

Unclassified

DSTI/STP/MS(98)2



Organisation de Coopération et de Développement Economiques
Organisation for Economic Co-operation and Development

OLIS : 16-Nov-1998
Dist. : 17-Nov-1998

English text only

**DIRECTORATE FOR SCIENCE, TECHNOLOGY AND INDUSTRY
COMMITTEE FOR SCIENTIFIC AND TECHNOLOGICAL POLICY**

DSTI/STP/MS(98)2
Unclassified

Megascience Forum

SUMMARY

Workshop on Global-Scale Issues: Strengthening the Interaction between Science and Policy-Making

held March 4-6, 1998, in Saltsjöbaden, Sweden

Person to contact: Stefan Michalowski, Tel: 33 1 45 24 96 99
Fax: 33 1 45 24 96 44, E-mail: msforum@oecd.org

71877

Document complet disponible sur OLIS dans son format d'origine
Complete document available on OLIS in its original format

English text only

**ORGANISATION FOR ECONOMIC CO-OPERATION
AND DEVELOPMENT**

Pursuant to Article 1 of the Convention signed in Paris on 14th December 1960, and which came into force on 30th September 1961, the Organisation for Economic Co-operation and Development (OECD) shall promote policies designed:

- to achieve the highest sustainable economic growth and employment and a rising standard of living in Member countries, while maintaining financial stability, and thus to contribute to the development of the world economy;
- to contribute to sound economic expansion in Member as well as non-member countries in the process of economic development; and
- to contribute to the expansion of world trade on a multilateral, non-discriminatory basis in accordance with international obligations.

The original Members countries of the OECD are Austria, Belgium, Canada, Denmark, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States. The following countries became Members subsequently through accession at the dates indicated hereafter: Japan (28th April 1964), Finland (28th January 1969), Australia (7th June 1971), New Zealand (29th May 1973), Mexico (18th May 1994), the Czech Republic (21st December 1995), Hungary (7th May 1996), Poland (22 November 1996) and the Republic of Korea (12th December 1996). The Commission of the European Communities takes part in the work of the OECD (Article 13 of the OECD Convention).

© OECD 1998

Applications for permission to reproduce or translate all or part of this publication should be made to:

**Head of Publications Service, OECD
2, rue André-Pascal, 75775 PARIS CEDEX 16, France**

FOREWORD

This document is a summary of the OECD Megascience Forum¹ *Workshop on Global-Scale Issues: Strengthening the Interaction between Science and Policy-Making*, held on 4-6 March 1998 in Sweden.

There has recently been growing concern over a series of large-scale threats to human societies, such as unbalanced population growth, new and re-emerging diseases, environmental degradation, and unsustainable consumption of food, energy and natural resources. At the ninth meeting of the Megascience Forum in June 1996, the Japanese delegation, recognising that each of these problems is complex, that they are closely connected, and that internationally co-ordinated, large-scale efforts to improve the science community's ability to provide integrated scientific advice and analysis to decision makers are therefore needed, proposed a workshop on international co-operation to address global-scale issues.

The Workshop's programme was developed by an international steering group² nominated by Forum member countries. The Workshop received major support from the governments of Japan and Sweden, plus additional support from the governments of the Netherlands and the United States.

The opinions expressed in this report are those of the participants and do not necessarily reflect the views of individual OECD Member countries.³ The report is published under the responsibility of the Secretary-General of the OECD.

Background documents prepared by speakers for this Workshop can be found on the OECD Megascience Forum Internet site (www.oecd.org/dsti/sti/s_t/ms).

¹ The Megascience Forum provides a venue for information exchange and consultation among government science policy officials regarding large science programmes and projects. The Megascience Forum sponsors activities by its working groups to address issues in specific scientific disciplines and cross-cutting international megascience policy issues. In addition, it sponsors occasional single-event workshops, where scientists and government officials can discuss topics that require the special attention of governments.

² The International Steering Committee was chaired by Prof. Keiji Higuchi. Members of the steering committee are listed in the appendix. The preparation of the Workshop was co-ordinated by Ms. Sachiko Ishizaka of the OECD Megascience Forum Secretariat.

³ This report was originally prepared by Dr. Robert Corell in consultation with Prof. Bert Bolin, Co-chairs of the Workshop.

TABLE OF CONTENTS

EXECUTIVE SUMMARY	5
Background	5
Case studies	6
Overall perspectives and conclusions	7
Recommendations	8
INTRODUCTION AND BACKGROUND	9
Context	9
Challenges	9
THE WORKSHOP AND ITS PROGRAMME.....	11
Programme and agenda.....	11
What is integrated assessment?	11
The rationale for the workshop	13
Principles of effective assessments.....	13
THE CASE STUDIES.....	16
An integrated assessment strategy for addressing issues in the coastal seas	16
Recommendation for action	17
Request to the OECD.....	18
An integrated assessment of land use and food production.....	18
A new mechanism for providing integrated assessments of biodiversity	21
CONCLUSIONS AND RECOMMENDATIONS	24
Overall perspectives.....	24
Overall recommendations	24
APPENDIX I	26
Programme	26
APPENDIX II.....	31
Members of the International Steering Committee	31
APPENDIX III	32
List of participants	32

EXECUTIVE SUMMARY

Background

The Workshop on Global-scale Issues, organised under the auspices of the OECD Megascience Forum, was held at the Grand Hotel Saltzjöbaden near Stockholm, Sweden, on 4-6 March 1998. It brought together leading scientists, decision makers, and scholars from around the world to discuss the interaction between science and policy/decision-making processes with respect to global-scale issues. These issues include the impacts of rapid population change, new and re-emerging diseases, environmental degradation and change, and unsustainable needs with respect to food, energy, and natural resources. Participants closely examined the role that science can play in providing government officials and other decision makers with relevant advice grounded in scientific results and systematic analysis.

More specifically, the workshop explored the potential of an emerging set of strategies, referred to as integrated assessment, to develop viable policy options for governments on global-scale issues associated with the environment. Traditionally, scientific advice to policy makers was unidirectional. That is, policy makers asked a scientific group to provide advice on a given issue. After due deliberation, that group submitted a report, and the policy makers decided to follow, modify, or ignore the advice contained in the report. In such an approach, consideration of the impact of uncertainties in the scientific data on policy options, as well as the possibility of feedback between policy needs and the development of scientific programmes, are largely lacking.

In contrast, integrated assessments, which seek to integrate scientific knowledge, understanding and predictive capabilities into policy-making processes, require the joint participation not only of scientists and policy makers, but also of others groups with a stake in the issue under consideration.

The workshop's point of departure was a deceptively simple question, namely:

Integrated assessments have achieved a reasonable level of success for topics covered by international conventions, such as climate change. Can integrated assessments of other types of global-scale issues organised under the auspices of appropriate international bodies be of substantive use to the international policy/decision-making community and to societies and nations at large?

Within the framework defined by this question, participants sought to draw generic lessons from past scientifically based assessments, from the literature, and from insights of scholars, which would provide the foundation for assessments that could meet the basic needs of the policy/decision-making communities. They wished to identify the fundamental elements essential for:

- initiating, organising, and implementing assessment exercises in response to societal needs;
- presenting those results in a policy-relevant and useful form for decision making;

- providing advice and counsel to policy communities on how to solicit and participate in integrated scientific assessments;
- incorporating those assessments most effectively into policy-making processes.

Case studies

The Stockholm workshop provided the first opportunity for a broad, international group of scientists and policy makers to explore these elements by comparing integrated assessments carried out in diverse areas. Three cases were selected as illustrative examples to highlight the substantive issues involved in strengthening the interactions between science and policy making: oceans, land use and food production, and biodiversity.

