

**“Wetlands: water, life, and culture”**

**8th Meeting of the Conference of the Contracting Parties  
to the Convention on Wetlands (Ramsar, Iran, 1971)**

**Valencia, Spain, 18-26 November 2002**

**Ramsar COP8 DOC. 8**  
**Information Paper**  
**English only**

**Ramsar Bureau note:**

Contracting Parties are invited to consider the recommendations made in paragraphs 26-29 of this document concerning possible COP8 action on this matter. There will be a presentation in plenary on the Millennium Ecosystem Assessment (MA) on Tuesday 19 November, followed by a lunch-time side event to provide opportunities for further discussion on the MA.

**MILLENNIUM ECOSYSTEM ASSESSMENT  
REPORT TO THE CONFERENCE OF THE PARTIES OF THE  
RAMSAR CONVENTION ON WETLANDS**

*Status and Draft Outline*

*July, 2002*

1. This note has been prepared by the Secretariat of the Millennium Assessment to provide the 8th meeting of the Conference of Parties with a progress report and to outline past and potential interactions with the Ramsar Convention on Wetlands and more specifically with Scientific and Technical Review Panel (STRP) in addressing identified assessment needs.

*Executive Summary*

2. The Millennium Ecosystem Assessment, launched in June 2001, is an integrated assessment, designed to meet some of the assessment needs of the Ramsar Convention on Wetlands, the Convention on Biological Diversity, the Convention to Combat Desertification, and other users including the private sector, civil society, and indigenous peoples. It has been invited by these three conventions to provide assessment input to their scientific and technical subsidiary bodies.
3. Through COP Resolution VII.2 concerning the *modus operandi* and composition of the STRP, the Conference of Contracting Parties recognized the desirability of cooperation between the STRP and a number of expert networks, specialist groups and societies. To this end, the STRP and the MA together identified areas where mutual cooperation is possible (e.g., ecological characters of wetlands and assessment methods, water allocation for ecosystem functions etc.). The STRP recognized the strong links between a series of issues on which the Panel is working, in particular on ecological character of wetlands and assessment methods, and the programme of work of the Millennium Ecosystem Assessment, encouraged the MA in its work, and expressed its intention to contribute to that process through an ad hoc working group for the purpose. The STRP designated Max Finlayson and Doug Taylor as STRP focal points in order to establish a permanent relationship between the MA and the STRP, and invited its members to channel input to the MA through them (Decision STRP 10.1).
4. The technical design phase of the Millennium Assessment was initiated in April 2001, and concluded in January 2002 with the Board approval of the design. Two technical design workshops (in the Netherlands and South Africa) and numerous consultations with the users of the

Assessments have been undertaken as part of the design phase. The set of assessment topics that the MA will seek to address was strongly influenced by consultations with the Ramsar secretariat, STRP members, and reactions to the MA draft design solicited by MA Secretariat at STRP meetings. The basic design and substantive outlines that guide the work of the MA are presented in Annex IV. The Assessment phase has now begun and the first product will be released early in 2003. The final documents and a summary for Policymakers targeted at the needs of Ramsar will be forwarded to the STRP in late 2004.

5. The MA has developed a series of mechanisms to facilitate the interaction of interested stakeholders throughout the world with the assessment process; the Secretariat of the MA encourages their active use.
6. Review of Ramsar decisions, recommendations and resolutions, and in particular consultations with STRP yielded a list of priorities for Ramsar that the MA can address. Additionally, components of the MA support some principles outlined by the Ramsar Convention resolutions, recommendations and decisions, such as the involvement of local and indigenous peoples in assessment activities and capacity building to undertake integrated ecosystem assessments and act on their findings.
7. Decisions taken by Ramsar COP-8 could strengthen the contribution of the MA by supporting and welcoming the draft outline of the MA as contained in Annex IV of this document; requesting STRP to continue to identify opportunities for collaboration with the Millennium Assessment in contributing to the assessment needs of the Convention; requesting status reports on progress of the assessment as appropriate at meetings of STRP or COP; and urging developed country Parties to provide assistance to developing country Parties to facilitate participation of developing country experts and assessments in the work of the MA.

## I. BACKGROUND

8. The 7th meeting of the Conference of the Contracting Parties of the Convention in 1999 noted “the scope of the proposed Millennium Assessment of the World’s Ecosystems, currently under development, to deliver valuable related information of relevance to the application of the Convention;” (COP-7 Resolution VII.20).
9. Through Resolution VII.2 concerning the *modus operandi* and composition of the STRP, the Conference of Contracting Parties recognized the desirability of cooperation between the STRP and a number of expert networks, specialist groups and societies which exist. To this end, the STRP:
 

“...recognized the strong links between a series of issues on which the Panel is working, in particular on ecological character of wetlands and assessment methods, and the programme of work of the Millennium Ecosystem Assessment, encouraged the MA in its work, and expressed its intention to contribute to that process through an ad hoc working group for the purpose. The STRP designated Max Finlayson and Doug Taylor as STRP focal points in order to establish a permanent relationship between the MA and the STRP, and invited its members to channel input to the MA through them (Decision STRP 10.1).”
10. Exchanges on the above-identified issues between the experts associated with the MA process and the STRP members have taken place. The MA Secretariat has provided an analysis showing STRP-9 recommendations relative to MA’s “Synthesis Questions” and suggesting possible reciprocal inputs (Agenda paper STRP10/1). A list of areas in which the MA could contribute to the identified assessment needs of Ramsar was submitted to STRP and discussed in detail at that tenth meeting of the STRP in June 2001. A presentation was made to the STRP-10 by Ian Noble, then Co-Chair of the Conditions Working Group of the MA. Parties were informed of the proposed

MA at that time through a plenary presentation by Dr. Robert Watson, MA Board Co-chair, and a side event briefing offering delegates the opportunity to discuss the proposed assessment. From the time of COP-7 to present, the MA has benefited enormously from the active participation and substantive contributions and guidance of Mr. Delmar Blasco, Secretary General of Ramsar and member of the MA Board; Mr. Nick Davidson, Deputy Secretary General, who participated in both technical design meetings hosted by MA; and designated STRP representatives Max Finlayson (Coordinating Lead Author for the MA Conceptual Framework report and the MA Conditions and Trends Report) and Doug Taylor.

## II. MA OVERVIEW AND STATUS REPORT

11. The Millennium Ecosystem Assessment, launched in June 2001, is an integrated assessment, designed to meet some of the assessment needs of the Ramsar Convention on Wetlands, the Convention on Biological Diversity, the Convention to Combat Desertification, and other users including the private sector, civil society, and indigenous peoples. It has been invited by these three conventions to provide assessment input to their scientific and technical subsidiary bodies.
12. The objectives of the MA are to help meet the needs of decision-makers for peer-reviewed, policy-relevant scientific information on issues they are confronting concerning ecosystems and human well-being. The MA will also build human and institutional capacity to provide such information. If the MA process is successful it is anticipated that the process would be repeated at regular intervals (of possibly 5 or 10 years).
13. The Millennium Ecosystem Assessment is being undertaken at multiple scales. It consists of a global assessment as well as series of linked regional and national assessments. The Assessment is being carried out through four expert working groups. Each working group is intended to produce a report by late 2004 focused on the following topics:
  - a) The Sub-Global Working Group will present a generic methodology for conducting multi-scale assessments, and summarise the findings from each of the sub-global assessments associated with the MA. The sub-global components of the MA will directly meet the needs of decision-makers at those scales. In addition, the sub-global components of the MA will strengthen the global findings with on-the-ground reality and inform the local findings with global perspectives, data, and models. Approved assessments that have become components of the MA include: Southern Africa Multiscale Assessment; Norway National Assessment; Integrated Ecosystem Assessment for Western China; Local Assessments in the Mala Village Cluster in India; Local Assessments in Sweden; Alternatives to Slash and Burn sites and Small Islands of Papua New Guinea. In addition, several "candidate" assessments have been proposed: a multiscale assessment in Southeast Asia, tropical coastal region of Australasia, the Altai-Sayan ecoregion in Central Europe/Russia, a multiscale assessment in Central America, the Colombian Andes coffee-growing region, the Sinai peninsula/Egypt, the Vilcanota sub-region of Peru, the Atacama Desert in Chile, and Indigenous Assessments. Discussions are underway regarding additional proposals. Any proposed sub-global assessments meeting basic criteria developed by the MA (available on the MA website) can become a full component of the MA process. Additional sub-global assessments will be initiated during the course of the MA, and although some may not be initiated in time to contribute to the official findings, their primary purpose is to meet decision-makers needs at the scale at which they are conducted. Currently, the MA is able to provide only seed funding for the sub-global assessments, with the bulk of funds raised individually by each sub-global assessment.
  - b) The Condition Working Group will describe each major ecosystem service. The condition and geographical distribution and trends of the supply and demand for each service will be considered and the capacity of ecosystems to supply these services, and the impacts of the

changes in ecosystems on their provision will be described. A description of the current extent, condition and trends of ecosystems, presented in commonly referenced ecosystem and biome units (e.g., forests, freshwater, coastal, mountain, etc.) biome by biome, and options for trade-offs between the provision of the various services will be laid out. Chapters will also address issues such as species use of multiple ecosystem types; areas with multiple examples of rapid change; land conversions, and Protected Areas. The final section of the product will aim to assess the impacts of ecosystem change on human well being, covering indicators of health, environmental security, cultural security, economic security and equity.

