

The logo for the Asia-Pacific Network for Global Change Research (APN) features the letters 'APN' in a large, bold, blue serif font. A thin horizontal line with an arrow pointing to the right is positioned across the middle of the letters 'A' and 'P'.

APN

Asia-Pacific Network for Global Change Research

**Building local capacity for
global change research:
the Millennium Ecosystem
Assessment sub-global
activities in the
Asia-Pacific region**

Final report for APN project 2004-05-CMY-Reid

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**Building local capacity for global change research: the
Millennium Ecosystem Assessment sub-global activities in
the Asia-Pacific region**

2004-05-CMY-Reid

Final Report submitted to APN

Overview of project work and outcomes

Non-technical summary

In March 2005, findings from the largest and most authoritative assessment of the connections between ecosystem health and human well-being, the Millennium Ecosystem Assessment (MA), were released. Central to the MA's success was a set of 'sub-global assessments' conducted at scales ranging from local communities to multi-country regions. These sub-global assessments, in locations in the Asia-Pacific and worldwide, were undertaken as part of the MA together with the global assessment. APN funds were used to increase the participation of Asia-Pacific researchers in two core activities: a workshop on modeling and scenario-building, and meetings of the MA Sub-global Working Group. These activities helped to improve the technical capabilities of scientists in the region to develop and quantify future scenarios of ecosystem change. They also strengthened regional cooperation in the area of ecosystem change research through the exchange of data and lessons learned, and increased the participation of scientists in the region in global change research. Overall, this increased capacity to undertake integrated ecosystem assessments in the region contributes in the longer term to improved environmental decision-making at every scale of governance.

Objectives

The main objectives of the project were to:

1. Increase the capacity of individuals and organizations in the Asia-Pacific region to conduct multi-scale, integrated assessments of ecosystem change and human well-being.
2. Meet decision-makers' needs for information on the consequences of ecosystem change for human well-being and options for enhancing human well-being without undermining ecosystems.
3. Increase the training and participation of junior scientists in the MA in order to ensure long-term impact on the capacity to conduct global change research in the Asia-Pacific region.
4. Enhance mutual learning among the MA experts and increase regional cooperation on global change research.

Amount received for each year supported and number of years supported

2003: \$25,600

2004: \$23,000

Participating Countries

Australia, China, Fiji, India, Indonesia, Malaysia, Papua New Guinea, the Philippines, Thailand, Vietnam

Work undertaken

The specific MA sub-global activities supported by APN funds included a workshop on modeling and scenario-building held in Penang, Malaysia in April 2003, and meetings of the MA Sub-global Working Group in Alexandria, Egypt in March 2004 and in Kuala Lumpur, Malaysia in September 2004.

The four-day workshop on scenarios and modeling held in Penang involved 33 participants from the various MA sub-global assessments, including 15 from the Asia-Pacific who were

supported by APN. The workshop was designed to provide training on the process of developing scenarios, including the use of quantitative models on the impacts of changes in driving forces on ecosystems and human well-being, as well as developing plausible storylines. During the workshop, participants were introduced to the strengths and weaknesses of various approaches to scenarios (e.g. qualitative vs. quantitative, exploratory vs. anticipatory). Specific types of scenarios and modeling approaches, including those used for climate change (e.g. the IPCC emissions scenarios), land use and land cover change, socio-economic change (e.g. Shell), and UNEP's GEO-3 scenarios, were presented. Specific methods used by the sub-global assessments, such as the local village assessments in India, were shared. Scenarios were also discussed as a tool for engagement with stakeholders. Participants then joined small group exercises to gain more hands-on experience in building scenarios. Structured to be highly interactive, the workshop included significant discussion time in breakout groups.

The MA Sub-global Working Group meeting in Alexandria was the fourth meeting of the working group, involving 70 participants, of which about 30 were from the Asia-Pacific region. The main objectives of the meeting were to review the progress of the sub-global assessments within the broader MA process including linkages with the global assessment, and to ensure progress on the working group report which was one of the core technical assessment volumes of the MA. Every MA sub-global assessment produces reports and other products for assessment users in their respective locations, but the working group report is a synthetic document which analyzes the approaches used and the lessons learned across the entire set of sub-global assessments. Extensive information was shared by representatives of the sub-global assessments with authors of each chapter of the report, through "knowledge market" sessions organized specifically for that purpose. The working group also discussed and refined drafts of the Summary for Decision-makers and the synthesis chapter of the report. Significant time was spent by participants in teams of authors for each chapter, developing the draft texts and main messages of each chapter. The meeting was held immediately after the MA's international conference on Bridging Scale & Epistemologies, which enabled participants to interact with other experts and practitioners interested in scale and knowledge issues in assessments.

The fifth meeting of the Sub-global Working Group in Kuala Lumpur was attended by about 50 participants, of which around 20 were from the Asia-Pacific region. The main objective of the meeting was to revise the draft chapters of the working group report in the light of comments received during the internal review of those chapters. The chapters were subsequently subjected to external review by experts and governments. This meeting was part of a combined meeting of all of the MA working groups, which also allowed for direct exchanges with authors of the MA global assessment, as the chapters from all working groups were being finalized.

Results

The report of the MA Sub-global Working Group will be published by Island Press in September 2005 as *Multiscale Assessments: Findings of the Sub-global Assessments Working Group*, Volume 4 in the *Ecosystems and Human Well-being* series of MA technical reports. The report synthesizes the experiences and lessons learned from the entire set of MA sub-global assessments. Chapters on key themes in integrated ecosystem assessments include ecosystem services and human well-being, multi-scale approaches, knowledge systems, community assessments, and the assessment process. Other chapters examined the methods and approaches used for specific technical assessment components, such as drivers of ecosystem change, condition and trends of ecosystem services and human well-being, scenarios, and responses to changes in ecosystems and well-being.

In addition to the working group report, individual sub-global assessments have also produced products targeted at the primary audiences in their respective locations. In the Asia-Pacific region, these include the assessments in Western China, the Laguna Lake Basin in the Philippines, the Downstream Mekong Wetlands in Vietnam, and Jakarta Bay and Bunaken National Park in Indonesia. These products include printed reports, CDs, and websites.

The long-term impact and results of these activities, however, can only be known in a few years. These can principally be measured in terms of the contribution of assessment results to improved ecosystem-related decision-making in the locations of the sub-global assessments, and the establishment of further sub-global assessments based on the MA framework and approach in other locations and countries. The achievements to-date have been encouraging; for example, the Ministry of Science and Technology and the State Environmental Protection Administration jointly launched the findings of the Western China assessment with the Executive Director of UNEP, Dr Klaus Toepfer and the Minister of Science and Technology, Prof Xu Guanhua, in attendance. Government agencies in China, Indonesia and Vietnam have also welcome the assessment findings and provided funding in support of the assessment activities.

Relevance to APN scientific research framework and objectives

With respect to the APN priority areas, this project focused strongly on Human Dimensions of Global Change. More generally, the MA assessment framework is consistent with the overarching APN research framework. In particular, the MA gave emphasis to Changes in Terrestrial Ecosystems and Biodiversity, Changes in Coastal Zones and Inland Waters and addressed with somewhat less emphasis (since these are addressed by IPCC) Climate Change and Variability and Changes in Atmospheric Composition. A core feature of the MA was the integration of findings of natural science with social and economic factors. The motivation behind the MA was to provide input to policy-making and implementation. Each of the sub-global assessments used the MA framework, with adaptations as required to local conditions and information needs.

Self evaluation

The MA sub-global assessments were an experiment in applying the MA conceptual framework on the ground in varied locations and circumstances worldwide. In some contexts, complementary conceptual frameworks were also needed to capture the complex and dynamic nature of interactions between ecosystems and humans. Multi-scale assessments also face additional challenges related to analytical approaches and stakeholder involvement. As such, these assessments are resource-intensive and time-intensive, and adequate expertise, leadership, funding and time are needed to ensure success; not all the MA sub-global assessments have been completed, although this was recognized from early in the process and was factored into the MA design. Better geographical coverage and representation of ecosystems could have been achieved, but this was weighed against the benefits of greater innovation, diversity and user demand from a bottom-up selection process for assessments. Overall, the MA sub-global assessments have catalyzed the development of new tools and methodologies, and have provided information for better decision-making on sustainable management of ecosystems for human well-being. The intangible results, primarily related to capacity-building, have been important as well, complemented by the network of institutions and researchers developed during the course of the MA.

Potential for further work

Follow-on activities to the MA have been discussed in various meetings, including by the MA

Board and representatives of partners institutions. Activities that have been identified include the development of a methodology manual (together with WRI, UNU and the World Bank Institute), training workshops in different regions once the manual and associated training modules have been developed, and continued coordination of the network of sub-global assessments and support for further fund-raising for these assessments – in collaboration with ICSU and its interest in place-based research. UNEP is preparing a medium-sized project proposal to GEF, but co-financing will also be needed to match the GEF funds.

Publications

Institute of Geography, 2005: *Downstream Mekong River Wetlands Ecosystem Assessment: Synthetic Report*. Institute of Geography, Vietnamese Academy of Science and Technology, Hanoi, 227pp.