Expert groups explored these areas in parallel during the second day of the workshop. They agreed that integrated assessments are very important for formulating policy options for the relevant issues and made specific recommendations for future assessments, as follows:

Oceans: The Case Study Group on Oceans examined the level of interaction between the science and policy communities, the usefulness of integrated assessments, and the level of development of the science and technology base for sustainable ocean management. The Group noted that long-term assessment of oceanic issues is fully covered by existing frameworks such as the Framework Convention on Climate Change, and that the oceans are already monitored by observations and existing programmes and experiments. However, in view of the steady degradation of the coastal seas, including loss of coastal ecosystems and habitats, the group agreed that an integrated assessment of the coastal seas should be undertaken. It also recommended that the assessment should fully utilise experience derived from relevant integrated assessments as well as information from water management projects such as the Global Environmental Facility-Global International Water Assessment.

Land use and food production: The Case Study Group on Land Use and Food Production noted that there has never been a comprehensive international assessment of this issue. It agreed on the importance of an integrated assessment that would extend beyond the borders of the agricultural sector to link it with such issues as exploitation of the oceans, biodiversity, forests, and fresh water, on the one hand, and socio-economic issues such as trade, population, governance and land tenure, culture and consumption patterns, on the other. The group discussed the assessment's scope and target audience, and identified uncertainties and knowledge gaps requiring further research. It also suggested that the assessment should be conducted through a series of workshops involving relevant stakeholders and that it should cover global, regional and local levels, taking into account temporal variations resulting from fluctuations in natural systems or in economic and political conditions. It recommended that an appropriate and effective venue for conducting the assessment should be established under the auspices of, or in co-ordination with, existing governmental and non-governmental organisations, such as the United Nations Commission on Sustainable Development, the Food and Agricultural Organisation (FAO), the United Nations Environment Program (UNEP), or the International Council of Scientific Unions (ICSU), in close conjunction with its International Geosphere-Biosphere and Human Dimensions of Global Change Programmes.

Biodiversity: The Case Study Group on Biodiversity noted that although an international assessment of biodiversity has recently been completed, it has not been adequately integrated into the policy processes of the Convention on Biological Diversity. The group noted that future assessments, to be effective, must be connected with the Convention and recommended that such a venue be established as soon as possible. Assessment activities in the biodiversity area should be targeted to identifiable needs of the Convention, as determined by participating nations. It is likely that, in the near future, assessments will focus on regional issues.

Overall perspectives and conclusions

The workshop was based, in part, on lessons learned from past instances of science/policy interactions. More specifically, it examined how integrated assessments can:

- reveal the current state of scientific knowledge and identify questions that still require an answer;
- incorporate uncertainty and contingency;
- be made commensurate with the international dimensions of the issue considered;
- best incorporate multidisciplinary insights involving both the social and the natural sciences;
- reflect a variety of time scales and perspectives;
- best produce and communicate policy-relevant results.

Participants frequently referred to principles that are essential to effective assistance in policy/decision-making processes. They concluded that a useful assessment process must not only incorporate scientific knowledge and understanding, but also communicate policy-relevant insights and be aware of what is essential to effective implementation. Principles to guide assessments can usefully be divided into three categories:

- delineating and organising the assessment;
- determining scientific involvement in the assessment;
- conducting and communicating the assessment.

Participants agreed that integrated assessments of global-scale issues are a valuable mechanism which can help the scientific community to draw together its expertise and present it in a manner that is useful for policy/decision-making processes. Integrated assessments at international level on topics not linked with or enabled by international conventions and protocols (including the three areas considered at the workshop) would help the international policy/decision-making communities to determine policy options. Integrated assessments can also help society at large to grasp the dimensions of global-scale issues. Moreover, they can help guide the scientific community as it determines future research directions.

Integrated assessments are still very much in the early stages of their development. Participants agreed on the need for critical comparisons and discussions of best practices in integrated assessments in several areas as a means of improving the underlying methodology.

Recommendations

Workshop participants recommended fuller exploration of issues associated with integrated assessments of global-scale issues, including those highlighted in the prospectus for this workshop:

- identifying issues meriting examination that are related to the foundations for, and the strategic frameworks of, integrated assessments, which involve a number of existing institutions, including international organisations and regional networks;
- developing guidelines and principles for initiating, organising, and conducting integrated assessment exercises in response to societal needs and for presenting the results of such assessments in a manner that can be used by decision makers;
- developing strategies for providing advice to policy communities on how to solicit and implement integrated scientific assessments, and on how to incorporate the results of such assessments into policy-making processes;
- continuing to document generic lessons learned from past assessments, particularly at international level.

Participants stressed that, in organising and conducting integrated assessments, special attention should be paid to avoiding duplication of effort or the creation of additional international institutions. The participation of scientists from all relevant disciplines as well as scientists and policy makers from developing countries should be sought. Linkages with existing conventions and protocols should be developed and established in such a way that the scientific integrity and independence of the assessment body is preserved.

Workshop participants suggested that the OECD in its capacity as an intergovernmental organisation, with expertise not only in science and technology policy but also other policy issues concerned with sustainable economic growth, could provide a useful venue for the exploration of issues associated with integrated assessment and for the planning of some of the above-mentioned activities.

INTRODUCTION AND BACKGROUND

The Workshop on Global-scale Issues, organised under the auspices of the OECD Megascience Forum, was held at the Grand Hotel Saltzjöbaden near Stockholm, Sweden, on 4-6 March 1998. The workshop was proposed by the Japanese delegation at the ninth meeting of the Megascience Forum in June 1996. An international steering group nominated by Forum member countries developed the programme. The governments of Japan and Sweden provided major support; additional support came from the governments of the Netherlands and the United States.

The workshop examined the role that science can play in providing integrated analyses and advice on global-scale issues to government officials and other decision makers. More specifically, it explored the potential of an emerging set of strategies, referred to as integrated assessment, to develop viable policy options for governments on global-scale issues associated with the environment. It brought together leading scientists, government officials responsible for policy/decision making, and scholars from around the world to discuss the interaction between science and policy/decision-making processes.

Context

The twentieth century closes with a crucial question:

How, if at all, can a balance be achieved between global-scale geopolitical, economic and societal changes of unprecedented proportions and a set of related global-scale threats evolving out of the complex interplay among the Earth's natural and human-related systems?

Rapid population change in many parts of the world, new and re-emerging diseases, environmental degradation and change, and an unsustainable need for and consumption of food, energy, and natural resources are but a few of the challenges for the twenty-first century. The Earth's complexity, its component systems, and their interactions make understanding and prediction difficult, but advances in scientific knowledge have substantively increased our collective understanding of global-scale environmental change and the role of human activities in such change. It has become apparent that humans play a powerful and expanding role as agents of that change. In short, the current and future state of the Earth system and its life-sustaining environmental envelope is inevitably linked to human activities and thus to decisions at international, national, and local levels. It is also increasingly apparent, and demonstrated through international science-based assessment processes, that fundamental scientific information, understanding, and ability to outline and analyse different development paths for the future are crucial to policy/decision-making processes.

Challenges

In a note prepared prior to the workshop, Bert Bolin, former chairman of the Intergovernmental Panel on Climate Change (IPCC), summarised the challenges to the scientific community posed by growing scientific – and societal – awareness of the character and scope of global-scale issues:

Fundamental scientific research and innovation have indeed been of great importance for the development of the industrial nations of the world. This workshop is an attempt to look at the interplay of science and politics in order to grasp better the characteristic features of this process. The socio-economic sciences, because of their immediate importance for the development and organisation of society, must be included in the analysis of this issue. The medical sciences have similarly found an important place in society through the building of institutions of medicine, thereby contributing to social welfare, which should also be considered.