- c) The Scenarios Working Group will assess the findings of previous global scenario analyses concerning goods and services and develop a set of scenarios providing quantitative estimates of the consequences of various plausible changes in primary driving forces on proximate forces, ecosystem goods and services (including biodiversity), and the human well-being. It will illustrate the connection of global changes in ecosystem services at every large scale (global to local) and the connection of ecosystem services to human well-being. And
  - d) The Responses Working Group will begin with an introduction to the conceptual framework and the typology of response options within categories of disciplinary tradition, social control, drivers and scale. Then there will be an assessment of past and current response options, which will provide the basis for practical recommendations, tools and guidelines for the various users through an evaluation of existing literature and the MA sub-global assessments. Finally, there will be a synthesis of the “ingredients for successful responses”, based on an evaluation of available policies and scenarios.
14. A more detailed outline of the Working Group Assessment Reports and the Conceptual Framework for the MA is provided in Annex IV. In addition to the full assessment reports, an overall Summary for Policy Makers will be prepared and a synthesis report will be prepared that addresses high priority needs identified by the Ramsar Convention on Wetlands.
  15. The MA will not report information for individual nations. The information and findings that the MA will produce will be summarized by region or wetland type – not by nation – for the global synthesis. Disaggregated data will be available for use by others in national assessment processes.
  16. The MA will use a wide range of data and information, relying heavily on peer reviewed findings in the published literature and global datasets. The process will also incorporate indigenous and traditional knowledge, national data available from a wide range of ministries, private sector information and so forth. In particular, the MA will seek to incorporate information from National Strategies and Actions and will seek to develop products and build capacity that can be directly helpful in updating National Strategies and Action Plans.
  17. The MA interacts with other environmental and sectoral assessment processes including IPCC, the Global International Waters Assessment (GIWA), the Global Environment Outlook (GEO), the Forest Resources Assessment (FRA), the Land Degradation Assessment (LADA), etc. to ensure that it adds value to activities already underway.
  18. Major sponsors of the MA include GEF, UN Foundation, David and Lucile Packard Foundation, and the World Bank with additional financial and in kind support provided by the Government of Norway, CGIAR, UNEP, FAO, UNDP, UNESCO, WHO Rockefeller Foundation, U.S. National Aeronautics and Space Administration and others. (See Annex III)
  19. The MA Board is multisectoral and representative of different communities of ecosystem users. The Secretary General of Ramsar and the Chair of STRP are represented in the MA Board. Representatives of other conventions (CCD, CBD) and other key international institutions such as UNEP, UNDP, FAO, UNESCO, WHO, The World Bank, CGIAR, ICSU, IUCN, GEF, UN

Foundation, and the FCCC are also included in the Board. The United Nations Environment Programme (UNEP, Nairobi), World Resources Institute (WRI, United States) and World Fish Center (ICLARM, Malaysia) administer funds for the assessment. UNEP coordinates the distributed secretariat: the MA Director is based at ICLARM; technical support units for the working groups are based at the Scientific Committee on Problems of the Environment (France), UNEP-World Conservation Monitoring Centre (United Kingdom), Institute for Economic Growth (India), and the World Fish Center. In addition, support is being provided at this level by staff at RIVM in The Netherlands, University of Wisconsin in the US and CIMMYT in Mexico. Engagement and outreach activities are supported through World Resources Institute and Meridian Institute (US).

20. Because the MA is a ‘needs driven’ assessment process a number of steps were taken to involve intended users in the MA design through both formal and informal dialogues:
- a) Information needs from the MA were discussed at the tenth Ramsar STRP meeting (June 2001) as well as the sixth (March 2001) and seventh (November 2001) meetings of CBD SBSTTA and the Committee on Science and Technology of the Convention to Combat Desertification (CCD CST) Bureau (August 2001), and the CCD CST (October 2001);
 

During the tenth Ramsar STRP meeting held in June 2001, Ian Noble (the then Co-chair of Millennium Assessment Conditions Working Group) made a presentation on the structure, objectives, and directions of the MA and outlined areas where MA’s activities are pertinent to issues addressed by Ramsar.
  - b) The MA sub-global assessment activities now underway in Southern Africa, Southeast Asia, China, India, Norway, Sweden, Peru and other countries all include extensive involvement of the users in their planning phase;
  - c) Workshops and briefings are being organized for the private sector including a session that was held in early October 2001 jointly with the World Business Council on Sustainable Development (WBCSD) involving individuals from the private sector to explore how the MA could contribute to sustainable development planning within business;
  - d) A series of meetings and consultations are being planned to explore user needs within civil society and indigenous peoples’ organizations.
  - e) The first draft of the “user needs” outline was made available through the MA website in August 2001 and comments were incorporated based on the input of some 27 individuals and institutions including representatives of governments (8), international organizations (2), NGO’s (8), academia (7), and private sector (2). This document is being updated on an ongoing basis and the working groups are charged with responding to the defined user needs to the greatest extent possible in their work.
21. In addition, the MA has developed a series of mechanisms to facilitate the participation of stakeholders in the assessment process. More information on these can be found in the MA’s website ([www.millenniumassessment.org](http://www.millenniumassessment.org)):
- a) User Forums. The MA is establishing opportunities for dialogue at the regional, national and local levels with the multiple stakeholders identified as beneficiaries of the assessment.
  - b) Affiliated Scientific Organizations and Academies of Sciences. The MA has developed a mechanism to interact more broadly with the scientific community, in particular with organizations responsible for fostering scientific, technical or technological research,

monitoring, or assessment or linking scientific research or assessment to the needs of decision-makers.

- c) Sub-global Assessments. The MA is a 'multiscale' initiative involving assessments at the global, regional, basin, national and local scales. Applications to become MA-affiliated assessments will be reviewed throughout 2002 and exceptionally during 2003.
  - d) Access to information. The MA is an open, transparent process. As it develops, the MA will provide broad access to the information it generates and mobilizes. A Data and Information Support System to organize and facilitate access to this information is under construction.
  - e) Newsletter. To subscribe to our quarterly electronic newsletter, please visit the MA website and follow the newsletter links on the homepage <http://www.millenniumassessment.org/> (the MA will not divulge or share contact information with any third party).
22. A work plan outlining in more detail the forthcoming steps in the MA is provided in Annex I. The Assessment Report outlines (as provided in Annex IV) and work plan, drafted in light of the recommendations of the technical bodies of Ramsar, CBD and CCD and other users were approved by the MA board in January 2002.

### III. MEETING RAMSAR NEEDS

23. The MA has identified a set of assessment needs shared widely among various users and a limited number of additional "high priority" needs of individual users. With a view to identifying the priorities of the Ramsar Convention, the MA Secretariat reviewed the decisions of the COP and recommendations and resolutions of STRP to identify opportunities where the MA could directly assist in meeting the assessment needs of Ramsar. Generally, the MA will contribute to the assessment needs of Ramsar Convention in the following manner:
- a) *Ecological character of wetlands and assessment methods*: The goods and services focus of the MA will have enormous benefit. Interaction with Ramsar in this context would be very valuable as the MA defines goods and services related to wetlands. MA will develop an internally consistent set of methodologies for different levels of assessment and ensure that the various assessments conducted as components meet the standard set for the assessment and review process. This information will be available for use in national reports.
  - b) *Information about loss of wetlands*: The MA Conditions Working Group will be developing trend information – the level of scale most useful to Ramsar may come from the sub-global assessment work.
  - c) *National Scientific inventories for identifying sites suitable for inclusion in the list of wetlands of international importance (Ramsar List)*: The remote sensing resources that will be utilized in the MA can be of assistance to Ramsar. The MA is working closely with the international remote sensing community and has emphasized the importance of assembling global coverage of wetlands.
  - d) *Water allocations for ecosystem functions*: Involvement of MA in terms of devising methodologies to calculate water allocations, considering/defining water allocation systems and their functions would be of help to Ramsar.
24. Furthermore, based on the consultations with the STRP at its ninth meeting on the 28-30 June 2000, a priority list was developed. The following list outlines the needs of Ramsar where MA could provide information:

- i. Further definition of major wetland types within each bio-geographical region and a more precise evaluation of their area coverage, including that of wetlands that are of a transboundary nature.
- ii. Further definition of major wetland functions within ecosystems, and in particular those functions that have socio-economic relevance, such as:
  - a) wetland functions within the global water cycle, and within regional, national and local water regimes, in particular those functions that contribute to drinking water supply and environmental security (e.g. floods and coastal storms risk reduction);
  - b) wetland functions as host of species at different stages of their life cycle, in particular: flagship and keystone species; threatened, endangered and vulnerable species; and species with particular socio-economic values (e.g. fish species that form the basis for artisanal and/or commercial fisheries, and species with current or potential value for biotechnology, medicine, etc.);
- iii. Further evaluation of the effects of hydrological modifications that cause wetland change, degradation or loss (e.g. the effect of wetland drainage on local climate change, population displacements, loss of indigenous/endemic species, etc).
- iv. Further evaluation of trends in conversion and loss of particular wetland types, especially mangroves, coral reefs, intertidal flats and marshes, floodplains, and peatlands.
- v. Further evaluation of the effects of agroecosystems on wetlands, including the effect of irrigation systems and rice production.
- vi. Ecosystem-response scenarios to major wetland restoration projects.
- vii. Review of the state of the art concerning effective methods for economic valuation of wetland functions, including “quick valuation appraisal” methods.
- viii. Review of the state of the art concerning methodologies to calculate water allocations to ensure effective water ecosystems functions.

MA has given careful consideration to the specifics of the above list and has made provisions to incorporate them in the chapter outlines of different Working Groups (Annex - IV)

25. In addition to the specific areas identified by STRP, components of the MA support some principles outlined by the Ramsar Convention Resolutions, Recommendations and Decisions. For example:
  - a) Recognizing the importance of the involvement of local and indigenous people in the management of ecosystems, the MA is closely working with indigenous groups to establish a strategy for interactions and develop a selection and implementation plan for indigenous people-led assessment activities (supporting Ramsar Recommendation 6.3); this Recommendation further recalls the “Additional Guidance for the Implementation of the Wise Use Concept” (Annex to Resolution 5.6);
  - b) One of the primary objectives of MA is to strengthen the capacity of individuals and institutions to undertake integrated ecosystem assessments and act on their findings (supporting Ramsar Resolution VII. 17, which recognizes that *capacity building* and additional human and financial resources may be required in order to foster the development of restoration and rehabilitation initiatives).

