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UNITED NATIONS
ENVIRONMENT PROGRAMME

THE STATE OF THE ENVIRONMENT:

TEN YEARS AFTER STOCKHOLM

PROJECT PLAN

STATE OF THE ENVIRONMENT
AND SPECIAL ASSIGNMENTS UNIT

NAIROBI, JANUARY, 1979

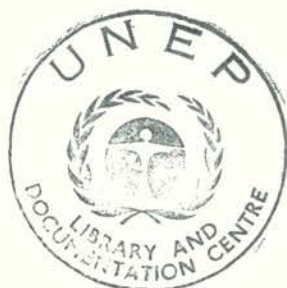


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PREFACE

One of the main functions of the Governing Council of the United Nations Environment Programme as directed by the General Assembly of the United Nations in its resolution 2997(XXVII) of 15 December, 1972 is to:

"keep under review the world environmental situation in order to ensure that emerging environmental problems of wide international significance receive appropriate and adequate consideration."

To assist in this task the Executive Director of UNEP was requested to prepare each year reviews of one or more of the priority subject areas of the environment programme and a report on the state of the environment.

Introducing the "State of the Environment" report at the third session of the Governing Council (1975), the Executive Director pointed out that the report should attempt to cover:

(a) An identification of the major environmental issues facing the world at the international, regional, sub-regional and, if possible, national levels;

(b) A brief account of:

- (i) The development and action taken and planned during the period of review in the field of environmental management;
- (ii) The global and regional conventions concluded or being considered for the protection of the environment;
- (iii) The legislation enacted and institutional mechanisms established at the national and international levels to deal with relevant environmental issues.

The Governing Council, however, considered that the State of the Environment report seeks to "identify emerging problems requiring the attention of Governments."

At the fourth session of the Governing Council (1976), the Executive Director pointed out that it would be more meaningful to restrict the annual state of the environment reports to some selected emerging issues and to carry out a comprehensive assessment of the state of the global environment every five years. The Governing Council endorsed this suggestion and, since 1977, the annual state of the environment reports have dealt with some selected topics.

Concerning the first 5-years state of the environment report, the Executive Director decided that the first comprehensive report should cover the period from 1972 to 1982, i.e. 10 years after Stockholm. He pointed out in the 1977 State of the Environment report that:

"The tenth anniversary of Stockholm, 1982, will be for the United Nations Environment Programme a year of audit. UNEP will publish a major study analyzing the changes that have taken place in the human environment over the decade, and evaluate the first ten years in which mankind has consciously and co-operatively attempted the rational management of a small planet. A similar exercise will be repeated every five years, forming a set of quinquennial state of the environment reports."

The project "The State of the Environment: Ten Years After Stockholm", as approved by the Executive Director of UNEP, has the following objective: "assessment of the state of the global environment in the decade after the Stockholm Conference." It should attempt to identify, analyze and interpret the different changes in various aspects of the environment and environmental situations, according to the available information. The study should display the inter-relationships among the different aspects of the subject and should have a systems approach. In this way, trends may be identified which would indicate current and possible future changes in the different ecosystems.

A Senior Scientific Advisory Board (see Annex 1) has been established for this project and has met twice to formulate the present detailed project plan.

CHAPTER 1

INTRODUCTION

What is the "State of the Environment"?

The main focus of the state of the environment is the changes - positive and/or negative - that occur in the different components of the natural environment (atmosphere, hydrosphere, lithosphere, etc), with particular attention to the interacting processes between these components. These processes demonstrate the functional inter-relationship between the non-living, or abiotic, environment and the biotic community of plants, animals, and microbes that is fundamental to environmental dynamics.

Disruptions of the relationships between the components of the natural environment could be attributed to natural or man-made factors; the latter have been increasing in recent times and have triggered an awakening of the environmental move in the world. The present project should assess these factors in detail.

Environmental policies are no longer focussing simply on the control of pollution and the abatement of nuisances, but indeed on more positive actions directed at the improvement of the quality of life that depends on the health and viability of the natural and man-made environments. Environmental policies are also tending to become more closely integrated with considerations regarding the prudent husbandry of finite resources. Such an increasingly more positive and integrated approach to environmental policies should be at the core of the assessment of the state of the environment.

Environmental policies clearly need to focus more and more on preventive actions rather than merely follow the classical pattern of curative actions. Preventive actions, however, often call for changes in conventional economic processes and consequently require special efforts in the harmonization of environmental and economic policies. The relationships between man's economic activities on the one hand and the state of the environment and environmental responses and policies on the other must be clearly displayed in the assessments of the state of the environment.

Major environmental policies and their implementation not only affect various individuals and groups of the public differently, but future generations as well. The corresponding choices must be made on the basis of better knowledge and information concerning the state of the environment and its changes over time.

Audience

The assessment of the state of the environment in the decade after Stockholm should be undertaken with the following audience in view: research workers in the fields of environment, environmental policy-makers, and the public at large. Accordingly, the results of the analytical work to be undertaken in this project should be presented in three forms as outlined in Fig. 1.

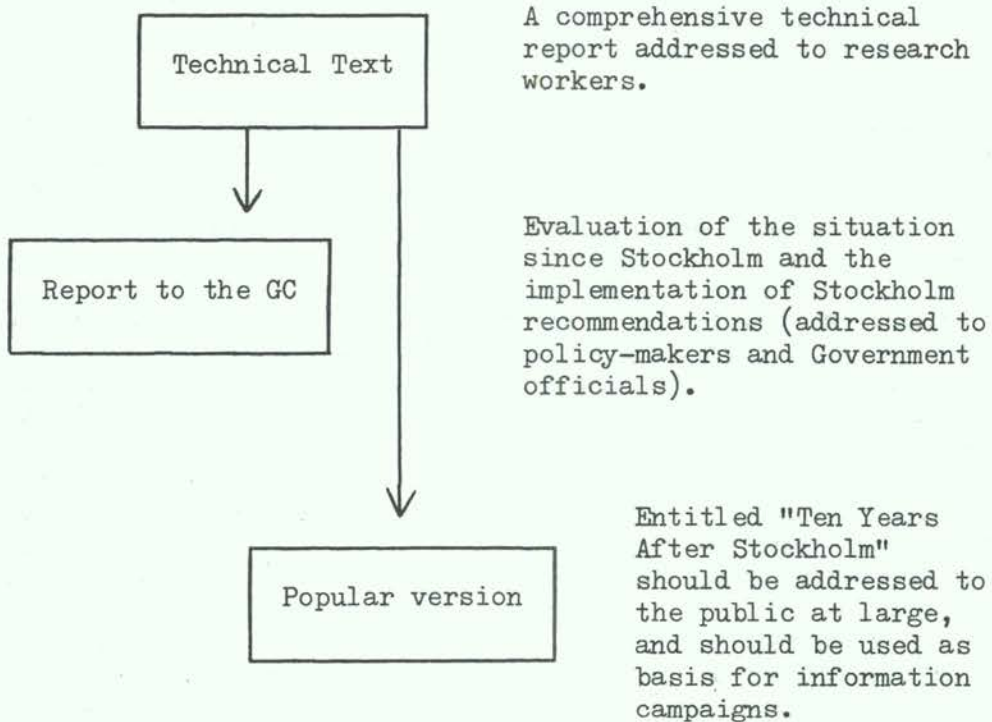


Fig. 1

Basic Principles for Assessing the State of the Environment

In order to carry out a meaningful study of the state of the environment in the decade after Stockholm, the following basic principles should be borne in mind:

1. The study must have an introduction explaining the approach. It should stress that while an authoritative study is the main target, the world environment is changing so fast that it will

not be comprehensive or long enduring. It will be a starting point, up-dated in successive 5-year reviews.

2. In each section of the study the main environmental systems and categories of human activity must be briefly described and their functional mechanisms and inter-relationships explained. These characterizations should provide the background against which changes in the decade under consideration should be analyzed and interpreted.

3. The systems approach referred to above should not be taken as demanding detailed simulation models in all areas, but existing modelling studies should be drawn upon, and some new basic modelling of the main components and inter-relationships may be useful in order to explore robustness and sensitivity and aid in the analysis of likely trends under various circumstances, natural and man-made. The main value of models under today's circumstances is as an aid to the understanding of systems rather than as a foundation for policy.

4. Whenever possible the changes that have occurred should be identified by reference to available scientific information and the application of existing data and research. The potential and results of new methods of investigation should also be explored and evaluated. Where gaps in understanding are apparent, attention should be drawn to the need for innovative thinking and methodological development and thus for appropriate resources.

5. Wherever possible changes should be quantified, and the variations in the nature and rate of regional changes should be indicated. The aim must be to indicate how large and how widespread the change is.

6. Analysis of the cause of change should differentiate between natural and man-made factors. Most natural changes are slow by comparison with those induced by man, and some involve cyclical fluctuations. The period under review (broadly the decade 1970-1980) should be put in its proper time perspective, and in some cases may need to be related to trends in human activities over long periods (e.g. the millennia during which man has been changing the use of land or the centuries for which chemical pollution has been a factor in some places). The extent to which past changes are described must, however, be governed by their relevance to the understanding of the decade under detailed review.

7. In each section, the review should illustrate and summarize, but not seek to be encyclopaedic. If comprehensive reviews of particular subject areas appear desirable these might take the form of separate reports. Thus, the broad scale and pattern of environmental systems and changes should be indicated, but selective examples within the broad accounts should be used to illustrate the range of variation in systems, changes, trends and options. The report should identify areas of continuing and significant lack of knowledge and indicate what constitutes

effective and ineffective environmental practice. It should indicate the principles that should govern the improvement of environmental management where existing knowledge permits, and the steps that should be taken to redress inadequacies in knowledge. It should stop short of analysing the inadequacies of particular governments or of proposing specific measures for particular areas.

8. The Stockholm Principles and Recommendations should constitute the starting point of the study, and should be kept in mind during the analysis.

CHAPTER 2

BASIC OUTLINE OF THE PROJECT

The review of the state of the environment in the decade after Stockholm will consist of the following main parts:

1. Assessment of the changes in the components of the natural environment and their impacts.
2. A general discussion of environmental quality since Stockholm based on the analyses given in the previous part, dealing also with institutional responsibilities, legislations, environmental impact assessment, etc.
3. A discussion of the relationship between environmental quality and development on the basis of material from the previous two parts. / Special emphasis should be made on population growth, pattern of human settlements, industrialization, agricultural development (or bioproductive systems), use of natural resources including energy, etc, in relation to environmental quality.
4. Executive summary and future prospects.

The main subjects to be dealt with in this project are summarized in the following. It should be noted that these do not necessarily represent corresponding chapters in the final technical text, but serve only as a guide for practical analytical purposes. The titles of the different chapters will be decided upon at a later stage during the process of editing the technical version.

- (1) Atmosphere
- (2) Marine Environment
- (3) Inland Waters
- (4) Lithosphere
- (5) Terrestrial Biota
- (6) Population and Health
- (7) Human Settlements
- (8) Bioproductive Systems Including Food
- (9) Mineral Resources
- (10) Energy
- (11) Industrial Production and Environment
- (12) Transport
- (13) Recreation and Tourism
- (14) Basic Needs and Environmental Quality
- (15) Peace and Security
- (16) Environmental Education and Training and Public Awareness

Table 1 is a model representing the main lines along which the analyses of the state of the atmosphere in the decade after Stockholm should be undertaken. These lines might vary according to subjects, but the general trend should be maintained in order to ensure uniformity in the analytical approach.

TABLE 1

Atmosphere

<p>I. General</p>	<p>Brief description of atmosphere, its physical and geochemical characteristics, atmospheric processes, etc.</p>
<p>II. A. State of the atmosphere in early 1970's</p> <p>B. Changes in 10 years</p> <p>C. Impact of changes</p>	<ul style="list-style-type: none"> - Composition - Abundance of pollutants: <ul style="list-style-type: none"> Chemical (SO_x, NO_x, CO, CO₂ organic, metals, etc.) Physical (particulates, thermal, radioactivity) Biological - Assessment (refer also to Stockholm background papers and recommendations) - Natural - Man-made - Magnitude of change - Evaluation of change: regional, global (with case studies) on: <ul style="list-style-type: none"> - Climate (regional, global) - Human health (include working environment) - Terrestrial ecosystems - Socio-economic development (food production, land use, industrialization, tourism, etc)
<p>III. Curative and/or preventive measures</p>	<ul style="list-style-type: none"> - Status of technologies (cost/benefit analysis) - Legislations and standards (national, regional, international)
<p>IV. Future prospects</p>	<ul style="list-style-type: none"> - Needs for improvement of the state of the atmospheric environment - Areas for further research. Proposed plan of action.

The following chapters give detailed descriptions of the issues to be dealt with under each subject area.

CHAPTER 3

ATMOSPHERE

Air that has sufficient oxygen for respiration, and is not contaminated with toxic substances, is vital for maintaining life. In this respect, the main risks to human health from inadequate oxygen supplies or polluted air arise from occupational hazards, where the air may be contaminated in a confined working space with poor ventilation. The outdoor atmosphere is seldom badly enough contaminated to cause health risks, except in certain industrialized and urban environments. Problems do arise, particularly for people with respiratory ailments, in areas with high sulphur dioxide, particulate materials and nitrogen oxide emissions.

Globally, no atmospheric changes can be identified as a hazard to human health, except the increase in ultraviolet light caused by erosion of the ozone layer in the stratosphere by chlorofluorocarbons among other man-made emissions. However, certain atmospheric emissions must be recognized as having global impact. Carbon dioxide concentrations in the atmosphere have been increasing; the "greenhouse effect" of which is expected to give rise to higher global temperatures and possible climatic changes. Increased particulate matter in the atmosphere from man-made emissions is expected to reduce the amount of incident solar radiation, and this may compensate in part for the temperature increase due to higher carbon dioxide levels, although this has been questioned by some investigators.

