

Interim Report on UNEP Foresight Process 2011

21 Emerging Issues for the 21st Century

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Objectives

The purpose of the UNEP Foresight Process is to produce every two years a careful and authoritative ranking of the most important emerging issues having to do with the global environment. The aim is both outward- and inward-looking. On one hand, UNEP aims to inform the UN and wider international community about these issues. On the other hand, the Foresight Process also has the goal of providing specific and usable input to UNEP's own Program of Work and increasing the confidence of its senior managers that UNEP is covering the world's most urgent environmental issues.

Guidelines for “emerging issues”

The concept of “emerging issues” was not strictly defined so as not to limit the creativity of participants. Hence, participants in the process were only given “guidelines” for identifying emerging issues rather than a restrictive definition. The guidelines were as follows:

The emerging issue must be critical to the global environment and can be either positive or negative. The issue must be environmental in nature, or environmentally-related.

The issue should be given priority over the next one to three years in the work programme of UNEP and/or other UN institutions and/or other international institutions concerned with some aspect of the global environment.

The issue has to be of a large spatial scale. It should be either global, continental or "universal" in nature. (By "universal" we mean an issue occurring in many places around the world).

The issue must be recognized as very important by the scientific community, but has not yet received adequate attention from the policy community. Hence it is considered an "emerging issue" from the vantage point of the policy community rather than the scientific community. Definitions of "very important" and "adequate" are left open.

The Foresight Process

The Foresight Process was organized by the Chief Scientists Office and DEWA and designed to promote legitimacy and creativity. The process consists of a set of alternating “open” and “closed” steps. The ‘open’ steps open up the process to a wide range of views, while the “closed” steps allow the relatively small Foresight Panel to debate the issues in depth and select a limited set of priority issues. The entire process will take eight months (1 December 2010 – 31 July 2011)

At the core of the process is a Foresight Panel consisting of 22 distinguished members of the scientific community recruited from developing and industrialized countries and internationally recognized because of their expertise in one or more environmental and related issues (see Appendix 2.). The Panel covers a wide spectrum of research disciplines from environmental governance to marine sciences. 5 Panel members are from Africa, 6 from Asia and the Pacific Region, 3 from Latin America, 5 from Europe, and 3 from North America. 14 work mostly in the natural sciences and 8 in economics or the social sciences. 15 are men and 7 women.

- 1) *Canvass of UNEP Community*. The Process began with a canvass of the UNEP community to solicit their opinions about important emerging issues. This canvass resulted in a list of 68 issues

which were described in a background report sent to Foresight Panel members before their first meeting.

- 2) *Preliminary List of Issues.* Before the first Panel meeting, Panel members took the list of 68 issues from the UNEP community and added their own ideas which resulted in a preliminary list of 95 issues. The Panel then scored the issues and the scores were used to rank the 95 issues. This ranked list was a main input to the First Panel meeting.
- 3) *First Panel Meeting.* At their first meeting, Panel members debated the 95 issues in a systematic way, giving more attention to the higher ranked issues. (Procedure will be described later.) Some issues were combined and redefined. The output of the first meeting were **21 priority issues**.
- 4) *Electronic Consultation.* An interactive electronic questionnaire was prepared with descriptions of the 21 priority issues from the First Panel meeting. This questionnaire was sent to 933 scientists around the world who were asked to score the issues between 1 and 10, and to suggest additional issues and issues to be dropped. The distribution list was prepared by SCOPE with the help of UNEP and was aimed to have a balanced representation of regions, gender, and expertise. The response rate was excellent. (428 responses, giving a nearly 1 in 2 response rate compared to a typical 1 in 4 response rate.) The regional distribution of responses was excellent (Africa 17%, Asia/Pacific 16%, Europe 27%, Latin America 13%, North America 18%, West Asia 10%). Disciplinary and gender balance of responses reflected current realities in the scientific community (natural science 76%, social science and economics 24%; male 73%, female 27%). The Consultation validated the selection of the 21 issues coming from the Foresight Panel since all the issues received fairly high average scores. Results were summarized in a report and sent to the Foresight Panel.
- 5) *Second Foresight Panel Meeting.* The Panel considered the results of the Electronic Consultation, especially the scoring of issues and the suggestions for adding issues. They reorganized and redefined some issues and settled on a list of “top ten” and “bottom eleven” issues. (The procedures followed will be described later). These lists are given in Section 4 below.
- 6) *Next Steps.* Panel members and staff are now producing final descriptions of the issues. These descriptions will make up the core of the final summary report of the Process. A draft of this report will be available by the end of July 2011. A major outreach effort is planned after July, including both external and internal briefings.

