

5. Environmental problems

5.1. INTRODUCTION

An environmental problem arises whenever there is a change in the quality or quantity of any environmental factor which directly or indirectly affects the health and well-being of man in an adverse manner. Environmental problems can be studied from two different viewpoints. One is simply to look for adverse effects without regard to their origin in order to detect trends that call for further investigation; the other is to try to understand the cause and effect relationships, which make better prediction and proper management possible.

Some of the environmental problems which are critical at the present time are fairly widely known because of the growing awareness of all levels of society, including governments, general public and the scientific community. However, our present information on the structure and function of the biosphere is not sufficient to allow an accurate evaluation of the total situation, except to indicate some broad problem areas. There may be serious potential problems of which we are as yet unaware; other known problems may be less serious than we think.

The Commission has made an extensive survey and analysis of those problems which are currently regarded as being of critical importance. The following criteria were used in an attempt to assess the critical nature of the problems to be solved in the near future:

- a) Number of people and nations involved
- b) Geographical distribution of the problem
- c) Temporal distribution of the problem (temporary or long-term effects)
- d) Degree of irreversibility of the effects
- e) Degree of impact on health, standard of living, social structure and economy
- f) Degree of international significance of the problem

Although these criteria overlap and may not be exhaustive, they form a useful basis for judgement.

The consensus of the Commission's survey was that a fairly restricted number of problems were found to recur time and again. The major critical problem may be summarized as, "the adverse effects of a changed environment on human health and well-being"; i.e., the possibility that a changing environment may lead to increased mortality, increased frequency of diseases, lowered nutritional status via decreased agricultural productivity, or lowered psychological value of the environment. Concern has been widely expressed that these possible effects on man may be caused by direct input of toxic substances into the environment or improper land use. Climatic changes as a result of human activity may also adversely affect the standard of living through, for example reduced crop productivity, and increased energy consumption, etc.

Those problems considered most relevant for early implementation by a global environmental monitoring system are:

1. Potentially adverse climatic change resulting from human activities
2. Potentially adverse changes in biota and man from contamination by toxic substances including radionuclides
3. Potentially adverse changes in biological productivity caused by improper land use (reduced soil fertility, soil erosion, extension of arid zones etc.)

A second category includes problems that, although of great importance, are not suitable for early global monitoring either because of their nature or because further study is necessary to determine whether they should be included in a global environmental monitoring system. These problems are:

4. Potentially adverse changes in the growth, structure and distribution of the human population
5. Changes in the subjective human perception of the environment
6. Eutrophication of waters
7. Decreasing freshwater resources
8. Natural disasters

5.2. DISCUSSION OF CRITICAL ENVIRONMENTAL PROBLEMS

5.2.1. Potentially Adverse Climatic Change Resulting from Human Activity

Large-scale climatic changes could be caused by alterations in the earth-atmosphere system through changes in: the atmospheric content of carbon dioxide; atmospheric turbidity (aerosol content); mean global cloudiness; the earth's surface; the composition of the stratosphere; and the amount of heat generated by man's activities.

The concentration of atmospheric carbon dioxide is increasing at an average annual rate of nearly 0,3 percent. This increase, which is due to the burning of fossil fuels, is expected to accelerate in the future accompanying global economic development. Atmospheric carbon dioxide can influence climate through the "green-house effect", i.e. it is transparent to incoming solar radiation but partially absorbs the outgoing longer wavelength energy emitted by the earth. The best current estimates suggest that by 2000 A.D. the effect of increased CO₂ alone will be an average warming of the global surface temperature by roughly 0,5°C.

Atmospheric aerosols attenuate solar radiation by absorbing and scattering (re-directing) it and are thereby potentially capable of affecting local and global climate. The nature of the climate change (warming or cooling) depends on the relative importance of these two radiative processes as well as the character of the earth's surface. In addition, atmospheric particles can affect the physical processes of precipitation and cloud formation through their role as condensation nuclei. Recent estimates have indicated that on a global basis, man's production of atmospheric particles is now roughly 10 to 50 percent of the natural rate. Locally, of course, the man-made contribution may far exceed that occurring naturally.

