

THE CHANGING ATMOSPHERE: IMPLICATIONS FOR GLOBAL SECURITY

CONFERENCE STATEMENT

SUMMARY

Humanity is conducting an unintended, uncontrolled, globally pervasive experiment whose ultimate consequences could be second only to a global nuclear war. The Earth's atmosphere is being changed at an unprecedented rate by pollutants resulting from human activities, inefficient and wasteful fossil fuel use and the effects of rapid population growth in many regions. These changes represent a major threat to international security and are already having harmful consequences over many parts of the globe.

Far-reaching impacts will be caused by global warming and sea-level rise, which are becoming increasingly evident as a result of continued growth in atmospheric concentrations of carbon dioxide and other greenhouse gases. Other major impacts are occurring from ozone-layer depletion resulting in increased damage from ultra-violet radiation. The best predictions available indicate potentially severe economic and social dislocation for present and future generations, which will worsen international tensions and increase risk of conflicts among and within nations. It is imperative to act now.

These were the major conclusions of the World Conference on The Changing Atmosphere: Implications for Global Security, held in Toronto, Ontario, Canada, June 27-30, 1988. More than 300 scientists and policy makers from 46 countries, United Nations organizations, other international bodies and non-governmental organizations participated in the sessions.

The Conference called upon governments, the United Nations and its specialized agencies, industry, educational institutions, non-governmental organizations and individuals to take specific actions to reduce the impending crisis caused by pollution of the atmosphere. No country can tackle this problem in isolation. International cooperation in the management and monitoring of, and research on, this shared resource is essential.

The Conference called upon governments to work with urgency towards an *Action Plan for the Protection of the Atmosphere*. This should include an international framework convention, while encouraging other standard-setting agreements along the way, as well as national legislation to provide for protection of the global atmosphere. The Conference also called upon governments to establish a *World Atmosphere Fund* financed in part by a levy on the fossil fuel consumption of industrialized countries to mobilize a substantial part of the resources needed for these measures.

THE ISSUE

Continuing alteration of the global atmosphere threatens global security, the world economy, and the natural environment through:

- Climate warming, rising sea-level, altered precipitation patterns and changed frequencies of climatic extremes induced by the "heat trap" effects of greenhouse gases;
- Depletion of the ozone layer;

- Long-range transport of toxic chemicals and acidifying substances.

These changes will:

- Imperil human health and well-being;
- Diminish global food security, through increases in soil erosion and greater shifts and uncertainties in agricultural production, particularly for many vulnerable regions;
- Change the distribution and seasonal availability of fresh water resources.
- Increase political instability and the potential for international conflict;
- Jeopardize prospects for sustainable development and reduction of poverty;
- Accelerate the extinction of animal and plant species upon which human survival depends;
- Alter yield, productivity and biological diversity of natural and managed ecosystems, particularly forests.

If rapid action is not taken now by the countries of the world, these problems will become progressively more serious, more difficult to reverse, and more costly to address.

Scientific Basis for Concern

The Conference calls for urgent work on an *Action Plan for Protection of the Atmosphere*. This Action Plan, complemented by national action, should address the problems of climate warming, ozone layer depletion, long-range transport of toxic chemicals and acidification.

Climate Warming

1. There has been an observed increase of globally-averaged temperature of 0.5°C in the past century which is consistent with theoretical greenhouse gas predictions. The accelerating increase in concentrations of greenhouse gases in the atmosphere, if continued, will probably result in a rise in the mean surface temperature of the Earth of 1.5 to 4.5°C before the middle of the next century.
2. Marked regional variations in the amount of warming are expected. For example, at high latitudes the warming may be twice the global average. Also, the warming would be accompanied by changes in the amount and distribution of rainfall and in atmospheric and ocean circulation patterns. The natural variability of the atmosphere and climate will continue and be superimposed on the long-term trend, forced by human activities.
3. If current trends continue, the rates and magnitude of climate change in the next century may substantially exceed those experienced over the last 5000 years. Such high rates of change would be sufficiently disruptive that no country is likely to benefit in toto from climate change.
4. The climate change will continue so long as the greenhouse gases accumulate in the atmosphere.