#### IV. FUTURE COLLABORATION WITH RAMSAR COP

26. Cooperation between the MA and the Ramsar Convention process, in particular STRP, has been very productive. Regular reports on the MA will be presented as requested at future meetings of STRP and the MA would welcome the opportunity to provide such reports to COP. Side events or working group discussions will be arranged as needed to provide opportunities for detailed input from parties. Also even though the technical volumes produced by the Working Groups of the MA will be prepared to meet the needs of multiple users, a separate Summary for Policymakers will respond to targeted needs of Ramsar.
27. More specifically, there are four areas that COP may wish to consider in order to further promote cooperation and linkages between the MA process and Ramsar.
- a) First, all Parties to the Ramsar Convention were invited to nominate experts for the Working Groups and the Ramsar Secretariat was consulted to identify experts. MA will have most of the Lead Authors identified by November 2002, with nominations for reviewers accepted through 2003 and expert reviewers through early 2004. The composition of the group of Coordinating Lead Authors and Lead Authors for a section or chapter of MA reports will reflect the need to aim for a range of views and expertise and a balanced gender and geographical representation (ensuring appropriate representation of experts from developing and developed countries and countries with economies in transition). Draft reports of the MA will undergo two rounds of peer review, one by experts and one by governments and experts. Though support from STRP and the Parties would help MA ensure that the experts in the Working Groups were regionally balanced and did represent the best experts available, the participation of many developing country experts will be contingent upon the availability financial support and direction from the COP may assist in securing such support.
  - b) Second, considerable interest exists among institutions and countries to undertake “sub-global” assessments at national or sub-national scales as part of the MA process. The MA can provide seed funding to such activities in developing countries, but each of these ‘candidate’ assessments must obtain more than half of the financial support for their involvement. The Government of Norway, for example, has provided a significant grant in support of the Southern African multiscale assessment and has also arranged a ‘twinning’ arrangement for the exchange of experts involved in the Southern African and Norway sub-global assessments. Similar actions taken by other governments or direction from COP could assist other countries and institutions in securing the resources needed for their involvement.
  - c) Third, the MA would welcome a request to report regularly to STRP on progress of the assessment as it relates to the work of Ramsar.
  - d) Fourth, a mechanism could be established to organize the review by STRP of the findings of the Millennium Ecosystem Assessment, and provide recommendations to the Conference of the Parties based on the review. A mechanism of this sort has been established by the Convention on Biological Diversity (*UNEP/CBD/COP/VI/7*).
28. Based on the foregoing, decisions taken by Ramsar COP-8 could strengthen the contribution of the MA by supporting and welcoming the draft outline of the MA as contained in Annex IV of this document; requesting STRP to continue to identify opportunities for collaboration with the Millennium Assessment in contributing to the assessment needs of the Convention; requesting status reports on progress of the assessment as appropriate at meetings of STRP or COP; and urging developed country Parties to provide assistance to developing country Parties to facilitate participation of developing country experts and assessments in the work of the MA.
29. The MA looks forward to continuing the fruitful cooperation established with Ramsar.



## ANNEX I. MA WORKPLAN

### 2000

July 2000 1st MA Board Meeting (Norway)

### 2001

April 1st Technical Design Meeting (Netherlands)

October 2nd Technical Design Meeting (Cape Town)

November Call for Nominations for Working Groups

### 2002

January 2<sup>nd</sup> MA Board Meeting (Kuala Lumpur)

March to June 1<sup>st</sup> MA Working Group Meetings

### 2003

Release of 1<sup>st</sup> MA Product “Conceptual Framework and Methodology Report”

2nd Working Group meetings

### 2004

Review Process for Assessment Reports

Release of Final Products

Note: Active consultation with the users of the MA will continue throughout the process, both through the direct involvement of representatives of the users on the MA Board and through active involvement of the users and stakeholders in the process.

**ANNEX II. EXPLANATORY MATRIX OF RAMSAR CONVENTION NEEDS AND HOW THEY RELATE TO THE MA SYNTHESIS QUESTIONS AND WORK PLAN**

MA Synthesis Questions	Ramsar Resolutions & Recommendations and Specific recommendations forwarded to the MA by Ramsar:	Possible Linkages to MA
<p><i>Ten synthesis questions were drafted during the First Technical Design Workshop of the MA. Many of them relate to the priorities of Ramsar. The list of synthesis questions is as follows:</i></p>		<p><i>This Column includes discussion of ways in which the work of the MA could assist Ramsar and how the work of Ramsar could assist the MA. In some cases questions are posed to assist in gaining a greater understanding of opportunities for collaboration.</i></p>
<p><i>1. What ecosystems provide what goods and services and how do they contribute more generally to sustainable development?</i></p>	<p>Further definition of major wetland functions within ecosystems, and in particular those functions that have socio-economic relevance, such as:</p> <p>a) wetland functions within the global water cycle, and within regional, national and local water regimes, in particular those functions that contribute to drinking water supply and environmental security (e.g., floods and coastal storm risk reductions);</p> <p>b) wetland functions as host of species at different stages of their life cycle, in particular: flagship and keystone species; threatened, endangered and vulnerable species; and species with particular socio-economic values (e.g., fish species that form the basis for artisanal and/or commercial fisheries, and species with current or potential value for biotechnology, medicine, etc.)</p> <p><i>Resolution VI.7: The Scientific and Technical Review Panel (STRP). NOTING that the Standing Committee, after review of the tasks enumerated in Resolution 5.5, requested the STRP to concentrate on specific items, namely:</i></p> <p>a) review of the Criteria for Identifying Wetlands of International Importance and especially the establishment of criteria and guidelines on the importance of wetlands for fishes, both as regards biodiversity and fishery yields, as called for in Recommendation 5.9;</p> <p>b) definition of “ecological character” and “change in ecological character” in relation to wetlands designated for the List of Wetlands of International Importance, as called for in Recommendation 5.2;</p>	<p>The goods and services focus of the MA should be of benefit. Interaction with Ramsar would be very valuable as the MA defines goods and services related to wetlands.</p> <p>Information produced by the MA may be of assistance in establishing criteria for these purposes.</p>

<p>2. <i>How have ecosystems changed in the past and how has this increased or reduced their capacity to provide goods and services?</i></p> <p>- <i>What thresholds, non-linearities or irreversible changes have been observed?</i></p>	<p>Further definition of major wetlands types within each bio-geographical region and a more precise evaluation of their area coverage, including that of wetlands that are of a transboundary nature.</p>	<p>The MA will need to select a basic classification scheme for the “units of analysis” (e.g., ecoregions, biomes, etc.). It would be valuable to have Ramsar input during this process and the outcome could also be of use to Ramsar.</p>
	<p>Further evaluation of the effects of hydrological modifications that cause wetland change, degradation, or loss (e.g., the effect of wetland drainage on local climate change, population displacements, loss of indigenous/endemic species, etc.).</p>	<p>The Scenarios Working Group of the MA will be addressing these issues in the context of overall scenario development. Collaboration with Ramsar would be very valuable in this context.</p>
	<p>Further evaluation of trends in conversion and loss of particular wetland types, especially mangroves, coral reefs, intertidal flats and marshes, floodplains, and peatlands.</p>	<p>The Conditions Working Group will be addressing these issues; collaboration with Ramsar would be very valuable.</p>
	<p>Recommendation 6.7: Conservation and wise use of <b>coral reefs</b> and associated ecosystems, including <b>mangrove forests</b> and seagrass bed. Supplemented by Recommendation 4.7, which specifically identifies coral reefs in the list of Marine and Coastal Wetlands Types; NOTING Chapter 17 of Agenda 21, which identifies coral reefs, mangrove forests, and seagrass beds as marine ecosystems of high biological diversity and production, and recommends that they be accorded high priority for identification and protection; WELCOMING the International Coral Reef Initiative, which is a partnership of governments and international and national non-governmental organizations with the goal of promoting sustainable management of coral reefs and associated ecosystems through more effective research, monitoring, and management, and related capacity-building.</p> <p><i>Resolution VI.23: RECOGNIZING the important <b>hydrological functions of wetlands</b>, including groundwater recharge, water quality improvement and flood alleviation, and the inextricable link between water resources and wetlands</i></p>	<p>This will not be a specific focus of the MA except perhaps in the context of a specific sub-global assessment.</p>
<p>3. <i>What are the most critical factors affecting the observed changes?</i></p>	<p>Wetland functions as host of species at different stages of their life cycle, in particular: flagship and keystone species; threatened, endangered and vulnerable species; and species with particular socio-economic values (e.g., fish species that form the basis for artisanal and/or commercial fisheries, and species with current or potential value for biotechnology, medicine, etc.,)</p>	

<p>4. <i>What are the costs, benefits, risks and distributional effects of the observed changes in ecosystems?</i></p>		
<p>5. <i>What are plausible future changes in ecosystems and in the supply of and demand for goods and services?</i></p> <p>- <i>Under what circumstances are thresholds, non-linearities or irreversible changes likely to occur?</i></p>	<p>Resolution VI.21: <b>Assessment and reporting</b> on the status of wetlands, Notes the difficulties associated with measuring and reporting on the state of wetland resources by Contracting Parties, and consistent with Action 6.1.3 of the Strategic Plan 1997-2002;</p>	<p>The Conditions Working Group will be addressing issues of this type – collaboration with Ramsar would be very valuable.</p>
<p>6. <i>What are the most critical drivers and factors affecting future changes?</i></p>		
<p>7. <i>What are the costs, benefits, risks, and distributional effects of plausible future changes in ecosystems?</i></p>	<p>COP7 URGES Contracting Parties to produce information about wetland losses, including an assessment of the lost processes, functions, composition and values of wetland areas. This information should include data about the restoration potential of these sites and the full benefits of restoration, including identification, at all appropriate levels and using standardized protocols for data gathering and handling as requested in Resolution VII.20, of sites that are a priority for restoring for the benefit of people and the natural environment;</p>	<p>The Conditions Working Group will be developing trend information – the level of scale most helpful to Ramsar may come from the sub-global assessment work.</p>
<p>8. <i>What response options and processes can be used to realize or avoid specific futures?</i></p> <p>- <i>What are the trade-off implications of the response options?</i></p> <p>- <i>How does inertia in the social and natural systems impact management decisions?</i></p>	<p><i>Recommendation 6.8: Strategic planning in coastal zones</i></p> <p>1. NOTING that an estimated 60% of the world's population and many development activities are concentrated along the coastal strip which extends from shoreline to less than 60 km inland, and that increasing population and development are posing immense pressure on coastal wetlands in terms of depletion of living resources, pollution loads, reclamation, land fill, and other uncoordinated development, all of which <b>impact on biological diversity</b>; 2. FURTHER NOTING that coastal wetlands need increased consideration in land-use plans in relation to the protection of overall <b>water resources</b> and cumulative impacts of human activity.</p> <p>COP-6 REQUESTS all Contracting Parties to seek appropriate means to ensure that strategic planning in the coastal zone as well as environmental impact assessments are carried out competently and in a timely fashion so as to ensure that use of wetlands and related environmental components will be wisely managed.</p>	<p>Methodologies developed by the MA for local assessments could assist Ramsar in establishing strategic planning methods for these regions.</p>

