Mostly government experts involved in preparing national reports and experts from agencies dealing with the topic	Required a new approach developed by intergovernmental working group	Come from national reports
State of the World's Animal Genetic Resources for Food and Agriculture (SoW-Animals)	Global, but also regional and national analyses	Animal genetic resources for food and agriculture	Focus on genetic level of biodiversity among domestic animals and other animals used for food and agriculture. Little attention to ecosystem services	First report in 2007, second planned for 2017, so periodicity of about 10 years	FAO Commission on Genetic Resources for Food and Agriculture, approved by FAO Conference	Based on national reports, plus additional literature and contributions from collaborating agencies. Best available source	Affects FAO Global Plan of Action; may have impact at national level	Variable, but designed to be broad at the country level	Detailed procedure developed to enhance utility	Best available; established Domestic Animal Diversity Information System
The Economics of Ecosystems and Biodiversity (TEEB)	Global	Value of ecosystems and their services	Focus on ecosystem services, with biodiversity used when quantifiable	One-off, but initial reports already issued and final report due in 2010	G8+5 environment ministers	High, based on quality of contributing scientists, economists and other experts	Unpredictable, but high demand for economic aspects of the issues	Mostly from those involved in the process	Standard total economic value framework, but applied to ecosystem services and biodiversity	From the peer-reviewed literature and other published sources; database being developed
Intergovernmental Panel on Climate Change (IPCC)	Global	Climate change, its impacts, and human involvement	Recognizes impacts of climate change on biodiversity and ecosystem services, but these are treated as of secondary importance	About every 6 years for synthesis report, but other reports periodically	United Nations General Assembly	Very high, based on quality of contributing scientists, economists and other experts	Very strong, main source of information for decisions made by United Nations Framework Convention on Climate Change; also influences government policies (though other factors often considered more important)	Mostly Governments and climate-related scientists	Innovative, to address new challenge of climate change; evolves as science becomes stronger	Best available science from climate-related centres of expertise
Global International Waters Assessment	Megaregions and subregions	Waters that are shared by two or more countries, both freshwaters and seas	Both covered, but somewhat superficially	One-off	Global Environment Facility and UNEP	High, based on quality of contributing scientists and collaborating organizations	Largely confined to Global Environment Facility	Mostly scientific community	Innovative and systematic, using multiple scales to address common problems and address new challenge of climate change; evolves as science becomes stronger	Many data collected in the field; considerable original research

	Scale	Themes and focus	Ecosystem services and biodiversity	Periodicity and time frame	Authorizing environment	Scientific credibility	Policy impact	Stakeholder involvement	Conceptual framework	Data used
Assessment of Assessments (marine)	Global, but only oceans	State of the marine environment	Deals with these, but uses different terms	Expected to be the beginning of a broader process; first Integrated Assessment due in 2014	World Summit on Sustainable Development, later endorsed by United Nations General Assembly	Very high, but fairly narrow so far; more scientists may be involved later	Still potential, but aimed at relevant multilateral environmental agreements	Mostly experts and institutions involved in marine environment	From General Assembly resolution 61/222, using ecosystem approach developed under Convention on Biological Diversity	Coming from contributing partners, including some primary data
IUCN Red List assessment	Global	Status of species (48,000 assessed to date)	Addresses species level of biodiversity; ecosystem services not addressed directly	Now fairly continuous (e.g. two updates produced in 2009)	IUCN and its 1,000 members, including Governments, government agencies and non-governmental organizations	Very high, based on quality of 7,000 contributing scientists and other experts	Strong, but usually indirect. Red List Index formal indicator for Millennium Development Goal 7	Mostly experts involved in the various taxa being assessed	Based on objective quantitative criteria	Best available science from experts working on the taxa involved; data freely available on website
Africa Environment Outlook (AEO)	Continental	All aspects of Africa's environment	Biodiversity has a full chapter; ecosystem services covered by implication	About every 4 years	African Ministerial Conference on the Environment	High, based on quality of contributing scientists from within Africa and some foreign scientists who have extensive experience in Africa	Strong in those countries who have adopted the AEO assessment framework (22 of them to date)	Wide consultations by hundreds of contributors	Based on the GEO framework	Best available science from within the continent, but not systematically presented
Southern African Millennium Ecosystem Assessment	Southern Africa (subglobal), but several scales within the region	Applying the Millennium Ecosystem Assessment to the Southern African region	Mostly ecosystem services, but biodiversity considered a service that underpins all of the others	One-off	Steering Committee of the Millennium Ecosystem Assessment	Very high, using best available expertise from within the region	Moderate to date, but perhaps also influential outside its region due to its innovative approaches	Very extensive, especially at the more local scales; most successful assessment in involving local knowledge	Built on Millennium Ecosystem Assessment framework, but applied at multiple scales and across scales, a significant innovation	Literature, plus direct interviews with local people; oral tradition also involved (an important innovation)
Nepalese biodiversity strategy	National	Convention on Biological Diversity implementation in Nepal	Mostly on biodiversity; ecosystem services not specifically mentioned	So far, a one-off exercise; but has been basis of four national reports to the Conference of the Parties to the Convention on Biological Diversity	Convention on Biological Diversity Article 6	High, based on best available information on Nepal's biodiversity; by fourth national report, quality improved, and most science done by Nepalese scientists	Helped define priorities for investment in biodiversity in Nepal, influencing donors; impact reduced due to internal security problems	Narrow for the national strategy, but broader by the fourth national report	Directly from the Convention on Biological Diversity	Best available science from the available literature

	Scale	Themes and focus	Ecosystem services and biodiversity	Periodicity and time frame	Authorizing environment	Scientific credibility	Policy impact	Stakeholder involvement	Conceptual framework	Data used
Kenya national report to the Convention on Biological Diversity	National	Implementation of the national biodiversity strategy and action plan, published in 2000	Covered biodiversity but not ecosystem services (which were not included in the national biodiversity strategy and action plan)	Fourth national report; others in 1998, 1999, 2005	Kenya's National Environment Management Agency and Convention on Biological Diversity Article 6	Relatively weak, with few data presented and peer review process not described	Remains rather modest, given Kenya's other priorities. Fourth report indicates some improvement, however	Confined to workshop to review comments of first draft report	Builds on national biodiversity strategy and action plan, which in turn was based on guidelines provided by Secretariat of the Convention on Biological Diversity	Scanty, as report was mostly descriptive