The natural sciences and technology early made important contributions to a rational development of agriculture, forestry and fisheries, i.e. to provide food and fibre for a rapidly increasing world population. Policy in these fields essentially implied creating the opportunities for exploiting scientific findings for the benefit of these sectors of society. There were rather few cases where controversies arose concerning the utilisation of scientific findings.

During the last four decades, however, this basically optimistic attitude about the development of society has gradually changed. Environmental problems have arisen and grown into global concerns. The exploitation of the natural resources on Earth has created new political issues because of fears of their over-exploitation. Initially local or national in character these concerns have become global. In the course of this development, the interplay between science and politics has changed markedly. Conflicts have appeared between different interest groups in society, and also between nations. Scientific information has become of importance in the political debate.

In attempting to analyse this situation it is important that we do not limit ourselves to considering the technical aspects of how to make science useful in politics, but take a broader look at the role of science in society. There are a number of actors on the scene. Many interest groups wish to be noted, particularly representatives for industry, on the one hand and environmentalists, on the other. The press, TV, and radio are no longer passive means for transmitting information, but themselves play important political roles. All contribute to forming policy in a democracy and all try to get support for their views from the general public. The analysis of how to strengthen the interaction between science and policy making on global-scale issues must therefore not be limited to examining critically the role of the scientific community in providing integrated analyses and advice on global-scale issues to government officials and other decision makers.

Collaborative efforts will increase in importance. The creation of new forms of assessment of scientific knowledge as well as new institutional arrangements may be necessary. It will be increasingly important that the credibility of the scientific input into the political process be well handled, since otherwise the knowledge base for political action will be diffuse and therefore challenged.

THE WORKSHOP AND ITS PROGRAMME

The OECD Megascience Forum's Workshop on Global-scale Issues brought together international experts from a range of natural and social science fields and policy-making bodies to explore and ponder the lessons learned from past assessments of major environmental issues, and to consider how to advance future efforts of a similar kind. Three specific areas (oceans, land use and food production, and biodiversity) were examined, and feasible means of refining and extending the international assessment process to serve a wider range of scientific and policy-making needs were considered.

Programme and agenda

The first day of the three-day workshop was devoted to a review of past experiences and a selection of common themes and issues around which the organisers hoped that discussions would develop. Bert Bolin, who chaired the session, discussed the origin and goals of the workshop; presentations by experts from the scientific community, the policy community and the media followed. Speakers from each of these three groups addressed integrated assessments of global-scale issues from their differing professional perspectives and described their community's expectations *vis-à-vis* the other two. Experts on the interaction between the science and policy communities were then invited to examine past instances of integrated assessments of climate change (based on IPCC experiences), transboundary air pollution and acid rain, biodiversity (based on the Convention on Biological Diversity), and forests. Three experts then provided comments on past events from the perspectives of their disciplines/methodologies.

On the second day of the workshop, parallel sessions were convened to consider questions and issues involving large-scale assessment exercises in three selected areas: oceans, land use and food production, and biodiversity. These sessions were chaired by Nicholas Flemming of the Southampton Oceanographic Centre, Louise Fresco of the Food and Agriculture Organization (FAO), and Harold Mooney of Stanford University, respectively. The primary goal was to develop a better understanding of how integrated assessments could serve the needs of scientists and policy-makers in these three fields.

On the third day, following a general discussion, conclusions, recommendations and possible follow-on activities were developed, on the basis of reports from the three case studies. Robert Corell of the National Science Foundation chaired the session.

The full programme and agenda of the workshop are contained in the appendix.

What is integrated assessment?

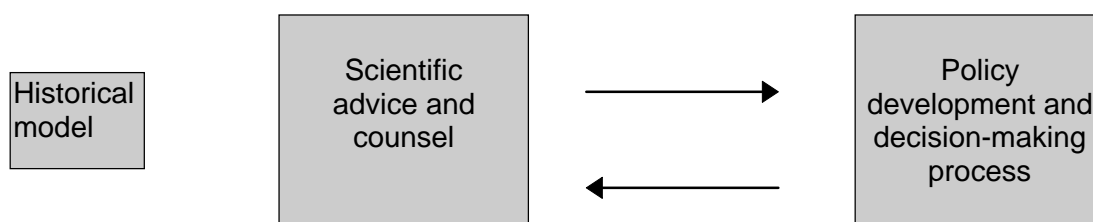
Historically, the complexity of global-scale issues and their interconnectedness with the Earth system have made it difficult to relate scientific information effectively to policy/decision-making processes. Traditionally, policy makers seeking and using scientific advice have typically followed a linear science-to-policy/decision-making process. That is, policy makers typically ask scientists to provide advice on a specific set of issues, then determine how to make use of that advice. In this approach, the scientific and

policy realms remain largely separate, so that the impact of uncertainties in the scientific data on policy options is not considered, and possibilities of feedback between the needs of policy makers and the development of scientific programmes are largely ignored.

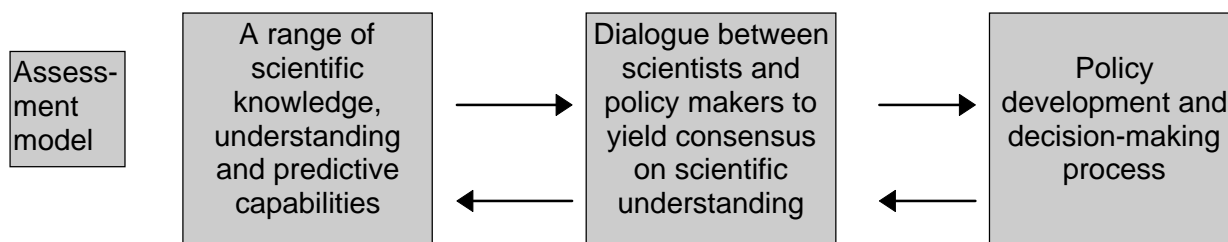
Many complex, policy-sensitive areas such as national security and foreign relations have historically relied on expert knowledge and information as a guide to decision making. In these areas, integration of expert knowledge and advice with decision making has evolved from a unidirectional expert-to-policy maker approach to a set of more complex assessment strategies. Like these areas of public policy, the complexity of global-scale issues of the type addressed at the Stockholm workshop, and the uncertainties of knowledge and insights associated with such issues, has created a need for new approaches and a fundamental change in the strategy for integrating scientific knowledge, understanding and predictive capabilities into policy/decision-making processes.

Figure 1 shows the differences between these two approaches. The principal novelty is the introduction of the third box in the lower portion of the diagram. This box encompasses the formal, open, inclusive and often world-wide dialogue between scientists and policy makers, which is the key activity in developing integrated assessments.

Figure 1. Two models for connecting scientific knowledge to policy/decision making



Historically, the connection was generally direct. Individual scientists or small groups of scientists from a nation or a small group of nations conducted an analysis/assessment for the policy development and decision-making process.



The assessment model seeks to connect leading scientists in the relevant fields from around the world and from virtually all nations to the policy/decision-making process through an intermediate and formal process. This process seeks to build a consensus, within the science community, on the state of scientific knowledge, understanding, "best" practices for scenarios and predictions, and the consequences/impacts of a global-scale issue for societies, and to provide a scientific consensus on the "collective wisdom" on the topic. The third box, which involves structured dialogue between scientists and policy makers, is the key activity in developing integrated assessment.

The rationale for the workshop

Against this background, the workshop was based, in part, on a deceptively simple question:

Integrated assessments have achieved a reasonable level of success on topics, such as climate change, covered by international conventions. Can integrated assessments of other types of global-scale issues organised under the auspices of appropriate international bodies be of substantive use to the international policy/decision-making community and to societies and nations at large?