Kementerian Lingkungan Hidup, 2004: *Conditions and Trends of the Jakarta Bay and the Bunaken National Park Ecosystems – Indonesia*. Deputi Pelestarian Lingkungan, Kemenerian Lingkungan Hidup, Jakarta, 50pp.

Lasco, R.D., M.V.O. Espaldon, M.A. Tapia, 2005: *Ecosystems and People: The Philippine Millennium Ecosystem Assessment (MA) Sub-global Assessment – Synthesis Report*. Environmental Forestry Programme, College of Forestry and Natural Resources, University of the Philippines Los Banos, 34pp.

Liu, J.Y., T.X. Yue, H.B. Ju, Q. Wang and X.B. Li, eds., 2005: *Integrated Ecosystem Assessment of Western China*. China Meterological Press, Beijing, 120pp.

Millennium Ecosystem Assessment, 2005: *Multiscale Assessments: Findings of the Sub-global Assessments Working Group*. Ecosystems and Human Well-being, vol. 4. Island Press, Washington, DC.

Further information on the MA sub-global assessments, and downloadable copies of all MA reports, are available from www.MAweb.org.

Acknowledgments

The work of the MA and the sub-global assessments has been the collective effort of researchers, users and stakeholders, reviewers, donors, and other supporters. The extensive list of specific individuals, institutions and donors is contained in the working group report and is also available from the MA website (www.MAweb.org). Other MA funders are listed in Appendix IV. The MA wishes to thank APN for supporting the additional participation of researchers from the Asia-Pacific in the MA sub-global activities. We also thank the START International Secretariat for facilitating the administrative arrangements for this grant, and the MA co-executing agencies involved in this grant, Meridian Institute and the WorldFish Center.

Technical Report

Preface

This report presents an overview of the work, outputs and outcomes of the sub-global assessments that were part of the MA, with particular reference to the capacity-building activities which were undertaken as part of the MA process, with funds from APN. The MA sub-global assessments have catalyzed the development of new tools and methodologies. Capacity-building which has taken place as part of the MA has strengthened the ability to undertake integrated ecosystem assessments and to use the information from such assessments. This has been complemented by the network of institutions and researchers developed during the course of the MA.

Table of Contents

1.0 Introduction

2.0 Methodology

- 2.1 Scenarios and modeling workshop
- 2.2 Working group meetings
- 2.3 Overall approach taken for the sub-global assessments

3.0 Results & Discussion

- 3.1 Ecosystem services and human well-being
- 3.2 Condition and trends of ecosystem services
- 3.3 Drivers of ecosystem change
- 3.4 Scenarios in the sub-global assessments
- 3.5 Responding to ecosystem change
- 3.6 Communities, ecosystems and livelihoods
- 3.7 Issues of scale
- 3.8 The role of multiple knowledge systems
- 3.9 Lessons for future sub-global assessments
- 3.10 Products and outcomes

4.0 Conclusions

5.0 Future Directions

Appendices

- Appendix I: Scenarios and modeling workshop – agenda and participants
- Appendix II: Working group meeting, Alexandria – summary of proceedings
- Appendix III: Working group meeting, Kuala Lumpur – summary of proceedings
- Appendix IV: Other sources of funding for the MA

1.0 Introduction

In March 2005, findings from the largest and most authoritative assessment of the connections between ecosystem health and human well-being, the Millennium Ecosystem Assessment (MA), were released. Central to the MA's success was a set of 'sub-global assessments' conducted at scales ranging from local communities to multi-country regions. These sub-global assessments, in locations in the Asia-Pacific and worldwide, were undertaken as part of the MA together with the global assessment. APN funds were used to increase the participation of Asia-Pacific researchers in two core activities: a workshop on modeling and scenario-building, and meetings of the MA Sub-global Working Group. These activities helped to improve the technical capabilities of scientists in the region to develop and quantify future scenarios of ecosystem change. They also strengthened regional cooperation in the area of ecosystem change research through the exchange of data and lessons learned, and increased the participation of scientists in the region in global change research. Overall, this increased capacity to undertake integrated ecosystem assessments in the region contributes in the longer term to improved environmental decision-making at every scale of governance.

1.1 Objectives

The main objectives of this APN project were to:

1. Increase the capacity of individuals and organizations in the Asia-Pacific region to conduct multi-scale, integrated assessments of ecosystem change and human well-being.
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3. Increase the training and participation of junior scientists in the MA in order to ensure long-term impact on the capacity to conduct global change research in the Asia-Pacific region.
4. Enhance mutual learning among the MA experts and increase regional cooperation on global change research.

2.0 Methodology

The specific MA sub-global activities supported by APN funds included a workshop on modeling and scenario-building held in Penang, Malaysia in April 2003, and meetings of the MA Sub-global Working Group in Alexandria, Egypt in March 2004 and in Kuala Lumpur, Malaysia in September 2004.

2.1 Scenarios and Modeling Workshop

As part of their assessments, each sub-global assessment developed scenarios describing how ecosystem services and their impacts on human well-being could change under various plausible future changes in driving forces. These scenarios were not designed to 'predict the future' but rather to explore the consequences of different decisions that could be taken today.

The four-day workshop on scenarios and modeling held in Penang involved 33 participants from the various MA sub-global assessments, including 15 from the Asia-Pacific who were supported by APN. The workshop was designed to provide training on the process of developing scenarios, including the use of quantitative models on the impacts of changes in driving forces on ecosystems and human well-being, as well as developing plausible storylines.

During the workshop, participants were introduced to the strengths and weaknesses of various approaches to scenarios (e.g. qualitative vs. quantitative, exploratory vs. anticipatory). Specific types of scenarios and modeling approaches, including those used for climate change (e.g. the IPCC emissions scenarios), land use and land cover change, socio-economic change (e.g. Shell), and UNEP's GEO-3 scenarios, were presented. Specific methods used by the sub-global assessments, such as the local village assessments in India, were shared. Scenarios were also discussed as a tool for engagement with stakeholders. Participants then joined small group exercises to gain more hands-on experience in building scenarios. Structured to be highly interactive, the workshop included significant discussion time in breakout groups.

Materials used in the workshop have been compiled into a training module that is available from the MA website. The MA has encouraged participants to share their experiences and learning with other members of their sub-global assessment teams, and to use the training module as a tool to train others. In addition, the material is being incorporated into other training tools on integrated ecosystem assessments, for example a UNEP Poverty & Environment project in 7 African countries.

2.2 Working Group Meetings

During 2004, the MA held two meetings of the Sub-Global Working Group, which groups all the MA sub-global assessments. The first working group meeting in 2004 was held in March at the Bibliotheca Alexandrina in Egypt, in conjunction with the MA's international conference on "Bridging Scales & Epistemologies". The second working group meeting in 2004 was held in September, in Kuala Lumpur, Malaysia.

The overall focus of both meetings was on 1) the exchange of information and substantive findings from each of the sub-global assessments, providing opportunities to share lessons learned and best practices for conducting multi-scale assessments; and 2) writing the sub-global working group report, synthesizing the findings and lessons learned from the sub-global assessments. The working group report is one of the volumes in the core set of MA publications to be published in September 2005. While every MA sub-global assessment produces reports and other products for assessment users in their respective locations, the working group report is a synthetic document which analyzes the approaches used and the lessons learned across the entire set of sub-global assessments.

The MA Sub-global Working Group meeting in Alexandria was the fourth meeting of the working group, involving 70 participants, of which four were supported with APN funds. The main objectives of the meeting were to review the progress of the sub-global assessments within the broader MA process including linkages with the global assessment, and to ensure progress on the working group report which was one of the core technical assessment volumes of the MA. Extensive information was shared by representatives of the sub-global assessments with authors of each chapter of the report, through "knowledge market" sessions organized specifically for that purpose. The working group also discussed and refined drafts of the Summary for Decision-makers and the synthesis chapter of the report. Significant time was spent by participants in teams of authors for each chapter, developing the draft texts and main messages of each chapter. The meeting was held immediately after the MA's international conference on Bridging Scale & Epistemologies, which enabled participants to interact with other experts and practitioners interested in scale and knowledge issues in assessments.

The fifth meeting of the Sub-global Working Group in Kuala Lumpur was attended by about 50 participants, of which around 20 were from the Asia-Pacific region. The main objective of the meeting was to revise the draft chapters of the working group report in the light of comments received during the internal review of those chapters. The chapters were subsequently subjected to external review by experts and governments. This meeting was part of a combined meeting of all of the MA working groups, which also allowed for direct exchanges with authors of the MA global assessment, as the chapters from all working groups were being finalized.

APN support enabled the increased participation by Asia-Pacific researchers in these working group meetings, and in the authorship of the working group report. Contributions to the report by assessments being undertaken in Asia-Pacific were significant, including from the assessments in China, India, Papua New Guinea, the Philippines, and Vietnam. Participants from the Asia-Pacific benefited from the experience of contributing to a global scientific assessment report focused on the multiple scales of ecosystem change, as well as from the learning opportunities from interactions with other parts of the MA's network of sub-global assessments.

The summaries of proceedings for both working group meetings are included in an annex to this report. Information on individual sub-global assessments is available from the MA website, www.MAweb.org.