Changes in the earth's reflectivity (albedo) are dominated by variations in

cloudiness. Thus, any activity of man that affects large-scale cloudiness is likely to have an impact on climate. Potential examples of such activity include subsonic and supersonic aircraft flights that add moisture to the atmosphere at high altitude, atmospheric particles that serve as condensation nuclei, and attempts at weather modification.

Man-made changes in the earth's surface can affect the albedo and the availability of solar energy. Examples of such changes include deforestation, erosion, extension of arid or desert land, irrigation, urbanization, and the creation of artificial lakes. Although large local climatic effects result from these activities, the global consequences are not well understood and may be insignificant.

The combustion of fuels and the use of energy result in the liberation of heat. In large, temperate-latitude cities during winter this man-made energy can often equal or exceed that naturally available from solar radiation. Man-made energy is, however, not yet significant on a global scale but within 30 to 40 years it will equal several percent of the available solar energy over large, highly industrialized regions. The specific regional climatic consequences are unknown but are likely to be significant.

Plans to build commercial fleets of supersonic aircraft that cruise in the lower stratosphere have caused some scientists, but certainly not all, to become concerned about possible stratospheric contamination. The exhaust products from these aircraft—soot particles, water vapour, nitric oxide, etc.—could attenuate solar radiation, increase cloudiness or decrease ozone concentrations. Since these substances would have a much longer average lifetime than those emitted near the earth's surface, a relatively small stratospheric emission rate could lead to significant ambient concentrations. Thus an early programme is needed to obtain baseline measurements of substances in the stratosphere and to determine whether they have a natural or man-made origin.

5.2.2. Potentially Adverse Changes on Biota and Man from Contamination by Toxic Substances including Radionuclides

This is one of the most complex and widespread of the environmental problems because many potential contaminants are involved, with the list growing each year, and immense number of species that could be affected. Many cases of local catastrophes or widespread poisoning in man and wildlife have already occurred.

The more hazardous toxic substances include heavy metals (lead, mercury and cadmium), organochlorine compounds (DDT, its degradation products and metabolites, polychlorinated biphenyls) and possibly petroleum products. Contamination occurs in all media: air, land, water and biota. Of particular importance, however, are those parts of the biosphere where the substances show long residence times, namely in soils and sea water. The sea is the ultimate repository of almost every kind of pollutant material created by man. Industrial effluents and biocides are discharged directly into coastal waters or carried to the sea by rivers. Toxic materials

are often dumped in quantity on the sea bed or into the open waters of the oceans. Hazardous cargoes, transported by ships as freight or fuel, are released either by accident or design into the sea. Pollutants transported by the atmosphere are continuously transferred by precipitation or direct diffusion onto the surface waters.

The use of the biosphere as a recipient for toxic and other waste products will inevitably affect animal and plant species, their growth and reproduction. Every kind of pollutant in some measure affects the character of an ecosystem structure by decreasing the species diversity. Toxic substances may endanger man's health directly or by passage and accumulation through food chains.

The effects of contaminants on biota can be studied by considering various biological effects, such as changes in the numbers and distribution-ranges of organisms, changes in the structure of plant and animal communities, replacements of whole ecosystems and changes in productivity. Thus, by assessing selected parameters which describe changes in single species or biological systems of higher order, both specific and general effects on biota can be determined.

Important changes in many species populations, including extinctions, are well known. Inadvertant or deliberate simplifications of ecosystems with a resulting decrease in stability and tolerance of environmental stress have occurred many times. The transfer of natural ecosystems to monocultural agricultural systems constitute the best examples of ecosystem simplification which now need continuous management to preserve the desired state. In some cases whole ecosystems have been completely replaced by new ones because of intensive pollution or grazing by domestic animals. Possible adverse effects on agricultural productivity are of special concern because any factor that tends to decrease the production of food and fibre must receive a high priority in the monitoring system. To arrive at the optimal combination of exploitation and management of natural resources, programmes must be developed that provide continuous information on the use of these resources and permit evaluation of the consequences of predicted future developments.