In order to address this question, participants sought to identify:

- generic lessons learned from past scientifically based assessments, from the literature, and from insights of scholars which could provide the foundation for assessments that meet the needs of policy/decision-making communities;
- elements essential to initiating, organising, and implementing assessment exercises in response to societal needs;
- effective means of presenting these results in a policy-relevant and useful form for decision making;
- ways to provide advice to policy communities on how to solicit and participate in integrated scientific assessments;
- means of effectively incorporating those assessments into policy-making processes.

Principles of effective assessments

Workshop participants frequently referred to key principles that underlie any process intended to assist effectively in policy/decision-making processes. They concluded that any useful assessment process must not only incorporate scientific knowledge and understanding, but must also communicate policy-relevant insights and be aware of what is essential to effective implementation. Principles to guide assessments can usefully be divided into the following three categories.

Delineating and organising the assessment

- *Demonstrable need:* An assessment should be initiated on the basis of a clear, timely, and demonstrable need by the policy maker/stakeholder.
- *Scope:* The scope of the assessment should be carefully determined. It can range from a comprehensive assessment of a particular global-scale issue to a targeted assessment of specific sub-issues, as determined by need, timeliness, frequency, and policy factors.
- *Strategy:* An integrated assessment is a comprehensive process during which expert knowledge related to a policy problem is organised, evaluated, integrated and presented in documents intended to inform policy/decision making. It can also be a valuable process for

establishing a sustained dialogue between scientists from developed and developing countries and other stakeholders. The comprehensive character of the process requires integration of scientific and policy-making perspectives in all steps, from definition of the problem and the scope of the assessment to external review of the results and preparation and dissemination of final conclusions and recommended options. Results should be available as a detailed report authored by scientific participants, as a closely related succinct summary for policy makers, and as other forms suitable for broad public dissemination.

- *Role of scientific participants:* Scientific participants should provide accurate information as a basis for policy formulation by illuminating the consequences of different policy options. However, they should avoid advocating specific policy actions. Participation of representatives from all relevant disciplines in both the natural and social sciences and from both developed and developing countries is critical.
- *Connectedness:* The assessment should be carried out in co-operation with an international institution or organisation that can bring the results to the attention of appropriate national and international policy makers.

Determining scientific involvement in the assessment

- *Scientific basis:* The assessment must be objective and credible in the eyes of the scientific community. It must clearly identify issues on which agreement can and cannot be reached, as well as the reasons why.
- *Scope of the scientific aspects:* The assessment should: integrate, evaluate, and interpret scientific knowledge, insights and findings; evaluate scientific uncertainties associated with such findings; provide analyses for policy makers on the consequences, impacts and vulnerabilities associated with the problem being studied; and assess both human-induced and natural aspects of the problem.
- *Conditions and time scale:* The conditions, boundaries, and scenarios for the assessment should be carefully determined and documented. Further, the period of time over which the assessment seeks to address the implications of the problem should be explicitly determined. In some cases, the relevant time scale may be a few years; in others, it may have implications for future generations.

Conducting and communicating the assessment

- *Breadth of participation:* The process should be characterised by openness, inclusiveness, and the broad participation of natural and social scientists, policy makers/stakeholders and others with relevant knowledge and insights. Assessment activities should include participants from both developed and developing countries and from all relevant sectors of society.
- *Credibility/openness:* The process should be open and transparent. The assessment is best served by subjecting its results to open review and to comments and suggestions from a broad audience of interested individuals, parties, and organisations.

- *Scientific integrity and independence*: Because policy options associated with global-scale issues are highly sensitive, political pressures must be strenuously resisted so as to ensure the scientific integrity and independence of the assessment body.
- *Uncertainty*: The degree of uncertainty that is the result of the simplifying assumptions inherent in the theoretical models used, of insufficient data for model validation, and of the stochastic nature of the assessment should be made clear.
- *Communicating the process, the results and the final products*: The assessment process is markedly improved, and in the end made more effective, when there are mechanisms during the actual assessment for communicating, broadly and continuously, all relevant information regarding the content of the assessment and the assessment process. An assessment should be designed to provide policy makers, planners, managers, organisations, and the public with the documents and other communication media to support policy-making processes.
- *Language*: The use of simple, jargon-free language in reports meant for policy makers and the broader public is essential. Journalists and science writers can play a significant role in the integrated assessment process; their involvement at an early stage is highly desirable.

These principles address matters of strategy, content, venue, participation, and communication. They suggest that an effective integrated assessment must be: characterised by partnerships among public and private entities; focused on specific questions and information needed by policy makers/stakeholders who are in a position to implement long-term coping strategies; and characterised by scientific excellence, openness, full participation, transparency, relevance to decision making, and adequate communication.

Application of these principles to the three specific areas explored during the second day of the workshop illustrates both their generality and their specificity.

THE CASE STUDIES

The workshop, through panels of scientists and policy makers, critically examined the specific case study issues and sought to identify the role of the scientific community in providing integrated analyses and advice on specific global-scale issues to government officials and other decision makers. The summary reports from each Case Study Group are contained in the three sections that follow. The three case studies (on oceans, land use and food production, and biodiversity) were used as illustrative examples to highlight substantive issues for strengthening the interaction between science and policy making.

An integrated assessment strategy for addressing issues in the coastal seas⁴

The Oceans Case Study Group received four presentations on the interaction of global ocean science and policy and reviewed the case for and against the development of an integrated assessment for oceans. It agreed that the long-term climate dimension of the oceans was fully accounted for by the existing framework of the Framework Convention on Climate Change (FCCC), the Intergovernmental Panel on Climate Change (IPCC), and regular assessments. The observation and monitoring of global climate change in the oceans is covered by the Global Climate Observing System (GCOS), the Global Ocean Observing System (GOOS), and proposed experiments such as the Global Ocean Data Assimilation Experiment (GODAE). Additionally, it decided that concern for biodiversity in the oceans is the responsibility of the Convention on Biological Diversity.

The Group decided that the most important topic for an integrated assessment of the oceans is the coastal seas. The forces that have created a steady and dangerous degradation of the coastal seas include urbanisation and industrialisation of coastal lands, loss of coastal ecosystems and habitats, waste disposal and contaminants, over-exploitation of marine resources, coastal erosion, introduction of invasive species, disturbances caused by the production of greenhouse gases, and the continuous increase in demand for coastal space for recreation and development. All these trends are likely to continue to cause further degradation. Since it will inevitably take 20-30 years to contain the damage already done and to control or reduce the forces that are causing the damage, plans to conduct an integrated assessment should focus on the consequences of allowing present trends to continue unchecked for 20-30 years or more. The motive for conducting the integrated assessment is to avoid the damage to the economy, public health, and the environment which would otherwise occur over this period and beyond. The potential losses to industry and services are of the order of billions of dollars a year, while the damage to the environment and public health is serious, but not quantifiable in financial terms.

The proposed integrated assessment of the coastal seas should answer the following question: Are the human activities that threaten the global coastal seas tending to cause unacceptable and unsustainable damage to economic resources, the environment, and human health, and if so, can we determine corrective action that will reverse the process?

⁴. This summary was prepared by Dr. Nicholas Flemming, Chairman of the Case Study Panel on Oceans.

The Oceans Case Study Group received information on the Global Environment Facility (GEF) the Global International Waters Assessment (GIWA) project, and the contracted arrangement with UNEP for this project. GIWA includes many elements and principles which are consistent with the objectives identified by the Group, but has some different criteria and boundary conditions. The objective of the GIWA project is to provide guidance and a strategic framework for identifying priorities for GEF programmes in international waters, including major rivers, lakes, and drainage basins on land. The Group considers that an integrated assessment of coastal seas could, in principle, be carried out by estimating the fluxes of fresh water and other critical substances from land to sea, without actually studying the complete drainage system from the watershed to the coast. In addition, an integrated assessment of coastal seas would include detailed study, in principle, of all relevant factors in the exclusive economic zones of all participating countries and adjacent seas, whether the factor was of concern to GEF or not.