General Outline of Analysis

Structure and dynamics of the atmosphere:

- 1.1 Structural components
 - 1.1.1 Troposphere
 - 1.1.2 Stratosphere
 - 1.1.3 Boundary layer
- 1.2 Atmospheric dynamics and processes
 - 1.2.1 Diffusion
 - 1.2.2 Heat transfer and cloud processes
 - 1.2.3 Role of ground surface (effects of deforestation, et al)
 - 1.2.4 Role of oceans.
2. Climatic fluctuations and effects:
 - 2.1 Climatic variations and trends (seasonal, yearly, long-term)
 - 2.2 Climatic effects (droughts, floods, storms, et al)

- 2.3 Changes in climatic understanding and modelling over the last decade
- 2.4 Climatic monitoring (methods, instruments, systems including remote sensing)
3. Changes in chemical composition of the atmosphere and their effects (natural and anthropogenic sources of atmospheric pollutants, their abundance, chemical and physical transformations, residence times, sinks).
 - 3.1 Local scale trends and effects (daily, seasonal and yearly variations, impact of fuel consumption, industry and transport impacts, demographic and urban structure impacts, meteorological and climatological factors)
 - 3.1.1 Particulates, SO_x and CO pollution
 - 3.1.2 Hydrocarbons, NO_x and photochemical smog
 - 3.1.3 Heavy metals, carcinogens, asbestos, pollen grains, fluorides, et al.
 - 3.1.4 Effects of local air pollution (human health, plant damage, damage to materials, et al)
 - 3.1.5 Heat island in urban areas and their effects.
 - 3.2 Regional scale trends and effects
 - 3.2.1 SO_x and particulates long-range transport
 - 3.2.2 Photochemical smog long-range transport
 - 3.2.3 Heavy metals, pesticides, et al
 - 3.2.4 Effects of regional air pollution (soil and water acidification, damage to ecosystems, et al)
 - 3.3 Global scale trends and effects
 - 3.3.1 Carbon dioxide, particulates and heat balance
 - 3.3.2 Effects of NO_x and freons on ozone layer
 - 3.3.3 Possible effects of atmospheric global changes (geophysical, health, ecological)
4. Monitoring and prevention:
 - 4.1 Air quality criteria and standards (health criteria and standards, ecological standards, emission standards). Legislation.
 - 4.2 Air quality monitoring and warning systems (measurement methods and instrumentation, local and background monitoring, integrated monitoring, remote sensing, emission monitoring, calibration)
 - 4.3 Changes in air pollution control technology, cost-benefit analysis.
5. Present and future international collaboration:

- 5.1 International co-operation in the field of air pollution research, monitoring and control (on local, regional and global scales)
- 5.2 Future prospects (needs for improvement of the state of the atmospheric environment, areas for further research. Proposed plan of action).

MARINE ENVIRONMENT

To place the marine environmental issues in proper perspective for the decade after Stockholm, it is essential to prioritize the various problems that face humanity in terms of their potential impact on the oceans and their living resources. An issue that continues to be important globally is food supply. This has significance to the marine environment in a number of ways. First of all, the oceans are an important source of protein, particularly for many developing countries. Although natural stocks of the traditional species are nearing their upper limit of exploitation, there are vast stocks of unexploited krill (in the Antarctic waters) equal to or exceeding all the other fisheries combined (50-70 million metric tons per year). There is also a great potential for mariculture in many coastal areas and for enhancement of existing anadromous and inshore stocks through improved and enlarged spawning grounds and nursery areas. However, to realize the increased production by such practices, it is essential to preserve, and, in some cases, restore, the environmental quality in the estuaries and inshore coastal waters so that the marine organisms can successfully reproduce and grow in a healthy environment.

A problem emerging with the development of new technologies, which may come under international control, depending on the success of the new Law of the Sea, is the environmental effect of seabed mining. Seabed mineral resources for copper, nickel and cobalt, as well as manganese, are abundant and the techniques for their exploitation appear now to be so routinely practical that such mining operations are inevitable on a large scale in the near future. Although the dredging of such mineral resources has never been regarded as a highly polluting operation, the sea bottom disturbance could be so vast that there is bound to be some rather unfavourable environmental consequences in the part of the sea where the dredging takes place. Moreover, the concentrating and reduction processes to isolate and purify the metals will undoubtedly discharge wastes into the sea either from a concentrator ship or from shore-based concentrator and smelting facilities.

General Outline of Analysis

1. Physical and chemical characteristics of the oceans and marginal seas:
 - 1.1 Water masses, current systems, mixing and dispersing processes, upwelling, and coastal vs. oceanic conditions.
 - 1.2 Chemical characteristics - major natural constituents, minor constituents, nutrients, organic constituents and dissolved gases. Geochemical cycle.
 - 1.3 Interaction between marine environment, lithosphere and atmosphere.

2. Biological characteristics of the marine environment:
 - 2.1 Nutrient-rich coastal waters - due to upwelling, mining, and river runoff.
 - 2.2 Desert-like oceanic areas.
 - 2.3 Productive offshore upwelling regions - convergence zones.
 - 2.4 Latitudinal variations - tropical to polar regions.
3. State of the marine environment during the early 1970's:
 - 3.1 Changes in estuaries, inshore coastal waters and marginal seas. Examples of European and North American estuaries with heavy pollutant loads of municipal and industrial wastes - metals, chlorinated hydrocarbons, petroleum hydrocarbons, oxygen - consuming substances and solid organics.
 - 3.2 Oceanic areas - some pollution identified from petroleum hydrocarbons in surface waters and halogenated hydrocarbons in biota. No clear-cut trends in other persistent pollutants.
 - 3.3 Marine transportation. Increasing larger cargo carriers, tankers and barges. Coastal terminals. Improving control of spillage of cargo by national legislative measures. In spite of this, numerous leaks, oil spills from maritime disasters and accidental releases.
 - 3.4 Fisheries. Coastal fisheries under heavy exploitation. Some fisheries collapse owing to over-fishing and environmental changes, e.g. Peruvian anchovy and North American Pacific and Atlantic herring. Pollution could assist in decline of pelagic species but not the prime cause. Anadromous species reduced by destruction of freshwater spawning habitats, estuarine nursery areas, and impediment to spawning migration by hydroelectric dams. Some species, e.g. native oysters, decline. Molluscan shell-fish stocks in many areas contaminated by sewage bacteria, metals and persistent organic substances.
 - 3.5 Assessment of degradation in marine environment. No global assessment available - baseline programme not yet developed from which to measure trends. Regional studies underway in Baltic and North Sea under ICES and other regional bodies. A plan for Mediterranean studies in the initiation stage. Some global mass balance evaluations made on such persistent pollutants as DDT, PCB's, mercury and lead.
4. Marine environmental changes in the decade 1972-1982:
 - 4.1 Increase in discharge of municipal wastewaters. Larger volumes of treated and untreated domestic sewage entering the sea. In some cases, larger outfalls with greater volume discharge focus impact on certain coastal areas. Nutrient increase has led to over-enrichment causing

- "red tides" in areas of previously clear waters, e.g. the Ravenna coast of Italy on the Adriatic Sea (discoloured water and fish kills in late 1976).
- 4.2 Increasing oil spills from large tankers and coastal storage tanks. "Argo Merchant" on the East Coast of USA in December 1976, "Amoco Cadiz" on the coast of France in March 1978, Mizushima shore-based oil spill in the Seto Inland Sea of Japan in December 1975.
 - 4.3 Increasing marine pollution from industrial sources.
 - 4.4 Increasing pollutant input from non-point land sources - agricultural runoff, atmospheric emissions, river discharges.
 - 4.5 Destruction of coastal marine and estuarine habitats by coastal area developments, especially mangroves, river deltas, and coral reefs.
 - 4.6 Exploration and exploitation for petroleum hydrocarbons on the continental shelves - adverse effects of concern in Arctic and Antarctic Regions and coral reef areas.
 - 4.7 Pilot monitoring project for petroleum hydrocarbons underway in North Atlantic under IGOSS of IOC.
5. Changes in living marine resources during 1972-1982:
- 5.1 Declines in some coastal stocks of pelagic fish species due to heavy exploitation.
 - 5.2 Decline of some anadromous species (e.g. Atlantic Salmon).
 - 5.3 Decline in ground fish stocks with heavy exploitation by distant fishery nations.
 - 5.4 Whale populations decline.
 - 5.5 Pollution effects on marine living resources. No clear-cut evidence of declines of fish stocks due to pollution alone. Some declines may be assisted by pollution, e.g. Pacific herring spawn on vegetation in inter-tidal zone and would be vulnerable to destruction by an oil spill. Local problems of toxicity and low dissolved oxygen concentrations due to pollution cause fish kills. Some marine species have high levels of metals persistent chemicals and taint affecting marketing.
 - 5.6 Exploitation of new stocks. Traditional species being exploited to maximum. Previously unexploited stocks considered, e.g. sea urchins, squids, mussels and certain fish species on coast of N. America. Krill a major resource in Antarctic available for human exploitation with decline in whale stocks.
 - 5.7 Mariculture.

6. Non-living marine resources:

- 6.1 Hard minerals and sedimentary deposits - manganese nodules a major issue in the Law of the Sea; may be on verge of exploitation by 1982. Phosphorite deposits. Sand and gravel extraction for construction.
- 6.2 Petroleum hydrocarbons - exploration and exploitation extend into deeper water on continental shelf and slope.
- 6.3 Freshwater supply - desalination is being applied increasingly to provide fresh water for irrigation and potable supplies in arid regions of the world.
- 6.4 Energy source - potentially an energy source through tidal and wave power, harnessing of currents and temperature differential between deep water and surface water.

7. Socio-economic developments:

- 7.1 Ports and harbours for transportation - construction of offshore deep-sea ports for bulk loading.
- 7.2 Marinas and small-craft harbours.
- 7.3 Coastal recreational facilities - swimming beaches, water skiing, SCUBA diving, marine parks and preserves.
- 7.4 Coastal residential developments - hotels, apartments, condominiums, cottages and marina/apartment complexes.
- 7.5 Coastal industries - pulp mills, petroleum refineries, chemical plants, power stations.
- 7.6 Gas (LNG) and oil terminals.

8. Impact of coastal modification on coastal ecosystems:

- 8.1 Destruction of coastal habitats - dredging and filling may destroy valuable spawning and nursery habitats for fishes, invertebrates and aquatic wildlife.
- 8.2 Pollution from coastal installations - developments may be a continuing source of pollution inimical to the coastal habitat. Power stations may discharge hot water.
- 8.3 Disturbance of migration routes - coastal installations may affect migrations of species along the coast or into rivers.

9. Curative and/or preventive measures:

Various international conventions for protection of living marine resources:

- 9.1 Protection of coastal stocks of pelagic commercial fish species - improved management in waters under national jurisdiction with strict quotas. International conventions and treaties apply protective measures for depleted stocks.

- 9.2 Restoration of groundfish stocks - strict quotas imposed in national and international management strategies on depleted stocks of groundfish. Fishing gear and techniques governed by national regulations and international conventions for protection of undersized fish and depleted species.
- 9.3 Restoration of anadromous species - banning of high-seas fishing of anadromous species in some areas. Principle of management responsibility for anadromous species by state where fish spawn generally being accepted. Restorative procedures of some anadromous species include banning commercial fishing (Atlantic Salmon) in some areas and artificial enhancement techniques, e.g. hatcheries and artificial spawning channels, for others (Pacific Salmon). Protection of freshwater habitats against pollution and other man-made destruction through national legislative measures.
- 9.4 Protection and restoration of whale stocks - by international agreement, banning of exploitation of some species and strict quotas imposed by others. Some states have voluntarily stopped exploitation of whale stocks.
- 9.5 Restoration efforts on other marine mammals. Transplanting activities on Pacific Sea otter.
- 9.6 International control of marine pollution:
 - 9.6.1 Global conventions
 - Convention on the Continental Shelf, 1958.
 - Convention on Fishing and Conservation of the Living Resources of the High Seas, 1958.
 - International Convention for the Prevention of the Sea by Oil, 1954, with Amendments of 1962, 1969, 1971.
 - International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties, 1969.
 - International Convention on Civil Liability for Oil Pollution Damage, 1969.
 - International Convention for the Prevention of Pollution from Ships, 1973 (not yet in force).
 - Treaty Banning Nuclear Weapons Tests in the Atmosphere, in Outer Space and Underwater, 1963.
 - Convention on Third Party Liability in the Field of Nuclear Energy, 1963.
 - Regulations for the Safe Transport of Radioactive Materials.
 - Convention for the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972. (London Dumping Convention)

Conventions Arising from the Third Law of the Sea Conference.

9.6.2 Regional conventions

Convention for the Prevention of Marine Pollution by Dumping from Ships and Aircraft (Oslo Dumping Convention).

Convention on the Protection of the Marine Environment (Mediterranean). (Barcelona Convention)

Protocol for the Prevention of Pollution of the Mediterranean by Dumping from Ships and Aircraft (part of the Barcelona Convention).

Agreement Concerning Co-operation in Dealing with Pollution of the North Sea by Oil, 1969.

The Convention on the Protection of the Marine Environment of the Baltic Sea Area (The Helsinki Convention).

Convention for the Prevention of Marine Pollution from Land-based Sources (Paris Convention).

9.7 National control of marine pollution - national legislation has been harmonized with above international conventions by contracting parties. Coastal states generally have national fisheries, anti-pollution and habitat protection legislation and regulations.

9.8 Cost/benefit analysis - in general costs of mitigative and enhancement measures for marine living resources are leading to increased costs of these resources.

10. Future prospects:

10.1 Inshore living marine resources - continued degradation of habitats will require further protective, restorative and mitigative measures. Anadromous and inshore stocks, particularly of shellfish species, will continue to be threatened by coastal developments. Enhancement strategies with natural stocks will increase. "Wild" stocks will diminish; cultured stocks will increase. Drastic action needed to protect estuaries for shellfish and anadromous species. Degree of preservation and restoration will depend on action by coastal states and some regional international agreements. Research required on coastal ecosystems and sub-lethal effects of pollution and habitat alterations.

10.2 Pelagic fisheries resources - improved national and international management strategies will help to restore some depleted fish stocks. Better understanding of environmental

(natural and man-made) effects on fisheries required. Species spawning inshore and on the sea bottom require special protection against pollution and degradation and destruction of habitats. Restoration of some stocks such as California sardine may never occur, or their populations may be somehow related to secular changes. Overfishing of high-seas species, such as tuna, require management under international conventions.