In contrast to the above problems, monitoring of radioactive contaminants is currently being efficiently provided by UNSCEAR, IAEA and other agencies. Thus, it is not anticipated that any new programmes, other than support of the current effort, will be necessary for this very important problem. In the future, however, the predicted growth of nuclear-powered electrical generating plants will necessitate greater awareness of the potential hazards from storage of radioactive wastes.

5.2.3. Potentially Adverse Changes in Biological Productivity Caused by Improper Land-use

The land surface in extensive parts of the world is changing because of the intense agricultural methods necessary to provide for a growing population with an increasing per capita consumption. In many parts of the world,

improper land use has resulted in irreversible degradation of soils and vegetation. Soil erosion by wind and water, leaching of nutrients, salinization and extension of arid zones have been caused by such improper land-uses as overgrazing in arid zones, deforestation in areas with unstable soils and over-use of both surface and ground-water resources.

Usually, these problems are local or regional in nature and are the responsibility of individual governments. However, because similar changes in soil fertility have occurred throughout the world in many nations, a global, multi-governmental approach to the problem is appropriate. Moreover, because the local effects of decreased soil fertility may be very significant, the economy of adjacent regions may also be affected. Extension of arid zones can also induce large-scale climatic changes by allowing considerable amounts of windblown dust to become airborne.

5.2.4. Potentially Adverse Changes in the Growth, Structure and Distribution of the Human Population

The fast growth of the human population in combination with changes in its distribution pattern, particularly the strong and increasing tendency towards urbanization, constitutes one of two major factors responsible for the creation of environmental problems; the other being technological developments. Among the variety of environmental problems that are affected by population growth and urbanization are: over-utilization of land; deterioration of natural areas; ecological changes; depletion of natural resources; dietary deterioration; increase of urban pathology; increased wastes; and the consequences of national policies to reduce or increase fertility.

We are satisfied that the United Nations will continue to improve its already valuable collection and evaluation of information on population size, vital statistics and demographic data which will provide supporting information both to the environmental monitoring system and to other international and national activities, particularly those related to human health monitoring.

5.2.5. Changes in the Subjective Human Perception of the Environment

Changes of the environment may or may not be harmful to man. However, both kinds of change may be perceived by people as annoying, dangerous or even irrelevant. This not only applies to laymen, but also to environmental scientists, planners and decision makers. Consequently the subjective perception of environmental problems constitutes an important factor in relation to environmental monitoring activities. It may serve as a kind of qualitative evaluation of the results of control management. Thus, although the Commission recognizes this environmental problem, it is not included as an operative part of the system.

5.2.6. Eutrophication of Waters

Both natural and man-made lakes have suffered from eutrophication and its secondary effects. In lakes receiving nitrogen and phosphorus compounds and other agricultural fertilizers, unprecedented blooms of algae have occurred. The algae themselves can spoil water quality and recreational conditions. When they die and decay, the oxygen demand may exceed the supply with resultant fish kills. The average oxygen content of some fresh water bodies has decreased very markedly in historic times. The effects of added nutrients on marine life are not well known but there may be particularly important synergistic effects, for example, if the oxidation of oil in the sea is biologically controlled. Fertilization of the seas may enhance the production of directly economically valuable species. Because eutrophication is primarily a local problem, it has not been included in the global environmental monitoring system.

5.2.7. Decreasing Freshwater Resources

The availability to man of freshwater of high quality is becoming an acute problem in many countries. Water requirements continue to increase with the growth of populations and living standards and the expansion of agriculture and industry. Water is needed for power generation irrigation, navigation and community water supply. Often it is drawn from international rivers or lakes and in many instances international co-operation is needed in the allocation of water and the financing and technical aspects of water resource development projects. The availability of ground water is most often a local problem but it has international implications in relation to the general effects which a depletion of ground water may have within a larger region.

5.2.8. Natural Disasters

Although natural disasters constitute a very important environmental problem, it is not pertinent to include a programme directly related to natural disaster monitoring or warning within the global environmental monitoring system. It is appropriate, however, that the system should provide assistance in reporting phenomena that relate to natural disasters.