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Global Ministerial Environment Forum**
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Item 4 (a) of the provisional agenda*
Policy issues: state of the environment

**State of the environment and contribution of the United Nations
Environment Programme to meeting substantive environmental
challenges**

Report of the Executive Director¹

Summary

The present report summarizes the key policy issues emanating from the assessment and early warning activities of the United Nations Environment Programme (UNEP) that need to be brought to the attention of the Governing Council/Global Ministerial Environment Forum at its twenty-sixth session and also to policymakers at the relevant level. The issues are drawn from the findings of various integrated and thematic assessments conducted over the past two years at the global, regional, national and city levels across all six subprogrammes in response to the UNEP mandate of keeping under review the world environmental situation.

* UNEP/GC.26/1.

¹ The mention of firm names and commercial products does not imply the endorsement of the United Nations.

I. Suggested action by the Governing Council

1. The Governing Council may wish to consider the adoption of a decision along the lines suggested below:

World environmental situation

The Governing Council,

Pursuing its functions and responsibilities, as outlined in General Assembly resolution 2997 (XXVII) of 15 December 1972, including to keep under review the world environmental situation in order to ensure that emerging environmental problems of wide international significance are prioritized and receive appropriate and adequate consideration by Governments, and to promote the contribution of the relevant international scientific and other professional communities to the acquisition, assessment and exchange of environmental knowledge and information,

Recalling its decisions 22/1 of 7 February 2003 on early warning, assessment and monitoring, 23/6 of 25 February 2005 on keeping the world environmental situation under review, SS.X/5 of 22 February 2008 on the Global Environment Outlook: environment for development, and 25/2 of 20 February 2009 on the world environmental situation,

Noting the findings contained in a number of other environmental assessment reports and publications released since the twenty-fifth session of the Governing Council/Global Ministerial Environment Forum, in particular, those prepared by the United Nations Environment Programme in cooperation with partners and presented in the report of the Executive Director on the state of the environment and the contribution of the United Nations Environment Programme to addressing substantive environmental challenges,²

Noting also the findings of scientific environmental assessments conducted between 2009 and 2011³

Expressing concern that the documented environmental degradation and widespread changes resulting from human activity together with natural processes and the loss of ecosystem services are barriers to the attainment of internationally agreed development goals,

Welcoming with appreciation efforts by the United Nations Environment Programme to increase the impact of its scientific assessments by improving their coherence and scientific rigour and to build regional and national capacities for environmental data collection, information and assessment, performed in cooperation with other United Nations entities, national Governments, non-governmental organizations and other partners,

Recognizing that a core mandate of the United Nations Environment Programme is to keep under review the world environmental situation and provide policy-relevant guidance in addressing emerging environmental problems in response to the findings of key scientific assessments,

Recalling section III of its decision 25/2, by which it called for a set of requirements for a migration to targeted assessments on thematic priority areas supported by a UNEP-Live enabling framework, section II of its decision 25/2 on improvements to the international environmental assessment landscape and section I A of decision 22/1 on strengthening the scientific base of the United Nations Environment Programme,

Mindful of the needs articulated in the Bali Strategic Plan for Technology Support and Capacity-building that, among other things, called for capacity-building in developing countries and countries with economies in transition to improve the management of environmental data and information for environmental assessment, reporting and early warning,

Welcoming the report submitted by the Executive Director in response to section III of decision 25/2,⁴

2 UNEP/GC.26/4.

3 UNEP/GC.26/INF/13.

4 UNEP/GC.26/4/Add.1.

I

Scientific findings of recent assessments**Climate change**

1. *Acknowledges* the role that the United Nations Environment Programme played as convener, together with the European Climate Foundation and the Mexican Institute of National Ecology, in bringing together leading scientists and analysts in the preparation of the publication: *The Emissions Gap Report – Are the Copenhagen Accord Pledges Sufficient to Limit Global Warming to 2° C or 1.5° C?*;

2. *Notes* that the report clearly identified the ranges of greenhouse-gas reductions possible in the implementation of Copenhagen Accord pledges under various scenarios, notes further that the report outlines the gap that remains even with the best or the most rigorous implementation of the pledges and therefore encourages the international community and climate negotiators to look at the study and consider how far they could go with existing pledges and how much more they need to do to keep the temperature increases to safe levels;

3. *Calls upon* the United Nations Environment Programme to continue this work in collaboration with other relevant agencies within and outside the United Nations system and to keep the topic under review until such time as the parties to the United Nations Framework Convention on Climate Change decide otherwise;

4. *Also acknowledges* the cooperation between the United Nations Environment Programme and the World Meteorological Organization, the Stockholm Environment Institute, the International Institute of Applied System Analysis, the European Commission Joint Research Centre and the National Aeronautics and Space Administration Goddard Institute for Space Studies in developing the scope of the Integrated Assessment of Black Carbon and Tropospheric Ozone and Its Precursors and ensuring its implementation;

5. *Notes* the findings of the Integrated Assessment of Black Carbon and Tropospheric Ozone and Its Precursors as presented in its summary for decision makers and calls upon Governments, intergovernmental organizations, the private sector and other relevant stakeholders to consider implementation of the mitigation measures recommended by the assessment as important complementary measures to reductions of long-lived greenhouse gases, such as carbon dioxide, in order to help impede both near-term and long-term climate and to promote major positive effects on human and ecosystem health and agriculture, through their relevant environmental policies, plans, programmes and activities;

6. *Encourages* the Intergovernmental Panel on Climate Change to take note of the outcomes of the Integrated Assessment of Black Carbon and Tropospheric Ozone and Its Precursors in preparing its fifth assessment report;

Disasters and conflicts

7. *Calls upon* Governments, United Nations agencies, international financial institutions, the private sector and civil society fully to consider key findings on the potential impacts of environmental degradation, climate change and poor governance on disaster and conflict vulnerability and to demonstrate leadership in promoting ecosystem services and the sustainable management of natural resources as an integral part of disaster resilience, conflict prevention and peacebuilding strategies;

8. *Acknowledges* the development of environmental assessment methodologies for inter-agency post-crisis needs assessments and other post-crisis priority-setting exercises, and urges their systematic application by Governments, United Nations agencies and international financial institutions, where relevant;

9. *Also acknowledges* the cooperation of the United Nations Environment Programme with the United Nations International Strategy for Disaster Reduction in preparing the 2011 Global Assessment Report on Disaster Risk Reduction, which calls upon Governments to protect and enhance the services provided by ecosystems for natural hazard mitigation, livelihood security and building resilience against climate change impacts, and to use ecosystem-based management approaches for disaster risk reduction;

10. *Notes* the findings of the report of the Secretary-General on climate change and its possible security implications,⁵ in particular the need for early warning systems, research to improve the understanding of linkages between climate change and security, and targeted preventive diplomacy and mediation, and also the report of the Secretary-General on peacebuilding in the immediate aftermath of conflict,⁶ which calls upon Governments and the United Nations system to make questions of natural resource allocation, ownership and access an integral part of peacebuilding strategies;

Ecosystem management

11. *Urges* Governments, international financial institutions, the private sector and civil society fully to consider the key findings of the Economics of Ecosystems and Biodiversity report and to demonstrate leadership in considering biodiversity, ecosystems and the services that they provide an integral part of development planning and an integral part of the infrastructure critical to the attainment of development targets;

12. *Encourages* Governments to use the results of scientific assessments to inform decision-making and to support the development of an intergovernmental science-policy platform on biodiversity and ecosystem services;

Environmental governance

13. *Notes* the findings of the United Nations Environment Programme *Year Book 2011*⁷ on emerging environmental issues associated with plastic debris in the ocean, phosphorus use and food production, and pressures on forest biodiversity;

14. *Acknowledges* the technical assistance and capacity-building provided by the United Nations Environment Programme to support regional, national and subnational assessments, and calls for this assistance to be intensified and for national assessments to be integrated into work programmes being undertaken in United Nations Development Assistance Frameworks, with a view to further enhancing the “Delivering as One” initiative;

15. *Also acknowledges* the progress made in the production of the fifth report in the Global Environment Outlook series and in refocusing the report to include an analysis of policy options to speed up realization of the internationally agreed goals and targets;

16. *Urges* Governments fully to consider findings resulting from interlinkages between the international environment governance process, the integrated scientific assessments by the United Nations Environment Programme, such as the fifth report in the Global Environment Outlook series, the International Panel for Sustainable Resource Management, and the green economy processes;

17. *Urges* Governments and others with the means to do so to provide technical and financial resources to support the fifth report in the Global Environment Outlook series and all other major assessments;

Harmful substances and hazardous waste

18. *Acknowledges* the findings of the global, regional and national scientific assessments conducted by the United Nations Environment Programme to assist Governments to understand the sources, transport and fate of mercury releases and the means to reduce them, and requests the Executive Director, coordinating as appropriate with Governments, intergovernmental organizations and other stakeholders, including the partners of the Global Mercury Partnership, to continue and enhance efforts to strengthen the scientific basis of work to reduce risks from mercury releases;

19. *Urges* Governments to consider, as appropriate, the findings of these scientific assessments in their negotiations to develop a legally binding instrument on mercury and in ranking their immediate actions to reduce mercury release and encourages those with the means to do so to provide technical and financial resources to support such assessments;