The Issues: 21 Issues for the 21st Century (Interim Results)

Issues 1 to 10 (not according to their ranking within the top 10)

Six of the top ten selected issues cover the major themes of the global environment – land/food, climate, water, biodiversity, chemicals and energy:

- **New Challenges for Ensuring Food Safety and Food Security for 9 Billion.** Although food security is a longstanding issue, the world needs to confront a new set of challenges including competition from bioenergy production, diminishing phosphorus supplies, and increasing water scarcity. An urgent task is to increase the safety and security of the world’s food supply by improving the food-processing pathway, reducing food waste, and increasing agricultural efficiency.
- **Climate Change Mitigation and Adaptation: Managing the Unintended Consequences.** When scaled up, mitigation and adaptation measures may have unintended consequences that need to be anticipated and if possible, avoided: Large scale wind farms may disrupt migratory behavior of birds; new massive sea walls will protect the population but may also eliminate valuable natural wetlands; and large scale geoengineering schemes could have many unintended impacts.
- **New Insights on Water-Land Interactions: Shift in the Management Paradigm.** Recent scientific research has provided a new view on how water and land interact locally to globally: For example, scientists now better understand the magnitude by which changes in land use profoundly

affect downwind rainfall patterns, and have computed the huge volumes of water appropriated by society to produce rainfed crops (“blue” versus “green” water flows.). This new knowledge has important implications on how we manage water and land; it provides a new impetus for boosting water use efficiency, and for bringing water and land management closer together.

- **Beyond Conservation: Integrating Biodiversity across the Ecological and Economic Agendas.** In recent years, two important threads of research have documented how biodiversity is intertwined with other aspects of society and nature: One thread has articulated the linkages between biodiversity and other ecological issues (impact of climate change on ecosystems; interaction between ecosystems and the water cycle), and the other the interrelationship between biodiversity and economics (valuation of ecosystem services; the biodiversity underpinning of economic activities). It is time to act on these new scientific insights and to handle biodiversity as more than an issue of nature conservation. It is now time to fully integrate the issue of biodiversity into the global ecological and economic agendas.
- **Greater Risk than Necessary? The Need for New Approaches to Minimizing Risks of Novel Technologies and Chemicals.** We are fixed in a pattern by which society first produces new technologies and chemicals and then *ex post facto* tries to evaluate the impacts of what it has produced. The latest examples are the questions raised by applications of synthetic biology and nanotechnology. A new approach is needed by which the implications of novel technologies and chemicals are systematically and comprehensively assessed *before* they reach the production phase with the aim to minimize their risks to society and nature. While this is being done in some parts of the world for some technologies and chemicals, it needs to become a universal approach and this may require new forms of international governance.
- **Accelerating the Implementation of Environmentally-Friendly Renewable Energy Systems.** As the world seeks solutions to climate change it looks increasingly towards implementing renewable energy systems. But regardless of the large potential for renewable energy worldwide, this potential has not been realized due to the many barriers it has to face. An important task is to identify the means to remove the economic, regulatory, and institutional disadvantages that make renewable energy less competitive than other conventional sources.