- 10.3 Groundfish (Demersal) fish stocks - susceptible to rapid over fishing when heavily exploited. Restoration of stocks requires many years. Require national and international measures for strict management of stocks applying rigid quota system. Bottom habitats (especially spawning grounds) may be destroyed by ocean dumping. Trawl fisheries may be interfered with by dumped solid wastes (now controlled by Dumping Conventions). Better understanding of population dynamics and effects of environmental changes on different species should allow better management.
- 10.4 Marine mammals - whale stocks should increase if moratorium on exploitation of some species maintained. Prospects good for re-establishment of species like Pacific Sea Otter. Declines of certain species of seals (in Baltic Sea) associated with high chlorinated hydrocarbon concentration.
- 10.5 Marine pollution control - need for international control of land-based sources of pollution (atmospheric, marine outfalls and river discharges). Need for international control of pollution from drilling platforms (e.g. for petroleum and manganese nodules). Third Law of the Sea Conference examining the foregoing. Ship pollution will be controlled by the International Convention on Prevention of Pollution from Ships, 1973, when ratified and brought into force. IMCO will administer conventions on pollution prevention from ships.
- 10.6 Global marine pollution monitoring programmes - baseline study needed urgently. Monitoring may develop from integration of various regional programmes, e.g. North Sea, Mediterranean, North Atlantic, Caribbean. UNEP Global Environmental Monitoring System (GEMS), UNESCO/IOC Marine Pollution (Petroleum) Monitoring Pilot Project. UNESCO/IOC Working Committee on the Global Investigation of Pollution in the Marine Environment. UNEP Mediterranean Project. Remote Sensing with Satellites (SEA-SAT). Other advanced techniques for measurement of pollutants in the sea.
- 10.7 Research needs - better understanding of effects of environment (natural and man-made) on fish stocks. Ecosystems changes due to long-term pollution stress. Sub-lethal effects of pollutants on marine organisms. Improved techniques for biological effects monitoring. Long-term effects of low concentrations of pollutants

on organisms (acclimation and sub-lethal stress). Synergistic effects of multiple pollutant and other environmental stresses. Research support for administration of various environmental legislation and conventions.

10.8 Tissue banks, gene pools, genetic development of resistant strains and hybrids, and preservation of rare and endangered species.

11. Proposed plan of action:

11.1 National

11.2 Regional

11.3 Global

CHAPTER 5

INLAND WATERS

Over the past decade, there has been a remarkable advance in the way people think about water. The new appreciation of the natural environment has focused attention on the vulnerability of water. A growing proportion of mankind understands water can no longer be treated as a free good to be exploited and polluted at will and without penalty. There is a greater awareness of the pressure populations are putting on the finite resources of land and water. It is increasingly realized how critical water will be to the quest for greater self-sufficiency in food, and, most significantly, the availability of pure water for all is seen both as a right and a possibility that can be fulfilled.

The hydrological cycle provides the earth's surface with a supply of fresh water. Man's many water requirements vary according to geographical and socio-economic factors; each kind of water use has its own quality requirements. Population growth and economic and industrial development have led to an increase in per capita demand for water, and to water quality degradation as a result of waste disposal.

The number of pollutants threatening water quality is constantly increasing. Pollutants can be dissolved or suspended, and may be chemical, thermal or biological in nature. The most important are synthetic organic compounds, heavy metals, and biodegradable organic compounds which not only affect the local water supply, but may also contribute to the global problem of marine pollution through river discharges into the sea. Water quality is also seriously affected by infective or parasitic diseases.

Water resources development is closely related to development activities of wider scope, e.g. agricultural development, industrialization, urbanization, soil preservation and energy production. Major water resources projects have important consequences for public health, social and economic structures, public administration and climate, which go beyond the direct benefits of water use. Similarly, in what appears to be a headlong plunge to develop water resources for man's varied needs, the way is filled with opportunities for small and large ecological disasters. The threat of damage to wetlands and waterways, to soil and forests, to man and wildlife, is no less real than the need for increased and improved water supplies throughout much of the world.

General Outline of Analysis

1. General:

- 1.1 Definition and scope - relationship with other eco-spheres.

- 1.2 Hydrological processes - distribution of world's water
- estimates of volume of fresh water.
2. General description of surface water in rivers, lakes and ground water resources.
3. Physical, chemical and biological characteristics of fresh water:
 - 3.1 Rivers (select rivers in different continents).
 - 3.2 Lakes (natural and man-made).
 - 3.3 Ground water.
4. Environmental disruptions of inland waters:
 - 4.1 Natural
 - 4.1.1 Floods

The section on floods should

 - (i) Review the major flood events in the world during 1970-1980.
 - (ii) Assess damage to human and animal life, property, dislocation of economic life, disruption of agricultural and industrial production, and transportation.
 - (iii) Review the situations in respect of deforestation, and, in general, upstream watershed management practices, snow melt as contributory to flood runoff, and examples of unusually heavy precipitation, and encroachments on flood plains and marshes as a result of increasing urbanization.
 - (iv) Cite major examples of efforts to reduce flood losses by afforestation, and by structural and non-structural measures like flood and river forecasting, flood plain management, etc.
 - (v) Analyse, if possible, whether the incidence of floods in different regions has been on the increase or decrease as a result of the measures taken during the period.
 - (vi) Sum up the lessons learnt during the period in mitigating flood losses; and
 - (vii) Assess the adequacy of the institutional set up in different countries and regions to cope with flood losses.
 - 4.1.2 Droughts

The section dealing with droughts should, likewise,

 - (i) Review the major drought events in different regions during the period 1970-1980.
 - (ii) Assess the extent of damage done by drought and desertification to plant, animal and human life and to

the affected national economies in different regions during the period.

(iii) Review the efforts made during 1970-1980 to mitigate drought loss.

(iv) Sum up the lessons learnt during the period 1970-1980 in managing the losses caused by droughts.

(v) Assess the role accorded to water development during the period in the efforts to mitigate drought loss.

(vi) Take stock of the position concerning the action initiated at the national, regional and global levels, to implement the Action Plan to combat desertification adopted at the UN Conference on Desertification in 1977.

4.1.3 Earthquakes

In so far as water related aspects of earthquakes are concerned, the review should include

(i) A review of examples of seismic tremors produced by impoundment of large quantities of water in man-made lakes.

(ii) Cite examples where earthquakes and landslides are known to have caused changes in the hydrological regimen of rivers, and

(iii) Developments in the field of technology of earthquake resistant designs of water projects.

4.2 Man-made

4.2.1 Pollution of rivers and natural lakes

Sources of pollution, types of pollutants, fate of pollutants, effects of pollutants, etc.

As water pollution can be caused by industrial, municipal and agricultural development practices, all the aspects can be conveniently dealt with in an integrated and comprehensive manner in one section. This section should contain an overall survey of the incidence of water pollution, disaggregated on a regional basis, during the period 1970-1980 and should contain a discussion of

(i) Increase in the incidence over the years of pollution caused by municipal, agricultural and industrial effluents.

(ii) Changes in trends and patterns.

(iii) Types of control measures: technical, economic, legal, etc.

(iv) The relation of water pollution to other forms of pollution.

(v) Resources devoted to the management and control of water pollution during the period.

(vi) Scientific and technical advances in the abatement of water pollution in the period and their effects.

(vii) Institutional set up to deal with the control and management of water pollution and its adequacy.

(viii) Growth in training facilities.

(ix) Case studies to be given to illustrate the changes in 1970-1980.

4.2.2 Man-made lakes and their environmental impacts (Physical, biological, geo-chemical, socio-economic, etc, with case studies.)

(i) Including the environmental impacts of diversion of major rivers such as the transfer of parasites from one river to another river.

5. Water in the process of development:

5.1 Hydroelectric power generations, including

5.1.1 Estimates of installed capacity and generation during the years 1970 to 1980, in different regions, relation to known potential, changes in the patterns and trends of production and consumption, relation with other forms of energy production.

5.1.2 Environmental impact of hydroelectric power generation and measures taken during the period to minimise the impact of possible adverse environmental effects.

5.1.3 Thermal pollution, consequences and remedial measures.

5.2 Crop and animal production, including

5.2.1 A review of the production of food and non-food crops, under rainfed and irrigated agriculture in different regions, with particular reference to the trends of production and consumption in the decade under reference.

5.2.2 Relation to the needs and pressures of increasing populations in different regions.

5.2.3 Extent of water use in food and agricultural production, variations in the quantities used in different regions over the years in the decade under review.

5.3 Fisheries

5.3.1 Trends of production and consumption in different regions during the decade, fish farming, fish culture, etc.

- 5.4 Water supply and sanitation, including
 - 5.4.1 Rural and urban population of different countries and regions over the years during the decade 1970-1980, populations served and still to be served with basic water supply and sanitation facilities, trends of increase or decrease in the position of these services in different regions.
 - 5.4.2 Standards of supply, quantity and quality.
 - 5.4.3 Levels of services provided, in rural and urban areas in different regions, trends of changes in these standards and levels.
 - 5.4.4 Impact of water pollution on the provision of water supplies.
 - 5.4.5 Role of water in influencing the patterns and growth of human settlements.
- 5.5 Inland water transport, including a discussion of
 - 5.5.1 Increase in the length of navigable waterways in different regions over the years of the decade.
 - 5.5.2 Increase in the volume of traffic of different commodities in different regions over the years of the decade.
 - 5.5.3 Changes in the role of water transport vis-a-vis other modes of transport during the decade.
 - 5.5.4 Changes in the role of water transport and its impact on the economies of land locked countries in different regions of the world.
 - 5.5.5 Possible environmental impact of inland water transport developments.
 - 5.5.6 Effects of navigation structures on aquatic life in rivers and lakes, illustrated with specific case studies.
- 5.6 Development of shared water resources, including a discussion of
 - 5.6.1 The increase in the number of intergovernmental agreements for the development of shared water resources over the years of the decade.
 - 5.6.2 Growth of new patterns of institutional arrangements and activities to promote the development of shared water resources.
 - 5.6.3 New legal treaties, conventions, etc.
 - 5.6.4 New ideas and concepts to promote intergovernmental co-operation in this field.
 - 5.6.5 Measures taken during the period to implement the recommendations of the Stockholm Conference.

6. Public health and water development:
 - 6.1 Incidence of water borne diseases like malaria, bilharzia, etc, with specific reference to the increase during the period 1970-1980 in different countries and regions.
 - 6.2 Increase of incidence in water borne diseases in specific water projects in different regions.
 - 6.3 Nature of control measures instituted and the effectiveness of such measures.

7. Interaction between hydrosphere and atmosphere:
 - 7.1 Weather modifications.
 - 7.2 Evaporation suppression.
 - 7.3 Micro-climatic effects of man-made lakes.

8. Water management and use:
 - 8.1 Changes in water availability and use, including
 - 8.1.1 Availability of water in the rivers, lakes and groundwater reserves in 1970 and in 1980 and for an average year during the period, regionally and globally.
 - 8.1.2 Extent of use of the waters in rivers, lakes and groundwater sources for different purposes like drinking water supply, agriculture, industry, and for other purposes in 1970 and 1980 (or in the preceding decade), on the basis of which it will be possible to work out the present levels of utilization of river, lake and groundwaters for various purposes as percentages of available potential in different regions and globally.
 - 8.1.3 Study of the changes in the trends and patterns of water availability and use, overexploitation or underexploitation, depletion or replenishment during the decade under reference, regionally and globally.
 - 8.2 Trends in water management during the decade, including
 - 8.2.1 Studies on the techniques of water management in the provision of drinking water supplies dealing with the efforts being made to minimise transmission and distribution losses - the attempts being made to encourage economy in the use of water - overdesign and underdesign of distribution networks - innovations in the field of expanding rural and urban water supply systems.
 - 8.2.2 Notable trends in the field of industrial water management, in the location and exploitation of raw water supply - advances in the techniques and processes of water treatment - recycling and

re-use of water relevant to developments within the decade under reference, separately in different regions, if found convenient and desirable,

- 8.2.3 Studies on agricultural water management highlighting main trends in dryfarming techniques or rainfed cultivation - management in irrigated areas with and without drainage facilities - recycling or re-use of irrigation water for agricultural development - discussion of the water saving devices adopted during the decade in the fields of drinking water supply, irrigation and industry in different regions, with suggestions for better management in future if possible.

8.3 Aquatic bio-systems

Fresh water fish, weeds, effects of introduction of exotic plant species and their environmental impacts and management.

8.4 Legislation

Legislation for the protection of water resources - national and international arrangements.

9. Need for rational use of water resources and proposed plans of action, including an overall review of the implementation of the Stockholm recommendations relating to water (on national, regional and international levels.)

CHAPTER 6

LITHOSPHERE

'Lithosphere' - as opposed to hydrosphere and atmosphere - stands for the solid earth, on the surface of which we live, and from which we obtain all inorganic raw materials and almost all of our energy resources.

Different geological, geophysical and geochemical processes have taken place over geological ages and have caused considerable changes in the lithosphere, leading to the concentration of certain minerals here or there. The processes of weathering and soil formation are two of the important processes that have a pronounced impact on our life. Such processes took place over very long periods of time, and led to the formation of different types of soils in different regions, which have provided the base for food production and development. Some of these processes are, however, not so beneficial; natural hazards (earthquakes, volcanic eruptions) cause, in some areas, considerable disruptions of the ecosystems. Soil degradation due to natural or man-made processes has also a marked impact on the food-production system in some regions. In this section, an assessment of the changes in lithosphere in the decade after Stockholm will be given.

General Outline of Analysis

1. General:
 - 1.1 Definition, Structure.
 - 1.2 Geological processes, time-scales.
2. State of the lithosphere in the early 1970's:
 - 2.1 Status of natural resources exploitation.
 - 2.2 Soil status, land use.
 - 2.3 Degree of pollution (chemical, physical, biological).
3. Trends over the decade:
 - 3.1 Natural changes
 - 3.1.1 Volcanic eruptions: (Estimate of volume of volcanic lava and volcanic ash deposited at the surface of the earth during the decade 1970-1980.)

List most important volcanic events during decade.

Compare with older data, discussion: decrease or increase in rate of addition, or is decade too short for such considerations?

- If possible, give data on the distribution of volcanic material deposited by single years (tendencies to be observed?), by regions, by rock types (types of volcanoes).

- List of number of victims, damage produced to man's works and to the environment, in comparison to previous periods.
- If available, give also new data on volcanic gases erupted during the decade, compare with older data, regarding quantity, also locally, composition and derivation (hydrogen and oxygen isotope data to recognize mobilized groundwater).

3.1.2 Geochemical and biogeochemical changes

- Estimates on quantities of limestone sedimented world-wide per year, per decade, per regions; estimates on quantities of salt evaporated per year, per decade, etc.