20. *Acknowledges* the findings of the final reviews of the scientific information on lead and on cadmium and their appendices, and requests the Executive Director, coordinating as appropriate with Governments, intergovernmental organizations, and other stakeholders, to continue and to enhance efforts to strengthen the scientific basis of work to reduce risks from releases of these metals;

5 A/64/350.

6 A/63/881-S/2009/304.

7 UNEP/GC.26/INF/2.

21. *Also acknowledges* the scientific assessment work of the United Nations Environment Programme in support of the implementation, evolution and global monitoring of the chemicals and waste multilateral environment agreements, including the Montreal Protocol on Substances that Deplete the Ozone Layer, and of the Strategic Approach to International Chemicals Management, including of those emerging issues identified by the International Conference on Chemicals Management at its second session;

22. *Welcomes* current plans to incorporate findings of the scientific assessment of harmful substances and hazardous waste, in particular the Global Chemicals Outlook, in the fifth report of the Global Environment Outlook process and requests the Executive Director, coordinating as appropriate with Governments, intergovernmental organizations and other stakeholders, to continue and to enhance efforts to strengthen the scientific basis of work to reduce risks to human health and the environment from harmful substances and hazardous waste;

Resource efficiency

23. *Urges* Governments, United Nations agencies, financial institutions, the private sector and civil society to consider key environmental assessment findings, in particular those related to biodiversity, ecosystem services and the sustainable use of natural resources and their environmental impacts over the full life cycle, such as those from the International Panel for Sustainable Resource Management, in the light of the growing awareness of the complexity of those challenges and their links to human well-being, resource scarcity and economic crisis, disaster and conflict risk reduction, and development goals;

24. *Calls upon* Governments to demonstrate strong leadership individually and collectively and to implement effective, science-based policy responses, including, where appropriate, economic instruments and market mechanisms such as those highlighted in the forthcoming green economy report and the Economics of Ecosystems and Biodiversity report, and those assessed in the reports of the International Panel for Sustainable Resource Management to regulate and manage the environment and to ensure efficient use of its resources, and to continue to cooperate within the framework of multilateral processes that aim to reverse environmental degradation;

II

Impact of scientific assessments

25. *Urges* Governments to promote the use of integrated environmental assessments reporting on the state of the environment as regular information in relevant national and international policy processes to strengthen the scientific basis of environmental management and decision-making, and raise general awareness of emerging environmental issues;

26. *Requests* the Executive Director:

(a) Through the programme of work, to continue efforts towards improving the coherence of assessments through the application of consistent and appropriate methodologies and improving their scientific rigour through consistent, rigorous and appropriate review processes to assist in developing scientific assessment processes that are credible, relevant and legitimate to enhance their impact, and to strengthen the capacities of countries that are not meeting their environmental assessment and reporting obligations;

(b) To assist countries in capacity development, as appropriate, through the programme of work, to use global knowledge and experience in scientific assessments, notably the customization of global methodologies to other scales of implementation such as the national and city levels, to assist countries in building their capacity in the use of national and local data, and to support countries in identifying key environmental policy issues that require scientific research;

(c) To ensure consistency of messages between scientific assessment processes and macroeconomic research conducted under the green economy initiative of the United Nations Environment Programme, considering that other United Nations Environment Programme processes and products which will be linked to the fifth report in the Global Environment Outlook series include the Economics of Ecosystems and Biodiversity reports, the green economy report, the International Panel for Sustainable Resource Management and regional resource efficiency outlook reports, alongside the Global Chemicals Outlook;

(d) To ensure a holistic approach and coordination within the United Nations Environment Programme and across the Organization, through the programme of work, to assist countries in

integrating the findings of the scientific assessments at all levels into national development policies, focusing on efforts to contribute to the attainment of the Millennium Development Goals;

(e) To mobilize resources to identify knowledge gaps in the use of natural resources from a life-cycle point of view;

(f) To engage with the co-sponsors of the International Basic Safety Standards for the Protection against Ionizing Radiation and for the Safety of Radiation Sources, with a view to the co-sponsorship of a revised version that considers emerging issues from the evaluations conducted by the United Nations Scientific Committee on the Effects of Atomic Radiation;

III

Future assessment of environmental change over the period 2012–2013

27. *Requests* the Executive Director through the programme of work:

(a) To continue to conduct comprehensive integrated global and thematic environmental assessments to support decision-making processes at all levels, in the light of the continuing need for up to date, scientifically credible, policy-relevant information on environmental change worldwide, including analyses of cross-cutting issues;

(b) To engage all relevant stakeholders in conducting global and thematic environmental assessments to support and strengthen further their scientific credibility, policy relevance and legitimacy;

(c) To undertake policy-relevant global and thematic assessments of environmental change in accordance with the option that embeds the global assessment within the framework of the medium-term strategy;

(d) To allocate sufficient resources to facilitate the finalization of the summary for policymakers of the fifth report in the Global Environment Outlook process in time to feed into the United Nations Conference on Sustainable Development in 2012;

(e) To organize scientific assessments on the environmental impact of resource use from a life-cycle perspective;

28. *Urges* Governments to follow up on the work initiated with the Millennium Ecosystem Assessment by building their capacity and conducting new assessments of ecosystems and biodiversity and by using the results of the existing assessments to establish priorities for development and environmental protection;

29. *Encourages* Governments to support assessments of freshwater resources, both surface and groundwater, and land degradation and to take into account the critical role of ecosystems and biodiversity for food security and sustainable food production systems;

30. *Invites* the Executive Director, through engaging appropriate institutions, research networks and other partners, to establish a global open-ended consultative process on short-lived climate forcers to keep under review emerging science and associated policies and mitigation measures and to inform Governments, international organizations and main stakeholders appropriately;

31. *Calls upon* Governments and relevant institutions to provide extrabudgetary resources for technical cooperation and capacity-building to support assessment initiatives;

32. *Requests* the Executive Director to report on progress in implementation of the initiative to the Governing Council at its twenty-seventh session, in 2013;

IV

International assessment landscape

33. *Invites* the Executive Director to consider developing a classification of environmental assessment methodologies with a view to assisting Governments in applying them effectively;

34. *Recommends* to Governments that they prepare regular, periodic assessments of the state of the environment at the regional, national and subnational levels, as part of legal, regulatory and budget frameworks;

35. *Requests* the Executive Director, subject to resource availability, to strengthen assistance to developing countries, in conducting environmental assessments and acting on their findings;

36. *Also requests* the Executive Director to develop and maintain a web-based platform to monitor the status of the international environmental assessment landscape;

37. *Further requests* the Executive Director to undertake a review of the integrated environmental assessment methodology with other methodologies widely and to propose ways to improve coherence and consolidate methodologies;

V

UNEP-Live

38. *Requests* the Executive Director to proceed with the development of the UNEP-Live platform and present:

(a) The pilot proof-of-concept phase of a UNEP-Live platform, consisting of a repository system, to the Governing Council at its twelfth special session, in 2012;

(b) A detailed set of requirements and costing of resources needed for the development of a more elaborate version of the UNEP-Live platform, to the Governing Council at its twenty-seventh session, in 2013;

39. *Also requests* the Executive Director:

(a) To mobilize partnerships and institutional and technical networks in the non-governmental and private sectors to provide technical assistance for the development of the UNEP-Live platform;

(b) To support and build the capacity of relevant environmental institutions in developing countries and countries with economies in transition, with a view to:

(i) Collecting, managing, assessing, synthesizing and disseminating environmental, social and economic data, information and indicators;

(ii) More effectively carrying out their assessment, monitoring and reporting activities;

(c) To develop the global environmental information network in the international environmental governance initiative as an institutional support mechanism to underpin the development of the platform;

40. *Invites* Governments to engage in the development of the pilot UNEP-Live platform and make available the necessary data, information and indicators on priority environmental issues, and to engage national institutions as distributed participants in the platform;

41. *Requests* the Executive Director to provide an interim report on the status of the UNEP-Live platform to the Governing Council at its twelfth special session, in 2012.

II. Keeping the world environmental situation under review: background on underpinning assessment with sound science

2. The aim of the present report is to provide a basis for the deliberations of the Council/Forum under agenda items 4 (a), on policy issues: state of the environment, and 6, on the budget and programme of work for the biennium 2012–2013 and the Environment Fund and other budgetary matters.

3. The present report is intended to provide the Council/Forum and member States with recent scientific assessment findings, focusing on key policy issues identified at the global, regional, national and local levels, and an overview of planned, in progress and completed assessments. It also provides an update on intergovernmental scientific assessments, processes and platforms and an overview of the services that UNEP is providing to Governments and other stakeholders to build capacity in scientific environmental assessment and identification of emerging environmental issues.

4. It should be noted that, at its twenty-sixth session, the Council/Forum has before it a number of associated documents to inform its deliberations, including:

(a) A progress report on the implementation of decision 25/2, which is an addendum to the present report (UNEP/GC.26/4/Add.1) that summarizes actions undertaken to improve the international assessment landscape in response to section II of decision 25/2, and also presents the set of requirements for UNEP-Live in response to section III of decision 25/2;

(b) The UNEP *Year Book 2010*, which is presented in document UNEP/GC.26/INF/2, highlights recent environmental events and raises awareness of the emerging environmental issues associated with plastic debris in the ocean, phosphorus use and food production, and pressures on forest biodiversity;

(c) The summary for decision makers of the Integrated Assessment of Black Carbon and Tropospheric Ozone and Its Precursors, which is presented in document UNEP/GC/26/INF/20, sets out policy-relevant findings of the underlying report, in particular as they relate to the proposed mitigation action on black carbon, ground-level ozone and methane;

(d) The Inventory of Scientific Environmental Assessments led and supported by UNEP (2009–2010), which is presented in document UNEP/GC.26/INF/13, contains a detailed overview of all the assessments conducted since the twenty-fifth session of the Council/Forum and provides updated information on those assessments in progress.