	<p>Recommendation 6.13: COP-6 DIRECTS the Convention Bureau to disseminate by all appropriate means, <i>case studies and other information</i>, demonstrating active and informed participation of local and indigenous people in the management of wetlands</p>	<p>MA is closely working with indigenous groups to establish a strategy for interactions and develop a selection and implementation plan for indigenous-people led assessment activities.</p>
	<p><i>Resolution VII. 17: RECOGNISING that <b>capacity building</b> and additional human and financial resources may be required in order to foster the development of restoration and rehabilitation initiatives, but also AWARE that in many countries it is local people/stakeholders who are taking the lead with such initiatives, in recognition of the vital functions, services and benefits wetlands provide;</i></p>	<p>It is an objective of the MA to strengthen capacity of individuals and institutions to undertake integrated ecosystem assessments and act on their findings.</p>
	<p>COP 6 requests that over the next triennium, the Bureau, in consultation with Contracting Parties, establish an agreed <i>scientific process for assessing the state of wetland resources nationally, regionally and globally</i>; and establish a <i>review process</i> that would revise, if necessary and appropriate, the guidelines on preparing National Reports in time for the next Conference of Parties, with a view to examining the structure of the information presented in these regular reports to maximize their contribution to the ongoing assessment of wetlands.</p>	<p>The MA will involve individuals with expertise in international, national, regional, and local assessments. MA will develop an internally consistent set of methodologies for different levels of assessment and ensure that the various assessments conducted as components of the MA meet the standards set for the assessment and review process. This information will be available for use in National Reports. Opportunities for interaction in the context of the sub-global assessments should also be explored.</p>
<p><i>9. What are the most robust findings and key uncertainties that affect provision of goods and services, management decisions and policy formulation?</i></p>	<p><i>Recommendation 6.3: Involving <b>local and indigenous people</b> in the management of Ramsar wetlands. RECALLS the “Additional Guidance for the Implementation of the Wise Use Concept” (Annex to Resolution 5.6) which suggests that Contracting Parties establish procedures which guarantee that local communities are involved in the decision-making process related to wetland use, and provide local communities with sufficient knowledge of planned activities to assure their meaningful participation in the decision-making process; AWARE that many local and indigenous people, have long associations with the wetlands in their region and can assist with developing management techniques for modern times based on traditional management practices.</i></p>	<p>MA is closely working with indigenous groups to establish a strategy for interactions and develop a selection and implementation plan for indigenous-people led assessment activities.</p>

<p>10. What are the tools and methodologies that can be developed and used in the MA to strengthen capacity to assess ecosystems, the goods and services they provide, and the implications of response options?</p>	<p>Recommendation 4.6: Establishment of <i>national scientific inventories</i> of potential Ramsar sites, recognizes the value of establishing national scientific inventories of wetlands on the basis of these criteria for improving the general level of knowledge on the world's wetlands and for facilitating the designation of sites for the List; CONVINCED that the establishment of inventories carried out on the basis of the <i>best scientific information available at both national and international level</i> constitutes the most effective method to achieve the designation for the List of the largest possible number of sites.</p>	<p>The findings of the MA, and in particular the scenarios developed at global and regional levels, could provide assistance to decision makers to evaluate the changes in the goods and services obtained from its ecosystems.</p>
	<p>Issues associated with agro ecosystems will be addressed to some extent in the global context. In addition there may be some important opportunities at the sub-global assessment level.</p>	<p>Further evaluation of the effects of agroecosystems on wetlands, including the effect of irrigation systems and rice-production.</p>
	<p>In the early phase of the Conditions Work Group, a tools section will be developed and the methods of evaluating economic valuation of goods and services will be included in that work.</p>	<p>Review of the state of art concerning effective methods for <i>economic valuation</i> of wetland functions, including "quick valuation appraisal" methods.</p>
	<p><i>Resolution VII.10</i>: To ensure the appropriate application of early warning indicators, it is essential that the processes of selecting, assessing, analyzing and basing decisions on indicator responses be contained within a structured but flexible form of assessment framework. In the context of the Ramsar Convention, a modified ecological risk assessment framework, termed <i>wetland risk assessment</i>, is encouraged. The framework aims to outline how Wetland Risk Assessment can act as the 'vehicle' for driving the process of predicting and assessing change in ecological character, with a particular emphasis on the application of early warning techniques;</p>	<p>Ramsar assistance in the development of the indicators that will be developed by the MA would be very valuable and would assist in formulating methods that could assist in the development of wetland risk assessments.</p>
	<p><i>Resolution VII.20</i>: Recommendation 4.6, Resolutions 5.3 and VI.12 and Action 6.12 of strategic Plan 1997-2002 which recognized the value of national <i>scientific inventories</i> for identifying sites suitable for inclusion in the List of Wetlands of International Importance (Ramsar List) under the convention. Considering that this Conference has also adopted Guidelines for Developing and implementing National Wetlands Policies (Resolution VII.6), the Wetland Risk assessment Framework (Resolution VII.10), the Strategic Framework and guidelines for application of the Ramsar Criteria for Identifying Wetlands of International Importance (Resolution VII.11) all of which would be greatly assisted by the availability of national scientific inventories.</p>	<p>The remote sensing resources that will be utilized in the MA can be of assistance. The MA has already emphasized to the remote sensing community the importance of assembling global coverage of wetlands.</p> <p>Would it be helpful to Ramsar if the MA were address the development of "hot spot" detection methods for wetlands?</p>

	<p>Review of the state of the art concerning <i>methodologies</i> to calculate water allocations to ensure effective water ecosystems functions.</p>	<p>It would be helpful to know more about how Ramsar is considering/defining water allocation systems and their functions.</p>
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### ANNEX III

#### DONORS AND SUPPORTING AGENCIES

##### **Sponsors<sup>1</sup>:**

Global Environment Facility (GEF)  
United Nations Foundation (UNF)  
David and Lucille Packard Foundation  
The World Bank

##### **Cash Contributions to Core Budget:**

United Nations Environment Programme (UNEP)  
Government of Norway  
Rockefeller Foundation  
US National Aeronautic and Space Administration (NASA)  
Department for Environment, Food and Rural Affairs (DEFRA), UK

##### **In-Kind Contributions to Core Budget:**

Government of China (Support for China Assessment)  
Japan Ministry of Environment (Support for China Assessment)  
Asia-Pacific Environmental Innovation Strategy Project (APEIS – Support for China Assessment)  
Government of Norway (Support for Norway Assessment and Southern Africa)  
International Centre for Research in Agroforestry (ICRAF – Support for ASB Assessment)  
Stockholm University (Sweden Local Assessments)  
Tropical Resources Ecology Program (TREP – Southern Africa Assessment)  
Institute for Biodiversity (Support for Lake Constance Assessment)  
NASA  
The World Bank  
UNEP  
The World Fish Center - ICLARM  
United Nations Development Programme (UNDP)  
Food and Agriculture Organization of the UN (FAO)  
UN Education, Scientific and Cultural Organization (UNESCO)  
World Health Organization (WHO)

##### **Other In-Kind Services and Support<sup>2</sup>:**

The Australian National University  
Center for Environmental Science and Policy, Institute for International Studies, at Stanford University  
Center for Limnology, University of Wisconsin-Madison  
Centre for Environmental Economics and Policy in Africa (CEEPA), University of Pretoria, South Africa  
Chinese Academy of Sciences  
CNRS South Africa  
Conservation International (CI)  
Consultative Group on International Agricultural Research (CGIAR)  
The Cropper Foundation  
European Commission - Joint Research Centre

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<sup>1</sup> Contributing more than 10% to the overall MA budget

<sup>2</sup> Institutional support covering staff time, travel, lodging, and services rendered in support of the MA. Includes Additional Financial and in-kind support



The Ford Foundation  
German Federal Environment Ministry  
Global Change and Terrestrial Ecosystems International Project Office  
Indian Institute of Science  
Institute for Biodiversity Network  
Institute for Economic Growth, Delhi (IEG)  
International Council for Science (ICSU)  
International Food Policy Research Institute (IFPRI)  
International Maize and Wheat Improvement Centre (CIMMYT)  
International Water Management Institute  
International Geosphere-Biosphere Programme (IGBP)  
Land-Ocean Interactions in the Coastal Zone International Project Office  
Land Use and Land Cover Change Research Grant (LOICZ)  
Meridian Institute  
Ministry of Science and Technology, China  
Namibian National Biodiversity Programme (through GTZ)  
NASA  
The National Centre for Epidemiology and Population Health at The Australian National University  
The National Institute for Environmental Studies, Ministry of Environment, Japan  
National Institute for Public Health and the Environment, The Netherlands  
Natural Environment Research Council - UK  
Norwegian Institute for Nature Research  
Ramsar Convention Bureau  
Smithsonian Tropical Research Institute (STRI)  
Social Science Research Network (SSRN)  
Stanford University  
Third World Academy of Sciences (TWAS)  
UNEP- World Conservation Monitoring Centre (UNEP-WCMC)  
UN Framework Convention to Combat Climate Change (UNFCCC)  
United Nations University, Institute for Advanced Studies, Japan (UNU/IAS)  
University of Maryland  
World Bank  
World Resources Institute

**Support for Exploratory Phase Activities: (Pilot Analysis of Global Ecosystems, World Resources Report: People and Ecosystems – the Fraying Web of Life, Millennium Assessment Exploratory Steering Committee)**

The Avina Group  
David and Lucille Packard Foundation  
Global Environment Facility  
Government of Norway  
Swedish International Development Authority (SIDA)  
Summit Foundation  
UNDP  
UNEP  
UNF  
United States Agency for International Development (USAID)  
Wallace Global Fund  
The World Bank

## ANNEX IV. ASSESSMENT OUTLINES

### CONCEPTUAL FRAMEWORK REPORT

(Working Title: “People and Ecosystems: Framework for Assessment and Action”)

*The Conceptual Framework report will be a description and rationale of the conceptual framework and methodologies that will be used in the MA, in order to provide guidance to the authors and inform the user community. For example, the conceptual framework will outline the strengths, weaknesses and controversies surrounding the full range of valuation methodologies and decision-making frameworks, but will not critically assess each of them, because the full range will be evaluated and used in the assessment. In contrast, specific guidance will be given regarding the approach to uncertainties and some aspects of the costing methodologies.*

#### **Chapter 1. Introduction and Conceptual Framework**

**Authors:** Gretchen Daily, Stanford University, United States

##### **Assessment Panel**

Angela Cropper, Cropper Foundation, Trinidad & Tobago (co-chair)

Harold Mooney, Stanford University, United States (co-chair)