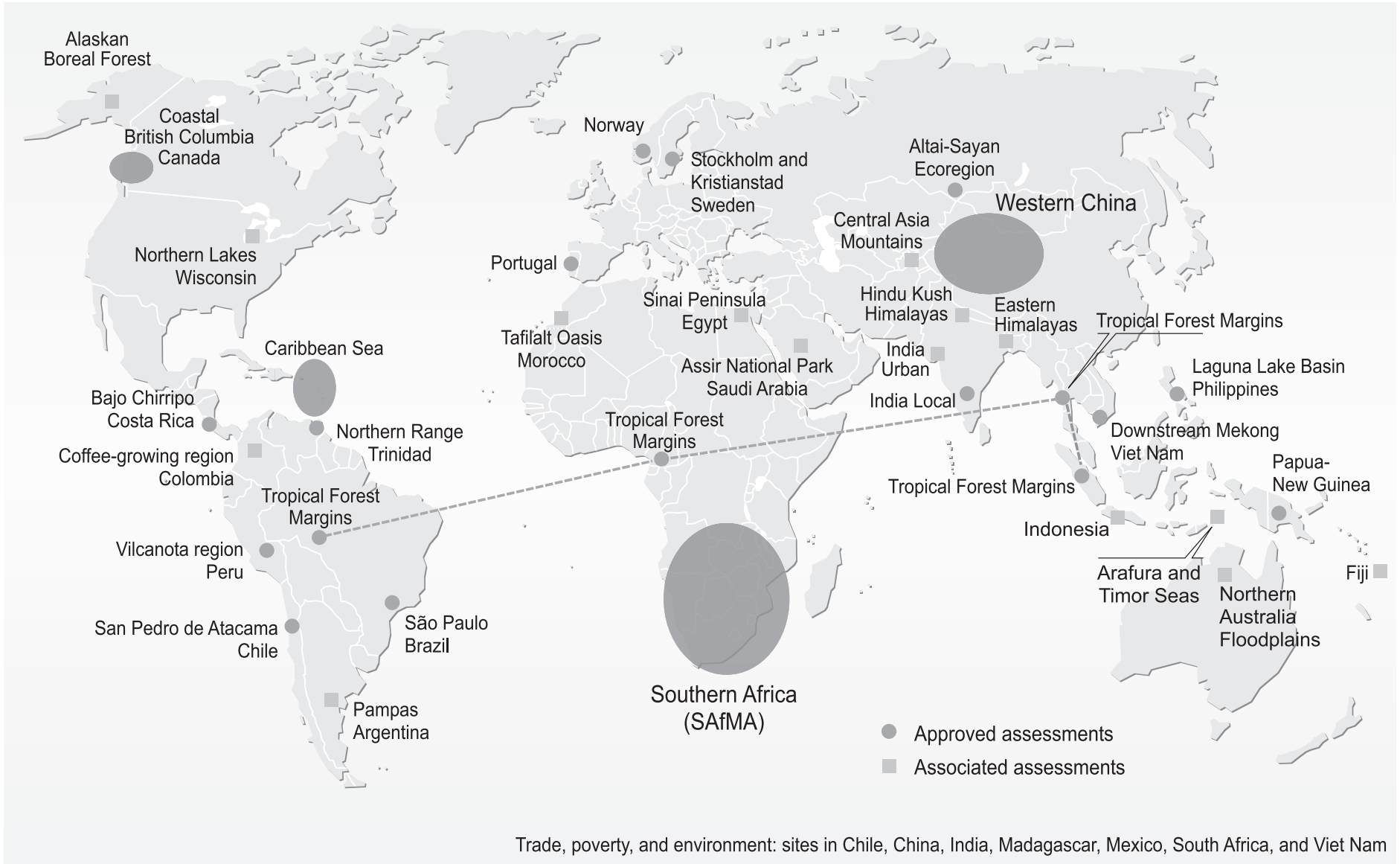
2.3 Overall approach taken for the MA sub-global assessments

The MA, which focused on ecosystem change and the impacts of such change on human well-being, included a set of sub-global assessments at multiple spatial scales, in addition to the global assessment. This was one of the innovations of the MA compared to other international assessments, which usually focus on global or regional scales alone. The global and sub-global assessments analyzed ecosystem services and human well-being from different perspectives and with different stakeholders involved. The MA sub-global assessments were led by institutions and individuals in those countries where the sub-global assessments were carried out.

The MA sub-global assessments were conceived as integrated assessments to analyze the relationship between direct and indirect drivers of ecosystem change, their impact on ecosystem services, and the consequences for human well-being. They were also designed to compare different spatial scales, involve a diverse set of stakeholders, and use different knowledge systems as part of the assessment process. This volume presents an overview of the main outcomes and conclusions from this process, with reflections on the lessons learned.

The MA design for sub-global assessments was intended to develop and test methodologies for multiscale assessments, meet the information needs of decision-makers at every scale, and build capacity to undertake such assessments. The initial approach taken was to develop sets of nested, multiscale assessments in selected regions of the world, complemented by a "cross-cutting" assessment of similar ecosystems in different locations and an "outlier" assessment in an ecosystem or region not otherwise represented. As the process developed, however, a bottom-up approach was adopted, backed by an open call for proposals and a set of selection criteria related to assessment design and stakeholder engagement. Many sub-global assessments were established where demand and interest in such assessments arose. This resulted in a globally diverse set of assessments that were driven by user demand but did not represent a comprehensive or "scientific" selection of ecosystems and locations around the world.

SUB-GLOBAL ASSESSMENT	ECOSYSTEM TYPES										ECOSYSTEM SERVICES								
	COASTAL	CULTIVATED	DRYLAND	FOREST	INLAND WATER	ISLAND	MARINE	MOUNTAIN	POLAR	URBAN	FOOD	WATER	FUEL and ENERGY	BIODIVERSITY-RELATED	CARBON SEQUESTRATION	FIBER and TIMBER	RUNOFF REGULATION	CULTURAL, SPIRITUAL, AMENITY	OTHERS
Altai-Sayan Ecoregion			•	•	•			•			•		•			•		•	
San Pedro de Atacama, Chile			•		•						•	•		•			•	•	•
Caribbean Sea	•					•	•				•	•		•				•	
Coastal British Columbia, Canada	•			•	•			•			•			•		•	•	•	
Bajo Chirripo, Costa Rica		•		•	•						•	•		•		•		•	•
Tropical Forest Margins		•		•							•	•		•	•	•			•
India Local Villages		•		•	•						•	•	•	•		•	•	•	•
Glomma Basin, Norway		•		•	•			•			•		•			•		•	•
Papua New Guinea	•	•				•	•				•	•	•	•		•	•	•	•
Vilcanota, Peru		•	•					•			•	•		•			•	•	•
Laguna Lake Basin, Philippines		•		•	•						•	•		•	•			•	•
Portugal	•	•	•	•	•	•	•	•		•	•	•		•	•	•	•	•	•
São Paulo Green Belt, Brazil	•	•		•	•				•		•	•		•	•	•	•	•	•
Southern Africa	•	•	•	•	•				•		•	•	•			•		•	•
Stockholm and Kristianstad, Sweden		•			•				•		•	•		•	•	•	•	•	•
Northern Range, Trinidad	•			•	•			•			•	•		•		•	•	•	•
Downstream Mekong Wetlands, Viet Nam	•	•			•						•	•	•	•	•	•	•	•	•
Western China		•	•	•	•			•			•	•		•	•		•		•
Alaskan Boreal Forest				•	•						•				•			•	•
Arafura and Timor Seas	•					•	•				•			•					•
Argentine Pampas		•									•	•						•	•
Central Asia Mountains								•			•	•		•					•
Colombia coffee-growing regions		•						•			•	•		•				•	
Eastern Himalayas				•				•			•	•	•	•				•	
Sinai Peninsula, Egypt			•					•						•			•	•	•
Fiji	•					•					•	•	•						•
Hindu Kush-Himalayas					•			•				•		•			•	•	•
Indonesia	•					•	•				•			•					•
India Urban Resource									•		•	•	•	•				•	•
Tafilalt Oasis, Morocco		•	•								•	•						•	•
Northern Australia Floodplains					•						•	•		•			•	•	•
Assir National Park, Saudi Arabia		•		•				•			•						•	•	•
Northern Highlands Lake District, Wisconsin				•	•							•			•	•	•	•	•



The MA process included a total of 33 sub-global assessments from around the world (see map for locations). These assessments analyzed the importance of ecosystem services for human well-being at local, national, and regional scales. The areas covered in these assessments ranged from small villages in India, to cities like Kristianstad (Sweden) and Sao Paulo (Brazil), to whole countries like Portugal, and large regions like southern Africa.

The MA design called for sub-global assessments covering multiple nested scales. For example, the Southern Africa sub-global assessment (SAfMA) included assessments of the entire region of Africa south of the equator, of the Gariep and Zambezi river basins in that region, and of local communities within those basins. This nested design was part of the overall design of the MA to analyze the importance of scale on ecosystem services and human well-being and to study cross-scale interactions. However, most sub-global assessments were conducted at a single spatial scale, with some multiscale analysis.