5. As the principal body for the environment in the United Nations system, UNEP has a mandate to keep the global environment and causes of environmental impacts under review. It also provides the world with an important environmental early warning service and monitors, assesses and reports on the state of the global environment. Science plays an important role in the delivery by UNEP of this mandate.

6. UNEP operates at the science-policy interface by ensuring the flow of knowledge from basic and applied research and that it is translated into policy action for the benefit of societies. Importantly, it also encourages the flow of information from the policy arena back to the scientific community.

7. In particular, UNEP works at the science-policy interface in four ways:

(a) It identifies new scientific issues of impending importance to the policy community;

(b) It uses scientific methods and tools to illuminate policy challenges and present policy options to policymakers based on best scientific understanding;

(c) It assesses the state of scientific knowledge about an issue and communicates it to policymakers;

(d) It convenes scientists to work on problems identified by the policy community.

8. UNEP ensures that its interventions are founded on sound science through the use of scientific assessment. Scientific assessments examine existing and emerging environmental issues to inform policymakers of gaps and challenges across the priority thematic areas addressed by UNEP.

9. Although integrated assessment is a keystone of UNEP work, it remains a relatively new methodology and its rigour can be improved. Furthermore, the current global assessment landscape is extremely complex, as seen by the proliferation of assessments at UNEP and elsewhere. The result is a bewildering cacophony of assessments of varying sizes, shapes and methodologies. On the one hand, some of this diversity is justified because assessments need to be tapered to a specific purpose. On the other, this proliferation of assessment types renders it difficult to compare assessments and learn from experience, to maintain quality and to decide on the type of assessment needed for a particular study.

10. The UNEP science strategy outlines two approaches to improve the quality and, therefore, the impact of assessments by improving their coherence and improving their scientific rigour:

(a) *Improving the coherence of UNEP assessments*: this coherence can be improved by developing a taxonomy that will specify objectives, styles and requirements of particular categories of UNEP assessments. Specifying the objectives of particular categories will make their added value easier to understand;

(b) *Improving the scientific rigour of assessments*: this involves the application of a consistent and appropriate methodology to each category of assessment, and the application of a consistent, rigorous and appropriate review process for each category of assessment.

11. The added value of implementing these two approaches will be the improved credibility of the assessments, easier presentation of the body of UNEP assessment work and the strengthening of the scientific objectivity of findings, which will help bolster the scientific base and impact of UNEP.

III. Keeping the world environmental situation under review: summary of findings of assessments conducted at the global, regional, national and city levels since the twenty-fifth session of the Governing Council

12. The assessments that have been reviewed consider various issues which, for the most part, focus on the relationship between the environment and sustainable development. The focus and findings of some of the assessments referred to in the present report are presented below under one or other of the six subprogrammes, namely, climate change; disasters and conflicts; ecosystem management; environmental governance; harmful substances and hazardous waste; and resource efficiency, with a view to informing the deliberations of the Council/Forum.

A. Climate change

13. Assessments in the area of climate change were conducted at the global, national and city levels.

14. Black carbon aerosols absorb solar radiation and lead to positive forcing (atmospheric and surface warming), while some aerosols, such as sulphates and nitrates, reflect solar radiation and have negative forcing (surface cooling). Globally, black carbon has a net warming effect on the climate system. Although the magnitude of its warming effect needs to be more precisely estimated, black carbon forcing has been estimated to constitute between 20 and 50 per cent of carbon dioxide forcing, making it the second or third largest contributor to global warming (1).⁸

15. Tropospheric ozone and black carbon are the two substances in the atmosphere directly and significantly threatening human well-being and ecosystem services through both climate change and degraded air quality. Reducing emissions of black carbon and the precursors of tropospheric ozone will have multiple benefits (2).

16. The selected measures have been successfully implemented in various parts of the world under existing policies and national and multinational structures. Significant barriers have been identified to the widespread implementation of some selected measures. Additional efforts to scale up, replicate and expand the implementation of the selected measures would be required to achieve the benefits identified. Such efforts could include public-private financing and partnership, technology support, regional cooperation and agreements, capacity-building and community empowerment (2).

17. The sustained implementation of the selected measures between now and 2030 will decrease near-term (20–30 years) warming. This would reduce global warming by $(0.4 \pm 0.2)^\circ \text{C}$ by 2035 compared to the reference scenario, based on current trends and agreed legislation (2).

18. The warming from black carbon and ozone has strong regional variations that can lead to substantial regional climate impacts. Warming from these pollutants is greater in the northern hemisphere. This asymmetry may affect tropical rainfall patterns. Large regional heating from absorbing particles can also disturb regional circulation patterns, such as the Asian monsoon. Warming is also more extensive in the Himalayas and other heavily glaciated regions, owing to the darkening of snow and ice surfaces by black carbon, which increases their absorption of sunlight and may increase the melting of snow and ice and affect water supplies (2).

19. In support of the climate change negotiations under the Framework Convention on Climate Change a preliminary assessment has found that, to keep the temperature increase under 2°C , the existing pledges under the Copenhagen Accord, even if fully implemented, will still leave a gap. The options currently on the table in the negotiations have the potential to reduce emissions by 7 gigatonnes of carbon dioxide equivalent as compared to the business-as-usual scenario. This can be achieved by realizing countries' highest ambitions and ensuring that genuinely strict rules result from the negotiations. It is feasible to bridge the remaining gap through more ambitious domestic actions, some of which could be supported by international climate finance. Whether or not a gap remains, however, current studies indicate that steep emission reductions are also needed after 2020 to meet temperature targets (3).

⁸ The references in brackets refer to numbered sources of the information, set out in the Inventory of Scientific Environmental Assessments led and supported by UNEP (2009–2010) presented in document UNEP/GC.26/INF/13.

20. Water resources in West Asia are scarce and vulnerable to climate change. Water policy reform is needed to put integrated water management high on the political agenda and enable decision makers to act effectively in the interest of sustainable water use (4).
21. The impacts of climate change are already being felt in, for example, Bangkok, where residents are experiencing higher temperatures. The average maximum temperatures observed in Bangkok have risen by 0.8° C, from 32.6° C in 1961 to 33.4° C in 2007. The impacts of climate change on the city are likely to be quite severe, including major flooding due to Bangkok's low elevation, increased land subsidence, which is already occurring, problems of water supply and contamination, air pollution and oppressive heat with associated health consequences, increases in infectious diseases and a decrease in biomass production (5).
22. With 7.1 tons of carbon dioxide produced per capita in 2007, the same level as New York City, Bangkok has become a major emitter of carbon dioxide. The principal sources of emissions in the city are transport (38 per cent) and electricity generation (33 per cent), along with solid waste and waste water. The action plan on global warming mitigation for the period 2007–2012 adopted by the Bangkok metropolitan administration is expected to bring the city's greenhouse gas emissions 15 per cent below the levels currently projected for 2012 (5).
23. In Mongolia some impacts have already been observed: the annual mean temperature has increased by 2.14° C over the past 70 years and precipitation has decreased in all but the western part of the country. In 2006, the country's net greenhouse-gas emissions stood at 6 tons of carbon dioxide equivalent per capita. The largest sources of emission were the energy sector (65.4 per cent), including transport, and the agricultural sector (41.4 per cent). Based on projections, the country's total emissions are expected to rise more than fivefold by 2020 (6).
24. The future climate scenario for Mongolia projects changes such as increased air temperatures, increased precipitation in some areas and reduction of water resources and arable land. The most vulnerable sectors in the country are agriculture, livestock-raising, land-use, water resources, energy, tourism and housing. Adaptation is thus essential to reduce the country's vulnerability to the adverse impacts of climate change (6).
25. The trend of recent climate change in Viet Nam is beyond the level of natural change. Countrywide, temperatures have increased by 0.05°–0.20° C per decade and sea level has risen by 2–4 cm per decade over the past 50 years. At a lower scale, average temperature increases have been highest in the coastal province of Ha Tinh, rising by 0.7°–1.0° C over the past 45–50 years. According to projections, by the end of the twenty-first century, the annual average temperature in Viet Nam will increase by between 1.1°–1.9° C and 2.1°–3.6° C. Rainfall is likely to increase by 1.0–5.2 per cent and 1.8–10.1 per cent, and sea level is likely to rise between 65 cm and 100 cm, by comparison with the period 1980–1999, under low and high emission scenarios respectively (7).
26. The potential impacts of climate change for Viet Nam are likely to be critical in water resources and key social and economic sectors such as agriculture, forestry, fishery, energy, transportation and health. Evidence from Ha Tinh province indicates a growing number of increasingly severe weather-related disasters, a trend which is likely to continue, adversely affecting production and the livelihoods of local communities. Viet Nam is currently developing a low-carbon economy and mitigation policies aimed to reduce greenhouse-gas emissions in key sectors, along with strategies to adapt to the impacts of climate change and reduce vulnerability (8).
27. In Sana'a, the issue of access to safe drinking water and sanitation is of great concern, in addition to air pollution, waste management and the impact of climate change. In Aden, Yemen's second city, the impact of climate change, coastal degradation and marine pollution are key concerns. The two cities are seeking to integrate environment in urban planning and management (9).