3.1.3 Changes of surface by river, coastal and wind erosion and by clastic sedimentation at other places.

- Attempt to set up a mass balance of erosion and sedimentation for years or for the whole decade, maybe for selected 'closed' regions, derive amounts transported per year or per decade, compare with older attempts, look for tendencies of change, — time for this is most probably too short.
- Give data on sediment transport through selected river mouths, such as, e.g. the Amazons, Ganges, Indus, Mississippi, Volga, or Yangtsekiang, list seasonal variation, if data are available, and look for variations during decade.
- Look for data on the regression of coastlines as the result of coastal erosion during decade.
- Collect estimates of quantities of wind-transported material, e.g. on research vessels on the oceans or since 1965 on Barbados regarding probable Sahara material transported there, look for changes during decade.

3.1.4 Changes by earthquakes, landslides, avalanches.

Report on most important natural disasters of these kinds during the decade, with number of victims, damage produced to man's works and to the environment, (e.g. earthquakes in China, Northern Italy, Romania and other places; displacements at surface measured in California).

3.2 Man-made and man-influenced changes:

3.2.1 Hard-rock use.

Building material - mineral resource (refer to mineral resources).

3.2.2 Man-triggered natural hazards.
Earthquakes - landslides - avalanches, etc.

3.2.3 Land use and land use planning.

Some land has been won for agriculture, by irrigation in arid climates, by destruction of tropical forest, by recovery from the sea (as in the North Sea), and other measures.

- Give data as far as possible per year and per decade, discuss trends (cross-link to food section).

Much more land, however, was lost to agriculture for various reasons: salinization, erosion, growth of settlement areas, growth of transportation systems, damage by floods, and others (cross-link to human settlements and transport sections), list in order of importance after data have been collected (cross-link also to food section).

- Give data, especially on growth of settlements and transport systems, by countries, continents, world-wide, per year and per decade, discuss trends; cross-links as above.

If possible, list separately land lost to expanding industries, mining camps, open-pit mining, waste disposal (cross-link to section on industrial production systems).

Waste disposal has become more and more of a problem, with waste deposits on land.

Special problems are posed by special wastes such as poisonous wastes, radioactive wastes.

- Give quantitative data per year and decade, as far as possible, discuss trends.

3.2.4 Soil degradation, desertification.

3.2.5 Soil erosion.

3.2.6 Pollution from various sources.

3.2.7 Waste disposal on land.

4. Impact of changes during decade:

4.1 Changes in overall use of earth's surface.

4.2 Impact of changes on human health.

4.3 Impact of changes on socio-economic development (cross-references).

4.4 Conservation and legislative measures during decade.

5. Future prospects:

5.1 Needs for conservation in general, for legislative measures.

- 5.2 Special needs on regional (and local) scales, especially towards land use regulations.
- 5.3 Improvement of terrestrial environment.
- 5.4 Proposed areas for research and plans of action.

CHAPTER 7

TERRESTRIAL BIOTA

The ecosystem is best considered as a total concept, and natural resources as its components. Soils, air, water, animals, plants and other genetic resources combine themselves to form ecosystems in which the fate of individual resources is bound up with that of others and of the ecosystem as a whole. Ecosystem problems can usefully be examined within the context of the ecosystem itself or by considering natural resources occurring widely in different ecosystems. At the same time, the intricacies of ecosystem function demand a highly specific and quantitative approach to the solution of problems brought about by imbalances in the system.

In view of this, the structure of the chapter on 'Terrestrial Biota' calls for a very brief 'plain man's guide' to world ecology and biogeography and to broad human influences. It includes a short description of each biome type to set the scene, to demonstrate the great difference between the problems of different biome types, and to provide the background for the analysis.

No doubt, the nature of human impact on the terrestrial ecosystem dates back to the earliest civilizations. The pressure of growing human demands on these systems has brought about a progressive transformation from natural to man-dominated ecosystems. What is required, therefore, is an analysis of the changes in the terrestrial biomes during the period under review (changes between 1970 and 1980), the way in which man has affected these systems, and measures that can regulate and improve these practices.

General Outline of Analysis

1. Introduction:

- 1.1 Definition of "terrestrial biota". Distinction between land, freshwater and marine largely a matter of convenience for there are major interactions especially between true freshwater ecosystems of lakes and rivers and those of swamps and other wetlands here treated as terrestrial. Similar intergradation in estuaries and marine coastal zone.
- 1.2 Classifications - biome and biome-type (tundra, boreal coniferous forest, etc.), compared with physiognomic system (forests, grasslands, wetlands, etc.).
- 1.3 Approach : to review changes in the distribution and extent of the natural and seminatural terrestrial ecosystems of the world, the nature of man's impact on them and recent measures for conservation of genetic and ecological resources.

(It is proposed to include some basic definitions of ecosystem structure and dimension and of the life strategies, resilience and response to stress of component organisms which in turn underly ecosystem responses.)

2. The biomes of the world:
 - 2.1 Brief account of typical ecological characteristics of forests, grasslands (humid and semi-arid), heathlands (dwarf shrub types), wetlands (fens, marshes, swamps), deserts and other vegetation types.
 - 2.2 Very brief description of biogeographical patterns: ocean barriers: factors underlying development of distinctive floristic and faunistic assemblages in different areas.
 - 2.3 Brief account of natural distribution pattern of main biome types over the world (biome types here defined as vegetation types with associated animals). Broad relationship to climatic zone. Within each short biome type account stress floral and faunal characteristics, broad dynamic relationships, potential productivity, and resilience of main components.
 - 2.3.1 Tundra and ice desert.
 - 2.3.2 Boreal coniferous forests.
 - 2.3.3 Arid temperate zone.
 - 2.3.4 Winter-deciduous temperate forests.
 - 2.3.5 Warm temperate forest.
 - 2.3.6 Sclerophyll Mediterranean climatic zone.
 - 2.3.7 Subtropical deserts and semideserts.
 - 2.3.8 Tropical vegetation with seasonal rains.
 - 2.3.9 Evergreen tropical rain forest.
 - 2.3.10 Special types on oceanic islands, continental coasts and high mountains.
3. The nature of human impact:
 - 3.1 Time perspective of human impact on terrestrial ecosystems. Geographical distribution of man over past millennia, with concentration in temperate and subtropical zones, especially in Old World.
 - 3.2 Impact of man as hunter-gatherer. Cropping of wild species: relation between intensity and effect.
 - 3.3 Impact of fire.
 - 3.4 Impact of grazing by managed livestock. Predator control.

- 3.5 Impact of forest clearance for cultivation (shifting and static).
- 3.6 Effects of introduction of plants and animals to new areas.
- 3.7 Impact of drainage and other changes of hydrological regime.
- 3.8 Impact of pollution. (Include defoliants, etc, used in war.)
- 3.9 Impact of tourism (to be separate assignment).

(NOTE: 3.2 - 3.9 can be very brief but need to point out the kinds of effect and the stages in the progressive transformation from natural to man-dominated ecosystem.)

4. The terrestrial biomes in 1970 and changes between 1970 and 1980:

Biome-type by biome-type description of situation as near to 1970 as possible and of rates of change typical in different geographical areas within each broad biome-type during period under review (precise statistics likely to be impossible). This section should be based very largely, if not entirely, on material collected by IUCN for the Conservation Strategy (but could also draw on other statistics, e.g. of forest cover if separately available - and maybe any useful data from IBP).

In each section (4.1 - 4.10) note should be taken of positive as well as negative aspects, e.g. extent to which land use change is planned and controlled, existence of specific measures to retain forest in upper reaches of catchments or of wetlands as aids in hydrological regulation, extent of conservation measures. (But leave agricultural and urban development as such to later section on bioproduction and settlements.)

5. Analysis and evaluation:

- 5.1 Discussion of scale and nature of changes. Geographical variation in degree and rate of terrestrial biotic modification.
- 5.2 Highlighted instances of endangered systems and species: threats to genetic diversity.
- 5.3 Attempted listing and evaluation of major threats - what, for example, is relative significance of pollution, fire, predator destruction, erosion, urbanization, agricultural development and tourism in different systems.
- 5.4 Successes (and limitations) of world conservation strategy and regional or national action to conserve ecological and genetic diversity.
- 5.5 Ecodevelopment: how far does this, as a principle, get put into practice as a way of allowing the areas most useful to man to be developed while retaining natural systems in the most appropriate place.

6. Current challenges:

What decisions now being taken are of most significance for terrestrial biota? What major problems are foreseeable (e.g. Forest clearance and changes in albedo CO₂ emission, soil and nutrient loss).

CHAPTER 8

POPULATION AND HEALTH

Population

The world population is now estimated to be about 4 billion people, and barring unforeseen catastrophic disaster, is projected to reach at least 6.5 billion by the year 2000. This projected growth will create problems concerning the generation of capacities to support the population while providing acceptable conditions of life, themselves dependent on the possibilities of productive employment within the limits of the capacity of the environment.

Population size and concentration affect the environment in a variety of ways and these factors need to be taken into consideration in many sections of the report, e.g. human settlements, intensity and extent of resource exploitation, energy, land use, etc.

The 1972 Stockholm Conference referred specifically to population problems and the Action Plan recommended increased research on human reproduction and family planning.

Since the environmental impacts of population changes are implicit in many sections of the report, this section should attempt to provide background information of the state of the human population in the early 1970's and the changes during the last decade.

General Outline of Analysis

1. Actual population numbers and structure (age and sex) by regions and countries, 1970-1980; with projections to, say, 2020 (high, medium and low).
2. Changes in rate of population growth, by region and country, 1970-1980:
 - 2.1 Consideration of possible causes of such changes, including implementation of recommendations of Stockholm Conference (family planning).
 - 2.2 Particular reference to
 - 2.2.1 Especially populous regions where there have been significant changes over the last decade (e.g. China, India).
 - 2.2.2 Countries where the birth rate is now about 1, and the significances of this.
 - 2.2.3 Nomads.
 - 2.2.4 Migration of labourers.
3. Information on changes in the concentration of population (e.g. urban-rural) by region and country.

4. Large scale migrations, either planned (e.g. in Indonesia) or inadvertent (India-Bangladesh, Vietnam, Cambodia, Angola).
5. Changes in the location of concentrations of population that will have significant environmental effects, e.g.
 - 5.1 Near sea-shores, estuaries.
 - 5.2 On lakes (including man-made).
 - 5.3 Moving up hill-sides (erosion effects).
6. Information of technology (including birth control methods) but also technological advancement with respect to the demographic transition and life styles on population growth rates.
7. Effects of changes in particular diseases that affect human reproduction and infant mortality.

Health

Man and his environment contribute a multi-component interacting system which encompasses the physical and biotic factors and the socio-economic and cultural setting. This relationship between man and his biophysical and socio-cultural environment is dynamic and interdependent, with both man and his environment being affected by the action of the other and responding to them. As man alters his natural environment to support his biological, cultural, social and economic needs, he creates new conditions which affect his health, his vitality, his productivity, his life expectancy, his comfort and his convenience.

Human health and well-being is central to the concern of man for the environment. Therefore, in addition to reviewing changes in understanding of human diseases due to pollutants that has occurred in the decade 1970-1980, and the improvements (or otherwise) of water supply, waste disposal, and sewage arrangements (on which the Stockholm Declaration concentrated), this section should look at all aspects of human health and well-being that are related to the environment.

General Outline of Analysis

This section should provide data and regional examples of improvements or worsening that relate to the following:

1. Parasitic diseases:
 - 1.1 Changes in the malaria situation.
 - 1.2 Changes in the incidence of schistosomiasis, both improvements (China) and spread (Africa).
 - 1.3 The initiation and development of the WHO plan for research on six tropical diseases.
2. Bacterial diseases:
 - 2.1 Emphasis on waterborne diseases, e.g. the spread of cholera during the decade; advances in development of safe water supplies.

- 2.2 The Expanded Humanization Programme of WHO.
3. Viral diseases:
 - 3.1 The global eradication of smallpox (including financial implications - saving of \$2,000,000,000 annually).
 - 3.2 The spread of exotic diseases
 - 3.2.1 of humans, e.g. lassa fever, Marburg disease.
 - 3.2.2 of livestock, e.g. African swine fever, blue tongue, African horse sickness.
 - 3.3 Effects of environmental changes (e.g. large dams) on mosquito transmitted infections (e.g. viral encephalitis).
 - 3.4 Effects of social changes (mobility, etc) on dengue hemorrhagic fever incidence.
4. Diseases associated with pollutants (SO_2 , NO_x , heavy metals, PCB, etc):
 - 4.1 Occupational diseases (asbestosis, amyl chloride, etc).
 - 4.2 General experience of population.
 - 4.3 Effects of the increasing sensitivity of chemical analytical methods in detecting threats to human health.
 - 4.4 Modes of analysing health risks caused by pollutants that affect public policy in relation to environmental risk.
5. Malnutrition:
 - 5.1 Protein-calorie malnutrition - acute (starvation) and chronic deficiency.
 - 5.2 Over feeding and diseases of obesity, diabetes, cardio-vascular diseases.
6. Diseases associated with changed life styles:
 - 6.1 Smoking (cardio-vascular disease, bronchitis, lung cancer).
 - 6.2 Drugs of addiction.
7. Mental health:
8. Changes in the approach to the provision of health care, e.g. from big hospital/high technology approach to community health care ("barefoot doctors" etc).
9. Cancers associated with environmental exposures:
 - 9.1 Changing incidence of lung cancer (smoking-related) in developed and developing countries (including sex changes).
 - 9.2 Regional differences in incidence of particular cancers (stomach, colon, liver, etc).
 - 9.3 Abuse of drugs.

CHAPTER 9

HUMAN SETTLEMENTS

Human settlements play a decisive role in development. They constitute the areas on which fixed capital assets and population are concentrated and which function at a certain, changing level of technology. They reflect the attained phase of development and hierarchy of social values accepted by a given society. By virtue of concentration of the economic forces and population, human settlements exert major influence in the environment. Their development is the main source of arising conflicts, of production of various pollutions and the vehicles of degradation and destruction of the environment. At the same time, due to their inherent characteristic, it is in the human settlements that major potential forces for the rationalization of human settlement-environment relationships do exist. What is going on in the human settlements today will be reflected in the environment tomorrow. That is why the development changes and trends in human settlements deserve a closer look since they constitute the key to the environment.

Human settlements are in a continuous process of change and development. These processes continually exert various types of influence on the natural environment. The study should try to bring out the dynamics of the changes. In this respect, the time period 1970-1980 should not be treated as a closed one. An attempt should be made to identify trends that have been manifesting themselves so far and indicate emerging trends that may bring about new phenomena and processes, the likely consequence of which for the environment should become the subject of immediate studies and research.