Doris Capistrano, The Ford Foundation, India

Steve Carpenter, University of Wisconsin, United States

Kanchan Chopra, Institute of Economic Growth, India

Partha Dasgupta, University of Cambridge, United Kingdom

Rashid Hassan, University of Pretoria, South Africa

Rik Leemans, National Inst. for Public Health & the Environment, Netherlands

Robert May, University of Oxford, United Kingdom

Walter Reid, Millennium Ecosystem Assessment, Malaysia

Bob Scholes, Council for Science and Industrial Research, South Africa

Prabhu L. Pingali, International Maize and Wheat Improvement Center, Mexico

Cristian Samper, Smithsonian Tropical Research Institute, Panama

Zhao Shidong, Chinese Academy of Sciences, China

- 1.1 Motivation for the MA
  - 1.1.1 Global context
- 1.2 Role of Ecosystem Services
- 1.3 Demand from users
  - 1.3.1 Motivation for ‘multiscale’ structure
- 1.4 Conceptual Framework
  - 1.4.1 Merits and drawbacks of this framework
  - 1.4.2 How the need for this sort of framework has arisen
- 1.5 Expected Outcomes of the MA
  - 1.5.1 Expectations for how the MA process and findings will be used and will influence decisions
  - 1.5.2 Recognition that any assessment process can empower some stakeholders at the expense of others

#### **Chapter 2. Ecosystems as Providers of Services**

**Authors:** Juan Carlos Castilla, P-Universidad Catolica de Chile, Chile

Steve Carpenter, University of Wisconsin, United States

Shahid Naem, University of Washington, United States

Ian Noble, World Bank, United States

Zhiyun Ouyang, Chinese Academy of Sciences, China

Jane Turpie, University of Cape Town, South Africa

Meryl Williams, ICLARM – The World Fish Center, Malaysia

- 2.1 Introduction
- 2.2 Ecosystems
- 2.3 Ecosystem services

- 2.3.1 From ecology to economics
- 2.3.2 Defining ecosystem goods and services
- 2.3.3 When does a function become a service to society?
- 2.3.4 Biodiversity and other ecosystem features with multiple functions
- 2.4 Classification of Ecosystem Services
  - 2.4.1 Provisioning services to society
  - 2.4.2 Supporting services to society
  - 2.4.3 Enriching (cultural) services to society
- 2.5 Assessment of services in the MA
- 2.6 Variability in the supply of ecosystem services
  - 2.6.1 Spatial variability in provision of ecosystem services
  - 2.6.2 Sustainability
  - 2.6.3 Ecosystem health and anthropogenic disturbance in determining output of services

**Chapter 3. Ecosystem Changes and Human Well-Being: Relationships And Impacts**

**Authors:** Robert Chambers, University of Sussex, United Kingdom  
 Kanchan Chopra, Institute of Economic Growth, India  
 Anantha Duraiappah, International Institute for Sustainable Development, Canada  
 Anthony McMichael, Australian National University, Australia  
 Niu Wen-yuan, Chinese Academy of Sciences, China

- 3.1 Introduction
  - 3.2 Ecosystem Change and Human Wellbeing: Definitions, linkages, impacts, response strategies
    - 3.2.1 Human Wellbeing: definition, scope and relationship to poverty
    - 3.2.2 Relationships between environment, population, poverty and health
    - 3.2.3 Present versus Future
  - 3.3 Ecosystem Services and Human Wellbeing: Linkages
    - 3.3.1 Ecosystem services
    - 3.3.2 Forms of linkage (to be described, with examples)
    - 3.3.3 Changeability of relationships
  - 3.4 Strategies to Enhance Wellbeing
  - 3.5 Institutions
    - 3.5.1 Effectiveness
    - 3.5.2 Efficiency and for whom?
    - 3.5.3 Conflicts and Tensions
    - 3.5.4 Examples
    - 3.5.5 Discussion
  - 3.6 Ecosystem Change and Non-Human Species
  - 3.7 Summary/Conclusion
- Appendix I : Responsible Wellbeing – Robert Chambers

**Chapter 4. Social and Economic Drivers of Changes in Ecosystem Goods And Services**

**Authors:** Eric Lambin, University of Louvain, Belgium  
 Alex McCalla, University of California-Davis, United States  
 Rik Leemans, National Inst. for Public Health & the Environment, Netherlands  
 Nandita Mongia, United Nations Development Programme, United States  
 Prabhu L. Pingali, International Maize and Wheat Improvement Center, Mexico  
 Robert Watson, World Bank, United States

- 4.1 Introduction
- 4.2 Main primary and proximate drivers of changes in ecosystem goods and services

- 4.2.1 Primary drivers
- 4.2.2 Proximate drivers
- 4.2.3 Mediating human-environment conditions
- 4.3 System dynamics
- 4.4 Nature of impacts
- 4.5 Policy implications

**Chapter 5. Decision-Making Framework and Response Options**

**Authors:** Tom Dietz, George Mason University, United States  
 Kirk Hamilton, World Bank, United States  
 Bedrich Moldan, Charles University, Hungary  
 Steve Percy, Former CEO of BP America, United States  
 Robert Prescott-Allen, PADATA, Inc., Canada  
 Ferenc Toth, International Institute for applied Systems Analysis - IIASA, Austria

- 5.1 Introduction
- 5.2 Responses: options and choices
- 5.3 Decision analytical frameworks and tools
- 5.4 Indicators

**Chapter 6. The Concept of Ecosystem Value and Valuation Approaches**

**Authors:** J. Baird Callicott, University of North Texas, United States  
 Rudolf de Groot, Wageningen University, Netherlands  
 Madhav Gadgil, Indian Institute of Science, India  
 Rashid Hassan, University of Pretoria, South Africa  
 Stefano Pagiola, World Bank, United States  
 Cristian Samper, Smithsonian Tropical Research Institute, Panama

- 6.1 The Concept of Total Value and Approaches to Valuation
  - 6.1.1 The Total Value Framework (corresponds to the ecosystem services box and other life on earth element of the overall MA framework)
- 6.2 Non-Utilitarian Approach and Methods
- 6.3 The Utilitarian Approach and Valuation Methods
  - 6.3.1 Observed Behavior Measures of Economic Value
  - 6.3.2 Hypothetical Behavior Measures of Economic Value
- 6.4 Capital Value
- 6.5 Scaling and Uncertainty in Valuation
  - 6.5.1 Scaling
  - 6.5.2 Uncertainty and Valuation

**Chapter 7. Dealing with Scale**

**Authors:** Doris Capistrano, The Ford Foundation, India  
 Louis Lebel, Chang Mai University, Thailand  
 Gerhard Petschel-Held, Potsdam Institute for Climate Impact Research, Germany  
 Cristian Samper, Smithsonian Tropical Research Institute, Panama  
 Bob Scholes, Council for Science and Industrial Research, South Africa  
 Thomas Wilbanks, Oak Ridge National Laboratory, United States

- 7.1 Why scale matters
- 7.2 Scales and Scaling
  - 7.2.1 Scales in ecological and human systems
  - 7.2.2 Scaling rules
  - 7.2.3 Time-space linkages
  - 7.2.4 Hierarchy and Networks
- 7.3 Integration across scales

- 7.3.1 Interaction across scales in dynamic systems
- 7.3.2 Integrating across scale
- 7.4 Scale and Policy
  - 7.4.1 Politics of Scale
  - 7.4.2 Institutional Fit and Interplay

## **Chapter 8. Analytical Approaches and Issues for the Millennium Assessment**

**Authors:** Joseph Alcamo, University of Kassel, Germany  
Elena Bennett, University of Wisconsin, United States  
Stephen Carpenter, University of Wisconsin, United States  
Jiyuan Liu, Ministry of Water Resources, China  
Jean Paul Malingreau, Joint Research Centre of the European Commission, Belgium  
Daniel Pauly, University of British Columbia, Canada  
Taylor Ricketts, Stanford University, United States  
Stanley Wood, International Food Policy Research Institute – IFPRI, United States  
Monika Zurek, International Maize and Wheat Improvement Center, Mexico

- 8.1 Introduction
  - 8.1.1 Objectives of chapter
  - 8.1.2 Definitions
- 8.2 Past and Present Conditions and Trends
  - 8.2.1 General typology of data, indicators, and models relevant to the M.A.
  - 8.2.2 Issues involved in analyzing conditions and trends
- 8.3 Scenario Issues and Approach
  - 8.3.1 Introduction
  - 8.3.2 M.A. Approach
  - 8.3.3 Scale
  - 8.3.4 Relationship with the Conceptual Framework

## **Annex I. Guidelines for Handling Uncertainty**

**Authors:** Neville Ash, UNEP-World Conservation Monitoring Centre, United Kingdom  
Richard Moss, United States Global Change Research Program, United States  
Stephen Schneider, Stanford University, United States

- I.1 Introduction
- I.2 Guidance for improving consistency and clarity
- I.3 Graphical Communication of Uncertainty

## **Annex II. Glossary**

# **SUB-GLOBAL ASSESSMENT REPORT**

## **Working Group Co-Chairs**

Doris Capistrano, The Ford Foundation, India  
Cristian Samper, Smithsonian Tropical Research Institute, Panama

### **Authors:**

Working Group Co-Chairs  
Jacqueline Ashby, International Center for Tropical Agriculture (CIAT), Colombia  
Madhav Gadgil, Indian Institute of Science, India  
Habiba Gitay, Australian National University, Australia  
David Kaimowitz, Center for International Forestry Research – CIFOR, Indonesia  
Gerhard Petschel-Held, Potsdam Institute for Climate Impact Research, Germany

Jeffrey Romm, U.C. Berkeley, United States  
Bob Scholes, Council for Science and Industrial Research, South Africa  
Dan Tunstall, World Resources Institute, United States  
Colin Filer, Australian National University (PNG Assessment), Australia  
Carl Folke, Stockholm University (Sweden Local Assessment), Sweden  
Yanhua Liu, Ministry of Science and Technology (Western China Assessment), China  
Signe Nybo, Norwegian Institute for Nature Research (Norwegian Assessment), Norway  
Tom Tomich, International Centre for Research in Agroforestry (Alternatives to Slash  
and Burn Site Assessments), Kenya

## **Summary for Policy-Makers**

### Part I: Introduction

#### **Chapter 1. Introduction**

- 1.1 Contextualisation of sub-global assessments
- 1.2 Epistemological issues
- 1.3 Multi-scale assessment theme
- 1.4 Issues of power relations

#### **Chapter 2. Overview of the MA Conceptual Framework**

### Part II: Adaptation of the MA Conceptual Framework

#### **Chapter 3. Primary and Proximate Drivers**

What were the differences and commonalities in how the primary and proximate drivers were developed, defined and used in the various sub-global assessments?