The sub-global assessments included a diversity of ecosystems (see summary table on ecosystem types and ecosystem services in the sub-global assessments). Examples include drylands in Chile and western China; tropical rainforests in the Amazon, Central Africa, and Southeast Asia; coastal and marine ecosystems in the Caribbean Sea and Papua New Guinea, and urban ecosystems in Sweden and Brazil, among others. Many assessments analyzed several ecosystems within a single study area. The majority of assessments (25 out of 33) included forests, inland water, or cultivated systems, which were the systems most commonly assessed. Island, coastal, and marine systems were not as widely represented (10 out of 33 assessed at least one of those systems), nor were urban systems (5 out of 33). Polar systems were not covered.

The sub-global assessments involved a diversity of stakeholders in their processes, including local, regional and national governments, nongovernmental organizations, local communities, research and academic institutions, and, to a lesser extent, the private sector and international organizations. The institutions leading the assessments were different across assessments, but they were often academic or research institutions. Including a diversity of stakeholders is considered essential for effective assessments, as it enhances stakeholder ownership of the outcomes.

3.0 Results & Discussion

Apart from the capacity-building results achieved as described in the activities and methodology used above, a number of interesting findings have emerged from the MA sub-global assessments, summarized below. It is important to note that researchers from sub-global assessments in the Asia-Pacific contributed to the findings summarized here, as well as benefited from increased capacity through their participation in working group discussions which synthesized these findings.

3.1 Ecosystem services and human well-being

Spiritual and cultural services are regarded as important ecosystem services at local scales, for wealthy as well as for poor communities and in both rural and urban settings. Several assessments conducted with and by local communities highlighted the importance of spiritual and cultural services. For example, local villages in India preserve selected sacred groves of forest for spiritual reasons. Urban parks provide important cultural and recreational services in

cities around the world, such as in Stockholm, where the principal urban park receives some 15 million visits every year.

There are clear trade-offs among ecosystem services; the nature of these trade-offs are context-specific and differ across assessments. The analyses performed by the sub-global assessments, in agreement with the global results, generally showed an increase in provisioning services over time, at the expense of regulating services, supporting services, and biodiversity. For example, deforestation caused by increased local demand for wood resulted in an increase in human disease in India, and mining and tourism activities in San Pedro de Atacama in Chile have had an impact on the availability and access to water by local populations.

The relationship between ecosystem services and human well-being can take on several different forms. The sub-global assessments found a wide range of relationships between ecosystem services and human well-being. Often, rising incomes are initially accompanied by declines in some ecosystem services. In the assessment of the downstream Mekong wetlands in Vietnam, for example, economic growth from agricultural expansion has improved human well-being, but at the expense of the regulation of soil quality. Once a sufficient level of wealth is achieved, societal priorities may emphasize the quality of the environment and the services it delivers. This was most obvious in the assessment of the Stockholm Urban Park, Sweden, where stakeholders are minimizing the impacts of urban sprawl. In some cases, there is no evidence for such a turnaround, and some services may decline continuously with increasing wealth. For instance, water as a provisioning service continues to be degraded in the wealthy, urban area of Gauteng in South Africa. In yet other cases, a particular service may possibly improve continuously in tandem with increasing wealth, which would be the case in Viet Nam if increasing agricultural production were managed sustainably. The sub-global assessments did not equate human well-being with wealth; but wealth was an important and frequently measured component of well-being.

In places where there are no social safety nets, diminished human well-being tends to increase immediate dependence on ecosystem services. The resultant additional pressure can damage the capacity of those local ecosystems to deliver services, and this capacity can decline to such a degree that the probability of disaster or conflict increases. For example, rural communities in the former tribal “homelands” in South Africa had no rights of permanent residence outside those areas, and they had few economic opportunities within them. As a result, they depended on the ecosystem resources that the areas offered, and in many cases overexploited them. In this type of relationship between poverty and the environment, particularly when property rights are not clearly defined and resource management institutions are weak, poor people can sink further into poverty as they are driven to participate in unsustainable resource use regimes.

Inequities in the distribution of the costs and benefits of ecosystem change are often displaced to other places, groups, or future generations. For example, the economic clout of cities enables many urban populations to draw on resources from distant ecosystems, and this trend is expected to continue with increasing urbanization; the Gariep basin assessment, for example, showed that the population of the urban area of Gauteng province in South Africa consumes nearly 30 times more wheat than is produced in the province itself. The increase in international trade is also generating additional pressures on ecosystem services around the world, illustrated in the cases of the mining industries in Chile and Papua New Guinea. In some cases, the costs of transforming ecosystems are simply deferred to future generations. An example reported widely across sub-global assessments in different parts of the world was tropical deforestation, which caters to current needs but leads to a reduced capacity to supply services in the future.

3.2 Condition and trends of ecosystem services

The sub-global assessments showed that ecosystem services are declining in many regions around the world. Despite some gains in the provisioning of food, water, and wood, the ecological capacity of the systems to continue to provide services is at risk in several locations. Problems with provisioning services include deterioration of water quality, deterioration of agricultural soils, and insufficient supply to meet demand. Some of the threats affecting regulating services are loss of forest cover, rangeland degradation by overgrazing (particularly in drylands), loss of wetlands to urban development and agriculture, and change in fire frequency. Problems with cultural services include loss of cultural identity and negative impacts from tourism. Biodiversity is decreasing due to the loss and fragmentation of natural habitats and the reduction of species population sizes, particularly of large bodied species, species occupying high trophic levels, and species that are harvested by humans.

Conclusions on conditions and trends may differ between global and sub-global analyses. Although there was overall congruence in the results from global and sub-global assessments for services like water and biodiversity, there were instances where local assessments showed the condition as either better or worse than expected from the global assessment. For example, the condition of water resources, as assessed in the sub-global assessments, was significantly worse than might have been expected from the global assessment in places like Sao Paulo (Brazil) and the Laguna Lake Basin (Philippines). On the other hand, biodiversity condition in the Gorongosa-Marrromeu component of the southern Africa assessment (SAfMA) was assessed to be better than the global assessment suggested. There were more instances of results differing between the global and sub-global analyses for biodiversity than for water provisioning, because the concepts and measures of biodiversity were more diverse in the sub-global assessments.

3.3 Drivers of ecosystem change

The biophysical drivers of change mentioned most often across the sub-global assessments were land use change, climate change and variability, pollution, and invasive species. These drivers were seen, at best, as only partially under the control of the decision-maker at the particular scale of analysis. Land use change comprises a whole range of processes, including urbanization and urban growth (for example, São Paulo or Portugal), encroachment on natural ecosystems by agriculture (for example, Eastern Himalayas or Coastal British Columbia), and infrastructure development (for example, Tropical Forest Margins or the Caribbean Sea). A striking example of invasive species is in the Caribbean Sea, where dust blown from the Sahara across the Atlantic introduced new pathogenic bacteria that were at least partially responsible for coral reef diseases in the last two decades.

Economic growth, structural change, and globalization were the most commonly identified indirect drivers. Their impacts on ecosystems are mediated by institutional and sociopolitical factors. Evidence from the sub-global assessments suggests that the impact of these indirect drivers depends on a range of institutional settings and on the structure of growth itself. The economic changes of the 1990s introduced a market system in the Altai-Sayan ecoregion in Russia and Mongolia. This resulted in higher cashmere producer prices, which in turn encouraged intensification of herding and the movement of herd locations closer to marketplaces, thus inducing overstocking in surrounding areas. On the other hand, in Trinidad, the liberalization of trade and the resulting competition forced down local produce prices, which made local production of market crops uneconomical. The increase in transport triggered by global trade is seen as a major indirect driver for increases in species invasions. For example,

the release of ballast water by ships coming from the Indo-Pacific region resulted in the introduction of green mussel *Perna veridis* to Trinidad in the early 1990s. The mussel clogs up the intake pipes of industrial facilities in Trinidad, costing millions of dollars annually to remove. In a period of ten years, the mussel spread across the Caribbean all the way to Tampa Bay, Florida. However the mussel is also being harvested as a source of food in some parts of the Caribbean.

Drivers operate over different spatial and temporal scales, and the spatial and temporal scales of any given driver may be related in different ways. For a large number of drivers identified in the different sub-global assessments, drivers operating over large spatial areas tended to be associated with slower processes of change, while “small” processes tended to take place relatively rapidly. However, a significant number of exceptions to this pattern were observed. For example, the São Paulo assessment mentioned governance and legislation as a local, but slow driver. The same held for soil degradation as a biophysical driver in Viet Nam. On the other hand, in San Pedro de Atacama, Chile, the rapid change of technology in the mining sector taking place globally appeared as an important driver. This characteristic of technology—that is, fast change at the global, or at least national, scale—also held for the Argentine Pampas.

Understanding drivers, their interactions, and the consequences for ecosystem services and human well-being is crucial to the design of effective responses. Although many responses target specific problems with ecosystem services, the nature of ecosystems means that such responses can have unintended consequences for multiple interacting drivers. Individual drivers may be difficult to influence without affecting others, and therefore response options targeted at interactions among drivers are often a more effective way to achieve a desired outcome, and may enable a more integrated and holistic approach to ecosystem service management. The adaptive co-management approach adopted by the Kristianstad Wetlands assessment in Sweden is an example; adaptive co-management systems are flexible, community-based systems of resource management tailored to specific places and situations, supported by, and working with, various organizations at different levels. Similarly, the river rehabilitation councils in the Laguna Lake Basin of the Philippines addressed a number of social and ecological drivers and engaged various stakeholders at different scales, resulting in several effective responses.