The GIWA project and the integrated assessment recommended by the Oceans Case Study Group have much in common. Actions recommended to the OECD include efforts to co-ordinate any OECD Megascience Forum initiatives with the existing plans for GIWA.

Conclusions on the design of integrated assessments

- The design of an integrated assessment of the oceans can learn from the experience of IPCC, the Vienna Convention for the Protection of Ozone Layer and its Montreal Protocol, the Convention on Biological Diversity, and other examples of integrated assessment.
- An integrated assessment of global coastal seas science issues should link logically to a set of global conventions and protocols.
- Even if no single dominant agency, authority or government is urgently requesting an integrated assessment of the oceans now, there is a strong public concern about the state of the oceans, especially coastal seas, and scientists share this concern. The present structural and modal weakness of the international mechanisms is no excuse for inaction.

Recommendation for action

- The Oceans Case Study Group recommends that an integrated assessment be conducted to address the problem of degradation of the coastal seas, as described above.
- The OECD Megascience Forum should act a facilitator or broker to bring together the interested parties concerned with undertaking an integrated assessment of coastal seas.
- The Megascience Forum is requested to report this recommendation to the Committee on Science and Technological Policy and to initiate procedures to create a group or panel to start planning for an integrated assessment of the coastal seas.
- The Group considered that the OECD, at an appropriate level, should take a prominent role in identifying priorities and an agreed mechanism for planning and conducting an integrated assessment of the coastal seas.

Request to the OECD

- The Ministers of Science and Technological Policy are requested to support the scientific design and implementation of an integrated assessment of the world's coastal seas.
- Given the large number and variety of international bodies, the many sectors involved, the protocols applying to the coastal seas, and the regional assessments already completed, no single organisation is at present capable of carrying out or organising an integrated assessment. OECD Ministers of Science and Technological Policy, who have always been supportive of marine research and technology, are requested to recognise this and to consider whether they, in the context of the OECD, could organise an activity to bring together an appropriate group of international bodies to start planning an integrated assessment of coastal seas. Where relevant, consultation at national level with ministers of fisheries, environment, shipping, and other appropriate governmental ministries and agencies would be appropriate.

An integrated assessment of land use and food production⁵

Identification of the issue

The Case Study Group concludes that there is a need for an authoritative, science-based integrated assessment of problems connected with land use and food production. Such an assessment should extend beyond the borders of the agriculture sector to bring in issues such as exploitation of the oceans, biodiversity, forests, and fresh water, on the one hand, and socio-economic issues such as trade, population, governance and land tenure, culture and consumption patterns, on the other.

Scope

The precise scope of the assessment must be formulated in a follow-up process. It should address the issue of how the food security and land use needs of a growing world population can be met over the next decades in a sustainable way.

This requires: identifying factors that can ensure optimal land use and food supply; optimising land use for multiple human needs by mitigating and/or adapting to forcing functions that disturbing optimal use; and identifying methods for integrating land management and water management.

Audience for an assessment

In the short term, an initial assessment should be targeted at the Commission on Sustainable Development (CSD), which will deal with agriculture in 2000. Other target audiences are the conventions, in particular those on biological diversity, desertification, but also climate. The assessment will be an iterative effort requiring multiple partial and regional sub-assessments. One outcome of the assessment should be a policy agenda for addressing the policy implications of the assessment results. Another should be a

⁵. This summary was prepared by Professor Louise Fresco, Chair of the Case Study Panel on Land Use and Food Production, and by Dr. John Marks, Rapporteur.

science agenda which identifies uncertainties and knowledge gaps. This agenda should be addressed to science ministers and ministers for agriculture and environment. Results should also be made available to the public at large. In fact, assessments should lead ideally to a situation where the science policy agenda is influenced by that of the public at large and *vice versa*. The Case Study Group recognised that the developing countries are key players for this issue and should be partners in the assessment and associated research from the outset. This implies a substantial capacity-building effort involving development aid agencies.

Main uncertainties, unknowns and needs

Uncertainties and knowledge gaps requiring research fall under the following headings:

- Natural science issues, such as:
 - * limits to crop productivity;
 - * potential of new technologies (e.g. biotechnology);
 - * effect of climate variability at regional level;
 - * thresholds and non-linearities.
- Human dimension research, such as:
 - * institutions and governance;
 - * consumer behaviour;
 - * perceptions and values (e.g. acceptability of new technologies);
 - * economic studies on market stability, income distribution, and employment;
 - * political sciences.
- Areas for joint socio-economic and natural science study, such as:
 - * the relation between land use and land cover change;
 - * water management.
- Data and monitoring, such as:
 - * the lack of long time series data sets on the natural sciences;
 - * globally comparable social science data sets;
 - * the need for integrated global observation systems.
- Development of new integrated modelling tools.

Mechanisms

After initial definition of the key questions, the assessment should be further developed in a series of (possibly “virtual”) workshops involving stakeholders, including policy makers, and the business community. The setting up of the assessment should be accompanied by a suitably organised public debate. Some possible models were discussed in the Case Study Group. As stated earlier, the full partnership of developing countries is essential to a successful assessment.

The actual assessment must meet the highest standards. It should be multidisciplinary and performed at different scales: global, but also regional and even local, taking into account temporal variations resulting from fluctuations in natural systems (e.g. in precipitation or climate) or in economic and political conditions.

It is essential that the assessment be executed independently of governments and stakeholders. The Commission on Sustainable Development (CSD) could take the initiative, and ICSU could be asked to act as the independent science sponsor.

Recommendations for follow-up

- Approach the CSD with the proposal to initiate an assessment and discuss the modalities with FAO and UNEP.
- Approach the Conventions on Biological Diversity and on Climate Change through their SBSTTAs with a request to consider including land use and food production in their assessments.
- Ask ICSU to take responsibility for ensuring the independent, authoritative science-based character of the assessment.
- Approach the Convention to Combat Desertification through its Committee on Science and Technology with a request to consider the setting up of a panel to carry out an integrated assessment of land use and food production in the drylands.
- Recommend that OECD science ministers invite their colleagues for agriculture, environment and development co-operation to share responsibility for the assessment.
- Recommend to OECD science ministers that they incorporate the science agenda resulting from an assessment in their national science agendas.

A new mechanism for providing integrated assessments of biodiversity⁶

Why is the problem urgent? why is biodiversity important?

Changes in biodiversity are more frequent now than they have been since the last mass extinction, aeons in the past. Moreover, the rates of change are increasing as a result of a broad spectrum of human activities. These changes include both the more familiar losses of species as well as the less well-known invasions and introductions, decreases in population sizes, fragmentation of populations, and losses of entire ecosystems. Climate change will exacerbate these trends.

The consequences of these changes are serious. Extinctions of species are irreversible. Losses of species from an ecosystem, and corresponding changes in its composition, may alter the functioning of the system and thus the delivery of ecosystem services. Intact, functioning ecological systems provide a range of benefits to humanity which include flood control, pest control, generation of fertile soil, climate regulation, and water, soil and air purification. Ecosystem goods and services provide the life support systems for all of life on Earth. As species are lost and ecosystems are degraded, the functioning of the systems changes and the delivery of ecosystem services and goods is impaired.

Status of public understanding of the problem

Misconceptions about biodiversity abound. They include the view that:

- current changes are not different from those of the past;
- humans may become independent of natural biotic systems;
- humans can replace everything that nature used to provide;
- attention to biodiversity means economic hardship and social inequity.