Four of the top ten issues cut across environmental themes and pertain to the social and political side of the global environment. They are especially thought-provoking:

- **Transforming Human Capabilities for the 21st Century: Meeting Global Environmental Challenges and Moving Towards a Green Economy.** Adapting to global change and realizing the green economy will require a new variety of skills and capabilities. For example, the expanding coverage of information systems and new social networks are providing unique and cost-effective opportunities to link governance and information systems so as to enhance the capacity for local governance. To realize the green economy and an environmental sustainability we also need to transform learning and education at all levels from universities to the household.
- **Broken Bridges: Reconnecting Science and Policy.** For society to cope with global environmental change it needs strategies and policies that are underpinned by a strong science and knowledge base. But many believe that the linkage between the policy and science communities is inadequate or even deteriorating, and that this “broken bridge” is hindering the development of solutions to global environmental change. This problem requires a new look at the way science is organized and how the science-policy interface can be improved.
- **Social Tipping Points? Catalyzing Rapid and Transformative Change in Human Behavior for the Environment.** New social science research has articulated the way in which damaging human behavior can be transformed by public policy in a positive direction within a relatively short period of time. An example is the transformation of the public view of cigarette smoking from being a fashionable activity to being a dangerous health hazard within one generation in many countries. Can these insights also be applied to transforming habits of consumption that lead to destructive environmental changes? What public incentives – economic, informative, prohibitive – would work best to achieve this transformation?

- **Aligning Governance to the Challenges of Global Sustainability.** The current system of international environmental governance, with its maze of interlocking multilateral agreements, evolved during the 20th century and is believed by many to be unsuited to the 21st century. Some commentators believe that this system lacks the necessary representativeness, accountability, and effectiveness for the transition to sustainability, and that a much a higher level of participation and transparency is needed. Although it is not clear what system would work better, new models of governance are being tried, ranging from public-private partnerships to alliances of environmentalist and other civil society groups.

Issues 11 to 21 (not according to ranking within this group)

Issues related to land:

- **The New Rush for Land: Responding to New National and International Pressures.** Factors including climate change, rising oil prices, and concerns over future energy and food supplies have led to a new rush for acquiring lands in developing countries by both foreign and national investors. Some research shows that the rate of land acquisition has accelerated over the past few years. There is a need for adequate understanding of the scale of the problem, the main countries at risk, the positive trade-offs, and the implication for livelihoods, food security, ecosystem services/benefits, and conflicts.
- **Boosting Urban Sustainability and Resilience.** Urban areas will play a key role in future local and global environmental change due to continuing urbanization. Activity in cities drives global environmental changes at multiple scales through material demands of production and human consumption. This affects land use and cover, biodiversity, and the hydrologic cycle, locally and regionally. Urbanization however, also provide solutions as a prime mover of cultural change, which can have a positive impact on the ideas, values, beliefs, social organization, economic growth, and social well-being needed to achieve changes in consumption patterns and lifestyles. Multidimensional and multi-scale approaches are therefore needed for boosting the sustainability and resilience of urban areas and to assist in the transition to a green economy.

Issues related to hydrosphere:

- **Potential Collapse of Oceanic Systems Requires Integrated Ocean Governance.** Oceans provide many earth system functions including the regulation of weather, climate and the hydrological cycle, as well as proving habitat for a rich diversity of organisms. But the oceanic environment is faced with increasing threats to its long-term integrity including acidification, overfishing, land and marine-based pollution, widespread habitat destruction, and proliferation of invasive species. There is a growing presumption that the current approach to managing oceans will be ineffective in avoiding a collapse of some oceanic systems. This is because, among other reasons, responsible bodies are dispersed across UN agencies. Reforms are needed and new forms of governance should be considered and evaluated, including the option of establishing a new coordinating body for international ocean governance.
- **Adaptive Governance for Addressing Increasing Pressures on Coastal Ecosystems.** Increased pressure from the exploitation of coastal resources is significantly affecting coastal ecosystems. Settlements, industries, agriculture, fisheries, and trade are concentrated in coastal zones; hence sensitive and highly valuable coastal ecosystems are subjected to on-going degradation. Present management approaches are inadequate for stemming the tide of degradation; hence an adaptive governance approach is needed that involves the delegation of management rights and power in such a way that the participation of all stakeholders is promoted.
- **Shortcutting the Degradation of Inland Waters in Developing Countries.** Water quality degradation, channel modifications, and overfishing are some of the factors posing a growing threat to the inland waterways and freshwater ecosystems of developing countries. But as developing countries stand on the brink of large-scale degradation of their inland waters, they have the option of shortcutting this degradation by taking advantage of forward-looking water

technology and management techniques that were not available to countries in Europe and North America at the time they began contaminating their waterways.