3.4 Scenarios in the sub-global assessments

Scenario-building is an important method for involving stakeholders in policy formulation and for encouraging citizens to adopt their own policies aimed at environmental protection. The relevance, significance, and influence of the scenarios that are constructed will ultimately depend on who is involved in their development. Decision-makers may have difficulty introducing new policies designed to alter behaviors without the support of the general population. Participants in scenario-building can provide essential input on the relevance of storylines being developed and on the nature of uncertainties that are important at sub-global scales.

Sub-global assessments used scenarios for multiple purposes, which often extended beyond the rationale for global scenarios. Besides being used by all of the sub-global assessments as a tool for decision-makers to plan for the future (as in the global scenarios), most sub-global assessments, such as SAFMA and the Northern Highlands Lake District of Wisconsin, also used scenarios as a means of communicating possible future changes and major uncertainties to stakeholders. In the San Pedro de Atacama, Chile, and the Bajo Chirripo, Costa Rica,

assessments, for example, scenarios also proved to be an important tool for acquiring data about stakeholder preferences, perceptions, and values. In a few cases, including the Wisconsin, Caribbean Sea, and SAfMA assessments, scenarios had a role in defining the boundaries within which discussions about management and policy options relevant to ecosystem services and human well-being could be held. All of these examples also illustrate the use of participatory scenario development approaches in the sub-global assessments.

Scenarios in the sub-global assessments differed markedly from the scenarios developed at the global level, although all were based on the same conceptual framework. The most significant differences were in terms of key uncertainties (which were much more context-specific at the local level), stakeholders involved, and the scales of analysis. Almost all sub-global scenarios identified institutional arrangements/governance as the key uncertainty, even with widely varying ecological and socioeconomic circumstances across the sub-global assessments. Many sub-global assessments sought to quantify the scenario storylines, but time constraints and the lack of available models prevented many from doing so, with the exception of the Western China and SAfMA Regional assessments. Nonetheless, substantive links were maintained with the global scenarios in the SAfMA, Caribbean Sea, and Portugal assessments, for example, through the use of global models in the development of regional scenarios.

3.5 Responding to ecosystem change

The effectiveness of a response is related to the degree of coherence among different types of policies and the degree of collaboration among stakeholders. Horizontal (multisector) collaboration ensures that multiple objectives (ecological, social, cultural, economic) are addressed in an integrated fashion. Vertical (multilevel) collaboration facilitates the generation of resources and increases the likelihood that responses have a positive impact on direct and indirect drivers of ecosystem change. Since these drivers typically occur at a continuum of social and ecological scales, responses would need to involve decision-makers (and actors) at multiple organizational levels. For instance, local responses such as coping and adapting to environmental change by the Bedouins in Egypt and by local communities in southern Africa have been largely ineffective due to the lack of institutional and financial support at the national level. In contrast, local people in the Eastern Himalayas took the initiative to form eco-development committees, and this became an effective response thanks to facilitative support from legislators. Collaboration is not only a local phenomenon; it has been initiated by all categories of actors operating at all identified organizational levels.

Collaboration among actors is often facilitated by “bridging organizations.” These provide arenas for multisector and/or multilevel collaboration for conceiving visions, trust-building, collaboration, learning, value formation, conflict resolution and other institutional innovations. Bridging organizations lower the transaction costs of collaboration and of crafting effective responses. They provide social incentives to identify possible win-win responses. The facilitation, leadership, and social incentives provided by bridging organizations or key persons in the community appear to be essential for capacity-building. For instance, in Kristianstad Wetlands, Sweden, a new organization called Ecomuseum has initiated a process based on collaboration, trust-building, and conflict resolution. Through voluntary participation within the existing legal framework, the ecosystem approach has been applied and an area with declining ecosystem services is now being transformed into a UNESCO Biosphere Reserve. In the Laguna Lake Basin of the Philippines, public agencies and nongovernmental organizations formed river rehabilitation councils that have been able to address social and ecological drivers in a collaborative and effective way. In San Pedro de Atacama, Chile, the assessment team provided the arena for collaborative learning, trust-building, visioning, and conflict resolution.

These three examples illustrate the formation of bridging organizations that have resulted from bottom-up, top-down, and external initiatives, respectively.

Declining ecosystem trends have been mitigated by innovative local responses. The “threats” observed at an aggregated, global level may be overestimated or underestimated from a sub-global perspective. Assessments at an aggregated level may fail to take into account the adaptive capacity of sub-global actors. Through collaboration in social networks, actors can develop new institutions and reorganize to mitigate declining conditions. On the other hand, in crafting their responses, sub-global actors tend to neglect drivers that are beyond their immediate influence. Hence, it is crucial for decision-makers to develop institutions at the global, regional, and national levels that strengthen the adaptive capacity of actors at the sub-national and local levels to develop context-specific responses that do address the full range of relevant drivers. The Biodiversity Management Committees in India are a good example of a national institution that enables local actors to respond to biodiversity loss. This means neither centralization nor decentralization but institutions at multiple levels that enhance the adaptive capacity and effectiveness of sub-national and local responses.

3.6 Communities, ecosystems and livelihoods

Ecosystems provide a sense of place and identity for local people, in addition to other ecosystem services. These intangible values, including aesthetic and recreational values, provide a rationale for management and precipitate management practices that enhance ecosystem resilience through caretaking and custodianship. In Vilcanota, Peru, spiritual values and belief systems, including the belief in Pacha Mama (Mother Earth) that encompasses the view that Earth is a living being, have allowed for the maintenance of a cultural identity among the Quechua peoples of the southern Peruvian Andes. In the Kristianstad Wetlands, Sweden, local farmers have once again begun to cultivate land previously abandoned, not primarily for economic gain, but more for the sense of place and identity that comes with the cultivation of this land. However, in many instances these values and belief systems have been eroded, leading to a shift in community-based management practices. For example, in San Pedro de Atacama, Chile, the erosion of the collective indigenous identity due to economic development has led to the sale of land to outsiders, and a consequent decline in agriculture and related traditional practices.

Diversity in ecosystems and their services is important in reducing communities’ vulnerability. Most communities seek to maintain a diversity of livelihood options. This diversity buffers people against shocks and surprises such as climatic and economic fluctuations. In Papua New Guinea and India, for example, local farmers cultivate a wide variety of crops to avert the risk of crop failure. In Costa Rica, local communities create a mosaic landscape, consisting of sacred places, springs, agroecosystems, and high mountains. This results in a diversity of livelihood options at the local level.

Local management systems are continuously evolving; some disappear while others are revived or newly invented. Many communities possess local, indigenous, or traditional knowledge about the interactions between humans and ecosystems. Local communities can affect ecosystem services and human well-being both positively and negatively. For example, in Xinjiang, western China, local people have elaborate traditional underground water harvesting structures (“karez”) that maintain both water quality and quantity. Traditional community institutions that regulate access to the karez water exist, but in some cases are being weakened. In the Eastern Himalayas, India, economic incentives for private forest owners have led in some instances to deforestation in native forests. Nevertheless, the recognition of the role of

communities as stewards of ecosystem services, and their empowerment, is essential to strengthen local capacity to manage ecosystems sustainably for human well-being.

Communities are affected by larger-scale processes, but their ability to cope with and shape change varies. Decisions taken at higher scales often do not take into account the realities of local communities, resulting in negative impacts at the local level. Communities that cope successfully with these external forces have learned to adapt or even take advantage of them by creating horizontal links with other groups, forming alliances with powerful actors at “higher” spatial scales, and linking with national or global processes such as policy forums, markets, and multinational agreements. The Vilcanota assessment in Peru is driven by the indigenous communities there to meet their own needs, and the link to the global MA process has provided benefits to both these communities and the wider MA process. When conditions become impossible to adapt to, for example due to inflexible national policies, people are forced to migrate or face a reduced quality of life. In Sistelo, Portugal, for example, a government afforestation program on common property land (*baldio*) diminished the locally available livelihood and coping strategies by reducing land available for pastoralism, thereby accelerating the process of rural-urban migration.

3.7 Issues of scale

The scale at which an assessment is undertaken significantly influences the problem definition and the assessment results. Findings of assessments conducted at different scales will differ due to differences in the questions posed and/or the information analyzed. Local communities are influenced by global, regional, and local factors. *Global* factors include commodity prices—for example, global trade asymmetries that influence local production patterns, as in Colombia, Portugal, SAfMA Gariep, and Altai-Sayan—and global climate change. Examples of the latter include sea level rise (Papua New Guinea) and receding glaciers (Vilcanota, Peru, and Altai-Sayan). *Regional* factors include water supply regimes (for example, safe piped water in rural areas, as in Southern Africa Gariep), regional climate (desertification as in Portugal), and geomorphological processes (soil erosion and degradation, as in Altai-Sayan, Trinidad). *Local* factors include market access (for example, distance to market, as in Papua New Guinea), disease prevalence (malaria, as in India Local and Papua New Guinea), or localized climate variability (patchy thunderstorms, as in SAfMA Gariep). Assessments conducted at different scales tend to focus on drivers and impacts most relevant at each scale, yielding different but complementary findings. This provides some of the benefit of a multiscale assessment process, since each component assessment provides a different perspective on the issues addressed.