#### **Chapter 4. Ecosystem Services**

What were the differences and commonalities in how ecosystems services were defined and analyzed across the sub-global assessments?

#### **Chapter 5. Human Well-being**

What were differences and commonalities in how did the sub-global assessments incorporated and assessed the emergent issues of human well-being and poverty reduction?

#### **Chapter 6. The Multi-scale Approach**

What were differences and commonalities in how the assessments addressed the multi-scale features of the process? What was scale-dependent and independent?

### Part III: Undertaking sub-global assessments

#### **Chapter 7. Assessment Process**

Processes used, methodologies, stakeholder engagement

#### **Chapter 8. Condition**

What were the difficulties and what are the lessons learnt for future condition and trends?  
Was there adequate information available on condition and trends at the sub-global scales

#### **Chapter 9. Scenarios**

How and what broad types of scenarios were developed?  
What interactions were there with the global scenarios work?

## **Chapter 10. Responses**

What kinds of responses were developed in the sub-global assessments, what interactions were there with global level work?

### *Part IV: Evaluation and reflections*

## **Chapter 11. Community Assessments**

Unique features, strengths and weaknesses of assessments conducted at the local scale

## **Chapter 12. Basin, National, Regional and Global Assessments**

Unique features, strengths and weaknesses of assessments conducted at the drainage basin, national, regional, global etc. levels (may be combined with the Ch. 4 on scale)

## **Chapter 13. Bridging Epistemologies**

How were different forms of knowledge (local and indigenous) been used and incorporated in the sub-global assessments? Did this strengthen the findings or their impact?

## **Chapter 14. Synthesis**

Reflections on the process of multi-scale ecosystem-based assessments as experienced at the sub-global levels

How did the multiscale approach influence the findings, capacity building, and impact of the assessments?

How did it empower or disempower certain stakeholders or users?

What are the options for the future and the range of possibilities?

## **Annex I**

Includes all approved Sub-Global Assessments; reference also to other ongoing works-in-progress

I.1 Brief summaries (1-2 pg.) on each SGA

I.2 Common structure – key elements need to be identified

I.3 Pointers to further information/resources on each SGA, e.g. contact info, reference publications

## **CONDITIONS ASSESSMENT REPORT**

### **Working Group Co-Chairs**

Bob Scholes, Council for Science and Industrial Research, South Africa

Rashid Hassan, University of Pretoria, South Africa

**Authors:** Listed by Chapter where available

### *Part I – Introduction*

## **Chapter 1. Preface and Roadmap**

**Authors:** Bob Scholes, Council for Science and Industrial Research, South Africa  
Rashid Hassan, University of Pretoria, South Africa

1.1 Purpose of this document

1.2 Process leading to this document

1.3 Organisation of the document

1.4 Other related documents

1.5 Acknowledgements

## **Chapter 2. Overview of the MA Conceptual Framework**

2.1 The origins, scope and nature of the Millennium Assessment

- 2.2 The basic structure of the conceptual framework
- 2.3 The drivers of change—primary and proximate
- 2.4 Fundamentals ecosystem concepts and services
- 2.5 The concepts of tradeoffs in services
- 2.6 How ecosystem services are valued
- 2.7 Dealing with temporal and spatial variability
- 2.8 Looking to the future
- 2.9 Possible response options for favorable outcomes
- 2.10 Summary

### **Chapter 3. Methods and Tools**

**Authors:** Ruth DeFries, University of Maryland, United States  
Stefano Pagiola, World Bank, United States

- 3.1 Introduction
- 3.2 Data availability for assessing linkages between ecosystem condition, services and well-being
- 3.3 Overcoming the data limitations
- 3.4 Tools for assessing conditions and trends
- 3.5 Assessing impacts on human well-being and biodiversity

### **Chapter 4. Drivers**

**Authors:** TBD

*To come*

### **Chapter 5. Biodiversity**

**Authors:** Juan Carlos Castilla, P-Universidad Catolica de Chile, Chile  
Georgina Mace, Zoological Society of London, United Kingdom  
Hillary Masundire, University of Botswana, Botswana

- 5.1 Introduction
  - 5.1.1 Levels of organisation
  - 5.1.2 Spatial structure
  - 5.1.3 Value of biodiversity
- 5.2 Magnitude and distribution
  - 5.2.1 Species
  - 5.2.2 Ecosystem
- 5.3 Effects of historical changes on factors that affect biological diversity
  - 5.3.1 Species
  - 5.3.2 Ecosystems
  - 5.3.3 Ecosystem structure, stability and function
- 5.4 Proximate and ultimate causes of observed change
  - 5.4.1 Drivers
  - 5.4.2 Interactions between drivers and biological systems
- 5.5 Concluding summary (addressing sustainability issues, near future)

### **Chapter 6. Patterns and Trends in Ecosystem Conditions and Human Wellbeing**

**Authors:** Suresh Babu, International Food Policy Research Institute - IFPRI, United States  
Kirk Hamilton, World Bank, United States

- 6.1 Executive Summary
- 6.2 Literature Review
- 6.3 Conceptual Framework
- 6.4 General patterns on the measures of wellbeing as they relate to ecosystems
- 6.5 Trends in the Measures of Wellbeing as they relate to the ecosystem services
- 6.6 Policy implications



6.7 Conclusion Section

**Chapter 7. Vulnerable Peoples and Places**

**Authors:** Roger Kasperson, Stockholm Environment Institute, Sweden

- 7.1 Introduction
- 7.2 Conceptual Discussion
  - 7.2.1 Definition and key concepts
  - 7.2.2 Conceptual framework
  - 7.2.3 Assessing vulnerability
- 7.3 Lessons From Experience With Natural Disasters
- 7.4 Selected Case Examples Of Major Problems And Vulnerable Peoples
- 7.5 Implications For Management And Resilience Building

**Chapter 8. Human Response**

**Authors:** Mark Levy, CIESIN, Columbia University, United States

- 8.1 Introduction
- 8.2 Analytical framework
- 8.3 Definition and measurement of human response attributes
- 8.4 Assessment of current condition and trends in human responses
- 8.5 Illustrative examples of success and failure
- 8.6 Synthesis and conclusions

*Part II – Ecosystem Services*

**Chapter 9. Freshwater**

**Authors:** Christian Leveque, CNRS – National Center for Scientific Research, France  
Charles Vorosmarty, University of Hew Hampshire, United States

- 9.1 Nature of the Issue
- 9.2 Current state and recent and historical trends in demand
- 9.3 Current state and recent and historical trends in supply
- 9.4 Relative distribution of demand & supply
- 9.5 Proximate and ultimate causes of observed changes
  - 9.5.1 Major factors
  - 9.5.2 Management (or mismanagement) strategies undertaken in past and implications for future management
- 9.6 Consequences of changes in the service of human well being

**Chapter 10. Food**

**Authors:** Simeon Ehui, International Livestock Research Institute - ILRI, Ethiopia  
Stanley Wood, International Food Policy Research Institute - IFPRI, United States

- 10.1 Nature of the Issues
- 10.2 Structure of Food Production
- 10.3 Trends in Demand
- 10.4 Trends in Production/Supply
- 10.5 Relative Distribution of Demand and Supply
- 10.6 Historic Changes in Ecosystems
- 10.7 Proximate and Ultimate Causes of Changes
- 10.8 Conclusions addressing human well-being and Sustainability Issues

**Chapter 11. Fibre, Timber and Fuel**

**Authors:** TBD

- 11.1 Nature of the issues

- 11.1.1 A Description of the Services
- 11.2 Current State and Trends in Demand
- 11.3 Current State and Trends in Supply
  - 11.3.1 Effects on the Provisioning Ecosystems
- 11.4 Relative Distribution of Demand and Supply
- 11.5 Proximate and Ultimate Causes of the Observed Changes
- 11.6 Conclusions, Sustainability etc

## **Chapter 12. Other Biological Products**

**Authors:** TBD

- 12.1 Nature of the Issues
  - 12.1.1 A Description of the Services
- 12.2 Current State and Trends in Demand
- 12.3 Current State and Trends in Supply
  - 12.3.1 Effects on the Provisioning Ecosystems
- 12.4 Relative Distribution of Demand and Supply
- 12.5 Proximate and Ultimate Causes of the Observed Changes
- 12.6 Sustainability Issues

## **Chapter 13. Nutrient Cycling and Fertility**

**Authors:** Michel Loreau, Laboratoire d'Ecologie, France

- 13.1 Nature of the issue
- 13.2 Definition and general features
- 13.3 Nutrient cycling
- 13.4 Magnitude and distribution of the service
  - 13.4.1 Mineralisation and nutrient capture (BNF)
  - 13.4.2 Soil physical structure: mechanical activities of living organisms and abiotic processes
  - 13.4.3 Synchrony (or buffering...)
  - 13.4.4 Effects of historical changes in ecosystems
- 13.5 Proximate and ultimate causes of observed changes
  - 13.5.1 Terrestrial
  - 13.5.2 Inland Waters
  - 13.5.3 Ocean
- 13.6 Consequences of changes in the service on human well-being

## **Chapter 14. Biological Regulation of Plant and Animal Distribution and Health**

**Authors:** Patrick Lavelle, IRD/University of Paris VI, France

- 14.1 Nature of the issue
- 14.2 Magnitude and distribution of the service
  - 14.2.1 Effect of historical changes in ecosystems on the underlying capacity of ecosystems to supply the service
- 14.3 Proximate and ultimate causes of observed changes
- 14.4 Consequences of changes in the service on human well-being
- 14.5 Current status and historical trends in the demand : the Green Revolution and the “Second Paradigm”
- 14.6 Current status and historical trends in the supply
  - 14.6.1 Oceans
- 14.7 Relative distribution of demand and supply
  - 14.7.1 Terrestrial
  - 14.7.2 Oceans

**Chapter 15. Atmospheric Composition and Climate Regulation**

**Authors:** Victor Brovkin, Potsdam Institute for Climate Impact Research, Germany  
Joanna House, Max Planck Inst Biogeochemie, Germany