It may happen that the facts, trends and processes to be described may allow for certain generalizations to be made. However, it should be borne in mind that there exists a wide variety of the environment in which human settlements grow, there are many specific features of the development processes, the social awareness and actual incorporation of the environmental issues in those processes are not uniform among various countries, etc. There is an urgent need to collect and analyse more empirical data and material before generalizations can be attempted at.

The problem of interdependencies between human settlements and the environment, and the processes that bring about quantitative and qualitative changes in their relationships can be investigated with various degree of detail. The phenomena of deterioration of the environment can cover various geographical extent: global, regional/sub-regional/national/specific countries/and local towns, metropolitan areas, etc. At variance with the other parts of the Project, the study concerning human settlements is basically restricted to the national and local level; in some cases, it may refer to the regional

level should the deteriorating influence of a settlements system bear directly upon the situation in neighboring countries. At the same time, this study should not become concerned with detailed issues of local character.

No definition of the term "human settlement" will be proposed to avoid academic discussion. However, it should be borne in mind that throughout the chapter human settlements are understood to include both urban and rural settlements in the traditional meaning of those terms.

General Outline of Analysis

1. General:

1.1 Five background papers should be written to analyze the changes in the decade after Stockholm in the different regions. The following are proposed:

- 1.1.1 Developed market economy country.
- 1.1.2 Socialist country.
- 1.1.3 Developing Asian country.
- 1.1.4 Developing Latin American country.
- 1.1.5 Developing African country.

The "background papers" will provide the basis for formulating the chapter on human settlements to be included in the technical text of the SOE.

1.2 The general structure of the chapter and background papers should consist of the following sections:

- 1.2.1 The relationships between human settlements and the environment.*
- 1.2.2 General background: the state of 1970.
- 1.2.3 Main environmental changes resulting from human settlements development processes 1970-1980.
- 1.2.4 Environmental aspects in policies for development of human settlements.
- 1.2.5 Future prospects.

2. Structure of background papers:

2.1 The state of the natural environment related to human settlements 1970

- 2.1.1 Description of the state of human settlements around 1970.
- 2.1.2 Description of major man-made vis-a-vis natural interactions and the resulting problems.
- 2.1.3 Explanation of trends and processes that led to the situation in 1970.

* This point will be dealt with in the Chapter only.

2.2 Main environmental changes resulting from human settlements development processes (1970-1980)

2.2.1 The processes of human settlements having repercussions for the environment:

The changes of the environment should be described in relation to each of the following six elements of human settlements: population, production, housing, transport, infrastructure, and leisure. It is proposed to study these variables from the following points of view:

(i) Social:

The growth of population and urbanization.
Mode of living. Stratification.

(ii) Economic:

Pattern of economic development (structure of economy, structure of industry).

Degree of concentration (population, housing: density and intensity of development, production: growth concentration, tendencies in location, etc, increase of the size of human settlements and their clustering, etc).

Exploitation of resources (growing need for land, water minerals and leisure areas, growing degree of exploitation of non-recoverable resources: minerals, water, etc, growing volume of waste, etc).

(iii) Spatial (physical) pattern:

Urbanization and industrialization development.

Human settlements network (both rural and urban).

Land use patterns (physical continuity, segregation, mix of use, high and low rise development, etc).

Low-income groups settlements.

Decreasing proximity to leisure and regeneration areas.

Increase of protected areas of various kinds.

(iv) Technological:

Technologies used (positive, negative, shifting pollutions from one sphere to another, etc).

Evaluation of technologies (direct impact, and social indirect influence).

2.2.2 Conflicts and changes (1970-1980):

Processes described under sub-point 2.2.1 should be related to four spheres: biota, lithosphere, atmosphere and hydrosphere.

Essential conflicts and the resulting change (1970-1980) should be identified for each of the spheres.

The conflicts between man's activities and the environment, and the resulting change, should be

characterized by the following features:
type of deterioration, scale of deterioration,
spatial distribution, etc.

2.2.3 Main problems (1980):

- (i) Identification of likely main problems.
- (ii) Desirable lines of action (in general terms).

2.3 Environmental aspects in policies for development
of human settlements

2.3.1 Social awareness for the need of environmental
planning:

(i) Social values:

Goals and objectives of planning and development
reflecting environmental concerns at the national
and local levels.

Legislation expressing such concern in relation
to human settlements. Origin of such legislation
(community inspired, initiated by planning
authority, etc). Types of such legislation
(constitution, a comprehensive Act, other related
Acts, by-laws, etc).

The degree of integration of environmental concern
with the socio-economic planning and development
(relationships, priority, mechanisms and
instruments, etc).

(ii) Planning machinery and its role in fostering
environmental concerns.

(iii) Administrative machinery and its role in
implementing environmental concerns.

2.3.2 Development policies:

(i) Socio-economic:

Structure of national development and the role of
environmental aspects in it.

Model of society and pattern of consumption.

Structure of extracting and manufacturing industry
and its repercussions for the environment.

(ii) Physical:

National level - Concepts of spatial distribution
of different activities and related infrastructural
networks. Ways of incorporating environmental
concerns.

Local level (urban and metropolitan areas) - Ways
of incorporating environmental concerns.

(iii) Technological:

Curative and preventive measures of pollution control
devices, recycling, etc.

Influence of technology on physical planning (production,
transportation, infrastructure, etc).

- 2.3.3 Tools of environmentally-sound development (short description):
 - (i) Social and economic development plans.
 - (ii) Physical development plans.
 - (iii) Planning technologies (methods, norms and standards, etc.)
 - (iv) Plan implementation instruments (site selection, development programmes, planning and environmental controls, social and financial incentives, technologies, etc.)

2.4 Future prospects:

- 2.4.1 Identification of trends in human settlements/environment development.
- 2.4.2 Assessment of the implementation of Habitat recommendations and Stockholm recommendations (insofar as they relate to human settlements).
- 2.4.3 Identification of inadequacies and/or lack of information, knowledge and scientific research concerning the relationship between human settlements and environment.
- 2.4.4 Needs for research:
 - (i) Analytical survey of environment (essential features of development and change, assessment of scale and direction of change, monitoring or periodic observations, etc).
 - (ii) Improvement of methods of analysis and diagnosis.
 - (iii) Improvement of methods of forecasting.
 - (iv) Exploration into solutions that could be "optimal" from the social point of view.
 - (v) Exploration into "rational" urban structure.
 - (vi) Research on "rational" planning of various components of human settlements, etc.

3. Structure of "Consolidated Chapter":

3.1 The relationship between human settlements and the environment

The purpose of this section is to provide some theoretical introduction into human settlement/environment relationships. It develops a matrix of essential relationships which is thought of as a basic logical framework for the section of the consolidated chapter.

3.1.1 The character of relationship:

Mutual two-way dependency: human settlements-environment.
Unequal "partnership".

3.1.2 Essential relationships matrix:

The environment may be viewed as consisting of four spheres (sub-systems): biota, lithosphere, atmosphere and hydrosphere. For the purpose of this study, human settlements may be considered as consisting of six main components (sub-systems): people, extracting and manufacturing production, housing, transport, technical infrastructure and leisure. The relationships between the sub-systems of the environment and the different components of human settlements can be illustrated by the following matrix:

Components of human settlements	sphere of the environment			
	biota	lithosph.	atmosph.	hydrosph.
People	x	x	x	x
Production		x	x	x
Housing	x	x		x
Transport	x	x	x	
Infrastructure	x	x		x
Leisure	x	x		x

3.1.3 Contradictions and conflicts:

The development of human settlements entails vast numbers of contradictions and conflicts with the existing environment. They may be classified into three broad categories:

(i) Contradictions between the anthropogenic components of human settlements and the various spheres of the environment.

(ii) Contradictions between the interest of an individual and the society that affect the development of human settlements and the environment.

(iii) Contradictions between immediate and long-term costs and benefits of different nature (economic, social, etc.).

These contradictions can be resolved only through the application of the trade-off principle. That principle implies certain losses of qualities (values) and certain recompensations. The search for optimal solutions consists in finding appropriate criteria (particularly equality of recompensations) in that trade-off process taking into consideration the totality of the environment and human settlements.

3.1.4 The resulting changes of the environment:

As a rule, the development of human settlements which is implemented through the process of finding solutions to the contradictions, induce change in the environment. That change may be of various kinds:

- (i) Neutral to the environment.
- (ii) Adverse to a varied degree: causing deterioration, degradation or total destruction.
- (iii) Enhancing the quality of the environment.

From the practical point of view, it is usually the second kind with which we have to deal with and which attracts the attention of planners and decision-makers.

3.1.5 Possible approaches:

Preservation of the environment.
Restructuring aimed at the increase of the carrying capacity of various sub-systems.
Rehabilitation of the environment.

3.2 General background: the state of 1970

Summary of the relevant parts of the background papers. The following points should be stressed:

- (i) Population.
- (ii) Urbanization and industrialization.
- (iii) Development of human settlements (both urban and rural).
- (iv) Systems of human settlements:
 - factors
 - migration, development and location of workplaces, etc.
 - features
 - size, expansion, types of urbanization, social segregation, restructuralization (planned, self-generating).
 - spatial forms
- (v) Human settlements/environment conflicts and the resulting problems.
- (vi) Trends and processes that led to the situation obtaining in 1970.

3.3 Main environmental changes resulting from human settlements development processes: 1970-1980

Analytical summary of relevant parts of the "background papers" (processes of development, conflicts and changes, main problems 1980 and the resulting need for action.)

3.4 Environmental aspects in policies for development of human settlements

Analytical summary of relevant parts of the "background papers" (social awareness, development policies, tools of environment-oriented development).

3.5 Future prospects

Analytical summary of relevant parts of the "background papers" (main trends, assessment of Habitat and Stockholm recommendations, areas of knowledge inadequately covered, needs for research).

BIOPRODUCTIVE SYSTEMS INCLUDING FOOD

The hundreds of millions of people engaged in agriculture have brought changes to the environment over a period going back toward the dawn of history. The natural productive resources of soil and water which are the basis of these industries have increasingly been put under great pressure as the need to increase food production becomes more urgent. It is estimated that already man's activities have despoiled some 10 per cent of the world's arable land through erosion, salination, desertification, etc. In addition, good agricultural land is coming under intense pressure, in both developed and developing countries, from urban encroachment. There is still land areas which can be brought under cultivation, but as larger and larger areas are given to farming, the unexploited tracts available to serve as reservoirs of species diversity and natural ecosystems become smaller and smaller.

Consequently, it has come to be recognized that any strategy that increases food production in the short term, while destroying the long term capacity to provide for and sustain increases, courts disaster. Hence, the need to move towards long term strategies based on sustained increases in food production, would be desirable.

Since the bioproductive systems rely on biological processes and on the productive capacity of natural resources, this section, therefore, should give an up-to-date state of knowledge of the overall biological processes as existing in various biotic communities and components. Careful comparisons should be made of the natural productive capacities of each component and distinctions should be drawn between components upon which human survival is based and those others essential for the total functioning of the ecological complexity. Hints should be given as to the vulnerability of resilience of each component to outside pressures and disturbances.

General Outline of Analysis

1. Man's interaction with the natural biotic communities: (Cross-reference, Terrestrial Biota)
 - 1.1 Perspectives of a changing relationship.
 - 1.2 Changes discernible in the last 10 years (1972-1982); Assessment of change (Diagnosis of Ecosystem Condition); Impact Assessment (Environmental Disturbance). Treatment should clearly bring out the issue of methodology of assessment and describe typical examples depicting the pathways of cause and effect leading from development activities through ecosystem disturbances to detrimental impacts. A few important ones are:
 - 1.2.1 Reduction in the natural resources base (typical of forestry depletion; soil erosion).
 - 1.2.2 Reduction in biological diversity (typical of endangered species and ecosystems).

- 1.2.3 Pollution effects
(both direct and indirect).
- 1.3 Reasons for change. Examples from human evolution and development, including
 - 1.3.1 Human population growth.
 - 1.3.2 Changing patterns of demand and supply.
 - 1.3.3 Effects of science and technology.
 - 1.3.4 "Outer Limits".
2. Cropping and production systems for food:
 - 2.1 Wildlands and wildlife - unstructured patterns of resource harvesting and utilization; rangeland management.
 - 2.2 General perspective of contemporary agricultural patterns of crop production -
 - 2.2.1 Crop selection and breeding.
 - 2.2.2 Crop nutrition.
 - 2.2.3 Management practices: limiters to productivity (emphasize variation in decade)
 - (i) water inputs
 - (ii) energy inputs
 - (iii) diseases and pests
 - (iv) microclimates
 - 2.2.4 Modern agricultural practices.
 - 2.2.5 Traditional aspects (shifting agricultural areas).
 - 2.3 General perspective of modern patterns of animal production and utilization.
 - 2.3.1 Patterns of animal use: "the improved variety in animal syndrome".
 - 2.3.2 Patterns of animal breeding.
 - 2.3.3 Range development and management of forage resources.
 - 2.3.4 Diseases and animal health.
 - 2.4 Perspectives of forest management.
 - 2.5 Patterns and perspectives in fishery resource utilization and management.
3. Recurrent themes in modern agriculture:
(Cross-reference to other sections)
 - 3.1 Land use problems
 - 3.1.1 Encroaching urbanization.
 - 3.1.2 Agrarian reforms.
 - 3.2 Soil resource problems
 - 3.2.1 Soil fertility depletion.
 - 3.2.2 Soil degradation and erosion.
 - 3.2.3 Salinity problems.
 - 3.3 Water resource problems
 - 3.3.1 Water availability and use.

- 3.3.2 Quality control; eutrophication.
- 3.3.3 Irrigation problems; weeds in dams.
- 3.4 Desertification.
- 3.5 Ecosystem restoration and conservation.
- 3.6 Genetic resources depletion.
- 3.7 Fishery resources and fish farming.
- 3.8 Chemical fertilizer substitution (biological nitrogen fixation).
- 3.9 Development of environmentally-sound pest management practices (pesticide use substitution).
- 3.10 Biologically-based energy for agricultural systems.
 - 3.10.1 Photosynthesis.
 - 3.10.2 Wastes and biogas generation.
- 3.11 Reductions in losses of products (highlighting food storage and food distribution systems).
 - 3.11.1 Harvest losses.
 - 3.11.2 Post harvest losses.
 - 3.11.3 Food and feed contamination and spoilage.
 - 3.11.4 Food waste in distribution.
 - 3.11.5 Food distribution and transport systems.
 - 3.11.6 Preservation of food.
 - 3.11.7 Consumer patterns.
- 4. Nutrition issues.
- 5. Human resources:
 - 5.1 Rural communities and the quality of life.
 - 5.2 Trained manpower for improved productivity.
- 6. Legal problems (agrarian reform).
- 7. The world food situation 1970-1980 (emphasizing changes in the decade).