B. Disasters and conflicts

28. Assessments in the area of disasters and conflicts were conducted at the global, regional and national levels.
29. Since 1990, at least 18 violent conflicts have been fuelled by the exploitation of natural resources. In fact, recent research suggests that over the past 60 years, at least 40 per cent of all internal conflicts have had a link to natural resources. As the global population continues to rise, and the demand for resources continues to grow, there is significant potential for conflicts over natural resources to intensify in the coming decades (10).
30. Global disaster risk has increased over the past decades, mainly due to greater exposure to natural hazards. Population growth and migrations to areas of high risk, such as coastal areas, drylands and urban centres, are raising the numbers of those affected by hazards, while climate change is likely

to result in more extreme and unpredictable climate-related hazard events. The linkages between environment and disaster risk are two-fold: environmental degradation accentuates disaster risk on the one hand, while on the other disasters damage the environment and thus increase people's vulnerability to future disasters. A disaster risk reduction approach that integrates environmental concerns therefore has both environmental and risk reduction benefits (11).

31. In Africa, based on an analysis of resource scarcity and economic degradation of past climate trends, UNEP has found that greater warming and more frequent occurrences of extreme weather events, such as drought and floods, will affect the majority of the population who depend on natural resources for their livelihoods. There is an urgent need for increased regional cooperation to address issues of migration and shared natural resources, including the development of policies for climate change adaptation and the prevention of further degradation, and the strengthening of governance capacities at all levels (12).

32. Mining and mineral processing have played a vital part in the history and economy of the Western Balkans. Richly endowed with mineral resources such as copper, chromite, lead and zinc, the region boasts some of the largest deposits in Europe. Capitalizing on such mineral assets will be a priority for South-Eastern Europe in order to boost local economies and attract foreign investment. To secure the environmental, economic and social sustainability of such new or restarted operations, the region will need to define and enforce a legal framework for sustainable mining practices (13).

33. The civil war in Sierra Leone had significant impacts on the basic environmental resources of the country – water and agricultural land – and caused major damage to its institutional capacity. In addition, many of the risk factors for conflict that existed in the 1980s and 1990s have not been adequately addressed, most prominently in the environment and natural resources sector (14).

34. Haiti's population suffers from severe poverty, food insecurity, health problems and disaster vulnerability, which are strongly interlinked with environmental issues, such as extensive deforestation, soil erosion, inadequate waste management, water scarcity and coastal zone degradation. Many of these problems have been further exacerbated by the recent earthquake, which led to a massive increase in the volume of waste and to severe water and sanitation difficulties and a wide range of environmental problems associated with the camps for the displaced. In addition, international experience shows that a multi-billion dollar relief programme such as that mounted in Haiti could – if not properly mitigated – have significant environmental consequences, which will have severe impacts on Haiti in the long term (15).

35. Gaza's underground water supplies, upon which 1.5 million Palestinians depend for agricultural and drinking water, are in danger of collapse as a result of years of overuse and contamination that have been exacerbated by the recent conflict. The UNEP assessment points to increased salinity from salt water intrusion caused by over-abstraction of the groundwater as a key concern, alongside pollution from sewage and agricultural run-off. UNEP estimates that some \$2 billion will be needed over 20 years to restore the aquifer back to health, including the establishment of desalination plants to take pressure off the underground water supplies (16).

C. Ecosystem management

36. Assessments in the area of ecosystem management were conducted at the regional level.

37. In Africa, findings indicate that local changes in precipitation lead to more frequent and devastating droughts and floods, reduced groundwater replenishment, variation in the surface flow of rivers, alterations in water levels of lakes and high evaporation rates (17).

38. Africa's and Asia's freshwater resources and ecosystems are degraded, resulting in threatened livelihoods for the poor. Available freshwater resources are declining, because of the excessive withdrawal of surface and groundwater; decreased water run-off from the surface is increasingly attributed to climate change. Its use for agriculture, industry and energy has increased markedly over the past 50 years. Water use exceeds the average annual natural replenishment (18).

39. In Asia, there is an increasing annual demand for water drawn from the continent's international rivers for human activities and ecosystems health. International, regional, and local-level conflicts relating to access to and the use of fresh water pose a serious threat, especially in areas severely affected by water scarcity. The fragmented approach to water management is a major challenge that requires an integrated water resource and ecosystem management approach. Some progress has been made, however, in the adoption of basin-wide approaches (19).

40. Lack of access to water resources poses a challenge to the livelihoods of a great majority of the population in many basins of South-East Asia, as two out of every five people in that subregion lack safe drinking water and proper sanitation. South-East Asia's largest river, the Mekong, has withstood

decades of pressure from rising population numbers, growing industrial activities and more demand for water and food for over 65 million people. Cambodia's Tonle Sap (Great Lake), the nursery of the lower Mekong's fish stock, and Viet Nam's Mekong delta are particularly at risk from alterations in the Mekong river's unique cycle of flood and drought. The anticipated impacts of climate change and sea-level rise in the Mekong river basin show that water-related vulnerability could be exacerbated in the coming decades as a consequence of global climate change. Reducing water vulnerability in the future implies consolidating the current cooperation among the riparian countries, expanding and strengthening understanding of climate change, and promoting education and awareness in the region (20).

41. The five major freshwater river basins in the North-East Asian subregion – the Chiangjiang (Yangtze), Huanghe (Yellow) and Songliao river basins in China, and the Orkhon and Tuul River basins in Mongolia – suffer from a scarcity of water resources, poor water use efficiency, weak basin management and coordination and a lack of safe drinking water, particularly in rural areas. Efforts by some Governments in the region to tackle the issue notwithstanding, coordination and cooperation across international borders and between national provinces need to improve if North-East Asia is to make better use of its water resources (21).

42. Groundwater levels are declining at a rate of between two and four metres per year in many parts of the Ganges-Brahmaputra-Meghna and Indus basins, as a consequence of intense pumping, which threatens soil and water quality and results in saltwater intrusion into groundwater aquifers. Water resources in the Indus and Helmand river basins are highly vulnerable, mainly owing to their ecological insecurity, manifested in the decreasing vegetation cover and declining water quality. The Indus basin is the most resource-stressed, based on water availability per person and variation in precipitation, and at the same time, most exploited of the three river basins. The Ganges-Brahmaputra-Meghna basin is also highly vulnerable but here it is management shortcomings that pose the greatest risk. In addition, climate change is likely to lead to severe water shortages in all the basins in the long term, as about 67 per cent of Himalayan glaciers are reported to be receding, reducing the glacial run-off that feeds these rivers (22).

43. Lessons learned from the past are guiding policymakers in water management decisions in Europe, in the midst of tension and potential conflict over shared waters. This is evident in the vulnerability of Europe's water resources, which are governed by regional institutions such as the European Union and the United Nations Economic Commission for Europe. These institutions ensure cooperation and prevention of potential conflict over water. Countries are committed to the integrated management of transboundary waters under treaty provisions flowing from a large body of international agreements, which in itself is testament to the development, in Europe, of the institutional capacity to accommodate economic, social, and environmental changes within transboundary basins in order to offset hydro-vulnerability (23).

44. In North America, water resources and their vulnerability are the subject of laws and the focus of attention of venerable institutions, such as the International Joint Commission and the International Boundary and Water Commission, which have dealt with transboundary water issues in a cooperative manner and succeeded in keeping conflict to the barest minimum. The international treaties of the countries in the subregion also reduce the potential impact of individual actions on transboundary waters and have helped sustain cooperation. There is great resilience in the institutions, which have been in existence for over a century and show no signs of weakening their control. They continue to resolve disputes. This resilience, however, is bound to be tested by the prolonged drought in the subregion, which is increasing water scarcity and raising the spectre of climate change that will alter the availability of water (24).

45. Ecosystems in selected sites in the Arab region are under increasing pressure from human activities leading to their degradation. There is a strong link between ecosystems, poverty and human well-being in the sites assessed. The sustainable management of ecosystems and efforts to bridge the gaps between science, technology and sustainable development offer the best way forward for the conversation and proper management of ecosystems in the region (25).

D. Environmental governance

46. Assessments in the area of environmental governance were conducted at the global, regional, national and city levels.

47. The third report in the Global Biodiversity Outlook series (*GBO-3*) demonstrates that the world has failed to meet its target of achieving a significant reduction in the rate of biodiversity loss by 2010. The report warns that further massive loss of biodiversity is becoming increasingly likely and, with it, a severe reduction of many essential ecosystem services. It projects the possibility of

approaching several tipping points, in which ecosystems shift to alternative, less productive states from which it may be difficult or impossible to recover. *GBO-3* concludes that the continued loss of biodiversity can no longer be seen as an issue separate from the core concerns of society (26).

48. The findings of 19 regional marine biodiversity assessments indicate that marine biodiversity is currently under threat from drivers of change, such as land-based pollution (increased intake of nutrient depositions), overexploitation of fisheries in many regions, the introduction of marine invasive species and the growing effects of climate change (including ocean acidification). The outlook projection to 2050 indicates that these drivers of change will become more acute, thereby heavily affecting the diversity and abundance of marine biodiversity across all regions (27).