A full multiscale assessment provides a powerful basis for evaluating the robustness and persistence of findings across scales. If an assessment of surface water availability finds that a specific region consistently experiences water scarcity across all the scales of analysis, the finding can be viewed with some degree of confidence. In contrast, if the same region is identified at one scale as water scarce, but is subsequently seen at another scale of analysis to exhibit varying degrees of scarcity and abundance, assessment teams are compelled to explore the possible reasons for such discrepancies. Inconsistency in findings across scales may stem from data or model inaccuracies or from local perceptions, needs, and/or requirements (for example, livelihood strategies at the local level that nullify broad-based patterns of access to subterranean water sources in areas that possess limited surface water). This full range of patterns emerged for different geographic areas in southern Africa during the regional, basin, and local scale assessments.

Multiscale assessments offer insights and results that would otherwise be missed. The variability among sub-global assessments in problem definition, objectives, scale criteria, and systems of explanation increased at finer scales of assessment (for example, the visibility of social equity issues increased from coarser to finer scales of assessment). The role of biodiversity as a risk avoidance mechanism for local communities is frequently hidden until local assessments are conducted (examples include India Local; Sinai, Egypt; SAfMA Livelihoods). Processes of common concern emerging at all scales of assessment assumed different meanings and implications at different scales. For example, institutional responses at the global scale include formal global agreements and financial commitments, but at finer and finer sub-global scales, they increasingly involve relatively informal but effective efforts such as cooperative local resource management; examples include Caribbean Sea; India Local; Coastal British Columbia; Kristianstad Wetlands, Sweden.

3.8 The role of multiple knowledge systems

Local and traditional ecological knowledge added significant insight about locally important resources and management practices, revealing information and understanding that is not reflected in the global assessment. This included names and uses of locally important plant species and practices to protect them (examples include India Local and Sinai), local drivers of change, specialized soil and water conservation practices, and coping strategies to protect human well-being. Local resource users also contributed valuable long-term perspectives about their socio-ecological systems (Bajo Chirripo, Costa Rica), as well as information on key ecosystem processes that are important, uncertain, and difficult to control (Wisconsin).

The extent to which local and traditional ecological knowledge contributed to the assessments varied, due to local context, the predisposition and expertise of the assessment team, and the resources allocated to understanding and using local knowledge. Local and traditional knowledge is both complex and inherently contextual, and a rigorous and comprehensive investigation and interpretation of such knowledge is needed to fully understand it and the insights it provides on ecosystem dynamics. Collaborative relationships, such as those developed in Vilcanota, Peru, and Bajo Chirripo, Costa Rica, as well as participatory tools that broaden the level of inquiry, often result in the emergence of key issues of local importance. For example, in the Bajo Chirripo assessment, local participants found that there was existing traditional knowledge about natural resource management strategies, so the assessment emphasized learning more about and reviving these instead of introducing new ones.

There is evidence that including multiple knowledge systems increases the relevance, credibility, and legitimacy of the assessment results for some users. For example, in Bajo Chirripó in Costa Rica, the involvement of non-scientists added legitimacy and relevance to assessment results for a number of potential assessment users at the local level. However, in many of the sub-global assessments, local resource users were only one among many groups of decision-makers, so the question of legitimacy needs to be taken together with that of empowerment.

Some sub-global assessments confirmed that local institutions have a role in conferring greater power to local knowledge holders in cross-scale decision-making. For example, in India local and Kristianstad Wetlands (Sweden), deliberate efforts were made to embed the assessment within existing institutions that link local knowledge to higher-level decision-making processes. However, in the SAfMA Livelihoods assessment, local community institutions help to maintain knowledge, but by themselves were unable to ensure the use of local knowledge at higher-levels of decision-making. The Vilcanota and Bajo Chirripó assessments attempted to

create space to begin a dialogue between local communities and decision-makers at higher scales. The success of these efforts can only be evaluated with more time.

3.9 Lessons for future sub-global assessments

Capturing the complex and dynamic nature of the interactions between ecosystems and humans required complementary conceptual frameworks in some contexts. Several community-based assessments adapted the MA framework to allow for more dynamic interplays between variables, capture fine-grained patterns and processes in complex systems, and leave room for a more spiritual worldview. In Peru and Costa Rica, for example, other conceptual frameworks were used that incorporated both the MA principles and local cosmologies. In southern Africa, various frameworks were used in parallel to offset the shortcomings of the MA framework for community assessments. These modifications and adaptations of the framework are an important outcome of the MA.

Capacity-building activities need to be an integral component of any assessment, but especially in a complex one such as the MA. Many sub-global assessments did not have the expertise to assess the various components of the MA conceptual framework, and there was a need to develop expertise through capacity-building activities. This included a need to develop methods to assess even the central tenet of the conceptual framework: the link between ecosystem services and human well-being. In addition to capacity-building activities initiated within assessments, the number and diversity of the assessments participating in the MA provided an ideal opportunity for capacity building across the sub-global network. Networks formed among assessments became a way of exchanging experiences and methods and helped in the progress of some assessments. To fully incorporate multiple scales and knowledge systems in the design of all the sub-global assessments would have required more time and funding to develop the necessary tools and expertise.

Both multiscale assessments and assessments incorporating multiscale analyses face analytical challenges not present in single-scale assessments. These challenges include: 1) the selection and measurement of ecosystem services and components of human well-being, and whether these should be consistent across scales; 2) determining the degree of nestedness; 3) establishing methods for cross-scale comparisons; and 4) ensuring information flow across the scales of the assessment.

Multiscale assessments face additional challenges related to the most appropriate model for stakeholder involvement and participation. The presence of stakeholder groups from different scales, each with their own needs from the assessment and differing perceptions, can result in tension. Whereas a more rigid methodology and protocol may better meet analytical needs for multiscale analyses, a more flexible approach is often necessary to accommodate or adapt to different stakeholders from different scales. Thus design approaches for multiscale assessments vary depending on the requirements of analytical rigor and stakeholder involvement.

Multiscale assessments are both resource- and time-intensive. These added costs may be justified when the goal is to inform and influence decisions, but a full multiscale assessment may not be necessary or desirable if the primary goal is only to formalize knowledge or to test the robustness of scientific findings. Sub-global assessments that were multiscale did obtain information benefits (improved assessment findings) related to the availability of more and better data, ground-truthing of data, and better analysis of the causes of change. However, many of these benefits could be as readily obtained (at lower cost) by working fully at one or two scales while considering intermediate scales (multiscale analyses), rather than by conducting a

full multiscale assessment. In contrast, a full multiscale design provided impact benefits associated with the use and adoption of the findings that could not be achieved through other approaches. The multiscale approach also increased the potential capacity of institutions and individuals involved to respond to changes in ecosystem services, even across existing political, national, and cultural boundaries (as in the case of SAfMA).

Each sub-global assessment process was embedded in political, social, and environmental circumstances. The heterogeneity of these circumstances, as well as constraints such as the availability of information or particular expertise, necessitated a variety of approaches to using the MA conceptual framework. This reflects the reality of conducting integrated assessments at the sub-global level. An exploration of institutions that could potentially implement assessment outcomes should be included in the exploratory stages of the assessment.

Assessments need champions. In many cases, specific individuals played key roles that were critical for providing the needed momentum and direction during different stages of an assessment. These roles include that of external facilitators who helped to establish the demand for an assessment, and leadership to guide and sustain the assessment process. In some cases, small dedicated teams of people championed the assessment together.

The groups that will use the assessment results must be involved throughout the entire assessment process, from the design of the assessment through to the communication of findings. Working with assessment users to identify processes that would use the assessment findings was essential, as it was an important part of establishing the demand for an assessment. The sub-global assessments responded to three broad categories of need for an assessment: (1) summary and synthesis of information on complex issues to support decision-making; (2) strengthening the capacity of the users to assess and manage their resources or to participate in resource management; (3) research to address gaps in knowledge for resource management. For the first two categories in particular, the assessments involved strong user engagement throughout the process.

3.10 Products and outcomes

The sub-global assessments have yielded a number of tangible outcomes. Most global assessments, including the global component of the MA, have focused on producing synthetic reports, with their findings as the main outcome. In this regard, the final reports from individual sub-global assessments (or, for those assessments still in progress at the time this volume was written, peer-reviewed 30-page summaries) are a comparable result. Each of these assessments contains a wealth of information regarding the condition of ecosystem services, scenarios, and response options, each focused and shaped by the circumstances and needs of their particular setting. In addition, this volume aims to provide an overview of the sub-global process, with some comparisons and emerging patterns observed to date.

The sub-global assessment process has catalyzed the development of new tools and methodologies, the collation and generation of baseline information, and the creation of governance mechanisms that empower stakeholders. The constraints faced by the sub-global assessments sometimes led to innovative approaches to overcoming these constraints. Examples include the development of a novel biodiversity intactness index by the Southern Africa Regional assessment, and the training of technicians and video operators in the Peruvian Andes to lead and document the assessment of soil, water and agrobiodiversity by community groups. Another example was the advisory group of the San Pedro de Atacama assessment in

Chile—which brought together different stakeholder groups to discuss ecosystem management for human well-being, for the first time.