Messages from the scientific community about biodiversity are perceived as confusing, when they discuss, for example, rates of loss and the consequences of changes, including the social and economic impacts. Neither the rates nor the consequences of the changes are generally perceived by the public or by policy makers as critical issues, despite the existence of the Convention on Biological Diversity and general recognition that biodiversity is an issue. Therefore, a mechanism for producing a single credible and authoritative assessment of the state of knowledge with respect to biodiversity would be informative.

Scientific knowledge to guide and inform policy decisions

Research on biodiversity is moving rapidly, and much of the resulting knowledge is immediately relevant to the management and policy processes. Moreover, new tools and networks are continually appearing. For example, the development of a global biodiversity information system to facilitate the sharing and use of biodiversity data was proposed by an earlier Megascience workshop. The Group endorses the concept

⁶. This summary was prepared by Professor Harold Mooney, Chair of the Case Study Panel on Biodiversity, and by Professor Jane Lubchenco, Rapporteur.

of a consolidated global information system on biodiversity which builds on existing systems and incorporates new co-operative approaches.

Integrated assessment has proven to be an effective vehicle for summarising the state of scientific knowledge in a way that can be used by policy/decision makers to inform policy on global-scale issues. To be most useful, an assessment should be supported by and responsive to the needs of the relevant policy organisation. Assessments that summarise areas of scientific certainty, areas of uncertainty, and the likely consequences of different policy options have been particularly helpful in the policy arena. To ensure scientific integrity, the assessment body must control the assessment process and the expression of its results. The products of the assessment should include both a peer-reviewed, scientifically credible report and a summary for policy makers, which explicitly links the science to the policy.

The United Nations Environment Program (UNEP) conducted a global assessment on biodiversity that provided considerable depth and breadth of material. However, there is a need for an ongoing assessment mechanism that is responsive to specific issues of interest identified by the Conference of Parties (COP) and the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA).

The Convention on Biological Diversity (CBD) and Parties to the Convention have identified a number of areas in which scientific knowledge is needed to inform decisions, set priorities, and guide implementation. A scientific assessment process could complement existing mechanisms within the CBD organisation in order to provide this guidance.

The need for a new assessment mechanism

A new scientific assessment vehicle is needed to serve the CBD, countries and other stakeholders. The dual requirements of scientific credibility and policy relevance would be served by an interdisciplinary group approved by the COP consisting of five members of the Bureau of SBSTTA and five independent scientists approved by ICSU in addition to a Chair who would be appointed by the UNEP Executive Director in consultation with the Bureau of SBSTTA and the International Council of Scientific Unions (ICSU). The assessment committee would evaluate issues identified by the COP and the SBSTTA.

Two types of assessments are identified as particularly useful at this time.

- *Targeted, technical assessments* of topics identified by the COP are deemed more useful than a general assessment at this point. Such topics include the consequences of losses and additions of species to the functioning of ecological systems and the subsequent delivery of ecosystem services; analysis of positive and perverse incentive measures in the conservation, use and benefit sharing of biodiversity; valuation and creation of markets for ecological services; best practices in capacity building; rules for ecosystem restoration; analysis of environmental impact assessment strategies; consequences of homogenisation; models of benefit sharing; status of biodiversity in oceans; consequences to biodiversity of different types of land use; identification of critical services and early warning of their impairment.
- *Regional integrated assessments* of the impact of specific regional-scale activities on biodiversity would fulfil an unmet need for improved understanding at this critical scale. Examples include the effects of agriculture, fisheries, energy production, tourism, transportation, forestry and mining on biodiversity and the consequences thereof.

Additional assessment topics will emerge in the future as a result of scientific research or new implementation issues. As the knowledge base expands, a comprehensive, integrated global assessment of biodiversity will be needed in the not too distant future.

Recommendations of the Biodiversity Case Study Group

- Relevant ministers, including those for science and technology policy, are requested to support the organisation of targeted scientific assessments to meet the needs of the Convention on Biological Diversity and the Parties thereto.
- The assessment structure should ensure the scientific integrity of the process.
- The Conference of the Parties of the CBD, in conjunction with the main international scientific bodies, are asked to be responsible for organising/establishing this structure. The member countries and the Global Environmental Facility should provide the resources needed to accomplish this work.
- Relevant ministers, including those for science and technology policy, are requested to consult, on a national basis, with their colleagues responsible for matters of biodiversity, to ensure that this new structure is recognised by the Conference of Parties as the Convention on Biological Diversity is further developed.
- In view of the importance of regional integrated assessments and in order to make available “best practice” experience with regional assessments, ministers of science and technology are requested to pursue, with relevant national colleagues, the possibility of organising a prototype regional assessment, for example on the impact of industrial agriculture on biodiversity, either with regional bodies such as the European Union or on a bilateral or trilateral basis. This cross-cutting issue encompasses the potential long-term damage of the industrialised countries’ agricultural practices on ecosystems and biodiversity.

CONCLUSIONS AND RECOMMENDATIONS

Overall perspectives

The Megascience Forum's Workshop on Global-scale Issues provided the first opportunity for a broadly based international group of scientists and policy makers to compare integrated assessments in several areas. Participants agreed that integrated assessments provide a valuable mechanism which can allow the scientific community to draw together its expertise and present it in a way that is useful in the policy/decision-making process. Integrated assessments at international level on topics not linked with or enabled by international conventions and protocols (including the three areas considered at the workshop), would help the international policy/decision-making communities to determine policy options.

On the basis of a review of existing international integrated assessments, participants agreed that such assessments would continue to be of crucial importance for helping the international policy/decision-making community to define policy options. Integrated assessments can also help society at large to grasp the dimensions of global-scale issues. Moreover, they help the scientific community to define future research directions, in part with a view towards providing more refined and timely inputs into policy/decision-making processes.

Although of undoubted value, integrated assessments are still very much in the early stages of their development. Participants agreed on the need for critical comparison and discussion of best practices in integrated assessments in several areas in order to improve the underlying methodology.

Overall recommendations

In addition to specific recommendations submitted to the plenary session of the Workshop on the third day by the three case study panels (see the previous section), participants agreed at that time on a set of general recommendations.

Participants recommended that issues associated with integrated assessments of global-scale issues should be more fully explored, including those that were highlighted in the prospectus leading to the workshop:

- identifying issues meriting examination that are related to the foundations for, and the strategic frameworks of, integrated assessments, which involve a number of existing institutions, including international organisations and regional networks;
- developing guidelines and principles for initiating, organising, and conducting integrated assessment exercises in response to societal needs and for presenting the results of such assessments in a manner that can be used by decision makers;

- developing strategies for providing advice to policy communities on how to solicit and implement integrated scientific assessments, and on how to incorporate the results of such assessments into policy-making processes;
- continuing to document generic lessons learned from past assessments, particularly at international level.

Special attention should be paid to avoiding duplication of effort, and the temptation to create new organisations or institutions should be avoided. Broad participation, including scientists and policy makers from developing countries, should be sought. Linkages to existing conventions and protocols should be developed in such a way as to preserve the scientific integrity and independence of the assessment body.

Workshop participants suggested that the OECD in its capacity as an intergovernmental organisation, with expertise not only in science and technology policy but also other policy issues concerned with sustainable economic growth, could provide a useful venue for the exploration of issues associated with integrated assessment and for the planning of some of the above-mentioned activities.