5. There can be a time lag of the order of decades between the emission of gases into the atmosphere and their full manifestation in atmospheric and biological consequences. Past emissions have already committed planet earth to a significant warming.
6. Global warming will accelerate the present sea-level rise. This will probably be of the order of 30 cm but could possibly be as much as 1.5 m by the middle of the next century. This could inundate low-lying coastal lands and islands, and reduce coastal water supplies by increased salt water intrusion. Many densely populated deltas and adjacent agricultural lands would be threatened. The frequency of tropical cyclones may increase and storm tracks may change with consequent devastating impacts on coastal areas and islands by floods and storm surges.
7. Deforestation and bad agricultural practices are contributing to desertification and are reducing the biological storage of carbon dioxide, thereby contributing to the increase of this most important greenhouse gas. Deforestation and poor agricultural practices are also contributing additional greenhouse gases such as nitrous oxide and methane.

Ozone Layer Depletion

1. Increased levels of damaging ultra-violet radiation, while the stratospheric ozone shield thins, will cause a significant rise in the occurrence of skin cancer and eye damage, and will be harmful to many biological species. Each 1% decline in ozone is expected to cause a 4 to 6% increase in certain kinds of skin cancer. A particular concern is the possible combined effects on unmanaged ecosystems of both increased ultraviolet radiation and climate changes.
2. Over the last decade, a decline of 3% in the ozone layer concentration has occurred at mid-latitudes in the Southern Hemisphere, possibly accompanying the appearance of the Antarctic ozone hole; although there is more meteorological variability, there are indications that a smaller decline has occurred in the Northern Hemisphere. Changes of the ozone layer will also change the climate and the circulation of the atmosphere.

Acidification

In improving the quality of the air in their cities, many industrialized countries unintentionally sent increasing amounts of pollution across national boundaries in Europe and North America, contributing to the acidification of distant environments. This was manifested by increasing damage to lakes, soils, plants, animals, forests and fisheries. Failure to control automobile pollution in some regions has seriously contributed to the problem. The principal damage agents are oxides of sulphur and nitrogen as well as volatile hydrocarbons. The resulting acids can also corrode buildings and metallic structures causing overall, billions of dollars of damage annually.

The various issues arising from pollution of Earth's atmosphere by a number of substances are often closely interrelated, both through chemistry

and through potential control strategies. For example, chlorofluorocarbons (CFCs) both destroy ozone and are greenhouse gases; conservation of fossil fuels would contribute to solving both acid rain and climate change problems.

Security: Economic and Social Concerns

As the *UN Report On The Relationship Between Disarmament And Development* states: "The world can either continue to pursue the arms race with characteristic vigour or move consciously and with deliberate speed toward a more stable and balanced social and economic development within a more sustainable international economic and political order. It cannot do both. It must be acknowledged that the arms race and development are in a competitive relationship, particularly in terms of resources, but also in the vital dimension of attitudes and perceptions." The same consideration applies to the vital issue of protecting the global atmospheric commons from the growing peril of climate change and other atmospheric changes. Unanticipated and unplanned change may well become the major non-military threat to international security and the future of the global economy.

There is no concern more fundamental than access to food and water. Currently, levels of global food security are inadequate but even those will be most difficult to maintain into the future, given projected agricultural production levels and population and income growth rates. The climate changes envisaged will aggravate the problem of uncertainty in food security. Climate change is being induced by the prosperous, but its effects are suffered most acutely by the poor. It is imperative for governments and the international community to sustain the agricultural and marine resource base and provide development opportunities for the poor in light of this growing environmental threat to global food security.

The countries of the industrially developed world are the main source of greenhouse gases and therefore bear the main responsibility to the world community for ensuring that measures are implemented to address the issues posed by climate change. At the same time, they must see that the developing nations of the world, whose problems are greatly aggravated by population growth, are assisted and not inhibited in improving their economies and the living conditions of their citizens. This will necessitate a wide range of measures, including significant additional energy use in those countries and compensating reductions in industrialized countries. The transition to a sustainable future will require investments in energy efficiency and non-fossil energy sources. In order to ensure that these investments occur, the global community must not only halt the current net transfer of resources from developing countries, but actually reverse it. This reversal should embrace the relevant technologies involved, taking into account the implications for industry.

A coalition of reason is required, in particular, a rapid reduction of both North-South inequalities and East-West tensions, if we are to achieve the understanding and agreements needed to secure a sustainable future for planet Earth and its inhabitants.

It takes a long time to develop an international consensus on complex issues such as these, to negotiate, sign, and ratify international environmental instruments and to begin to implement them. It is therefore imperative that action on serious negotiations start now.