MINERAL RESOURCES

Mineral resources are very unevenly distributed; a small number of countries have almost monopolies of certain metals and export ores of these metals (or the metals themselves) into the rest of the world.

The continuing consumption of industrial minerals and rocks, of metals and metal compounds, and of the production of the petrochemical industry by mankind, combined with the further advances in technology, leads to increasing demands for mineral resources.

The exponential increase in exploitation and consumption of many mineral resources - together with the exponential increase in number of the world population - has already led to earnest warnings of approaching depletion of several important resources, among them petroleum and several metals.

For many regions of the continents, at least all outcrops of mineral resources seem to have been found. Of course, the degree of exploration for resources in the various countries of the world is different with some of them almost without hope of new discoveries, while in others only cursory investigations have been made.

As almost all resources (except water and salts from sea water), are non-renewable resources (i.e. after exploitation a deposit is generally exhausted, and new deposits have to be found), all exploitation of mineral raw materials contributes to the changes of the environment during the decade in question.

For this chapter, quantitative data on the state of mineral resources should be collected worldwide, firstly on the situation in the early 1970's and secondly, for every year up to 1980. This will constitute a basis of the analysis of changes during the decade and the impacts of these changes.

General Outline of Analysis

1. General:
 - 1.1 Definition, non-renewability, distribution of mineral resources.
 - 1.2 Exploration for, and exploitation of, mineral deposits.
 - 1.3 Demand for mineral resources.
 - 1.4 Ore grade and accessibility.
2. State of mineral resources in the early 1970's:
 - 2.1 Status of demand situation.
 - 2.2 Status of resources and reserves estimates (to be given for important mineral resources only).
 - 2.3 Status of production of mineral resources.

- 2.4 Status of exploration and mining and processing methods.
- 2.5 Status of recycling and substitution.
- 3. Changes in decade:
 - 3.1 Changes in demand situation (compare population, industry).
 - 3.2 Changes in resources and reserves estimates: Rates of depletion.
 - 3.3 Changes in production, trends of changes regarding selected mineral resources, regarding regions, globally.
 - 3.4 Pollution problems connected with mining, availability of mining sites, reclamation of former mining sites.
 - 3.5 Progress in exploration, mining, and processing methods.
 - 3.6 Progress in recycling and substitution.
- 4. Impact of changes during decade:
 - 4.1 Impact on man and environment, on human health.
 - 4.2 Impact on socio-economic development.
 - 4.3 Legislative measures during decade.
- 5. Future prospects:
 - 5.1 Legislative measures needed.
 - 5.2 Discussion of depletion trends.
 - 5.3 Proposed areas for research, including recycling and substitution, especially in respect to the human environment.

ENERGY

Energy has long been viewed as an essential ingredient to meet our basic needs and to stimulate and support economic growth and our standard of living, so much so that often a nation identifies its well-being with its gargantuan and growing need for energy. For decades the rising global demand for energy has been met to an increasing extent by the use of fossil fuels. This trend was encouraged by the comparatively low price of oil, which in many instances has not been used in the most efficient manner. With the ever-rising demand for fossil fuels there has been an accompanying realization that these energy resources are finite in extent and should therefore be regarded as wasting assets.

The general realization of the finite nature of fossil fuels resources and the marked increase in their price in the present decade led to the reformulation of energy policies in several countries with the aim of looking for additional resources and adopting conservation measures that would reduce the consumption of conventional fossil fuels. In addition, it has been realized that the increase in the production and use of energy has caused considerable environmental impacts. These impacts have become of more than local significance and, by themselves or through their interactions with other factors, have become matters of regional or international concern.

General Outline of Analysis

1. General introduction:
 - 1.1 Brief description of energy sources:
 - (i) Fossil fuels (coal, oil, gas, oil shales, tar sands).
 - (ii) Nuclear energy.
 - (iii) Renewable sources of energy (solar, wind, hydro-power, biogas, firewood, tidal power, wave power, ocean thermal, geothermal).
 - 1.2 Description of energy systems.
 - 1.3 Energy and development (brief description of status in developed countries, status in developing countries with special reference to urban versus rural scenarios; energy for basic human requirements; energy for better living).
2. Energy production and consumption:
(Trends in decade after Stockholm)
 - 2.1 Estimates of reserves: assessment.
 - 2.2 Energy production and consumption (discussion by energy source and by geographical region).
 - 2.3 Patterns of consumption (domestic, transport, industrial, etc); picture in developed countries, picture in developing countries.

2.4. Future trends: Analysis of different scenarios proposed (use of coal, use of renewable resources, nuclear option, conservation scenarios). Discuss developed countries, developing countries. Regional trends.

3. Energy/environment relationship:

(Changes in the decade after Stockholm)

3.1 Environmental impacts of production, transport and use of fossil fuels.

Discussion of the impacts of exploitation, extraction, transport, processing and use of different fossil fuels on land, water, air, human health, plant and animal life. (Cross reference to annexes on atmosphere, marine environment, fresh hydrosphere, lithosphere, transport). Focus will be made on pollutants: thermal discharges, CO, CO₂, SO_x, NO_x, photo oxidants, particulates, organic and organo-metallic compounds. Technologies for reduction of pollutants; beneficial uses of thermal discharges; local and regional impacts.

3.2 Environmental impacts of nuclear fuel cycle (mining of uranium, milling, conversion, enrichment, fuel fabrication, reactor operation, reprocessing, management of radioactive wastes, transport of radioactive material). Air pollutants, thermal discharges; use of nuclear explosions for peaceful uses.

3.3 Environmental impacts of renewable sources of energy:

- (i) Hydropower (physical, bio-geochemical impacts, etc).
- (ii) Geothermal (air pollutants, liquid, solid wastes and their environmental impacts.
- (iii) Firewood (environmental impacts of production and use).
- (iv) Agricultural waste and cow-dung (emphasize differences in amounts of pollutants).
- (v) Biogas.
- (vi) Solar Energy.
- (vii) Wind energy.

3.4 Environmental impacts of transmission lines.

3.5 Comparative assessment of the environmental impacts of all sources of energy.

3.6 Environmental impacts of different energy strategies:

- (i) Shift to coal energy.
- (ii) Exploitation of oil shales and tar sands.
- (iii) Breeder reactors.
- (iv) Fusion energy.
- (v) Centralized versus decentralized production (energy parks or centres); Highlight regional implications, e.g. effect of thermal discharges on local climate; effect of increase of pollutants, etc.

3.7 Legislations related to environmental impacts of production and use of energy.

4. Conservation measures:

- 4.1 Efficiency of energy production and use (fossil fuels, nuclear, renewable sources).
- 4.2 Progress in increasing this efficiency.
- 4.3 Energy conservation measures and legislations, their environmental and socio-economic implications. Evaluation of measures adopted in the decade.

5. Renewable sources of energy:

- 5.1 Time factors in renewability - use case studies and cost/benefit analysis.
- 5.2 Developments in harnessing renewable sources of energy (solar, wind, geothermal, small hydropower, biogas, fast growing plants, biomass).
- 5.3 Renewable sources of energy as energy alternative to conserve fossil fuel (strategies of developed countries); environmental impacts.
- 5.4 Renewable sources of energy for developing countries.
- 5.5 Energy in rural areas; environmental problems of production and use; increase in efficiency; cost/benefit.

6. Future prospects:

Evaluation of the environmental implications of increase in production and use of energy. Environmental implications of different energy options. Needs for action (conservation, increase in efficiency of production and use, environmental protection, etc). Use of waste material.

INDUSTRIAL PRODUCTION AND ENVIRONMENT

Growing concern about the effects of industrial development on the environment has recently been evident in industrialized countries, and is now spreading more and more to the developing countries. This has arisen from a valid and underlying concern on whether industrialization is perceived as being beneficial or detrimental to the quality of the human environment and the quality of human life.

This section should concern itself with the patterns that are emerging of changing industrial structure in different countries and in different parts of the world, and the implications of these for changing environmental impact.

The basic approach will be to examine industrial production as part of a total development - environment system and in fact as one of the major agents for change in such a system. In addition, and as suggested by the following outline, the project report would be set out in terms of:

- (i) The existing situation, looking at industrial production systems around the world and their impacts on the total human environment.
- (ii) The economic and technological processes at work to shape the type and location of industrial production systems.
- (iii) The environmental protection processes at work to mitigate negative impacts due to industrial production systems.
- (iv) Major trends and a summary of changes which have taken place over the decade (1972-1982).

General Outline of Analysis

- 1. Introduction:
 - 1.1 Place of industry in the man-environment system.
 - 1.2 The contribution of industry to economic development and human welfare.
 - 1.3 The need for environmentally-sound industrialization.
- 2. Patterns of world industrialization and trends in location - 1972-1982:
 - 2.1 Factors influencing the location of industries with special reference to environmental resources including the absorptive capacity of the environment.
 - 2.2 Trends in industrial location by region and type of industry.

- 2.3 Changes in the scale of installations and the nature of industrial organizations.
- 2.4 Transfer of industry to developing countries with a description of the role played by government commercial policies and the multinational corporation.
3. The impact of industrial installations:
 - 3.1 The impact on land with cross-references to the section on the lithosphere.
 - 3.2 The impact on air quality with cross-references to the section on the atmosphere.
 - 3.3 The impact on water quality with cross-references to the sections on oceans and inland water.
 - 3.4 The impact on Quiet.
 - 3.5 The impact on Visual Aesthetics.
 - 3.6 The impact on worker and surrounding community health.
 - 3.7 Others.
4. The impact of industrial product:
 - 4.1 Changes in the quantity and nature of products with direct potential hazards, e.g. carcinogens.
 - 4.2 Trends in the production of goods with indirect hazardous effects, e.g. automobiles.
 - 4.3 Trends in the consumption of raw materials and energy in the production of industrial goods with cross-references to the sections on Energy and Mineral Resources.
5. Trends in the institutionalization and implementation of environmentally-sound industrial development:
 - 5.1 Worldwide developments in the enactment of environmental legislation.
 - 5.2 Conflicts arising from plant location between promoters, the community and administrative bodies.
 - 5.3 Occupational health and safety regulations.
 - 5.4 Environmental impact assessment requirements and coverage.
 - 5.5 Laws relating to land use and plant siting.
 - 5.6 Trends in the institutionalization of measures to assign the cost of environmental damage to the industrialist and the role of insurance companies.
 - 5.7 Law and Practice relating to Technology Assessment.
6. Changes in the environmental nature of production technologies:
 - 6.1 Trends in controlling and preventing pollution by region and type of industry.

6.2 Changes in the development and adoption of low-waste technologies.

6.3 Eco-development strategies in the third world: Small-scale, participative, resource conserving.

7. Conclusion and prospects:

The direction of trends in the decade; policy measures adopted so far; the lacunae that remains.

TRANSPORT

With the exception of marine transportation, the interaction of transport systems and the environment was not extensively covered during the Stockholm Conference, so that in some cases considerable base level information will be required. All modes of transport, air, marine, inland waterway, railroad, highway, and pipeline, will be included. Impacts within developing nations, as well as intermediate and developed areas, should be included.

Most environmental studies are focused within an ecosystem, and that tends to be the format followed in environmental reports. Transportation systems tend to span several or many ecosystems, and for that reason, organization of the report by mode of transportation may be more appropriate. Nevertheless, care must be taken to include the major geographic/ecological areas and ecosystems of the world. Technology, economics and relevant legal institutions and regulations should also be taken into account.

Most of the literature on the environmental impact of transportation tends to be concentrated in the transportation literature rather than the environmental literature. Hence, it would be desirable to assemble a selected bibliography of important contributions to the assessment of the environmental impact of transportation systems. This bibliography should include references to environmental standards pertaining to transportation modes and environmental impact assessment procedures relating to transportation, including the construction of transportation infrastructure, for example, air fields, highways, railroad rights-of-way, pipelines, ports, navigational aids, etc.

Since the focus of the report "State of the Environment: Ten Years After Stockholm" is to be on changes occurring since Stockholm, the transportation section should attempt to identify these changes, evaluate them as to scope, compile the details of the environmental effects produced by these changes in transportation systems, and assess them as to their importance of environmental impact.

General Outline of Analysis

1. General pattern of transportation. International; intercity; local; within-settlement. Transport modes and functions:
Amongst the changes to be considered are the following:
 - 1.1 Air (see also Atmosphere)
 - 1.1.1 The introduction of supersonic transports.
 - 1.1.2 The increase in number of aircraft in both developed and underdeveloped nations, and the increase in average size of aircraft since 1972.

- 1.1.3 The expansion of private light aircraft in North America, Europe, South America and Africa in particular.
- 1.1.4 The introduction of the executive jet.
- 1.1.5 The transmission of disease to new or unexpected areas through the medium of air transport.
- 1.1.6 The increased availability and capabilities of the helicopter.
- 1.1.7 The introduction of construction limitations on new airports throughout the world, including environmental limitations.
- 1.1.8 The more widespread use of military air vehicles in conflicts, particularly in the underdeveloped nations. The reduction in air operations in Southeast Asia, particularly with the ending of the Vietnam conflict.
- 1.2 Marine mode (see also Marine Hydrosphere)
 - 1.2.1 Introduction of supertankers, particularly in the larger sizes.
 - 1.2.2 The introduction and pending introduction of very large, very powerful ice breakers.
 - 1.2.3 The introduction of legislation designed to inhibit the purging of ballast tanks and other water fouling, particularly within territorial limits.
 - 1.2.4 The widespread introduction of two hundred mile territorial limits.
 - 1.2.5 The increase in recreational boating in coastal waters.
 - 1.2.6 The substantial increase in both floating and "portable" drilling ships and drilling platforms in marine "frontier" areas (Arctic, North Sea, North American East Coast, Australian Coast, East Indies Coast, etc).
- 1.3 Inland marine
 - 1.3.1 The drastic increase in power and availability of small outboard motors and very large outboard motors.
 - 1.3.2 The general increase in recreational boating in inland waters, particularly in North America and Europe.
 - 1.3.3 The introduction of accurate and relatively cheap depth finders (so-called fish finders) for both recreational and commercial fishing.
- 1.4 Rail mode (see also Lithosphere)
 - 1.4.1 Increased use of high speed rail passenger trains. For example, in Japan, France, United Kingdom, Germany, Italy and North America.