Some important results from the sub-global assessments are less tangible, and are primarily related to capacity building. These include the capacities that were developed to lead and undertake similar, and improved, assessments in the future. These capacities will be reinforced by the network of institutions and professionals that has been developed in the course of the MA. One example was the development of a program for young fellows, many of whom went on to work closely with the Coordinating Lead Authors of this assessment volume.

4.0 Conclusions

Future sub-global assessment processes modeled on the MA can deliver all of the benefits described above. However, the following tradeoffs should be taken into consideration:

- a rigorous approach to selecting assessments will ensure better geographical coverage and representation of ecosystems, but this should be weighed against the benefits of more innovation, diversity and strong user demand that arises from a bottom-up selection process;
- fully nested, multiscale assessments will deliver significant information and impact benefits, but may not always be necessary, especially in the light of the substantial resources and capacity required to undertake them; and
- focusing on a small set of services in common across all sub-global assessments will facilitate greater comparability, but the diverse circumstances and priorities of individual assessments may necessitate flexibility and a less rigidly uniform analytical approach.

A number of important additional considerations for future sub-global assessments would include:

- ensuring the availability of essential training and capacity building, and tools and methodologies, especially in areas like developing scenarios and multiscale approaches to assessment;
- fostering continued interdisciplinary approaches involving both natural and social scientists, to comprehensively analyze the links between ecosystem services and human well-being; and
- sufficient funding for the full set of assessment activities planned.

5.0 Future Directions

Follow-on activities to the MA have been discussed in various meetings, including by the MA Board and representatives of partner institutions. Activities that have been identified include the development of a methodology manual (together with WRI, UNU and the World Bank Institute), training workshops in different regions once the manual and associated training modules have been developed, and continued coordination of the network of sub-global assessments and support for further fund-raising for these assessments – in collaboration with ICSU and its interest in place-based research. UNEP is preparing a medium-sized project proposal to GEF, but co-financing will also be needed to match the GEF funds.

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Appendix I: Scenarios and modeling workshop – agenda and participants

Millennium Ecosystem Assessment Sub-global Scenarios Workshop

Penang, Malaysia

1-4 April 2003

Agenda

Tuesday 1 April

8:30 – 9:30 - Introductions and overview of the workshop

9:30 - 11:00 – overview of the MA, MA Conceptual framework and the subglobal assessments
(*Walt Reid, Marcus Lee*)

11:00 - 11:30 – coffee break

11:30 - 13:00 – What are scenarios and why are they needed? The research-assessment-policy nexus; use in the private sector. The Approaches (exploratory, normative, and then quantitative and qualitative) to Scenario Development and their application. What are some common features that need to be examined (e.g, baselines, data needs, drivers, dealing with uncertainties, branch points, who is the audience etc) (*Rik Leemans, Habiba Gitay*)

13:00 – 14:00 – lunch

14:00 - 18:00 – A brief overview of models and how they fit into many of the scenarios (*Habiba Gitay*)

Specific types of scenarios – overview of sectoral approach or causal chain approach (including integrated scenarios) and the narrative approach. Some that will be examined further are a) socio-economic and Shell scenarios, b) land use and land cover change and c) Climate Scenarios. Specific examples that will be used include the IPCC scenarios, local assessment scenarios. (*Rik Leemans*).

(15:30 - 16:00 – coffee)

Wednesday 2 April

9:00 - 13:00 – Examples and purpose of Socio-Economic and Shell Scenarios, Land-Use and Land-Cover Change with exploration for the need and development of baselines, the drivers and the use of these scenarios in scientific/policy arena and private sector. We will specifically examine: why is spatial and regional specificity needed for land use and land cover scenarios; how do these regional approaches help in dealing with scaling issues; how are reference conditions determined. If possible, examples of acid rain, water resources and marine pollution scenarios will also be examined. (*Rik Leemans*)

(Note 10:30 - 11:00 – coffee break)

14:00 to 15:30 - A brief overview and discussion of the Intergovernmental Panel on Climate Change (IPCC) Emission scenario and their storylines, approaches taken to develop the family of scenarios and how they were applied for the climate projections. The issues of dealing with branching points and uncertainties will be explored. (*Rik Leemans/ Habiba Gitay*)

15:30 - 16:00 – coffee

16:00 - 18:00 The process that is used in developing scenarios in the MA – Elements include use of narratives, involvement of stakeholder or user groups, decision on branch points, dealing with uncertainties, concentrate on the process. (*Walt Reid, Rik Leemans, Habiba Gitay*)

Thursday 3 April

8:30 - 9:30 – Scenarios that are being developed in the Millennium Ecosystem Assessment scenario working group (*Walt Reid*)

9:30 – 10:30 – overview of SafMA and the need for scenarios in that subglobal assessment (*Roberto Zolho, Brit Reichelt*)

10:30 - 11:00 – coffee break

11:00- 12:30 – Discussion and drawing lessons learnt from the SafMA and links to the global scenarios. (*Roberto Zolho, Brit Reichelt, Walt Reid, Habiba Gitay*)

1:30 to 5:30 – visit to ICLRAM and informal discussion of the MA

19:00 pm to late – Dinner

Friday 4 April

9:00 to 12:30 - Exercises in developing scenarios – mostly using a narrative approach. You will be given an exercise to do where you will be faced with having to develop some storylines drawing upon the knowledge you have gained during the workshop. These will be generic exercises, but where possible we will embed them into the types of situation that you are likely to face.

All trainers/facilitators would help during the group exercise

12:30 to 1:30 – lunch

1:30 to 4:30 – report back from the groups and general discussion including how to go forward.

**MILLENNIUM ECOSYSTEM ASSESSMENT
SUB-GLOBAL SCENARIOS WORKSHOP
APRIL 1-4, 2003
PENANG, MALAYSIA**

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Appendix II: Working group meeting, Alexandria – summary of proceedings and participant list

MILLENNIUM ECOSYSTEM ASSESSMENT SUB-GLOBAL WORKING GROUP MEETING ALEXANDRIA, 22-25 MARCH 2004

- SUMMARY OF PROCEEDINGS OF THE SUB-GLOBAL WORKING GROUP -

1 Introduction

The Sub-Global Working Group had its fourth working group meeting in Alexandria, Egypt, following the MA *Bridging Scales and Epistemologies* Conference. The Bibliotheca Alexandrina graciously hosted the meeting. About 70 participants from the sub-global working group attended the meeting, consisting of representatives of approved and associated assessments, and other authors of the sub-global working group report. Also in attendance were the MA Panel Co-Chairs, the working group Co-Chairs and the MA Secretariat.

The main products of the meeting were updated chapter drafts, which are available on the MA intranet in their appropriate folders (path: Sub-Global/Working Group Report). The list of participants is in Annex A.

2 Objectives

The objectives of the meeting were to:

1. Ensure progress on the Sub-Global Working Group Assessment Report, in particular:
 - Prepare first order executive summaries and fully developed chapter drafts for each chapter
 - Review details of workplan, timeline, for final writing assignments and subsequent review process
2. Review the progress of the sub-global assessments (SGAs), and of the Sub-Global Working Group, within the overall MA process
 - Discuss progress of Global - Sub-global linkage activities
3. Discuss plans to enhance the impacts and outcomes of the sub-global assessments, including:
 - Mechanisms for continued exchange of information and lessons learned from the network MA sub-global assessments, including associated assessments
 - Communication strategies and tools for sub-global assessments
 - Internal and external evaluations of the sub-global components of the MA

3 Plenary Discussions

- 3.1. Progress of chapters for the working group report

CLAs for each chapter presented status reports during the opening plenary session. More information was needed about certain sub-global assessments in order to fill gaps in the chapters. General comments included the need to make the report more colorful by including more graphics, boxes and photographs. The sub-global report should also make reference to the global assessment reports at appropriate parts in the text. Other issues raised included the need to be clear and internally consistent with the use of terminology, overlap between chapters, and the need to ensure a common writing style across chapters.

Solutions to some of these problems included:

3.1.1 Glossary: A glossary of terms used in the sub-global report is being compiled, which will be integrated with the glossaries from other working groups to produce a single MA glossary. Please send any terms that you feel need further explanation, as well as the suggested definitions for these terms, to the Secretariat.

3.1.2 Cross-chapter review: We have compiled a list of authors willing to review other chapters to check for overlaps or inconsistencies between chapters. **Review comments are due April 16th (see Annex B for list of reviewers)**. Any individual is of course more than welcome to submit internal review comments. Comments should be sent directly to the CLAs of the chapter concerned, with a copy to the Secretariat.

3.1.3 Style: It was suggested that all chapters follow the narrative style of the Ecosystem Services and Human Well being chapter.

3.1.4 2nd Sub-global “knowledge market”: To allow a last opportunity to share information between sub-global assessments and chapter teams, a knowledge market was set up using the same format as was used in Prague. Chapters prepared questions in advance and were given 15 minutes with each assessment to obtain answers to these questions.

3.2 Summary for Decision Makers and Synthesis chapter

The Co-Chairs of the working group put together a draft version of the SDM using the chapter executive summaries submitted at the beginning of the meeting. The working group commented on both drafts of the SDM and the Synthesis chapter during plenary, providing feedback on content and style.