- 15.1 Atmospheric Composition
  - 15.1.1 Nature of the Issue
  - 15.1.2 Impacts of “greenhouse gases” on climate change:
  - 15.1.3 Impacts of acid rain:
  - 15.1.4 Impacts of tropospheric O<sub>3</sub>:
  - 15.1.5 Impacts of stratospheric O<sub>3</sub> depletion:
  - 15.1.6 Impacts of particulates and other atmospheric pollutants:
  - 15.1.7 Fertilising effects of CO<sub>2</sub> and N
- 15.2 The Atmospheric Agents/constituents
  - 15.2.1 Carbon dioxide
  - 15.2.2 Methane
  - 15.2.3 Nitrogen
  - 15.2.4 Volatile Organic Compounds (VOCs)
  - 15.2.5 Other Products of Biomass Burning
- 15.3 Regulation of Local Climate Patterns by Ecosystems
  - 15.3.1 Nature of the Issue
  - 15.3.2 Magnitude and distribution including effects of ecosystems on changes in impacts
  - 15.3.3 Proximate and ultimate causes
  - 15.3.4 Conclusion and sustainability

**Chapter 16. Human Infectious Disease Agents**

**Authors:** Ulisses Confalonieri, National School of Public Health, Brazil  
Jonathan Patz, Johns Hopkins University, United States

- 16.1 Introduction – Nature of issue
  - 16.1.1 Overview of continued importance of infectious diseases
  - 16.1.2 Basic ecology of infectious diseases (e.g., agent, vector, host)
- 16.2 Magnitude and Distribution of the Problem
  - 16.2.1 Brief reference to disease-relevant drivers (from chap.4)
  - 16.2.2 Risks and benefits of ecosystem change
- 16.3 Observed Changes of links between ecosystems and human and zoonotic infectious diseases.
  - 16.3.1 Overview on changing biomes and disease emergence or reemergence
  - 16.3.2 Geographic variability of the effect of changing biomes on disease
  - 16.3.3 Mechanisms involved in the production of disease outbreaks
  - 16.3.4 Diseases and Changing Natural Systems (including Case Studies)
  - 16.3.5 Diseases and Managed Systems
- 16.4 Special ecological situations for transmission
- 16.5 Concluding summary
  - 16.5.1 Prospects for ecological disruption and disease emergence and re-emergence
  - 16.5.2 Priority knowledge gaps
- 16.6 Tools and methods (e.g., remote sensing technologies) in epidemiological surveillance and other approaches)
- 16.7 Future directions: available and recommended short- and long-term interventions

**Chapter 17. Waste Processing and Detoxification**

**Authors:** TBD

- 17.1 Nature of the issue
- 17.2 Magnitude and distribution of the service

- 17.2.1 Effects of historical changes in ecosystems on the underlying capacity of ecosystems to supply the service
- 17.3 Proximate causes of observed changes
- 17.4 Sustainability issues

**Chapter 18. Protection from Flooding, Erosion, Storms, & Fire**

**Authors:** TBD

- 18.1 Nature of the Issue
- 18.2 Magnitude and Distribution of the Service
  - 18.2.1 Effects of Historical Changes on Underlying Capacity
- 18.3 Proximate and Ultimate Causes of Observed Changes
- 18.4 Concluding summary, addressing sustainability

**Chapter 19. Cultural and Amenity Services**

**Authors:** Rudolf de Groot, Wageningen University, Netherlands  
P.S. Ramakrishnan, Jawaharlal Nehru University, India

- 19.1 Introduction
- 19.2 Cultural Diversity
- 19.3 Spirituality and Religion
- 19.4 Knowledge Systems
- 19.5 Traditional ecological knowledge
- 19.6 Formal scientific knowledge
- 19.7 Cultural Landscapes
  - 19.7.1 Sense of place
  - 19.7.2 Social interactions
- 19.8 Aesthetics and the Arts
- 19.9 Recreation

*Part III – Condition and Causality, Analysed by Ecosystems*

**Chapter 20. Cultivated systems**

**Authors:** Stanley Wood, International Food Policy Research Institute - IFPRI, United States

- 20.1 Summary
- 20.2 Scope
- 20.3 Profile of Conditions and Services
- 20.4 Tradeoffs Among Ecosystem Services Provided By Cultivated Systems
  - 20.4.1 Across different cultivated land sub-types
  - 20.4.2 Across time in the same cultivated system type
- 20.5 Resource Access and Use Rights in Cultivated Lands
- 20.6 Trends and Transitions in Cultivated Lands
- 20.7 Systems Strongly Linked to This System
- 20.8 Sustainability, Vulnerability, and Thresholds

**Chapter 21. Desert systems**

**Authors:** William Bond, University of Cape Town, South Africa  
Uriel Safriel, Ben-Gurion University of Ngev, Israel  
Irina Springuel, South Valley University, Egypt

- 21.1 Summary
- 21.2 Scope

- 21.2.1 Definition
  - 21.2.2 Brief description
  - 21.2.3 Major subtypes
  - 21.2.4 Land use and economic activities
  - 21.3 Major choices, conflicts and tradeoffs
  - 21.4 Land/water tenure and protection of desert lands.
  - 21.5 How system condition links to services
  - 21.6 Profile of condition and services
    - 21.6.1 The current and past condition of the system
    - 21.6.2 Services provided by the desert system
  - 21.7 Important processes driving changes
    - 21.7.1 Uncertainty as the key process
    - 21.7.2 Drought
    - 21.7.3 Others for each desert type
  - 21.8 Examples of responses
    - 21.8.1 Response of biota
    - 21.8.2 Human response
    - 21.8.3 Institution
    - 21.8.4 Systems strongly linked to this system
    - 21.8.5 By physical interactions
    - 21.8.6 By trade off between MA systems
    - 21.8.7 By obtaining essential human needs
  - 21.9 Sustainability and vulnerability
- Grass, shrub and savanna systems (To be Combined with Chapter 21)**
- 21.10 Summary
  - 21.11 Scope
    - 21.11.1 Temperate and montane grasslands
    - 21.11.2 Steppes (cold desert grasslands)
    - 21.11.3 Hot desert grasslands
    - 21.11.4 Tundra
    - 21.11.5 Winter rainfall grasslands
    - 21.11.6 Shrublands
    - 21.11.7 Tropical grassland and savannasForblands
    - 21.11.8 Hydromorphic grasslands
  - 21.12 Major choices, conflicts and tradeoffs
  - 21.13 Use rights and protection status
  - 21.14 How system condition links to services and wellbeing
  - 21.15 Profile of condition and services
  - 21.16 Important processes driving change
  - 21.17 Examples of responses
  - 21.18 Systems strongly linked to this system
  - 21.19 Sustainability and vulnerability

## **Chapter 22. Forest and woodland systems**

**Authors:** Adrian Newton, UNEP – WCMC, United Kingdom

- 22.1 Summary
- 22.2 Scope
- 22.3 Major choices, conflicts and trade-offs
- 22.4 Use rights and protection status

- 22.4.1 Use rights
- 22.4.2 Protection status
- 22.5 How system condition links to services
- 22.6 Profile of condition and services
- 22.7 Important processes driving changes
- 22.8 Examples of responses
- 22.9 Systems strongly linked to this system
- 22.10 Sustainability and vulnerability

### **Chapter 23. Urban Systems**

**Authors:** Gordon McGranahan, International Institute for Environment and Development – IIED, United Kingdom

- 23.1 Summary and key messages
- 23.2 Scope, Definition and Description
- 23.3 Major choices, conflicts and trade-offs
- 23.4 Use rights and protection status
- 23.5 Profile of conditions and services
- 23.6 Important processes driving change
- 23.7 Examples of responses
- 23.8 Systems strongly linked to this system
- 23.9 Sustainability and vulnerability

### **Chapter 24. Inland water systems (inc. wetlands)**

**Authors:** Max Finlayson, ERISS, Australia

- 24.1 Definition and description of inland waters (including wetlands)
  - 24.1.1 Outline types/sub-types and present maps and photos/illustrations
  - 24.1.2 Description of major types of habitats at global/sub-global levels.
  - 24.1.3 Maps of wetland distribution at global and continent-scales.
  - 24.1.4 Description of major ecosystem services provided
  - 24.1.5 Description of major pressures (threats/proximate drivers)
- 24.2 Tabulation (tables and text) by subtype and total
- 24.3 Use rights and protection status
- 24.4 Trends and transitions
- 24.5 Linkages to other systems
- 24.6 Sustainability, vulnerability and thresholds

### **Chapter 25. Coastal Systems**

**Authors:** Tundi Agardy, Independent, United States  
Jane Turpie, University of Cape Town, South Africa

- 25.1 Introduction
  - 25.1.1 Estuaries and marshes
  - 25.1.2 Mangroves
  - 25.1.3 Lagoons and salt ponds
  - 25.1.4 Intertidal shores & dunes (rock, sand, mud)
  - 25.1.5 Kelp forests
  - 25.1.6 Rock and shell reefs
  - 25.1.7 Seagrass and other soft-bottom communities
  - 25.1.8 Coral reefs and atolls
- 25.2 Comprehensive Overview of all coastal system subtypes
- 25.3 Characteristics, use rights and current service provision
- 25.4 Threats and drivers of change
- 25.5 Trends (up to present)

- 25.6 Key transitions/trouble spots (areas of rapid change)
- 25.7 Conditions based on vulnerability, thresholds and sustainability
- 25.8 Linkages with other systems
- 25.9 Conclusions

**Chapter 26. Marine Fisheries Systems**

**Authors:** Daniel Pauly, University of British Columbia, Canada

- 26.1 Introduction
- 26.2 Scope and Definitions
  - 26.2.1 Major ecosystem subtypes
- 26.3 Important processes driving changes
- 26.4 Elements to be considered:
  - 26.4.1 Tradeoffs
  - 26.4.2 Protected areas
  - 26.4.3 Marine contribution to global N and cycles
  - 26.4.4 Iron enrichment of ocean waters for carbon sequestration and fish production
  - 26.4.5 User (access) rights and equity issues
  - 26.4.6 Risk(s)
  - 26.4.7 Lessons learned

**Chapter 27. Polar systems**

**Authors:**

*To come*

**Chapter 28. Mountain systems**

**Authors:** TBD

- 28.1 Definition and description
- 28.2 Characteristics and statistics
- 28.3 Use rights and protection status
- 28.4 Trends and transitions
- 28.5 Linkages to other systems
- 28.6 Sustainability, vulnerability and thresholds

**Chapter 29. Island systems**

**Authors:** TBD

- 29.1 Introduction
- 29.2 Subtype analysis
- 29.3 Trends (to present)
- 29.4 Condition based on vulnerability, thresholds, sustainability
- 29.5 Linkages with other systems
- 29.6 Overview of all subtypes and conclusions

**Chapter 30. Drylands**

**Authors:** Mary Seely, Desert Research Foundation of Namibia, Namibia

- 30.1 Summary
- 30.2 Scope, Definition and Ecosystem Sub-Types
  - 30.2.1 Scope
  - 30.2.2 Definition
  - 30.2.3 Ecosystem Sub-Types
  - 30.2.4 Natural Processes and External Impacts
  - 30.2.5 Natural Ecosystems Functions' Responses to External Pressures
- 30.3 Trade-offs and Synergies

## 30.4 Linkages

### Chapter 31. Synthesis

**Authors:** Tony Janetos, Heinz Center, United States  
Roger Kasperson, Stockholm Environment Institute, Sweden

- 31.1 What are the most critical/important drivers of change?
- 31.2 What are the major trends and transformations within and among ecosystems/management types?
- 31.3 What are the major trends and transformations in the services provided to people and to other parts of the biosphere?
- 31.4 Where is there good evidence for non-linearities and thresholds in the provision of services?
- 31.5 What's the relationship between the transformation/use of the resources and the capacity of those resources to provide services?
- 31.6 What are the main technological and institutional opportunities for ensuring the continued provision of services?