Issues related climate:

- **Consequences of Glacier Retreat: Economic and Social Impacts.** Recent research shows that the rates of glacier retreat are much faster than previously predicted. These changes pose threats to many, especially in the Himalayas, Central Asia and South American Andes regions. Risks include a disruption of water supply patterns which could aggravate conflicts and threaten livelihoods such as farming and tourism. A good understanding of the hydrological consequences and social impact of glacier retreat is needed as well as the development of adaptation strategies.
- **Acting on the Signal of Climate Change in the Changing Frequency of Extreme Weather Events.** A spate of new scientific studies have compared climate modeling results against observational evidence and confirmed the hypothesis that climate change could alter the frequency of occurrence of extreme weather events. Such studies have linked global warming with increased risk of flooding in England and Wales, increased summer rainfall variability in the Southeast United States, and the intensification of heavy precipitation events over much of the land area of the Northern Hemisphere. These new studies underline the urgency for adapting to a changing frequency of extreme weather events, and suggest that “medium term” early warning systems may be possible.

Issues related to wastes and hazardous materials

- **The Decommissioning of Nuclear Reactors and their Environmental Consequences.** Many of the world’s nuclear reactors are aging and will need to be decommissioned very soon. The Fukushima nuclear accident of March, 2011 has further accelerated plans to close nuclear plants, with Germany and Switzerland now setting a timeline for shutting down their plants. Decommissioning is a major operation with implications such as treatment/storage of radioactive wastes. There is also the issue of the inadequate number of trained professionals to handle these operations. International interventions, procedures, policies and cooperation are needed to minimize the danger posed by decommissioning activities to humans and the environment.
- **Changing the Face of Waste: Solving the Impending Scarcity of Strategic Minerals and Avoiding Electronic Waste.** An increase in demand for high-tech and renewable energy equipment is contributing to a depletion in strategic minerals, including rare earth metals. Also contributing are planned obsolescence and other wasteful manufacturing habits. Moreover, the increased exploitation of minerals is causing greater waste management problems, in particular, the build-up of electronic wastes (e-wastes). Hence, society should consider an alternative approach by which it maximizes the recovery of metals and other materials from electronic and other waste streams. This will slowdown the extraction and depletion of minerals, reduce the quantity of their wastes, and thereby lessen the environmental and other impacts of the minerals industry.

Cross-cutting issues:

- **Coping with Migration Caused by New Aspects of Environmental Change.** Climate change and other global environmental changes may become an important factor in increasing human migration. Also, some policies to limit global environmental change such as increasing production of biofuels or hydropower dam projects, may also affect intra/inter country migration. Apart from social impacts, mass migration may again have negative effects on the environment e.g., changes in land-use patterns. The flows and patterns of future migration might not follow past trends; hence new institutions and services are needed to adequately plan/prepare for, and deal with such massive population movements, at all levels of governance.
- **New Concepts for Coping with Creeping Changes and Imminent Thresholds.** Many human interactions with the natural environment cause a slow, incremental and cumulative degradation of the environment; e.g., stratospheric ozone depletion, acid rain, air pollution, tropical deforestation, mangrove destruction, greenhouse gas emissions, soil erosion, biodiversity loss, water pollution, overfishing, and so on. Ironically, these creeping undesirable changes are typically overlooked

when they are easiest to address; they only become noticeable when their consequences appear and then they are costly to mitigate. It therefore important that creeping changes are addressed early on to avoid reaching tipping points or crisis situations. New monitoring strategies and new types of warning and response systems are needed to cope with them. Research is also needed to identify possible thresholds of step-like changes and their consequences and to identify and implement effective responses.