Legal Aspects

The first steps in developing international law and practices to address pollution of the air have already been taken: in the Trail Smelter arbitration of 1935 and 1938; Principle 21 of the 1972 Declaration of the UN Conference on the Environment; the Economic Commission for Europe (ECE) Convention on Long Range Transboundary Air Pollution and its Protocol (Helsinki, 1985) for sulphur reductions; Part XII of the Law of the Sea Convention; and the Vienna Convention for Protection of the Ozone Layer and its Montréal Protocol (1987).

These are important first steps and should be actively used and respected by all nations. However, there is no overall convention constituting a comprehensive international framework that can address the interrelated problems of the global atmosphere, or that is directed towards the issues of climate change.

A CALL FOR ACTION

The Conference urges immediate action by governments, the United Nations and their specialized agencies, other international bodies, non-governmental organizations, industry, educational institutions and individuals to counter the ongoing degradation of the atmosphere.

An *Action Plan for the Protection of the Atmosphere* needs to be developed, which includes an international framework convention, encourages other standard-setting agreements and national legislation to provide for the protection of the global atmosphere. This must be complemented by implementation of national action plans that address the problems posed by atmospheric change (climate warming, ozone layer depletion, acidification and the long-range transport of toxic chemicals) at their roots.

The following actions are mostly designed to slow and eventually reverse deterioration of the atmosphere. There are also a number of strategies for adapting to changes that must be considered. These are dealt with primarily in the recommendations of the Working Groups.

Actions by Governments and Industry

- *Ratify the Montréal Protocol on Substances that Deplete the Ozone Layer.* The Protocol should be revised in 1990 to ensure nearly complete elimination of emissions of fully halogenated CFCs by the year 2000. Additional measures to limit other ozone-destroying halocarbons should be considered.
- *Set energy policies to reduce the emissions of CO₂ and other trace gases.* in order to reduce the risks of future global warming. Stabilizing the atmospheric concentrations of CO₂ is an imperative goal. It is currently estimated to require reductions of more than 50% from present emission levels. Energy research and development budgets must be massively directed to energy options which would eliminate or greatly reduce CO₂ emissions and to studies undertaken to further refine the target reductions.
- *Reduce CO₂ emissions by approximately 20% of 1988 levels by the year 2005 as an initial global goal.* Clearly, the industrialized nations have a responsibility to lead the way, both through their national energy policies and their bilateral and multilateral

assistance arrangements. About one-half of this reduction would be sought from energy efficiency and other conservation measures. The other half should be effected by modifications in supplies.

- *Set targets for energy efficiency improvements* that are directly related to reductions in CO₂ and other greenhouse gases. A challenging target would be to achieve the 10% energy efficiency improvements by the year 2005. Improving energy efficiency is not precisely the same as reducing total carbon emissions and the detailed policies will not all be familiar ones. A detailed study of the systems implications of this target should be made. Equally, targets for *energy supply* should also be directly related to reductions in CO₂ and other greenhouse gases. As with efficiency, a challenging target would again be to achieve the 10% energy supply improvements by the year 2005. A detailed study of the systems implications of this target should also be made. The contributions to achieving this goal will vary from region to region; some countries have already demonstrated a capability for increasing efficiency by more than 2% a year for over a decade.

Apart from efficiency measures, the desired reduction will require (i) switching to lower CO₂ emitting fuels, (ii) reviewing strategies for the implementation of renewable energy especially advanced biomass conversion technologies; (iii) revisiting the nuclear power option, which lost credibility because of problems related to nuclear safety, radioactive wastes, and nuclear weapons proliferation. If these problems can be solved, through improved engineering designs and institutional arrangements, nuclear power could have a role to play in lowering CO₂ emissions.

- *Negotiate now on ways to achieve the above-mentioned reductions.*
- *Initiate management systems* in order to encourage, review and approve major new projects for energy efficiency.
- *Vigorously apply existing technologies* in addition to gains made through reduction of fossil fuel combustion, to reduce (i) emissions of acidifying substances to reach the critical load that the environment can bear; (ii) substances which are precursors of tropospheric ozone; and (iii) other non-CO₂ greenhouse gases.
- *Label products* to allow consumers to judge the extent and nature of the atmospheric contamination that arises from the manufacture and use of the product.

Actions by Member Governments of the United Nations, Non-Governmental Organizations and Relevant International Bodies.