49. There is a need for cross-sectoral approaches to the management of the marine and coastal environment and for further action by parties to multilateral environment agreements and regional agreements, such as the regional seas conventions and action plans, to set long, medium and short-term management targets. Furthermore, there is need for an improved information base for measuring progress in responding to pressures and the effectiveness of such responses. Lastly, the report emphasizes the need to support existing efforts at the General Assembly in the regular process for the global reporting and assessment of the state of the marine environment, including socio-economic aspects (27).

50. South Asia is endowed with vast natural resources, including the Himalayas, 10,000 km of coastline, rivers and wetlands, forests, coral reefs and mangrove stands. The combined stress of accelerating population growth, rising poverty and inequality, large-scale rural-to-urban migration and a dwindling resource base are all factors contributing to the destruction of fragile ecosystems, loss of biodiversity and environmental degradation (28).

51. As agriculture is the major source of livelihood in South Asia, land degradation caused by increasing demand, along with the intensity of land-use, constitutes a major problem. Access to clean water is also one of the main challenges for the region because of the seasonal nature and declining quality of the water supply, even though water availability is high. Urbanization and industrialization in South Asia have made air pollution a matter of genuine concern, especially in urban areas, as poor air quality threatens human health and causes other forms of environmental damage (28).

52. There are multiple threats facing the East Asian seas as a result of such factors as insensitive development, pollution, alien invasive species, marine litter and climate change. According to the report, economically important coastal habitats and ecosystems are under pressure, while 40 per cent of coral reefs and half of all mangroves have already been lost. A more systematic and integrated approach to managing coastal and oceanic issues, allied to improved data collection and management and economic incentives to encourage private sector involvement in environmental protection efforts, are recommended (29).

53. In the Mediterranean region, which considered an ecoregion, the economies of the various countries – especially on the southern rim – remain largely dependent on natural resources. Simultaneously an area of close exchange and of great divergence, the region remains in search of stability, which must be built on the basis of common approaches to shared issues. The current environmental status and development patterns of the Mediterranean are highly contrasted. Undeniable progress over recent years in terms of marine pollution and biodiversity conservation notwithstanding, considerable efforts are required to anticipate the impacts of climate change, to ensure the better management of rare natural resources, in particular water and energy, to support regional initiatives and to promote genuinely cleaner modes of consumption and production. Progress is also contingent on improving the quality of existing information, which remains incomplete and lacking in reliability, thus weakening analyses and hampering prospective exercises. Major research need to be conducted in this matter, on a regional scale, and its findings made available expeditiously by such initiatives as the Union for the Mediterranean (30).

54. Climate change, the loss of biological diversity, environmental degradation, emergencies caused by natural disasters, water scarcity and the accelerated urbanization experienced by the region all necessitate urgent and decisive changes in environmental management. There is also an urgent need to reach consensus on the building blocks for institutional frameworks that effectively promote sustainable development, integrate environmental considerations and internalize the value of ecosystems and environmental services into development policy. Attention is drawn to the difficulty of sustaining comprehensive and cross-cutting environmental policy, duly articulated with development policy, and to the need to improve actions and coordination between the countries of the region. It is also vital that there should be precise and good quality information on the state of the environment, and that more investment should be directed towards achieving environmental and social sustainability, essential for continued development in the region (30).

55. Conflicts with environmental implications have multiplied in Latin America and the Caribbean. On the one hand, the effects on the prevailing development pattern are so serious that States lack the necessary regulatory and administrative capacity to deal with them properly and, on the other, new rights established in national legislative systems and international standards are hindered by the failure of government institutions to take action. This failure to act has led to conflicts and sometimes to violent confrontations with tragic results (31).

56. There is vivid photographic evidence of environmental changes throughout the 33 countries of the region and across issues such as land-use change, mining, urban growth, freshwater pollution and the degradation of coastal areas. The results of policies applied by countries in relation to land-use and land-use changes are particularly evident in examples showing areas around international borders. The effectiveness of protected areas is also revealed by tracking the changes in vegetation cover change over time. In terms of progress toward meeting the targets of goal 7 of the Millennium Development Goal, there has been a general improvement in access to water and sanitation facilities, although the per capita production of carbon dioxide has increased and deforestation continues (32).

57. In the coastal area of Negril, Jamaica, ecosystem degradation, coupled with beach erosion and the increasing impacts of tropical cyclones, may over time undermine resource-dependent livelihoods, such as fishing, farming and tourism, which are vital to the local and national economy. Scientific evidence shows that, over the past 40 years, Negril's beaches have been experiencing severe and irreversible shoreline erosion and retreat. Estimations based on global projections of long-term or accelerated sea-level rise, together with local predictions of extreme storm waves and surges, show that, by 2060, the combination of accelerated sea-level rise and extreme wave surges will have a devastating impact on Negril's beaches and the coastal infrastructure behind Negril. Taking into account sea-level rise, exposure to storm surges and subsequent flooding are expected to put some 2,500 people or 14 per cent of the total coastal population at risk during a 50-year return storm event. The establishment of a comprehensive, cross-sectoral Negril development and management plan is recommended (33).

58. The first comprehensive and policy-relevant regional assessment for the Arab region indicates that, the progress made notwithstanding, especially since the 1990s, in various areas of environmental action, the challenges posed by traditional environmental issues have increased and intensified and new issues have emerged. The region is now among the world's most water-scarce. Sustainable development in the region requires integrating the environment in development plans and in the main framework of economic and social development policies, and the adoption of policies for regional cooperation and economic, social and environmental integration (34).

59. A study of existing multilateral environmental agreements in the context of Arctic biodiversity makes four recommendations to the Arctic countries, to focus their efforts with a view to ensuring the future sustainability of the Arctic and the protection of its biodiversity. These recommendations are, first, to strengthen investment in the joint management of adaptation programmes and in support for those programmes; second, to increase the extent of protected areas in the Arctic, in particular in coastal and marine zones; third, to increase the monitoring of Arctic biodiversity and to promote strengthened cooperation with non-Arctic States that share responsibility for Arctic migratory wildlife; and, fourth, that the Arctic Council should endeavour to play an even more progressive role in ensuring the protection and sustainable use of the living natural resources in the Arctic, comparable to its efforts in combating long-range transboundary pollutants (35).

60. The five water towers of Kenya – Mount Kenya, the Aberdare range, the Mau forest complex, Mount Elgon and the Cherangani hills – form the upper catchments of all the country's main rivers. They are the sources of water for irrigation, agriculture and industrial processes, and also for all installed hydropower plants, which produce some 60 per cent of Kenya's electricity. As such these forests are of great importance and, in one way or another, support the livelihoods of all Kenyans. At the same time, however, they are being lost or degraded by extensive illegal, irregular and ill-planned settlements and illegal forest resource extraction. Such destruction of natural assets and their economic value is a matter of national concern (36).

61. Sri Lanka's forests, wildlife and unique biodiversity are facing serious threats due to their market-driven and unsustainable exploitation. Land degradation and the resulting natural hazards are caused by uncontrolled development activities, including unauthorized landfills, deforestation, unplanned land-use and the uncontrolled expansion of the urban landscape. The coastal zone of Sri Lanka, which is of enormous ecological significance, has been subjected to particular degradation over the last few decades, including coastal erosion, habitat loss and the pollution of coastal waters. The report notes that Sri Lanka has many of the appropriate institutional frameworks and regulatory instruments, but still needs strong political will to support law enforcement and compliance (37).

62. Over the past 10 years, more than 40 per cent of Cambodia's national gross domestic product (GDP) has been derived from agriculture, fisheries and forestry. Increasing population growth and related demands have exerted pressure on these natural resources over the past three decades, degrading natural habitats and threatening the country's biodiversity. Thus, Cambodia's forest cover declined from 73 per cent in 1965 to approximately 61 per cent in 2002 (38).

63. Some of the key environmental issues in Cambodia are land degradation, the depletion of biodiversity, the degradation of inland aquatic resources, the management of coastal and marine resources and the management of waste. The country has the necessary suite of laws and regulations for environmental management and the Ministry of Environment is the authority responsible for their implementation, but it needs improved institutional coordination with other development ministries and stronger and more ample technical and financial resources (38).

64. In the Dominican Republic there is a need for a stronger mechanism for inter-institutional communication and collaboration in environment-related issues (39).

65. In Guatemala there is a need to integrate environmental, social and economic aspects in policies directed towards achieving sustainable development; without such integration, the goal of sustainable development cannot be reached (40).

66. Haiti's environmental problems are largely related to the poverty which affects a large proportion of its population and are exacerbated by the inappropriate management of its natural resources. An environmental policy that serves the entire country should be closely linked to a framework for sustainable economic development (41).

67. In the Bolivarian Republic of Venezuela, water and air pollution and the management of chemical substances and urban waste are considered among the most important environmental problems facing the country. The overlapping responsibility of governmental institutions in relation to specific environmental matters constrains the effectiveness of environmental policies, as do technological, scientific and budgetary limitations on policy implementation (42).

68. A common difficulty identified by most of the processes and reports carried out at the city level, such as those in Cordoba in Argentina (43), Georgetown in Guyana (44), Puerto Mont in Chile (45), Vitoria-Gasteiz in Spain (46), Ponta Pora, Piraña, Manrabá and Beberibe in Brazil (47), Quito in Ecuador, Trujillo in Peru, and Canelones (48), Colonia del Sacramento (49) and Rivera (50) in Uruguay, is the lack of information and communication from the environmental institutions to civil society and the public at large, along with the need to strengthen communication between institutions on environmental issues, which are too often seen as mere technical matters. Frequent changes in government administrations and consequent changes in views about how to deal with environmental issues also affect the implementation of environmental decisions and policies at the city level.