- 1.4.2 Increased electrification of railways.
 - 1.4.3 Recognition of noise and vibration pollution from railways and legislation to control this.
 - 1.4.4 The reintroduction of urban light railways and intermediate capacity transit systems.
 - 1.4.5 Construction of railways in the developing countries in South America and Africa as well as Southeast Asia.
 - 1.4.6 Railway construction in China and the Soviet Union.
- 1.5 Highway mode (see also Lithosphere)
- 1.5.1 General increase in weight and axle loading of trucks.
 - 1.5.2 Increased use and numbers of multiple trailers for highway transport.
 - 1.5.3 Recognition of emission standards, introduction of legislation to control emissions, introduction of emission control equipment, particularly in North American and Japanese vehicles.
 - 1.5.4 The fuel crisis and its effect on road transport.
 - 1.5.5 Increased road saturation by vehicles, particularly in North America, Japan and Europe, etc.
 - 1.5.6 The introduction of throughway restriction in the developed countries and recognition of the general environmental impact of throughways and highways.
 - 1.5.7 The increased use of automotive transport in the Soviet Union, in Asia generally, in Africa, in the Middle East, and in the underdeveloped nations.
 - 1.5.8 The increased production and use of four-wheel drive vehicles.
- 1.6 Pipeline mode (see also Energy)
- 1.6.1 The general impact of the petroleum price crisis on the construction of new pipelines and on the size of pipelines.
 - 1.6.2 The construction of Arctic oil pipelines in Alaska and the Soviet Union.
 - 1.6.3 The construction, or planned construction, of Arctic gas pipelines in Alaska, Canada, and the Soviet Union.
 - 1.6.4 The increase in energy exploration brought about by the fuel price crisis.
 - 1.6.5 Increased interest in and construction of slurry pipelines, particularly coal slurry pipelines.

- 1.6.6 The transmission and distribution of alternate fuels, liquid hydrogen, alcohol etc, likely to be brought about by the petroleum price increase.
- 1.7 Unconventional modes
 - 1.7.1 The proliferation in numbers and types of air cushion vehicles, so called all-terrain vehicles, recreational vehicles, etc.
 - 1.7.2 The introduction of all-terrain vehicles and recreational vehicles in the underdeveloped areas.
 - 1.7.3 The increased availability and use of snowmobiles.
- 1.8 Model split
 - 1.8.1 The change in model split in the decade, particularly in Japan, USSR, Europe, as well as absolute growth of automobiles in newly developed and developing regions.
2. Determinant processes. Persistence of transport patterns from earlier periods. Factors determining movement of people and goods. Factors determining apportionment between modes.
 - 2.1 For the air mode, scheduled air operations, local air operations and military air operations should be considered. In addition, the transmission of disease by air might be considered.
 - 2.2 For the marine mode, attention should be given to oil tankers, LNG tankers, other freight ships and recreational boat use. Sewage disposal can provide particular problems with recreational boats.
 - 2.3 For inland waterways, freighter movement, barge movement and the use of recreational boating must be considered.
 - 2.4 For the rail mode, construction of new railways, passenger operations, freight operations, and in particular operations in remote and rural areas should be considered.
 - 2.5 For the road and highway mode, due consideration should be given to trucks, buses, private automobiles, and, to some degree, the use of recreational vehicles, and also off-road use of road vehicles. For the petroleum pipeline section, importance should be attached to the movement of oil, of natural gas in the gaseous state and in the form of liquid natural gas, and the movement of products through pipelines. Of particular importance are large diameter pipelines in Arctic and jungle areas. In addition, special attention should be paid to the crossing of water obstacles, including the movement of petroleum and related substances from large tanker unloading points to shore stations.
 - 2.6 With respect to slurry pipelines, both coal slurries and other product movements should be considered.
3. Environmental impacts of transportation. Pollution: noise: atmospheric effects (ozone layer: oxidant smog especially in

towns): marine pollution (oil). Energy consumption. Inefficiencies through needless movement of goods for processing prior to re-export. Environmental effects of construction of transport systems within and between settlements, including loss of productive land. Impact of transport within settlement in movement of people and goods, and consequences to social systems. Growth in travel for recreation, with major impacts on settlements, national parks and conservation: also local adverse impacts via erosion, disturbance and interference with other uses of environment.

- 3.1 Some of the positive aspects of transportation should be mentioned, e.g., access to recreational areas (improved quality of life), separation of industrial and residential areas, opening up of new regions. Modern civilization itself may be said to be transportation dependent (with mixed blessings).
- 3.2 For each mode of transportation it will be necessary to examine air pollution, noise pollution, vibration pollution, soil pollution and water pollution considerations, and the loss of land use brought about by infrastructure construction (right-of-way, terminals, navigation aids, maintenance facilities, etc). With respect to each pollution factor it will be desirable to establish potential standards including an upper permissible limit and a desirable standard to be achieved. Again for each mode, the factors must be considered with respect to the urban, inter-urban and rural environments. Differences between the developed nations, intermediate areas, and the developing areas of the world must be taken into consideration as well. It might be desirable to collect or develop draft procedures for determining environmental impact of the various modes.
- 3.3 For all modes, a comparison of energy costs and recent cost changes would be desirable, including energy cost of manufacture and maintenance for both vehicles and infrastructure.
- 3.4 The advent of space exploration during the last two decades has begun to present new environmental problems including: chemical pollution, radiation pollution (from nuclear powered devices), and a direct hazard from debris and even vehicles which fail to burn up or fall in 'safe' areas.
- 3.5 It will be important to consider for each mode, existing legislation with respect to environmental impact, and also to consider future requirements for legislation in the light of the observed changes and environmental impacts of transportation.

4. Summary and future prospects:

Analytical summary of the relationship between Transport/Environment in the decade after Stockholm and proposed plan of action.

RECREATION AND TOURISM

The pressures of modern society have encouraged man to seek relaxation and to be involved in a variety of leisure activities beyond his normal habitat. This has led to a marked increase in tourism. International tourism has grown in scale from 140 million tourist arrivals in 1967 to 243 million arrivals in 1977, about 75 per cent increase in 10 years, and is expected to continue to grow in the years ahead, probably by at least 4 per cent per year.

Tourism, by its diverse and diffuse nature, is so integrated into the life and fabric of a country that developments within the industry affect, for better or worse, society, economy and environment generally. The planning of tourist development, therefore, requires a comprehensive approach which will consider the various aspects of tourism itself as it affects, and is affected by, society, economy and environment in its national, regional and local context.

Like other major sectors of human activities, tourism can have both positive and negative effects upon the physical environment. Where environmental damage has been caused by tourism developments, it is more often due to poor planning or control of individual tourism schemes and of the overall growth of the industry. A key principle advocated by those who seek a balance between tourism and the environment is that the type and scale of tourist development and activity should be related to the carrying capacity of tourist resources. Hence, it is important to link an overall plan for tourism to general physical planning.

General Outline of Analysis

1. General:
 - 1.1 Scope and need for recreation.
 - 1.2 Definition of tourism.
 - 1.3 Basic characteristics (renewable resources) responsible for tourism growth.
 - 1.4 Scale and nature of tourism.
2. Tourism and the physical environment:
 - 2.1 Positive impacts
 - 2.1.1 Protection of the heritage.
 - 2.1.2 Environmental improvement.
 - 2.1.3 Indirect benefits.
 - 2.2 Negative impacts
 - 2.2.1 Excessive and incongruous development.
 - 2.2.2 Damage to ecosystems, monuments, etc.
 - 2.2.3 Pollution.
 - 2.2.4 Exhaustion of resources.

3. Socio-cultural impact:
 - 3.1 Art
 - 3.2 Religion
 - 3.3 Human relations
 - 3.4 New life styles and disruption of traditional life style.
 - 3.5 Social advantages and disadvantages.

4. Socio-economic impact:
 - 4.1 Economic activities.
 - 4.2 Patterns of tourist expenditure and tourist income.
 - 4.3 Creation of new jobs.

5. Balance between tourism and the environment:
 - 5.1 National and regional planning.
 - 5.2 The carrying capacity of tourist resources.
 - 5.3 Placing discipline on built development.
 - 5.4 Management of tourist flows.

BASIC NEEDS AND ENVIRONMENTAL QUALITY

The fundamental needs of a human being are hard to define. Our perception of them varies according to our culture, time and technological progress. But some may be considered "basic" because unless they are sufficiently satisfied, dignified and active human life is impossible. They are food, shelter, health, clothing, education and creative productive work and they are felt by every human being irrespective of culture, race or sex. Closely linked with them there is another group of "social" or "cultural" goals such as entertainment, artistic and musical expression, participation in social affairs, travel, choice of employment and the like. It is hard to draw the line between human needs and desires. Once basic human needs are satisfied - and this in itself will be difficult to achieve throughout the world - people still have wants which relate to individual standards but also strongly reflect cultural influences. Aspirations and expectations mount as societies develop and economic growth proceeds: they are never fully attained. It is a feature of man that he is always searching for new goals - of knowledge, art, social choice, or physical quality of life.

No-one can deny that man has proved to be a powerful environmental force. He has not always brought harm: he has protected animals and plants unequal to changing natural as well as man-influenced environments; and he has created productive areas where once there were semi-arid deserts. Nevertheless, man's development activities have also caused environmental side-effects. In recent times he has moved beyond harming his immediate surroundings and has begun to threaten the stability and viability of his global environment.

The greatest challenge today is to design development which, while satisfying basic needs - beginning with the eradication of poverty - protected and indeed, whenever possible, enhanced, environmental quality and does not transgress the "outer limits" imposed by the capacities of the biosphere.

General Outline of Analysis

1. General:
 - 1.1 Significance of "Environmental Quality" (EQ) - meaning and situation of EQ in the whole framework of the present project.
 - 1.2 Role of EQ Indicator in the environmental management - key role as an interface between "changes of environmental components" and "environmental management policy" (policy evaluation, international comparison, decision-making). Sensitivity of indicators.
 - 1.3 Environment - development nexus.
2. Environmental quality relevant methodology and philosophy:
 - 2.1 Recent methodological development

- 2.1.1 Methodologies for EQI identification process and policy making process based on the defined EQI (multi-variable analysis, multi-objective decision making, gaming theory, delphei, optimization, cost-benefit, risk-benefit).
- 2.1.2 Review and illustration of typical examples.
- 2.2 Recent philosophical development
 - 2.2.1 Philosophical aspects on EQ (relation of EQ and QOL, variety nature of human preference, role of citizen's participation in decision making, etc.)
Cross-reference: Environmental Education and Training and Public Awareness.
 - 2.2.2 Identification of basic needs on "QOL" or "Welfare" with respect to different spatial and temporal scale.
- 3. Environment in context of development
 - 3.1 Implications of resource depletion and misuse (e.g. soil, irrigation, agriculture, woodland) using examples to illustrate the scale of damage (mainly local) and the needs for the future.
 - 3.2 Implications of wasteful use of resources e.g. urbanization on agricultural land, misuse of energy, overconsumption of food (local and regional: future can include NIEO).
 - 3.3 Implications of the failure to satisfy basic human needs (e.g. lack of energy leading to woodland devastation - mainly local. Future options either better-managed and quicker-growing timber or new energy sources).
 - 3.4 Implication of expanding impact on global systems (atmosphere, oceans, ozone layer): for future, major technological adaptation may be needed.
 - 3.5 Discussion of the adequacy of meeting problems by adapting existing systems or substitution of alternative patterns.
 - 3.6 Development imperatives and possibilities of transition to environmentally-sound development strategies.
- 4. Formulation of "Environmental quality indicator" (EQI):
 - 4.1 Review of EQI in this decade
 - 4.1.1 Extensive survey and analysis of previously proposed EQI, and their relationship with policy decision.
 - 4.1.2 Analysis of EQ components.
 - 4.2 Categorization of EQ components

- 4.2.1 Listing EQ components (physical-chemical, biological, socio-economic, and socio-cultural).
- 4.2.2 Categorization of components due to human need (basic need for survival, healthy environment, comfortable and convenient environment).
- 4.2.3 Stage of development and concerned EQ components (preference, trade-offs).
- 4.3 Comprehensive index
 - 4.3.1 Integration process of individual components (weighting factor, linear combination or non-linear one, etc.).
 - 4.3.2 Relationship between types of policy decision or goal of environmental management and EQI (vectoral objectives, multi-objectives, single comprehensive objectives or welfare function).
- 4.4 Interaction of each element
 - 4.4.1 Qualitative or quantitative evaluation of interaction between change in one element onto others (e.g. land erosion → air pollution → water contamination; SO_x - air pollution → acid water pollution, etc.)
- 5. Assessment of the change of environmental quality during 1970-1980:
 - 5.1 International comparison of EQ change in terms of several different EQI 1970-1980.
 - 5.2 Development and EQ change
 - 5.2.1 Comprehensive assessment of positive and negative effects of development on EQ.
 - 5.2.2 Typical examples of new developments and change of EQ (human settlement, transportation technology, food and energy sources, etc.).
- 6. Review of the conceptual advances and approaches related to the environment - development nexus of the last ten years including the future prospects for NIEO.
 - 6.1 Analysis of the environmental dimensions in development projects (give illustrative examples).
 - 6.2 Ecodevelopment (for ecologically sound development pattern) - taking advantage of the specific environmental resources of each ecosystem for the satisfaction of basic needs on a sustainable basis.

PEACE AND SECURITY

A critical environmental problem which we cannot predict too well and over which we sometimes have little control is global military conflict. This could be cataclysmic in nature and its aftermath would be too great for normal environmental buffering and resilience and for recovery processes to cope with it. Even if only the traditional forces of mass destruction were unleashed on a global scale, there could be a serious impact on the global environment. The more recent weapons of chemicals, biological and nuclear warfare could reach global catastrophic proportions from which there might be no complete recovery.

During the past 30 years, the total destructive power in the world's arsenals has increased several million-fold. The arms trade is spreading the most modern sophisticated weapons around the world. Feeding the war machine involves an immense diversion of financial, intellectual and natural resources which is a continued threat to global peace and security and could be more constructively used to improve the lot of mankind. The environmental consequences of arms race are well known. It is sufficient to mention that development, testing, transport and use of weapons, not only those of mass destruction, but also of conventional ones, have varying but sure deleterious effects on man's health, as well as the health of the environment, be it soil, water, air or any of the various ecosystems around us.