- *Initiate the development of a comprehensive global convention* as a framework for protocols on the protection of the atmosphere. The convention should emphasize such key elements as the free international exchange of information and support of research and monitoring, and should provide a framework for specific protocols for addressing particular issues, taking into account existing international law. This should be vigorously pursued at the International Workshop on Law and Policy to be held in Ottawa early in 1989, the high-level political conference on Climate Change in the

Netherlands in the Fall, 1989, the World Energy Conference in Canada in 1989 and the Second World Climate Conference in Geneva, June 1990, with a view to having the principles and components of such a convention ready for consideration at the Inter-governmental Conference on Sustainable Development in 1992. These activities should in no way impede simultaneous national, bilateral and regional actions and agreements to deal with specific problems such as acidification and greenhouse gas emissions.

- *Establish a World Atmosphere Fund*, financed in part by a levy on fossil fuel consumption of industrialized countries, to mobilize a substantial part of the resources needed for implementation of the *Action Plan for the Protection of the Atmosphere*.
- *Support the work of the Inter-governmental Panel on Climate Change* to conduct continuing assessments of scientific results and initiate government-to-government discussion of responses and strategies.
- *Devote increasing resources to research and monitoring efforts* within the World Climate Programme, the International Geosphere Biosphere Programme and Human Response to Global Change Programme. It is particularly important to understand how climate changes on a regional scale are related to an overall global change of climate. Emphasis should also be placed on better determination of the role of oceans in global heat transport and the flux of greenhouse gases.
- *Increase significantly the funding for research, development and transfer of information on renewable energy*, if necessary by the establishment of additional and bridging programmes; extend technology transfer with particular emphasis on the needs of the developing countries; and upgrade efforts to meet obligations for the development and transfer of technology embodied in existing agreements.
- *Expand funding for more extensive technology transfer and technical cooperation projects in coastal zone protection and management*.
- *Reduce deforestation and increase afforestation* making use of proposals such as those in the World Commission on Environment and Development's (WCED) report, "Our Common Future", including the establishment of a trust fund to provide adequate incentives to enable developing nations to manage their tropical forest resources sustainably.
- *Develop and support technical cooperation projects* to allow developing nations to participate in international mitigation efforts, monitoring, research and analysis related to the changing atmosphere.
- *Ensure that this Conference Statement, the Working Group reports and the full Proceedings of the World Conference, "The Changing Atmosphere"* (to be published in the Fall, 1988) are made available to all nations, to the conferences mentioned above and to other future events dealing with related issues.
- *Increase funding to non-governmental organizations* to allow the establishment and improvement of environmental education

programmes and public awareness campaigns related to the changing atmosphere. Such programmes would aim at sharpening perception of the issues, and changing public values and behaviour with respect to the environment.

- *Allocate financial support for environmental education in primary and secondary schools and universities. Consideration should be given to establishing special units in university departments for addressing the crucial issues of global climate change.*

SPECIFIC RECOMMENDATIONS OF WORKING GROUPS

The recommended actions in the Conference Statement are mostly general in nature and common to a number of Conference Working Groups. The specific recommendations of the Working Groups are given in the following section.

ENERGY

1. Targets for energy supply should be directly related to reductions in CO₂ and other greenhouse gases. A challenging target would be to reduce the annual global CO₂ emissions by 20% by the year 2005 through improved energy efficiency, altered energy supply, and energy conservation.
2. Research and demonstration projects should be undertaken to accelerate the development of advanced biomass conversion technologies.
3. Deforestation should be reduced and reforestation accelerated to significantly reduce the atmospheric concentrations of CO₂ and to replenish the primary fuel supply for the majority of the world's population.
4. There is a need to revisit the nuclear power option. If the problems of safety, waste and nuclear arms proliferation can be solved, nuclear power could have a role to play in lowering CO₂ emissions.
5. It is necessary to internalize externalized costs. Policies should be fashioned to achieve broad, complementary social objectives and to minimize total social, economic and environmental costs.