E. Harmful substances and hazardous waste

69. Assessments in the area of harmful substances and hazardous waste were conducted at the regional level.

70. An evaluation of some 60 national dioxin inventories shows that the most important source of dioxins is the open burning of waste or biomass, such as forest or agricultural fires, contributing an average of 54 per cent of the total emissions to air. Results for this source vary markedly, however, depending on the country situation; the lowest estimates, typically where open burning is prohibited, are zero and the highest estimate, where there are few industrial sources of emission, is 99 per cent (51).

71. Studies have identified dioxin emissions from the open burning of biomass such as sugar cane and forest fires. These show that the burning of sugar cane generated substantially different emissions from those produced by other fuels. In addition, the emission factor for sugar cane was higher than that for forest litter (4 grams of toxic equivalents per ton of fuels, as against 1 gram of toxic equivalents per ton of fuel) (51).

72. The use of chemicals in consumer products is ubiquitous and it would be difficult to find any products manufactured today that do not contain chemicals. These chemicals are part of the product specification and enhance its functionality or performance. In some cases, chemical residues may remain in the products from the process of their manufacture. Most chemical constituents are benign but there is growing concern that some may pose risks to public health and the environment. From toys and furniture to electronic equipment and cars, action is needed at many levels and involving many partners to tackle the problems and challenges posed by these chemicals in products. Informed decision-making requires sufficient and reliable information to pass along the supply chain with the chemicals and the products that contain them. Many public and private sector organizations have

recognized the critical need for such information and UNEP has commissioned four sectoral case studies that will examine the opportunities for and barriers to information flow. The findings of these case studies will be used to develop policy recommendations to be presented to the International Conference on Chemicals Management at its third session, in 2012 (52).

73. The first UNEP intercalibration study on persistent organic pollutants was successfully launched in Asia. The results revealed that, in general, the 14 laboratories of the Organization for Economic Cooperation and Development did not perform better than the 24 developing-country laboratories. One interesting finding, possibly skewed by the high number of Chinese laboratories with highly sophisticated analytical equipment (high-resolution mass spectrometers), the best performing laboratories were those analysing the most demanding chemicals (polychlorinated dibenzodioxins and polychlorinated dibenzofurans). Poorest results were obtained for organochlorine pesticides. Where competence and matrices are concerned, an overall good performance was observed for test solutions, whereas a substantial number of laboratories struggled with real matrices such as sediment, mothers' milk or fish. The results emphasize the need for all laboratories to pay more attention to quality assurance and method development. The study has been extended to the other United Nations regions in 2010–2011 and the results will be presented to the Conference of the Parties to the Stockholm Convention on Persistent Organic Pollutants at its fifth meeting, in April 2011 (53).

74. Mercury supply and demand in Asia will likely reach a rough equilibrium from about 2014 or 2015. After 2017, the urgency of an Asian mercury storage capability is likely to depend on the rate of demand reduction that may be influenced by control measures introduced as part of the global legally binding instrument on mercury currently under development. Substantial quantities of excess mercury can be expected in Asia after 2030. The quantity of excess mercury, mostly accumulated between 2030 and 2050, is likely to amount to just over 5,500 tonnes (54). Variations in the subregional and intraregional political, social, economic and environmental conditions are such that no single universally preferred option could be proposed and, accordingly, case-based approaches have to be used. Above-ground, specially engineered warehouses and export to foreign facilities are found to be the most appropriate options (55).

75. The principal future sources of mercury in Latin America and the Caribbean were identified as mercury recovered as a by-product of mining operations and recovered from the closure or conversion of mercury cell chlor-alkali plants. A base case scenario suggests that mercury supply may exceed demand as early as 2015, with the total excess accumulated over the period 2015–2050 possibly amounting to over 8,000 tonnes (56). The region's current geological, legal, economic and technical infrastructure is inadequate to provide a below-ground facility for the long-term storage of mercury. The options for above-ground facilities and for export to foreign facilities were found to be feasible storage options. Existing national hazardous waste treatment facilities may be an option for the interim storage of elemental mercury (57).

76. Mercury supply in Eastern Europe and Central Asia may exceed demand within the next one-three years, indicating that there is an urgent need for storage capacity in the subregion. The quantity of mercury accumulating between 2015 and 2050 that may need to be stored is most likely in the range of 2,000–10,000 tonnes (58).

77. The volumes of ozone-depleting substances in the atmosphere are responding to the control measures of the Montreal Protocol on Substances that Deplete the Ozone Layer. Globally, the ozone layer is projected to recover its 1980 level before the middle of the twenty-first century. The Antarctic ozone hole is projected to recover later in the century than any other region of the globe. Control of ozone-depleting substances by the Protocol has shown to produce co-benefits for climate. The decrease in such substances achieved under the Protocol is equivalent to a reduction of carbon dioxide five times larger than the target for the first commitment period of the Kyoto Protocol. Projections of hydrofluorocarbon (HFC) growth scenarios that assumed no controls suggested that by 2050 global-warming-potential-weighted emissions of HFCs could be comparable to global-warming-potential-weighted emissions of chlorofluorocarbons (CFCs) at their peak in 1988 (59).

78. In addition, the accelerated hydrochlorofluorocarbon (HCFC) phase-out agreed to by the parties to the Protocol in 2007 is projected to reduce ozone depletion and to help reduce climate forcing. Nitrous oxide, which is known both to deplete global ozone and to warm the climate and the current ozone-depleting potential (ODP)-weighted human-caused emission of nitrous oxide is found to be larger than that of any ozone-depleting substance. Deliberate large injections of sulphur-containing compounds into the stratosphere (a process known as geo-engineering) would alter the radiative, dynamic and chemical state of the stratosphere and could have substantial unintended effects on stratospheric ozone levels (59).

79. Options for further limiting future emissions of ozone-depleting substances, including phasing out the exempted uses and preventing emissions from existing banks of such substances, could bring recovery dates forward by a few years with an impact on future ozone levels much smaller than that already accomplished by the Montreal Protocol (59).

F. Resource efficiency

80. Assessments in the area of resource efficiency were conducted at the global and regional levels, led by the work of the UNEP International Panel for Sustainable Resource Management to assess social and economic drivers and ways of decoupling economic growth from resource use and environmental degradation.

81. As identified by the assessments, agriculture and food consumption are among the most important causes of environmental pressures, especially habitat change, climate change, water use and toxic emissions. The study showed that carbon dioxide emissions are highly correlated with income. Population and economic growth will hence lead to higher impacts, unless patterns of production and consumption are changed (60).

82. Furthermore, there are interlinkages between problems that may aggravate them in the future. For example, many proposed sustainable technologies for energy supply and mobility rely for a large part on the use of metals, such as in batteries, fuel cells and solar cells. As a rule, metal refining is energy-intensive; accordingly, the production of such novel infrastructure may be energy-intensive and cause a scarcity of certain materials. As these issues have not yet been adequately investigated, there is a need for analysis to evaluate trends, develop scenarios and identify sometimes complicated trade-offs (60).

83. Over the period 1932–1999, the in-use stock of copper grew in the United States of America from 73 kg to 238 kg per capita. In 2000, the world average for such stocks was 50 kg per capita. Comparison of the per capita stocks in industrialized countries with those in developing countries suggests that, if the total world population were to enjoy the same economic levels as the industrialized countries, the amount of global in-use metal stocks required would be from three to nine times those existing at present. Closing the information gaps about stocks in human society provides important information about the potential of metal recycling to meet future demand. Use of these growing metal stocks generated through recycling is expected to represent an important source for future metal supply (61).

84. The growing metal stocks in our society can serve as huge above-ground mines. Exploiting this potential can help reduce the extraction of metals from primary sources. This would contribute to the decoupling of resource use from economic growth. There are considerable data gaps, however, relating to the size of these metal stocks and their recycling potential. The recycling rates of many metals are low. Open material cycles are typical for consumer goods like cars and electronics. Accordingly, these product groups need special attention. Recycling rates are very low for specialty metals like lithium, for which an appropriate recycling infrastructure still has to be developed. Tapping into the full potential of above-ground mining and closing material cycles with appropriate global infrastructure are essential steps in establishing a green economy and securing sustainable development (61).

85. Bioenergy, which to date has largely been generated from the traditional use of biomass, is part of the energy mix. Long-term sustainability of the bioenergy sector can only be achieved with sound policies and planning that take into consideration a range of global trends, including population growth, yield improvements, changing diet patterns and climate change. Not all biofuels perform equally well in terms of their impact on climate, energy security and ecosystems. Environmental and social impacts need to be assessed throughout the entire life cycle. As future global biofuel demand is expected to increase, so is the demand on land. Land conversion for biofuel crops can lead to negative environmental impacts, including such implications as reduced biodiversity and increased greenhouse gas emissions. Water is another limiting factor, both in terms of quality and quantity (62).

86. Some avenues for the creation of a more efficient and sustainable production of biomass include improving the efficiency of that production; using biomass more efficiently; and considering various technologies. Measures that can reduce environmental pressures on natural resources and provide social benefits include sustainability standards, policies for biofuel consumption, programmes for sustainable land-use management, feed-in tariffs or market-oriented measures, or setting the policy framework to foster a more productive use of resources, which might be more effective than supporting specific technologies (62).