APPENDIX I

PROGRAMME

**Megascience Forum Workshop On Global-Scale Issues
*Strengthening the Interaction Between Science and Policy-Making***

Tuesday, 3 March

- 17:30 Registration**
18:30 Reception and Dinner

Wednesday, 4 March

Session 1: Opening Session (Plenary)

Chair: Prof. Bert Bolin, Former Chairman, Intergovernmental Panel on Climate Change

- 9:00-9:40 **Welcoming Remarks**
- Mr. Carl Tham
Minister of Education and Science, Sweden
 - Mr. Kaoru Mamiya
Deputy Director General, Science and Technology Agency of Japan
 - Dr. Michael Osborne
Deputy Director for Science, Technology and Industry, OECD
 - Dr. P.A.J. Tindemans
Chairman, OECD Megascience Forum
- 9:40-10:00 **Introduction**
- Prof. Bert Bolin
- 10:00-12:40 **Perspectives and Expectations**
- The policy community:*
- Prof. Umberto Colombo
- The scientific community:*
- Dr. Robert Watson
Director for the Environment, the World Bank
- The media:*
- Dr. Richard Gallagher
Office Head and Senior Editor, Europe Office, Science

Session 2: The Lessons of the Past (Plenary)

Chair: Prof. Bert Bolin

14:00-15:30 **Climate Change**

- Prof. Bert Bolin

Trans-boundary Air Pollution and Acid Rain

- Prof. Leen Hordijk
Center for Environment and Climate Research (WIMEK)
The Netherlands

Biodiversity

- Dr. José Sarukhán
Center for Conservation Biology, Stanford University
United States

Forests

- Prof. Akio Furukawa
Nara Women's University
Japan

Perspectives of non-OECD countries

- Prof. M. G. K. Menon
India

Perspectives from the Social Sciences

- Prof. Carlo Jaeger
Institute for Sociology, Technical University of Darmstadt
Germany

European Forum on Integrated Environmental Assessment (EFIEA)

- Prof. Pier Vellinga, Institute for Environmental Studies, Vrije University
The Netherlands

15:45-18:00 **General Discussion**
Conclusions

Thursday, 5 March

09:00-09:30 **Review of the First Day and Guidance for Case Studies (Plenary)**
By Prof. Bert Bolin and Dr. Robert Corell

Case Studies (Parallel)

Case Study 1: Oceans

Chair: Prof. Nicholas Flemming, Southampton Oceanography Centre, Director, EuroGOOS

Aspects of sustainable ocean management relevant to the design and initiation of Integrated Assessments: what generic lessons or problems can be identified in the case of oceans?

09:30-09:50 **Chairman's Introduction**

09:50-10:30 **The oceans science and technology base: do we understand enough to detect and define global-scale policy issues in the ocean?**

- Prof. Taro Matsuno, Director-General, Frontier Research Program for Global Change, Hokkaido University, Japan

10:30-11:10 **Towards operational oceanography, an analysis and some suggestions**

- Dr. Jean-Claude André, Centre Européen de Recherche et de Formation Avancée en Calcul Scientifique, France

11:10-11:50 **Marine water quality, waste management, sea productivity, and ocean fertilization**

- Prof. John Shepherd, Director, Southampton Oceanography Centre, UK

11:50-12:30 **Urbanization and industrialization of the coast and coastal seas; global implications, positive and negative**

- Dr. Vladimir Ryabinin, Head of the Marine Forecasting Research Laboratory of Russia

14:00-18:00 **General Discussion**
Synthesis and Conclusions

Case Study 2: Land Use and Food Production

Chair: Prof. Louise Fresco, Director, Research, Extension and Training Division, FAO, Rome

- 09:30-09:50 **Introduction**
- Prof. Louise Fresco
- 09:50-10:35 **Disagreements and uncertainties on future food demand and production**
- Dr. Nikos Alexandratos, Chief, Global Perspective Studies Unit, FAO
- 10:35-11:20 **Institutional platforms for public debate on food production**
- Prof. David Norse, University of College London
- 11:35-12:30 **Small Groups discussing focused questions**
- 14:00-14:45 **Advances in Science and Technology that will influence the debates and scenarios in Integrated Assessments on food production and land use**
- Dr. Ben Mifflin, Director, Institute of Arable Crop Research, UK
- 14:45-15:30 **Public communications and acceptance of new technology as a part of Integrated Assessments**
- Prof. John Durant, Imperial College, London
- 15:45-18:00 **Small Group Discussion**
General Discussion
Synthesis of Concrete Recommendations

Case Study 3: Biodiversity

Chair: Prof. Harold Mooney, Professor of Environmental Biology, Stanford University, USA

- 09:30-09:50 **Introduction**
Prof. Harold Mooney
- 09:50-12:00 **Perspectives from different communities**
- Dr. Colleen Adam, Executive Director, DIVERSITAS
 - Dr. Hiroya Kawanabe, Director-General, Lake Biwa Museum, Japan
 - Dr. Peter Johan Schei, Director General, Directorate for Nature Management, Norway
 - Dr. Jane Lubchenco, Department of Zoology, Oregon State University, United States
 - Dr. Frank Vorhies, Environmental Economist, The World Conservation Union (IUCN)
- 14:30-18:00 **General Discussion**
Synthesis and Conclusions

Friday, 6 March

Session 4: Concluding Session (Plenary)

Chair: Dr. Robert Corell, Assistant Director for Geosciences, U.S. National Science Foundation

09:00-10:45 **Reports from the Three Study Groups and Discussions**

Biodiversity

- Prof. Harold Mooney

Land Use and Food Production

- Prof. Louise Fresco

Oceans

- Prof. Nicholas Flemming

- 11:00-13:00 • **Discussions of Cross-Cutting Issues and Themes**
• **Development of Recommendations and Identification of Action Items**
• **Closing Remarks**

13:00 Adjournment

APPENDIX II

Members of the International Steering Committee

for the OECD Megascience Forum Workshop on Global-Scale Issues

Belgium	Dr. Luk VAN LANGENHOVE Mr. Ward ZIARKO
European Commission	Mr. Andrew SORS
France	Prof. Jean-Claude GASCARD Prof. Paul NIVAL Mr. Paul BARTOLI
Germany	Prof. Horst HAGEDORN
Japan	Prof. Keiji HIGUCHI (Chairman) Dr. Keiji KAINUMA Mr. Hiroshi TANI Mr. Osami NIIHORI
Netherlands	Dr. P.A.J. TINDEMANS Dr. John MARKS
Sweden	Prof. Bert BOLIN Prof. Thomas ROSSWALL (Representing Nordic Countries) Prof. Uno SVEDIN
Switzerland	Dr. Bruno MESSERLI
United Kingdom	Dr. Nic FLEMMING Prof. Bernard TINKER Prof. John WOODS
United States	Dr. Robert CORELL Prof. Harold MOONEY

APPENDIX III

**The OECD Megascience Forum Workshop On Global Scale Issues
Grand Hôtel, Saltsjöbaden, Sweden, March 4-6, 1998**

List of participants

AUSTRALIA

Dr. Peter BRIDGEWATER
Chief Science Adviser
Environment Australia

BELGIUM

Mrs. Nicole HENRY
Federal Office for Scientific, Technical and Cultural Affairs

Dr. Rudy HERMAN
Science and Innovation Administration

Ir. Jan VAN RENSBERGEN
Centrum voor teledetectie en atmosferische processen,
VITO

CANADA

Dr. Alexander MOSSELER
Canadian Forest Service, Atlantic Forestry Centre

CHINA

Prof. Erda LIN
Academy of Agricultural Sciences

DENMARK

Dr. Erik Steen JENSEN
Seniorforsker, Plant Biology & Bigeochemistry Dept
Risø National Laboratory