FOOD SECURITY

1. National governments are urged to reduce the contributions of agricultural activities to the concentration of greenhouse gases in the atmosphere. These contributions arise from destruction of forests, inefficient use of inorganic nitrogen fertilizers, the increased conversion of land to paddy rice cultivation and the increased number of ruminant animals.
2. National governments should take the prospect of climate change into account in long-term agricultural and food security planning, particularly with respect to food availability to the most vulnerable groups.
3. National governments and international agencies should give increasing emphasis to a wide array of policy measures to reduce the sensitivity of food supply to climatic variability in order to increase resilience and adaptability to climate change.
4. National governments are urged to increase efforts to build sub-regional and regional cooperation aimed at achieving food security. International agencies should assist in promotion of these regional cooperative efforts.
5. FAO, World Bank, WMO, UNEP, UNDP, CGIAR and other international organizations should encourage research leading to ecologically sound agricultural management systems.

URBANIZATION AND SETTLEMENT

1. Environmental impact statements and land-use management plans should consider future climatic conditions including the local effects of rising sea-level on coastal communities.

2. Urban authorities should undertake risk assessments and develop emergency planning procedures which take into account the effects of climate change, for example, the increased incidence of natural hazards.

3. National governments and the international aid community should develop policies and actions to deal with the likely increased movements of environmental refugees resulting from climate change.

4. Environmental education must be stressed, particularly with respect to the sustainable development of urban areas and human settlements, and should be strongly promoted by local and national authorities and by international bodies such as WMO, UNCMS, UNEP, UNIDO and UNDP.

5. Comprehensive world-wide assessments should be made by national and international organizations of the vulnerability of specific geographic regions and urban areas to the increased risk of higher incidence of spread of infectious diseases due to global climate change, including both vector-borne and communicable diseases. In these areas, assessments should be made of health care infrastructures of their ability to cope with the projected increased risks of the spread of infectious diseases; and steps should be identified to be taken by local and national authorities and international organizations to improve such capabilities.

6. Assessments should be made of the vulnerability of nuclear facilities, municipal and hazardous waste dumps, and of other waste disposal facilities to the increased hazard of sudden flooding or gradual inundation, and of their potential for the consequent spread of infectious pathogens or toxic chemicals to the surrounding land and sea areas, and appropriate steps should be taken to minimize such risks.

WATER RESOURCES

1. The efficiency of water use and the resilience of existing and planned water resource systems and management processes must be increased to meet existing climate variability.

2. Existing acid rain conventions must be extended to the global scale and modified to include toxic organic pollutants.

3. Integrated monitoring and research programs are urgently required to improve the methods of assessing the sensitivity of water resource systems, to identify critical regions and river basins where changes in hydrological processes and water demand will cause serious problems, and to understand and model the hydrological, ecological and socio-economic impacts of climate change.

4. To alleviate present and future water problems and to achieve sustainable development, we strongly endorse the global principle of inter-regional and inter-generational equity in all actions. International co-operation, open technology transfer, meaningful public involvement and effective public information programs are essential.

LAND RESOURCES

An international fund should be created specifically for development assistance and research in order to:

1. Maintain terrestrial reservoirs of carbon through the careful management and protection of tropical and temperate forests and their soils, tundra and wetlands that represent major carbon pools.
2. Encourage development of sustainable land-use practices through such activities as agroforestry, reforestation, development of varieties for adaptation to climate change, and development of effective management practices for waste treatment and disposal, and through policies for the use, settlement and tenure of land. This requires major changes in aid policy, commercial practices and policies of related organizations (ITTO, FAO/TFAP and ICRAF) as well as possible "debt swapping" for forest protection and access to a reforestation fund.
3. Identify the most productive agricultural lands so as to be able to implement a land reserve system that can be used to mitigate losses resulting from a more adverse climate and sea-level rise.
4. Increase awareness among the public of issues posed by climate change in relation to the continued wise use of lands in a sustainable manner.
5. Broaden existing programs that address the impact on land resources of acid and other toxic depositions, by taking account of their global dimension.

COASTAL AND MARINE RESOURCES

1. Research is required to understand which natural and human factors determine the productivity and variability of marine and coastal resources.
2. Institutional and legal arrangements for the wise use of common property resources must be greatly improved.
3. The flexibility of marine-dependent industries and coastal communities must be greatly enhanced to respond to climate-induced changes.
4. Site-specific impact studies of the effects of sea-level rise must be undertaken. These should include consideration of the human, economic and environmental risks and should result in local education programs.
5. The implications of climate change for coastal-zone planning must be considered, particularly the risk of sea-level rise and/or the potential need to locate new developments inland.