87. Reducing the overall energy demand, in particular, increasing fuel efficiency of vehicles and fostering a modal shift, may prove to be a much more efficient way of reducing greenhouse-gas emissions than expanding biofuel production. Considering various energy supply systems – with bioenergy as part of a mix – is also needed if resource use is to be optimized (62).
88. The research by UNEP and its partners also examines in a subregional context the efficient use of materials (fossil fuels, metals, and industrial and construction materials), energy, water, land, biomass and emissions and provides an overview of related regional and national policy responses that may support and promote resource efficiency. The findings clearly indicate that resource efficiency is urgently needed and is indispensable to the sustainability of development, for example in Asia and the Pacific. At the same time, resource efficiency alone is not sufficient to ensure that environmental targets can be met in the long run. While improvements in technology might be able to mitigate the exponential growth of emissions and waste and the relative consumption of resources, population dynamics and improvement in the overall standard of living in regional countries are in turn capable of offsetting any technology-driven gains. The research suggests that resource efficiency is necessary and capable of reducing per capita resource use by 2030 but that all benefits from technology cannot be sustained without structural and behavioural change (63).
89. Institutional strengthening and public-private cooperation are key factors in ensuring the success and sustainability of improved resource efficiency and better environmental management initiatives in Latin America and the Caribbean. Economic analysis tools are contributing positively to the design and evaluation of programmes and initiatives for the efficient use of resources as they make it possible to consider the total economic value of the resources, and help identify the social costs associated with negative environmental externalities arising from productive activities. To improve resource efficiency and take advantage of its potential applicability and contribution to the solution of environmental problems, it is essential to generate reliable and systematic information on resource use and the state of the environment; incorporating good production practices that promote productive efficiency or the implementation of sustainable practices in agriculture and industry can both improve the competitiveness and environmental situation and contribute to social inclusion and equity (64).

IV. Intergovernmental scientific assessments: processes and platforms

90. It was agreed at the third ad hoc intergovernmental and multi-stakeholder meeting on an intergovernmental science-policy platform on biodiversity and ecosystem services, convened in Busan, Republic of Korea, from 7 to 11 June 2010, that, among other functions, the new platform would perform regular and timely assessments of knowledge on biodiversity and ecosystem services and their interlinkages. These assessments must be scientifically credible, independent and peer-reviewed and must identify uncertainties. There should be a clear and transparent process for sharing and incorporating relevant data. Further information on this may be found in the Busan Outcome, available at www.ipbes.net (65).
91. A transparent and consistent nomination process allowing Governments and other stakeholders to nominate relevant experts was set up to ensure scientific credibility in the fifth report of the Global Environment Outlook (GEO) process. In addition, its Science and Policy Advisory Board, comprising reputable scientific and policy experts, has been established with the primary objective of supporting the process and providing guidance to chapter authors to ensure that the process is scientifically credible (66).
92. The Global Chemicals Outlook has a steering committee comprising representatives from the academic, government, civil society and private sectors. The scientific parts of the Outlook, in particular the assessment of the economic cost of inaction, will be peer-reviewed by economic scientists and scientists with experience in human and environmental effects of chemicals (67).
93. To ensure the continued scientific credibility of the Intergovernmental Panel on Climate Change (IPCC) assessments, an independent review of IPCC processes and procedures was carried out in 2010. A 12-member committee comprising highly reputable scientific experts reviewed the procedures and processes of IPCC and reported on its work to the United Nations (<http://reviewipcc.interacademycouncil.net/report.html>). The committee's findings and recommendations were considered by IPCC at its plenary meeting in October 2010, with a view to further improving the scientific robustness of the IPCC assessments, the overall management of the assessment process and communication strategies (68).
94. By its resolution 64/71 of 4 December 2009 the General Assembly decided to establish the United Nations Regular Process for Global Reporting and Assessment of the State of the Marine Environment, describing its first five-year assessment cycle (2010–2014), and agreed to prepare recommendations on the modalities for implementation of the Regular Process through the Assembly's

Ad Hoc Working Group of the Whole convened from 30 August to 3 September 2010. The recommendations of the Ad Hoc Working Group of the Whole were presented to the Assembly at its sixty-fifth session and are currently being debated under the agenda item on oceans and the law of the sea (69).

95. UNEP and the Intergovernmental Oceanographic Commission (IOC) of the United Nations Educational, Scientific and Cultural Organization (UNESCO) have continued to provide support to the Regular Process. In paragraph 182 of resolution 64/71, the Assembly requested the United Nations Division for Ocean Affairs and the Law of the Sea to provide support for the Regular Process, in cooperation, as appropriate, with relevant United Nations specialized agencies and programmes. The Regular Process has been involved collaboration between the following United Nations agencies: the Food and Agriculture Organization of the United Nations (FAO), the International Maritime Organization (IMO), the World Meteorological Organization (WMO) and the International Seabed Authority, among others (69).

96. In partnership with IOC, the International Hydrological Programme of UNESCO, the International Lake Environment Committee and several other organizations, UNEP is carrying out a transboundary water assessment project, with funding from the Global Environment Facility (GEF). The main objectives of this medium-sized project are to develop:

- (a) A methodology to undertake a global comparison of all transboundary water systems within the five categories of international water systems (transboundary groundwater; transboundary lakes and reservoirs; transboundary river basins; large marine ecosystems); and open ocean areas) for the purposes of identifying areas at risk;
- (b) A methodology to undertake a more detailed analysis for selected international water systems;
- (c) A partnership between organizations;
- (d) The arrangements needed to conduct a baseline transboundary waters assessment.

97. It is expected that the project will generate, among its outputs, feasible, ecosystem-based methodologies for a global assessment of five international water categories. The methodologies will be used for assessing the changing conditions resulting from human and natural causes. The methodologies will also cover interlinkages between five water categories (70).

98. The transboundary water assessment project is responding to the need for GEF to prioritize its work in the international waters focal area and to concentrate its scarce resources where they can be more cost-effective in tackling transboundary concerns. It will also focus global attention on the vulnerability of transboundary water systems. The intention is that the periodic assessment will be sustained in the future through the partnership of agencies and organizations and will include data collected by GEF International Waters projects that would be useful to agencies conducting assessments and to the UNEP Global Environment Outlook (GEO) process (70).

99. The UNEP subprogramme on harmful substances and hazardous waste focuses on scientific assessments, conducting global assessments of the environmental fate and exposure pathways of harmful substances, and raises awareness of these findings to help Governments and others take action. The subprogramme also assists in the development of legal instruments, the provision of tools for national implementation and the conduct of monitoring and implementation activities.

100. In line with its mandate to provide science-based global standards, UNEP is working with partners in the Inter-Organization Programme for the Sound Management of Chemicals (IOMC) and others on the development and updating of guidelines and state-of-the-art reports on such topics as endocrine disruptors and on guidelines for generating high-quality and comparable results from the analysis of persistent organic pollutants and for developing sound emission factors for the estimation of emissions of hazardous substances, such as emissions of dioxins and furans from the open burning of waste or biomass.

101. The Resource Panel aims to support decision makers in responding to this challenge through the issuance of an assessment report entitled: "Assessing the environmental impacts of consumption and production: priority products and materials". A wealth of studies helped in the assessment of the most important causes of environmental impacts from a production, consumption and materials standpoint.

102. The assessment panels of the Montreal Protocol have served as the pillars of the ozone protection regime since the inception of that agreement. Through the provision of independent, technical and scientific assessments and information, the panels have helped the parties reach

informed decisions. UNEP initiated the assessment panel process in 1988 pursuant to Article 6 of the Protocol. The panels for scientific, environmental, technology and economic assessments carry out periodic assessments of the scientific issues of ozone depletion; the environmental effects of ozone depletion; and the status of alternative substances and technologies, along with their economic implications.

V. Technology support, capacity-building and identification of emerging issues for keeping the world environmental situation under review

A. Technology-support and capacity-building

103. Technology support and capacity-building are carried out at the global, regional and national levels.

104. The key results and impacts flowing from the development of the training manual on integrated environmental assessment and reporting (the *IEA Training Manual*) may be summarized as the following:

(a) The *IEA Training Manual* has improved awareness of and access to relevant environmental assessment data, tools and methodologies, enhanced the capacity of assessment practitioners to undertake integrated environmental assessments and established a network to facilitate and promote the exchange of ideas and interaction between environmental practitioners and decision makers;

(b) Based on the feedback from participants involved in training in the various regions, relevant integrated environmental assessments methodologies and tools made available through this project were well received by Governments, partners and other stakeholders. Improved access to integrated environmental assessment tools and materials has helped project partners, such as the GEO collaborating centres, to expand and deepen their capacity in undertaking assessments;

(c) Customized versions and translations of the manual enhance its relevance to regional settings and help ensure that it meets the specific needs and requirements of the regions concerned. The manual is available online at www.unep.org/ieacp.

105. The internet platform known as the Marketplace for Environmental Training and Online Resources (MENTOR) is an extensive collection of training courses and other training materials developed by UNEP and its partners and covering all six subprogrammes (www.unep.org/mentor/). The platform provides two community-of-practice applications to support UNEP training activities in the areas of integrated environmental assessment and climate change. Through the platform, training courses and training resources spanning all six UNEP subprogrammes are being systematically integrated, thereby strengthening the sustainability of the wide range of environmental capacity-building initiatives undertaken by UNEP and partners in response to the Bali Strategic Plan for Technology Support and Capacity-building.