## SCENARIOS ASSESSMENT REPORT

### Working Group Co-Chairs:

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### **Preface**

- *Role of this report in the MA and its relation to other Working Groups*
- *Roadmap of the book*

### **Chapter 1. Ecology in global scenarios**

- 1.1 Rationale for MA scenarios
  - 1.1.1 Focal questions
- 1.2 Unique contributions of ecology to global scenarios



- 1.2.1 Ecosystem robustness
- 1.2.2 Ecological dilemmas
- 1.2.3 Ecological greenlash
- 1.2.4 Connections between ecology and poverty (and poverty reduction)

## **Chapter 2. Review of Scenario Literature**

- 2.1 Review of the scenarios literature
  - 2.1.1 Scenario work pre-1995
  - 2.1.2 Environmental scenarios post-1995

## **Chapter 3. Assessment of Driving Forces**

- 3.1 Driver Introduction
- 3.2 Primary Drivers
  - 3.2.1 Demographic Drivers
  - 3.2.2 Economic Drivers
  - 3.2.3 Global Biophysical Drivers
  - 3.2.4 Socio-political Drivers
  - 3.2.5 Technological drivers
  - 3.2.6 Other drivers
- 3.3 Proximate Drivers
  - 3.3.1 Agricultural Production Systems
  - 3.3.2 Natural resource extraction methods (water harvesting, mining, fishing, etc.)
  - 3.3.3 Recreation systems
  - 3.3.4 Industrialization/Urbanization
  - 3.3.5 Waste disposal systems
  - 3.3.6 Biotic Invasions
  - 3.3.7 Extinction Risk
  - 3.3.8 Disease emergence and drug resistance
  - 3.3.9 Toxic pollutants
  - 3.3.10 Nutrient pollutants
  - 3.3.11 Land use changes

## **Chapter 4. Assessment of Ecosystem Goods and Services (EGS) Quantification and Modeling Approaches**

- 4.1 Overview of models used for EGS in Global Scenarios
  - 4.1.1 PoleStar
  - 4.1.2 IMAGE
  - 4.1.3 WaterGap
  - 4.1.4 AIM
- 4.2 Additional Models Used for MA Scenarios
  - 4.2.1 IBIS/HYDRA
  - 4.2.2 Rosegrant model
  - 4.2.3 Extinction model
  - 4.2.4 Invasion models
  - 4.2.5 Biodiversity models
  - 4.2.6 Epidemiological models
  - 4.2.7 Others
- 4.3 Uncertainties in Projection of EGS

- 4.3.1 Quantitative estimation of errors
- 4.3.2 Partially-quantifiable uncertainties
- 4.3.3 Surprises and Uncertainties Beyond the Scope of Expert Judgment
- 4.4 Overview of Models Used for Global Scenarios Relevant to EGS

## **Chapter 5. Introductory Overview of MA Scenarios**

- 5.1 Questions Addressed by Scenarios
  - 5.1.1 How will changes in ecosystems interact with global dynamics?
  - 5.1.2 How will future changes in EGS affect human well-being?
  - 5.1.3 What makes EGS and humanity more/less vulnerable to change?
  - 5.1.4 What types of global policies encourage learning and adaptation?
  - 5.1.5 What types of global policies foster robustness in ecosystems?
- 5.2 Framework
  - 5.2.1 Build upon driver dynamics from earlier scenarios
  - 5.2.2 Emphasize unique capabilities of MA (Chapter 1)
- 5.3 Rationale
- 5.4 MA scenarios will differ in the global economic and policy system
  - 5.4.1 Distorted policies
  - 5.4.2 Level playing field
  - 5.4.3 Proactive Change
- 5.5 MA scenarios will differ in assumptions about ecosystem dynamics
  - 5.5.1 Ecosystems are robust
  - 5.5.2 Ecosystems are fragile
- 5.6 Road map to scenario presentations:
  - 5.6.1 Similarities across all scenarios
  - 5.6.2 Forces that influence all scenarios
  - 5.6.3 Assumed constants across all scenarios

## **Chapter 6. Scenario 1a: Distorted Policies, Low Ecosystem Robustness**

- 6.1 Narrative, possibly written as by a historian looking back from 2050.
- 6.2 Boxes: characters in different parts of the world tell relevant stories in the course of the scenarios.
- 6.3 Quantification: Present key indicators in a consistent way in each scenario chapter.

## **Chapter 7. Scenario 1b: Distorted Policies, High Ecosystem Robustness** (Presentation parallels Chapter 6)

## **Chapter 8. Scenario 2a: Level Playing Field, Low Ecosystem Robustness** (Presentation parallels Chapter 6)

## **Chapter 9. Scenario 2b: Level Playing Field, High Ecosystem Robustness** (Presentation parallels Chapter 6)

## **Chapter 10. Scenario 3a: Proactive Change, Low Ecosystem Robustness** (Presentation parallels Chapter 6)

## **Chapter 11. Scenario 3b: Proactive Change, High Ecosystem Robustness** (Presentation parallels Chapter 6)

## **Chapter 12. Lessons Learned**

- 12.1 Cross-cutting comparison of scenarios

- 12.1.1 Comparison of each EGS across scenarios
- 12.1.2 Comparison of each Human Well-Being (HWB) indicator across scenarios
- 12.1.3 “Bundles” of EGS and HWB for selected places on earth, compared across the scenarios
- 12.1.4 Synthesis: lessons learned by comparing the scenarios
- 12.2 Lessons learned about ecology

### **Chapter 13. Synthesis**

- 13.1 Implications for biodiversity (e.g., what would it take to stop the loss of biodiversity)
- 13.2 Implications for wetlands
- 13.3 Implications for desertification
- 13.4 Implications for the private sector
- 13.5 What are the levers for creating a more resilient world?
- 13.6 How quickly do you need to act?
- 13.7 Where would action have the most effect?
- 13.8 Transition to Response Options Group
- 13.9 New contributions of MA scenarios
  - 13.9.1 Demonstration of the potential impacts of EGS on global change
  - 13.9.2 Examination of the foundation of EGS vulnerability, robustness
- 13.10 Robustness of MA scenarios to assumptions
  - 13.10.1 What if the “policy reform” track breaks down?
  - 13.10.2 Implications of surprise
  - 13.10.3 Gaps in modeling capability
  - 13.10.4 Etc.
- 13.11 Research needs: What innovations could be accomplished in the next 5-10 years that would significantly improve the next generation of EGS scenarios?

### **Annex(es): Quantitative Details and Methods**

## **RESPONSES ASSESSMENT REPORT**

### **Working Group Co-Chairs**

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**Authors:** Listed by Chapter where available

### **Part I Conceptual framework for evaluating responses**

#### **Chapter 1. Preface and Roadmap**

**Authors:** Kanchan Chopra, Institute of Economic Growth, India  
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#### **Chapter 2. Overview of the MA Conceptual Framework**

#### **Chapter 3. Typology of Responses**

**Authors:** W. Bradnee Chambers, United Nations University, Japan  
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#### **Chapter 4. Assessing Responses**

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*Part II Assessment of past and current responses*

**Chapter 5. Introduction**

**Chapter 6. Biodiversity**

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**Chapter 10. Nutrient Cycling**

**Authors:** Robert Howarth, The Ecosystems Center, United States

**Chapter 11. Waste Management, Processing and Detoxification**

**Authors:** Nimbe Adedipe, University of Ibadan, Nigeria

**Chapter 12. Flood and Storm Protection**

**Authors:** Anand Patwardhan, Indian Institute of Technology-Bombay, India

**Chapter 13. Biological Disease and Vector Control**

**Authors:** TBD

**Chapter 14. Climate regulation**

**Authors:** Jyoti Parikh, Indira Gandhi Institute of Development Research; India

**Chapter 15. Cultural services**

**Authors:** D.K. Bhattacharya, University of Delhi, India

**Chapter 16. Integrated Responses**

**Authors:** Katrina Brown, University of East Anglia, United Kingdom  
Jens Mackensen, United Nations Environment Programme, Kenya  
Kuperan Viswanathan, ICLARM - The World Fish Center, Malaysia

*Part III Synthesis: "Ingredients for successful responses"*

**Chapter 17. Lessons learned: Consequences for Ecosystems, Human well-being and Poverty Reduction**

**Authors:** Anantha Duraiappah, International Institute for Sustainable Development, Canada

Timothy Swanson, CSERGE, United Kingdom

**Chapter 18. Lessons learned: Consequences and Options for Human Health**

**Authors:** Carlos Corvalan, World Health Organization, Switzerland  
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**Chapter 19. Choosing Responses**

**Authors:** Bedrich Moldan, Charles University, Czech Republic  
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Ann Hamblin, Bureau of Rural Sciences, Australia  
Kirk Hamilton, World Bank, United States

**Chapter 20. Responses in Scenarios**

**Authors:** Dale Rothman, Maastricht University, The Netherlands

**Chapter 21. Uncertainties in assessing the effectiveness of responses**

**Authors:** John Dixon, World Bank, United States  
Gary Yeoh, Wesleyan University, United States

**Chapter 22. Ingredients for Successful Responses**

**Authors:** Ingrid Hartman, Humboldt University-Berlin, Germany