FORECASTING AND FUTURES

1. In order to have any hope in coping with future change, we must acquire and make use of knowledge of the past and develop the ability to anticipate the possible future. No one model can or should be expected to deal with the uncertainties in forecasting, the details needed for making decisions, and the social, technical and economic implications of change. Hence an array of techniques must be used in order to produce useful results.

2. Not only are continued efforts needed to improve forecasting-methodologies and to integrate cause-and-effect modelling, but also improvements are needed in our ability to communicate and convey their implications for the broader culture so that individual and collective decisions can be made appropriately and with foresight. Attitudinal and institutional changes will be necessary because of the projected serious global consequences. Equally important is the need to take action, in an environmentally sustainable way, on the interrelated issues of population growth, resource use and depletion, and technological inequalities.

DECISION-MAKING AND UNCERTAINTY

1. The reduction of uncertainties requires advanced understanding of the chemistry of the atmosphere, of the implications of climate change on health, agriculture, economies, and other social concerns, and of the legal, political and other aspects of the possible responses to climate change (prevention, compensation and adaptation).

2. The industrialized nations should begin to restore the integrity of the environment, making atmospheric change the turning point for an ecological innovation of industrial economy.

3. Emission targets ought to be the subject of an international treaty between the nations that take the first step. Those nations should invite all the others to join them in advancing environmentally sustainable economic development.

4. Open decision-making may well provide for decisions that are not easily accepted by the public. We recommend a democratic discourse about possible responses to the atmospheric threat. Non-governmental organizations should play a decisive role in furthering this discourse.

INDUSTRY, TRADE AND INVESTMENT

Proposed as matters for urgent action are:

1. Creation of a World Atmosphere Fund financed by a levy on the fossil fuel consumption of industrialized countries, sufficient to support development and transfer fuel-efficient technologies.

2. Development of mechanisms for incorporating environmental considerations and responsibilities into the internal decision and reporting processes of business and industry.

3. Formation of an international consultative mechanism at the highest level, reporting to heads of government, to assure:

- accelerated research and development efforts;
- reduction of institutional barriers to the adoption of appropriate low-emission technologies by industries and households;
- improvement of market information to promote the shift of consumption toward ecologically appropriate products.

GEOPOLITICAL ISSUES

1. The particular regions of the world or sectors of the economy that will be damaged first or most strongly by a rapidly changing atmosphere

cannot be foreseen today, but the magnitude and variety of the eventual impacts is such that it is in the self-interest of all people to join in prompt action to slow the change and to negotiate toward an international accord on achieving shared responsibility for care of the climate and the atmosphere.

2. Coordinated international efforts and an all-encompassing international agreement are required along with prompt action by governmental agencies and non-governmental groups to prevent damaging changes to the atmosphere. Such actions can be based on improvements in energy efficiency, the use of alternative energy sources, and the transfer of technology and resources to the Third World.

LEGAL DIMENSIONS

1. More states should observe the international principles and norms that exist and all should be encouraged to enact or strengthen appropriate national legislation for the protection of the atmosphere.

2. The offer of the Prime Minister of Canada to host a meeting of law and policy experts in 1989 should be accepted. That meeting should address the question of the progressive development and codification of the principles of international law taking into account the general principles of law set out in the Trail smelter, Lac Lanoux, Corfu Channel cases, Principle 21 of the 1972 Declaration of the United Nations Conference on the Human Environment, the Convention on Long-Range Transboundary Air Pollution and related protocols, Part XII of the Law of the Sea Convention and the Vienna Convention for the Protection of the Ozone Layer and its Montréal Protocol. The meeting should be directed toward the elaboration of the principles to be included in an umbrella/framework Convention on the Protection of the Atmosphere - one that would lend itself to the development of specific agreements/protocols laying down international standards for the protection of the atmosphere, in addition to existing instruments.

INTEGRATED PROGRAMS

1. A thorough review is required to establish the institutional needs for cooperation in research, impact assessment and development of public policy options at the international, intergovernmental and non-governmental levels, at regional levels and at national levels. This review should be completed by 1992.

2. Extension and further development is required for a United Nations global monitoring and information system that will incorporate technological advances in measurement, data storage and retrieval, and communications in order to track systematic changes in the physical, chemical, biological and socio-economic parameters that collectively describe the total global human environment. The responsibility for development rests with governments. The monitoring system should be in place by the year 2000.

3. Also required is the development of an educational program to familiarize present and upcoming generations with the importance of addressing issues concerning sustainable development including the actions and integrated, interdisciplinary programs needed.