106. The 2010 Biodiversity Indicators Partnership (www.twentyten.net/) is a global initiative to develop and promote indicators for the consistent monitoring and assessment of biodiversity. The Partnership, which was set in place with major support from GEF, brings together a large number of international organizations working on indicator development, to provide the best available information on biodiversity trends to the global community and to assess progress towards the 2010 biodiversity target, namely, significantly to reduce the rate of biodiversity loss by 2010. The three main objectives of the 2010 Biodiversity Indicators Partnership are: first, to generate information on biodiversity trends which is useful to decision makers; second, to ensure that improved global biodiversity indicators are implemented and available; and third, to establish links between biodiversity initiatives at the regional and national levels, to enable capacity-building and to improve the delivery of the biodiversity indicators.

107. The publication entitled *Ecosystems and Human Well-Being: A Manual for Assessment Practitioners* is a stand-alone guide on how to conduct assessments of the impacts on humans of ecosystem changes. In addition, assessment practitioners who are seeking guidance on particular aspects of the assessment process will find individual chapters of this manual useful in boosting their understanding of best practices in ecosystem assessment. The manual builds on the experiences and lessons learned from the Millennium Ecosystem Assessment global and subglobal assessment initiatives.

108. The performance review and assessment of implementation system (PRAIS) was established to facilitate the reporting process of Parties under the United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa. It is based on a set of performance and impact indicators to measure progress against the operational and strategic objectives of the 10-year strategic plan and framework to enhance the implementation of the Convention (2008–2018). It also aims at measuring investment flows for the implementation of the Convention and the establishment of a knowledge management system, including the dissemination of good practices. The project focuses on three main components: first, the development of new, indicator-based reporting tools (templates, guidelines, training materials); second, capacity-building for regional institutions and country parties for the preparation of their fourth national reports to the Convention, based on the new reporting requirements; and third, establishment of a knowledge management system, including an online reporting platform, the PRAIS portal. The project has established a global network of 14 subregional and regional institutions, named reference centres that, under the supervision of the UNEP World Conservation Monitoring Centre, are currently working with the Convention's regional coordination mechanisms in order to provide training, capacity-building, and technical backstopping in each region.

109. The UNEP databank of laboratories analysing persistent organic pollutants has been developed since 2005 through the UNEP/GEF project on the assessment of existing capacity and capacity-building needs to analyse persistent organic pollutants in developing countries and is being maintained and updated by UNEP to support evaluations of the effectiveness of the Stockholm Convention (such as the Global Monitoring Programme for Persistent Organic Pollutants) and other needs of multilateral environmental agreements, and to serve as a reference for UNEP projects and for external clients in need of data on persistent organic pollutants. It also serves as a reference for the UNEP Worldwide Intercalibration Study on Persistent Organic Pollutants. The databank has recently been updated and now includes the nine newly listed persistent organic pollutants. Currently, the databank contains 229 laboratories worldwide (71) and is accessible at <http://212.203.125.2/databank/Home/Welcome.aspx>.

110. Technical assistance missions have been provided upon request to Nigeria, the United Republic of Tanzania (National Environment Management Council, through the United Nations Development Assistance Framework) and the Volta Basin Authority to advise and help design, develop and, where feasible, implement environmental information management infrastructures in accordance with global best practices and standards. These efforts have complemented and extended previous efforts to expand national capacity and infrastructure for environmental information management, such as the recently concluded UNEP/GEF project developing the clearing-house mechanisms for the States of the Western Indian Ocean as signatories to the Amended Nairobi Convention for the Protection, Management and Development of the Marine and Coastal Environment of the Western Indian Ocean. Capacity-development efforts by UNEP in the area of data and information have made possible the improved management of environmental and water resources at both the national level (Nigeria and the United Republic of Tanzania) and the regional level (integrated riparian management of the Volta basin by Benin, Burkina Faso, Côte d'Ivoire, Ghana, Mali and Togo).

111. In Africa, MENTOR is providing support for the development of the Pan-Africa e-Learning for the Environment Network (www.unep.org/mentor/africa) in response to decision 6, on environmental education and technology-supported learning, adopted by the African Ministerial Conference on the Environment at its twelfth session, held in Johannesburg, South Africa, in June 2008. Training was conducted in 18 African countries and the Network is now operational through a set of subregional hubs and national centres. Additional outcomes from this process include the development of an e-learning strategy for the environment sector, covering over 20 institutions, and the development of guidelines on e-waste which, in Kenya, will eventually lead to a government regulation on e-waste management.

112. In Asia and the Pacific, assessment activities have included capacity-building in integrated environmental assessment and in vulnerability and impact assessment for climate change adaptation in Bangladesh, Bhutan, the Democratic People's Republic of Korea, Pakistan, Papua New Guinea and the Pacific island countries, and also in the vulnerability of water to climate change in the urban centres of Mongolia, Thailand and Viet Nam.

113. In the process of customizing the *IEA Training Manual* for Asia and the Pacific, UNEP, in cooperation with the Thailand Environment Institute and the University of the South Pacific, reviewed more than 20 countries' environmental assessment and reporting at the national and city levels.

114. The process of customizing the *IEA Training Manual* for Europe was carried out by the Central European University in Budapest. Ten case studies were provided and the manual was also translated into Russian by the University. The customized manual was published on CD-ROM in March 2010.

115. The *GEO Cities Manual/Guidelines for Integrated Environmental Assessment of Urban Areas*, prepared as a working manual for the Arab region, forms an integral part of the GEO process conducted by UNEP. Its main purpose is to support capacity-building in the region for integrated environmental assessment and reporting at the city level. The fundamental objective of this initiative is to promote better understanding of the interaction between urban development and the environment, providing the region's local governments, scientists, policymakers and the public with reliable and up-to-date information to help them improve urban environmental planning and management.

116. The guidelines provide a detailed methodology for the development by the Arab region of a core set of sustainable development indicators. It provides know how to concerned agencies in the region to develop and implement the core set indicators at the national and regional levels.

B. Identification of emerging environmental issues

117. Early warning and new emerging issues were identified across thematic areas and levels.

118. The *UNEP Year Book 2010* highlighted lessons from environmental policy integration and conservation management in post-conflict areas; it called attention to new scientific insights on planetary boundaries and the nexus between climate change and biodiversity, looking also at the emerging issues of blue carbon, or the 70 per cent of carbon which is stored permanently in marine life, the assisted colonization of plants and animals, and ocean acidification; and it considered trends in sustainable energy production and global materials use. The report also demonstrates progress made in international environmental governance reform, particular in the areas of chemicals and waste, and stresses the need to manage ecosystems for resilience in the face of climate change.

119. The *UNEP Year Book 2011*, presented in document UNEP/GC.26/INF/2, highlights three emerging environmental issues: the persistent problem of plastic debris in the ocean that may present risks to both human health and the environment; the need to review current practices in phosphorus use and to enhance the resource efficiency of this important nutrient; and the benefits that forests provide in close association with their biodiversity, which may require further protection as it comes under increasing pressure from the development of new policy instruments and climate-related mechanisms, such as the extended programme to reduce emissions from deforestation and forest degradation that includes the role of conservation, the sustainable management of forests and the enhancement of forest carbon stocks, known as REDD-plus.

120. Some examples of hot-spot alerts include deforestation of the Amazon in Mato Grosso, Brazil; carp aquaculture in Lake Kolleru, in Andhra Pradesh, India; deforestation of the South American Atlantic forest in eastern Paraguay; land-cover change due to the Athabasca oil sands, in Alberta, Canada. Environmental science alerts have been released about such issues as sea-level rise in the Indian Ocean, a process which differs from region to region; the state of low-lying Pacific reef islands; the role that greening cement production can play in reducing greenhouse-gas emissions; the shrinking areas of mangrove forests worldwide; the overall decline in plant growth over the past decade; and success achieved by international action to stem illegal logging (73).

121. Topics covered by near real-time environmental event alerts include a massive iceberg breaking off Greenland's Petermann Glacier; the wide-scale and catastrophic flooding in Pakistan; and an overview of the Gulf of Mexico oil spill: the largest accidental oil spill in history. Satellite images also record how wildfires have destroyed 1 million hectares of forests in the western Russian Federation.

VI. Conclusion

122. After decades of producing scientifically based environmental assessments, countries have developed a significant level of capacity to engage in, and undertake, environmental assessments. These assessments generally result in sound recommendations for policymakers based on the best available science, using well recognized and accepted assessment methodologies such as the integrated environmental assessment approach applied in producing the GEO reports, and the methodology used to conduct the Millennium Ecosystem Assessment and other methodologies.

123. These methodologies have produced tools, training packages, methodology manuals, e-learning platforms and trainers' networks, and have succeeded in building capacity to undertake assessments at multiple scales, from the global to the subnational, and across a variety of themes.

124. The abundance of policy recommendations emanating from environment and ecosystem-based assessments notwithstanding, evidence indicates that the process of applying the recommendations that the assessments produce is difficult, at times confusing or even conflicting and can further impede the already slow rate of progress both in meeting national policy needs and in achieving internationally agreed environmental goals.