FINLAND

Mrs. Mirja ARAJÄRVI
Special Government Adviser, Ministry of Education

	<p>Dr. Mari WALLS Programme Director, FIBRE, Dept of Biology, University of Turku</p>
FRANCE	<p>Dr. Jean-Claude ANDRÉ CERFACS</p> <p>Dr. Mireille POLVÉ Professor, Observatoire de Toulouse, Université Toulouse III</p>
GERMANY	<p>Prof. Dr. Wolfgang CRAMER Potsdam Institute for Climate Impact Research</p> <p>Dr. Hans. C. ESCHELBACHER Director General, Federal Ministry of Education, Science, Research and Technology</p> <p>Dr. Larry R. KOHLER Executive Director, IHDP</p>
INDIA	<p>Prof. M.G.K. MENON</p>
INDONESIA	<p>Dr. Setijati SASTRAPRADJA Center for Research in Biotechnology , Indonesian Institute for Sciences</p>
ITALY	<p>Prof. Umberto COLOMBO</p> <p>Dr. Silvana VALLERGA IMC & National Research Council (CNR)</p>
JAPAN	<p>Prof. Akio FURUKAWA Professor, Faculty of Science, Nara Women´s University</p> <p>Dr. Kenichi HAYASHI Society for Techno-Innovation of Agriculture, Forestry and Fisheries</p> <p>Prof. Keiji HIGUCHI Director, Nagoya City Science Musuem</p>

Mr. Takao IIZAWA
Deputy Director, Office of Planning for International
Program, Science & Technology Policy Bureau, Science
and Technology Agency

Dr. Hiroya KAWANABE
Director General, Lake Biwa Museum, Professor Emeritus
of Kyoto University

Mr. Kaoru MAMIYA
Director General, Minister's Secretariat, Science and
Technology Agency

Dr. Taro MATSUNO
Professor, Hokkaido University

Mr. Osami NIIHORI
Director, Office of Planning for International Program,
Science and Technology Policy Bureau, Science and
Technology Agency

Mr. Tsuyoshi OGAWA
First Secretary, Scientific Affairs, Japanese Delegation to
the OECD

Mr. Hiroshi TANI
Executive Director, Japan Atomic Energy Research Institute
(JAERI), Special Assistant to the Minister of State for
Science and Technology

KENYA

Prof. Eric ODADA
Programme Director, University of Nairobi, Pan-African
START Secretariat (PASS)

KOREA

Dr. Sung Keun PARK
Professor, Korea University

NETHERLANDS

Prof. Leen HORDIJK
Director, Wageningen Institute for Environment and
Climate Research (WIMEK)

Dr. John MARKS
Head, Science, Technology, Environment, Ministry of
Education, Science and Culture

Dr. Peter A. TINDEMANS
Director, Research and Science Policy,
Ministry of Education, Science and Culture
Chairman of Megascience Forum

Prof. Dr. Harry VAN DER LAAN
Royal Academy of Arts and Sciences (KNAW)

Prof. Pier VELLINGA
Institute for Environmental Studies
Vrije Universiteit

NEW ZEALAND

Dr. Helen ANDERSON
Chief Scientific Adviser,
Ministry of Research, Science and Technology

Dr. David WARDLE
Scientist, Landcare Research Ltd

NORWAY

Mr. Jan ABRAHAMSEN
Director General, Ministry of Environment

Ms. Karin REFSNES
Director, Division of Environment and Development,
The Research Council of Norway

Dr. Peter Johan SCHEI
Special Advisor, Directorate for Nature Management

PORTUGAL

Prof. M. Teresa ANDRESEN
University of Aveiro

RUSSIAN FEDERATION

Dr. Vladimir RYABININ
Head, Marine Forecasting Research Laboratory,
Hydrometcentre of Russia

SLOVAK REPUBLIC

Dr. Stansislav DUBNICKA
Director General, Strategy of the Development of Science
and Technology Section

SPAIN

Dr. Josefina CASTELLVI
Cousejo Superior Invetigaciones Cientificas, Instituto
Ciencias del mar

Dr. Andres RIPOLL,
Vice-Rectorat d'Investigació,
Universitat de les Illes Balears

SWEDEN

Dr. M.R. BHAGAVAN
Swedish International Development Cooperation Agency
(SIDA)

Prof. Bert BOLIN
IPCC

Ms. Kerstin ELIASSON
Director, Ministry of Education and Science

Mr. Erik FELLENIUS
Director, National Environmental Protection Agency

Mr. Erik FORSSE
Director, Ministry of Education and Science

Prof. Rodhe HENNING
Dept of Meteorology, University of Stockholm

Prof. Arne JERNELÖF
Secretary-General, Swedish Council for Planning and
Coordination of Research

Ms. Monica JOHANSSON
Swedish Council for Planning and Coordination of
Research

His Excellency, Bo KJELLÉN,
Ambassador, Ministry of Environment

Mr. Lars NILSSON
Swedish Natural Science Research Council

Ms. Cecilia NORDLING
Deputy Director, Ministry of Education and Science

Prof. Erling NORRBY
The Royal Swedish Academy of Science

Mr. Berit ÖRRNEVALL
Swedish Council for Planning and Coordination of
Research

Prof. Thomas ROSSWALL
Rector, Swedish University of Agricultural Sciences

Prof. Uno SVEDIN,
Director of Research, Swedish Council for Planning and
Coordination of Research

Mr. Carl THAM
Minister of Education and Science, Ministry of Education
and Science

SWITZERLAND

Dr. Hans-Peter HERTIG
Secretary General, Swiss National Science Foundation

Prof. Carlo JAEGER
Human Ecology Group, EAWAG

Prof. Dr. Burno MESSERLI
University of Bern, Inst. of Geography

TURKEY

Dr. Metin DURGUT
Advisor, Scientific & Technical Research Council of
Turkey

UNITED KINGDOM

Prof. John DURANT
Science Communication Div., Science Museum

Dr. Nicholas FLEMMING
Director, EuroGOOS, Southampton Oceanography Centre

Dr. Richard GALLAGHER
Senior Editor, Science Europe Office,
AAAS Science International

Prof. Ben MIFLIN
Director, Institute of Arable Crops Research, (IACR)

Prof. David NORSE
Dept. of Geography, University College London

Prof. John SHEPHERD
Director, Southampton Oceanography Centre

UNITED STATES

Dr. David AUBREY
Woods Hole Oceanographic Institution

Dr. Lou BROWN
Directorate for Geosciences, National Science Foundation

Prof. William CLARK
John F. Kennedy School of Government,
Harvard University

Dr. Robert CORELL
Director, Directorate for Geosciences,
National Science Foundation

Dr. Jane LUBCHENCO
Distinguished Professor, Dept. of Zoology,
Oregon State University

Dr. Harold A. MOONEY
Professor, Dept. of Biological Sciences, Stanford University

Prof. José SARUKHÁN
Dept of Biological Sciences,
Center for Conservation Biology

EUROPEAN COMMISSION

Dr. Christian PATERMANN
Director, Environmental Research

Dr. Andrew SORS
Head of Unit, EC DG-XII, European Commission

IGBP

Dr. Steffen WILL
Executive Director, International Geosphere-Biosphere
Programme (IGBP),
The Royal Swedish Academy of Sciences

IUCN

Mr. Frank VORHIES, Environmental Economist
The World Conservation Union (IUCN)

FAO

Dr. Nikos ALEXANDRATOS
Chief, Global Perspectives Studies Unit

Prof. Louis O. FRESCO
Director, Research, Extension and Training Division

UNESCO

Ms. Colleen ADAM, Executive Director
DIVERSITAS, c/o UNESCO-MAB

World Bank

Dr. Robert WATSON
Director, Environment, World Bank

OECD

Ms. Sachiko ISHIZAKA
Project Co-ordinator, Megascience Forum

Ms. Suzanne LEPRINCE
Megascience Forum

Dr. Michael OBORNE
Deputy Director, Directorate for Science, Technology and
Industry

Ms. Yuko TANAKA
Megascience Forum