3.3 Summaries of each sub-global assessment for annex of report

The working group went through the template developed for the summaries of each sub-global assessment that will be included in an annex to the working group report. **Each sub-global assessment should submit a summary based on this template no later than 1 May**. The final template is included in Annex C,

3.4 Global – sub-global interactions

The working group was brought up to date on the activities of the ‘linkage’ team, which include the setting up of a global - sub-global review process, an information brokering system between the working groups, and a workshop on global – sub-global linkages that was held during the Bridging Scales & Epistemologies conference. A small sub-global team will be present at the Combined Working Groups meeting in Montreal in late April, to further improve interactions between global and sub-global components of the MA.

3.5 Future of the MA for the –sub-global assessments

There is some uncertainty about what will happen to the MA sub-global assessments after the MA winds down in March 2005. Many of the assessments will be continuing beyond that date, and there was a general consensus that some form of continued Secretariat support would be highly valuable. The MA is investigating future scenarios for continuing to support some activities after 2005 and there are a number of suggestions for ways to continue onwards coming from several agencies involved in the MA. A key factor will be funding. A suggestion arose that the various sub-globals should continue to seek funding on an individual basis, with additional funding raised to support a Secretariat function and future meetings.

4 Deadlines and Workplan

April 16	Cross-chapter reviews due – submit to CLAs
May 1	Chapter drafts due for MA review process – submit to Secretariat Sub-global 2-page summaries for appendices due
September 4	Authors receive review comments
September 26-30	Combined working groups meeting to incorporate review comments, Kuala Lumpur
November 1	Final chapter drafts due for approval and publication

5 Key points/reminders for authors and sub-global assessments

- Please submit a shapefile of your assessment area if you have not already done so
- Please be explicit about whether your sources have been peer-reviewed
- Use MA style sheet to format your chapters (on intranet)
- Put executive summaries at the beginning of all chapters
- Chapters will only undergo one review round, make sure that formatting, references, graphics etc are as close to camera-ready as possible by May 1. If anything will not be camera-ready, be sure to inform the Secretariat in advance.
- 2 page assessment summaries are also due May 1 (template in Annex C)
- See Annex D for guidelines on page length of each chapter
-
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- See Annex E for a list of Chapter Review Editors for the Sub-global volume. Note that there are several holes that need to be filled. Please send us the names of potential CREs for those chapters that need them, as well as names of anyone you think would be good as a reviewer for a specific chapter.
- Please upload any photos from meeting onto the intranet (folder: Sub-global/
Alexandria meeting/ Photos)

6 Further Information

Available for download from the document repository on the MA intranet are:

- Background materials distributed in advance of the meeting (folder: Sub-global / Alexandria Meeting / Background Materials);
- Revised Chapter drafts (folder: Sub-global / Working Group Report)

If you have any questions, please do not hesitate to contact Ciara Raudsepp-Hearne (c.raudsepp-hearne@cgiar.org) or Marcus Lee (m.lee@cgiar.org).

Annex A – Participant List

MILLENNIUM ECOSYSTEM ASSESSMENT
SUB-GLOBAL ASSESSMENT WORKING GROUP MEETING
MARCH 22-25, 2004
ALEXANDRIA, EGYPT

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Appendix III: Working group meeting, Kuala Lumpur – summary of proceedings

MILLENNIUM ECOSYSTEM ASSESSMENT 5TH SUB-GLOBAL WORKING GROUP MEETING KUALA LUMPUR, 26-30 SEPTEMBER 2004

- SUMMARY OF PROCEEDINGS -

Introduction

The Millennium Ecosystem Assessment (MA) held the third combined Working Group meeting in Kuala Lumpur, Malaysia, in late September 2004. The meeting was graciously hosted by the Malaysian Ministry of Natural Resources and the Environment. Over 200 participants attended, representing authors for the Working Group Reports, and members of the MA Science Panel, Board and Secretariat. The Sub-Global Working Group, meeting for the fifth time, was represented by 50 participants, including authors and coordinators of sub-global assessments. We thank all participants for their hard work and continuing efforts to produce products of quality and relevance to decision-makers and scientists around the world.

Objectives

The objectives of the meeting were to:

1. Review and discuss, among authors and chapter review editors, the review comments received from the internal round of review.
2. Finalize the MA glossary
3. Produce new chapter drafts for the second round of review by experts and governments.

Status of Working Group Report and Review Process

Sub-global report

The sub-global report became available for a formal government and expert review on Friday, October 22nd. The individual sub-global chapters all benefited from constructive interactions with the Chapter Review Editors during the meeting in Kuala Lumpur and without exception received a positive sign-off from the CRE before entering into the review period.

We request that every sub-global assessment review the chapters during this review period to ensure that the information included on your assessment is correct. This is your final chance!

Please submit your corrections as formal review comments. Chapters, and instructions on how to submit review comments, can be found at <http://www.millenniumassessment.org/en/products.chapters.aspx>. The deadline for submitting review comments is December 10, 2004.

State of the Assessment Reports

Seventeen state-of-the-assessment reports (also commonly called “30-pagers”) are included in the formal review process now. Invitations to review these reports have been issued to experts from the region of each sub-global assessment. If you would like us to send invitations to specific experts to review your sub-global report, please send us their names and contact information. The deadline for submitting review comments on the state-of-the-assessment reports is also December 10, 2004.

Timeline after the review period

Authors are expected to access the review comments for their chapters online starting on December 10. At that time, not all comments received will have been uploaded, but you will be informed when they are; we expect this to be around December 17. Based on these review comments, authors must submit a revised copy of their chapters, and responses to review comments in the Excel spreadsheet format, by Wednesday, 5 January, **PRIOR TO THE SCHEVENINGEN MEETING**.

Key decisions on formatting and citations

In KL several issues pertaining to formatting and style were discussed in plenary.

Referencing sub-globals. We decided to cite sub-global assessment 30-pagers as ‘SA-name of the assessment’, knowledge markets as ‘KM(1 or 2)-name of the assessment’ and personal communications as ‘pers. Comm. Name of person, name of the assessment. We are consulting our publishers to see whether this is the best format and we will develop final guidelines for citing sub-global findings that will be distributed by the end of this review period in time for the final editing of the chapters in December and January.

Referring to sub-globals informally. To facilitate the reader’s understanding, authors should be as explicit as possible when referring to sub-global assessments. E.g. When first talking about the Chilean assessment, introduce it as the San Pedro de Atacama assessment in Chile. Acronyms should be avoided as much as possible. Remember that the readers will probably have no prior knowledge of the MA Sub-global working group.

Great care should be taken to be as explicit as possible when referring to either sub-global assessment findings (final), preliminary findings, experiences, or process-related lessons. As much as possible, cite peer-reviewed findings. The chapter on Multiple Knowledge Systems can cite questionnaires that they distributed in July and August (as Q1 or Q2-name of the assessment).

Chapters are not expected to include new information that becomes available post-Kuala Lumpur in their chapters.

If authors are unsure about MA style guidelines, or have further technical questions about their chapters, please contact Ciara Raudsepp-Hearne (c.raudsepp-hearne@cgiar.org).

Glossary

A number of participants from all working groups participated in several glossary meetings during the week in KL. The objective of these meetings was to finalize the glossary that will be used in all the working group reports. The final version of the glossary is available on the intranet in the folder *MA Documents \ Combined Working Group Meeting - Kuala Lumpur*.

January meeting in Scheveningen, Netherlands

The January 9-13 meeting in Scheveningen, Netherlands was added as an extra meeting for the Sub-global Working Group, in response to a foreseen need to incorporate an extra round of review into the production of the Sub-global Report. For this reason, the meeting will be limited to CLAs and a number of LAs needed for the writing of sub-global chapters. During this meeting authors will respond to review comments and work with CREs to finalize the chapters for final approval by the MA Board. The Sub-global volume will be published in the months following Board approval.

Appendix IV: Other sources of MA funding

Donors that provided major financial support for the MA and the MA Sub-global Assessments include the Global Environment Facility; United Nations Foundation; David and Lucile Packard Foundation; World Bank; Consultative Group on International Agricultural Research; United Nations Environment Programme; Government of China; Ministry of Foreign Affairs of the Government of Norway; Kingdom of Saudi Arabia; and the Swedish International Biodiversity Programme.

Other organizations that also provided financial support include Association of Caribbean States; British High Commission, Trinidad & Tobago; Caixa Geral de Depósitos, Portugal; Canadian International Development Agency; Christensen Fund; Cropper Foundation, Environmental Management Authority of Trinidad and Tobago; Ford Foundation; Government of India; International Council for Science; International Development Research Centre; Island Resources Foundation; Japan Ministry of Environment; Laguna Lake Development Authority; Philippine Department of Environment and Natural Resources; Rockefeller Foundation; U.N. Educational, Scientific and Cultural Organization; UNEP Division of Early Warning and Assessment; United Kingdom Department for Environment, Food and Rural Affairs; United States National Aeronautic and Space Administration; and Universidade de Coimbra, Portugal.

Generous in-kind support has been provided by many other institutions (a full list is available at www.MAweb.org). The work to establish and design the MA was supported by grants from The Avina Group, The David and Lucile Packard Foundation, Global Environment Facility, Directorate for Nature Management of Norway, Swedish International Development Cooperation Authority, Summit Foundation, UNDP, UNEP, United Nations Foundation, United States Agency for International Development, Wallace Global Fund, and World Bank.