Note that the final ranking of issues by the Panel, based on the Electronic Consultation and their own deliberations, is given in Appendix 1.

Appendix 1

UNEP Foresight Process 2011 Final Ranking of Emerging Environmental Issues

Issue Title	Ranking*
Aligning Governance to the Challenges of Global Sustainability	1
Transforming Human Capabilities for the 21 st Century: Meeting Global Environmental Challenges and Moving Towards a Green Economy	2
New Challenges for Ensuring Food Safety and Food Security for 9 Billion	3
Broken Bridges: Reconnecting Science and Policy	4
Social Tipping Points? Catalyzing Rapid and Transformative Change in Human Behavior for the Environment	5
New Insights on Water-Land Interactions: Shift in the Management Paradigm	6
Accelerating the Implementation of Environmentally-Friendly Renewable Energy Systems	7 **
Climate Change Mitigation and Adaptation: Managing the Unintended Consequences	7 **
Beyond Conservation: Integrating Biodiversity Across the Ecological and Economic Agendas	7 **
Greater Risk than Necessary? The Need for New Approaches to Minimizing Risks of Novel Technologies and Chemicals	10
Boosting Urban Sustainability and Resilience	11
The New Rush for Land: Responding to New National and International Pressures	12
Potential Collapse of Oceanic Systems Requires Integrated Ocean Governance	13
Changing the Face of Waste: Solving the Impending Scarcity of Strategic Minerals and Avoiding Electronic Waste	14
Shortcutting the Degradation of Inland Waters in Developing Countries	15
Acting on the Signal of Climate Change in the Changing Frequency of Extreme Weather Events	16
The Decommissioning of Nuclear Reactors and their Environmental Consequences	17
New Concepts for Coping with Creeping Changes and Imminent Thresholds	18
Adaptive Governance for Addressing Increasing Pressures on Coastal Ecosystems	19
Coping with Migration Caused by New Aspects of Environmental Change	20
Consequences of Glacier Retreat: Economic and Social Impacts	21

* Ranking based on scoring of UNEP Foresight Panel after extensive deliberations and after consideration of polling results of over 400 scientists worldwide.

** Score not statistically different

Appendix 2 Members of UNEP Foresight Panel 2011

1	Prof. John Agard Professor Department of Life Sciences Faculty of Science and Agriculture The University of The West Indies St. Augustine Campus, Trinidad And Tobago	6	Dr. Michael H. Glantz Director Consortium for Capacity Building (CCB) INSTAAR, University of Colorado
2	Prof. Joseph Alcamo, Chair Chief Scientist United Nations Environment Programme (UNEP) P.O. Box 30552 - 00100 Nairobi, Kenya	7	Prof. Chris Gordon Ag. Director Institute of Environment and Sanitation Studies (IESS) University of Ghana
3	Prof. Frank Biermann Professor and Head, Department of Environmental Policy Analysis Director-General, Netherlands Research School for Socio- economic and Natural Sciences of the Environment Chair, IHDP Earth System Governance Project Institute for Environmental Studies VU University Amsterdam De Boelelaan 1087 1081 HV Amsterdam, The Netherlands	8	Dr. Thelma Krug INPE - Instituto Nacional de Pesquisas Espaciais National Institute for Space Research Av. Dos Astronautas 1758 Jardim da Granja SJ Campos 12227-010, Brazil
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5	Professor Carl Folke Stockholm Univ. Scientific Director and Theme leader Stockholm Resilience Center	10	Dr. Isabelle Niang Département de Géologie, Université Cheikh Anta Diop Dakar, Senegal
11	Dr. Shuzo Nishioka Project Leader of “Japan Low Carbon Society Scenarios toward 2050”, National Institute for Environmental Studies 16-2 Onogawa, Tsukuba, Ibaraki, 305-8506 Japan	17	Prof. Priyadarshi R. Shukla Indian Institute of Management Vastrapur, Ahmedabad 380015, India
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