Peace, environment and development are inseparable. Peace is the only road to a better quality of life, and a healthy, productive environment is essential to the development which so many nations badly need, and which the release of resources through disarmament would help to accelerate.

General Outline of Analysis

1. Peace, security and arms race:
 - 1.1 Brief history
 - 1.1.1 Science, technology and warfare.
 - 1.1.2 Socio-economic aspects.
2. The trends in the arms trade with Third World countries:
 - 2.1 The flow of arms.
 - 2.2 The weapons.
 - 2.2.1 Aircraft.
 - 2.2.2 Missiles.
 - 2.2.3 Armoured vehicles.
 - 2.2.4 Warships.
3. World military expenditure:
 - 3.1 Armed force.
 - 3.2 Arms and weapons production.

4. Consumption of raw material:
 - 4.1 Resources and armaments.
 - 4.2 Shortage of resources.
 - 4.3 Inflated prices.
5. The environmental impacts of warfare:
 - 5.1 Conventional warfare
 - 5.1.1 Population.
 - 5.1.2 Ecosystem:
 - (i) Short duration.
 - (ii) Long duration.
 - 5.1.3 Agriculture, industry.
 - 5.1.4 Acceleration of Third World countries major problems (disease, malnutrition, unemployment, urbanization, lack of investment, etc).
 - 5.2 Nuclear weapons
 - 5.2.1 Blast wave.
 - 5.2.2 Thermal radiation.
 - 5.2.3 Nuclear radiation.
 - 5.2.4 Accidents.
 - 5.2.5 Ecological consequences:
 - (i) Geosphere.
 - (ii) Atmosphere.
 - (iii) Biosphere.
 - 5.2.6 Spread of nuclear power.
 - 5.3 Chemical and biological weapons
 - 5.3.1 Anti-personnel agents.
 - 5.3.2 Chemical harassing agents.
 - 5.3.3 Lethal synthetics.
 - 5.3.4 Natural toxins.
 - 5.3.5 Micro-organisms and viruses.
 - 5.4 Environmental warfare
 - 5.4.1 Weather and climate modification.
 - 5.4.2 Manipulation of certain electro-magnetic radiation.
 - 5.4.3 Modification of certain electrical behaviour of the atmosphere.
 - 5.4.4 Modification of oceans and earthquakes.
6. Military satellites.
7. The arms race in space.
8. Developments in arms control and disarmament:
 - 8.1 The multilateral disarmament negotiation machinery.
 - 8.2 Major post-World War II agreements.
 - 8.3 UN General Assembly resolutions.
 - 8.4 The UN Special Session on Disarmament.

- 8.5 Measures to prohibit environmental warfare.
 - 8.6 The strategic arms limitation talks.
 - 8.7 Limitation of nuclear explosions.
 - 8.8 Prevention of nuclear proliferation.
 - 8.9 Prohibition of biological and chemical weapons.
9. Disarmament, development and environment:
- 9.1 Relationship between disarmament, development and environment.
 - 9.2 Improvement of socio-economic and physical environment.

ENVIRONMENTAL EDUCATION AND TRAINING
AND PUBLIC AWARENESS

Within the past decade, man has found his environment seriously threatened and his survival questioned. The protection of the environment has become a cause that reaches everyone, stirring emotions, destroying lethargy, inspiring talk and some action, and, as is usual with causes, calling upon schools to equip the oncoming citizens to prevent disaster.

As education is at the core of all development processes, this call for environmental education was seen as an indispensable means of reaching a balanced environmental development.

Since the Stockholm Conference (1972) which stressed the role of education, of both the public and the specialist, in the solution and prevention of the world's environmental problems, environmental education has developed rapidly and has contributed greatly towards the shaping of necessary new approaches.

Intelligent environmental action, however, cannot await the emergence of a new generation whose environmental literacy is the product of kindergarten, through secondary education and beyond. Therefore, significant changes shaped by the drive to achieve environmental quality have been initiated in a wide variety of areas - relating, in one way or the other, to environmental education and training and to the promotion of public awareness.

In addition to the introduction of environmental education in the mainstream of education during the past years, efforts have been made to educate and motivate every sector of the population on environmental issues. Environmental training has no doubt facilitated the tasks of those engaged in the work of environmental assessment and management. Likewise, dissemination of information on the state of the environment, on particular environmental hazards, on outer limits of the biosphere, on environmental problems of specific production activities, and of human settlements, as well as on environmentally sound development technologies, including technological alternatives, etc, has helped a great deal in the promotion of public awareness, and in effecting appropriate changes in attitudes and preferences, and life-styles of people.

The decade 1972-1982 would seem to be a useful vantage point from which to assess a variety of dimensions related to environmental education and training and public awareness. This section, therefore, should give a global view of the trends and development in the area of environmental education and training and public awareness (cross-link as appropriate to other sections), and analyze these trends, identify gaps and inadequacies, and propose future action.

General Outline of Analysis

1. General:
 - 1.1 Definition of environmental education.
 - 1.2 Distinction between environmental education and environmental training.
 - 1.3 Relation between environmental education and development.
 - 1.4 Relation between environmental education and environmental management.
2. Guiding principles of environmental education and training:
 - 2.1 Declaration of the United Nations Conference on the Human Environment.
 - 2.2 Belgrade Charter.
 - 2.3 Tbilisi Conference.
3. Trends in environmental education:
 - 3.1 Formal education
 - 3.1.1 Pre-primary, primary and secondary school level.
 - 3.1.2 Post secondary level.
 - 3.1.3 Teacher training.
 - 3.2 Non-formal education
 - 3.2.1 Environmental education for out-of-school youth.
 - 3.2.2 Adult education.
4. Environmental training:
 - 4.1 Training for sectoral specialists (in urban and regional planning, countering pollution and environmental damage, nature conservation and agronomic applications, health care, etc.), associated with specialist training (biology, chemistry, geography, agronomy, medicine, sociology, psychology, agriculture, etc.).
 - 4.2 Training for environmental generalists, which has the advantage of being based on a genuinely interdisciplinary training given from the start. This training permits a more comprehensive understanding of environmental problems and leads to greater adaptability to local conditions.
 - 4.3 Recurrent training. As the years pass, the problems raised by the environment change - Post-graduate refresher courses vital for those occupations concerned with the environment and its problems - All the more valid in the case of people with no training in environmental education.

5. General trends in the promotion of public awareness:
 - 5.1 Role of mass media.
 - 5.2 Institutional developments promoting public awareness of environmental matters.
6. National policies and strategies including environmental education and training legislations.
7. Regional co-operation and institutional organization of programme on environmental education and training.
8. Analysis of trends in the decade, and identification of gaps and inadequacies.
9. Future prospects.

CHAPTER 19

IMPLEMENTATION PLAN

A. Administrative and Consultative Infrastructure

1. The Senior Scientific Advisory Board (SSAB):

A Senior Scientific Advisory Board consisting of 14 internationally-known experts associated with the field of environmental sciences has been established by the Executive Director of UNEP (see Annex 1). The SSAB should meet to discuss major technical issues related to the project and to review the progress made in the implementation. The background papers and documents to be presented at the meetings of the Board for discussion will be prepared by the State of Environment and Special Assignments Unit, after consultations with relevant Task Forces and Units within UNEP. The recommendations of the Board will be submitted to the Executive Director of UNEP, through the Assistant Executive Director for Programme matters, for final consideration.

2. The Administration and co-ordination of activities:

The administration and co-ordination of all activities related to the project will be the responsibility of the Executive Director of UNEP, assisted by the State of the Environment and Special Assignments Unit of the United Nations Environment Programme (Nairobi). The SOE-SA Unit will follow-up the work of the team of experts entrusted with the analytical work and will ensure the continuous flow of up-to-date technical information to them. The Unit will be responsible for organizing the meetings of the SSAB, expert group meetings, workshops, etc, and co-ordinating these meetings to ensure the maximum output.

3. The Team of Experts:

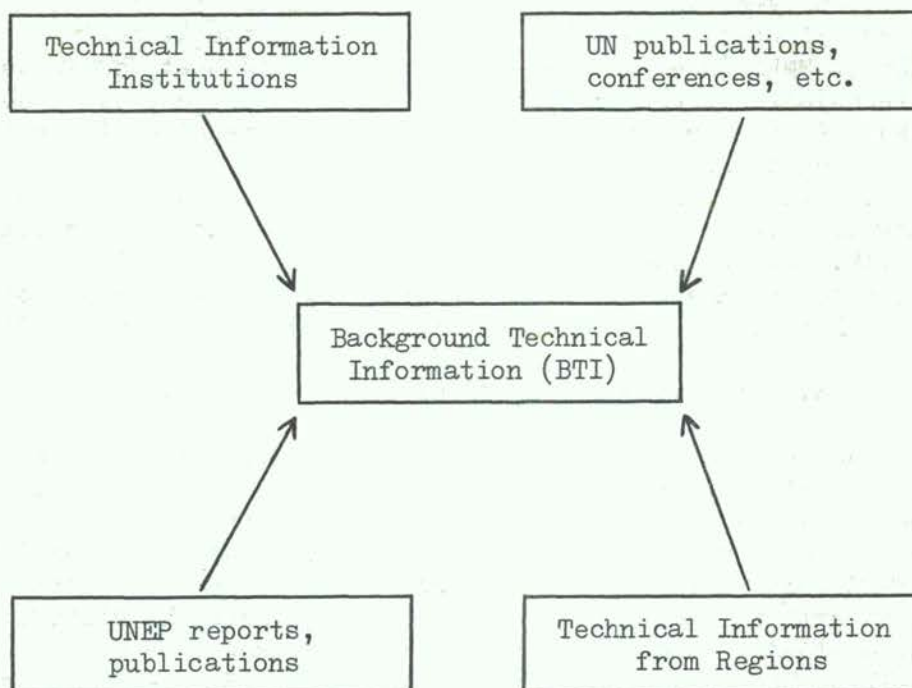
The institutions or team of experts to be entrusted with the analysis of the different subject areas should be highly qualified in the respective fields. The selection should be made in such a way as to maintain a reasonable geographical balance of distribution between developed and developing countries.

B. Technical Components of the Project

1. Background Technical Information (BTI):

The BTI is the backbone of the whole project. Without adequate coverage of the relevant technical information (and continuous updating), the analysis of the state of the environment will be incomplete and subject to many gaps and inadequacies. Since it is

not expected that the team of experts will be able to carry out a wide coverage of technical information since Stockholm 1972, information gathered by the SOE-SA Unit, in addition to data available through other systems within UNEP, will supplement the technical material available to the teams of experts. The BTI gathered by the SOE-SA Unit is summarized in the following diagram:



(a) Technical information institutions

A number of institutions have been identified which provide a variety of technical services, the most important of which are: assembling data files, search services and assessment reports. Contacts with these institutions have been established to obtain the relevant BTI related to the subject areas under investigation. Special effort should be made by the UNEP Secretariat to gather technical information from developing countries.

(b) UN publications, conferences, etc.

A complete set of all technical reports, proceedings of UN and international conferences related to the field of environment will be assembled.

(c) UNEP reports, publications, etc.

A complete set of published reports (projects, overviews, SOE reports, GEMS, etc), will be assembled at the BTI base of the SOE-SA Unit.

(d) Technical information from the regions

A network of institutions in the developing regions will be established from which information and technical reports related to environmental conditions will be gathered. Although this process will be made on an "ad hoc" basis, since many of these publications are not available in a centralized system, a fair amount of information will be collected. The UNEP regional offices will play a major role in providing assistance for gathering this information.

2. The component studies:

For every subject area, an institution or a team of experts (maximum of five) should be identified to undertake the assessment of a particular subject area. Before starting their work, the experts will be briefed about the activities of UNEP and about the objectives of the project. The experts will be provided with the background technical information gathered in their respective fields of activity in addition to their own sources.

3. Review of the studies:

Once the first drafts of the assessment are ready, these will be circulated to the members of the SSAB, the editor(s) of the technical version, UNEP staff, and some selected specialists for review and comments. The drafts of the different subject areas will then be put together in a consolidated draft technical text by a selected editor(s). An editor for the "popular version" should be nominated at this stage to take part in the discussions as early as possible.

4. Review of the main "technical" text:

A major workshop will be convened in Nairobi to review the main "technical" report which will be published as a reference book. The workshop should consist of:

- (i) Members of the SSAB.
- (ii) All principal investigators who carried out the analyses.
- (iii) A suitable number of invited experts (about 10).
- (iv) Members of the UNEP Secretariat.
- (v) Experts from relevant UN and other organizations.

The editor(s) will then revise the draft according to the comments of the workshop. At this stage, the editor of the popular version would start the preparation of his draft.

5. Review of the final technical text and the draft of the popular version:

The final draft of the technical text will be reviewed at a meeting of the SSAB and will be finalized and submitted to UNEP for publication. At the same time a review will be made of the popular

version. The report of the Executive Director which will be presented to the Governing Council will be prepared by the Secretariat and should analyze the "degree of implementation" of the various Stockholm recommendations. It should also review the activities of the UN system in the field of environment as related to these recommendations.

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Annex 2

Timetable for Implementation

April 1978	First Meeting Senior Scientific Advisory Board (Technical contents of project, implementation plan).
May-June 1978	Contact key-scientists for drafting detailed proposals for analysis of subject areas. Accelerate gathering of Background Technical Information.
July-August 1978	Prepare report on detailed proposals, circulate report together with proposals to members of SSAB.
October 1978	Second Meeting of SSAB and key-scientists. Discussion and finalization of sub-projects for the analysis of the subject areas. Nomination of institutions and teams of experts.
November-December 1978	Contact teams of experts and institutions. Briefing of teams of experts (or institutions).
January 1979	Teams and institutions start work.
SECOND HALF OF 1979	<hr/> <u>MEETING SSAB (EVALUATION OF PROGRESS MADE)</u> <hr/>
January 1980	First drafts of analysis ready. Circulate to UNEP staff members and members of SSAB for comments.
April-August 1980	Preparation of first consolidated version of technical draft. Circulate to members of SSAB and scientists to actual Workshop. Recommend editor for popular version.
September 1980	Workshop (Nairobi).
October 1980 - February 1981	Revision of first consolidated technical text - updating. Distribution to SSAB.
June 1981	SSAB to review second technical draft. Start prepare ED report to GC. Start prepare popular version.

July-September 1981	Final revision of technical text.
October-November 1981	Send technical text for publication.
January 1982	Send report for GC for translation and printing.
March 1982	Send popular version for printing.
June 1982	Technical text published. Popular version published.
