

## *Preface*

The General Assembly of the International Council of Scientific Unions (ICSU) directed its Scientific Committee on Problems of the Environment (SCOPE) to report to ICSU in October 1976, on global trends in the biosphere and environmental issues most urgently requiring international and interdisciplinary scientific effort. SCOPE was asked to indicate how far there was agreement, differences of judgment, and a need for further scientific research on these subjects. The Bureau of SCOPE entrusted the preparation of its report to a Steering Committee in collaboration with the officers.

The present Report comes at the end of two phases in the history of the Scientific Committee. During the first, formative phase, SCOPE played an active part, on behalf of ICSU, in providing scientific statements to the Secretariat preparing the United Nations Conference on the Human Environment, held at Stockholm in June 1972. SCOPE prepared a report that formed the basic working document for an Intergovernmental Working Group on Monitoring and put forward proposals for an International Registry of Toxic Chemicals, in both instances influencing the development of themes that now form part of the action programme of the United Nations Environment Programme. The second phase in the history of SCOPE, overlapping with the first and in many ways exceeding it in importance, has been the development and operation of the Mid-term Programme. The activities of SCOPE have been conducted in close liaison with a number of other members of the ICSU family; many elements in SCOPE's programme, for example, have built upon and developed work begun under the Special Committee for the International Biological Programme (SCIBP) which organized the World Programme on 'Biological Productivity and Human Welfare' from 1964 to 1974.

In compiling the Report, the authors were guided by the long-term objectives of SCOPE:

- Advancing knowledge of the influence of human activities upon the environment and the effects of the resulting changes on human health and welfare, with particular attention to those influences which are global or common to several nations; and
- Serving as a non-governmental, interdisciplinary source of objective advice for the benefit of governments and intergovernmental agencies with respect to environmental questions of wider purview than those of individual Unions and Committees of ICSU.

The Report addresses itself to three specific questions concerning selected aspects of the global environment:

- (a) what changes have been recognized by environmental scientists?
- (b) what other changes have been postulated but remain controversial, and should be regarded as issues for analysis rather than as certainties?
- (c) what changes may possibly be taking place, but cannot be regarded even as postulates without further evaluation?

The first part of this Report (Chapters 1 and 2) examines static and dynamic elements in the biosphere and considers their impact on the human situation today. Chapter 2 is especially concerned with the development of means for the more rigorous recognition, analysis, and evaluation of environmental changes and their effects. Both chapters provide a general philosophical preface to the second part (Chapters 3, 4, and 5) which summarizes progress in the seven projects of the Mid-term Programme of SCOPE and the related work by other ICSU Unions and Committees. The seven projects of the Mid-term Programme are concerned with:

- I. Biogeochemical cycles;
- II. Human impact on renewable natural resources;
- III. Environmental aspects of human settlement;
- IV. Ecotoxicology;
- V. Simulation modelling;
- VI. Environmental monitoring; and
- VII. Communication of environmental information and societal assessment and response.

Finally, Chapter 6, which forms the third part of the Report, takes a forward look at ICSU's opportunities in the environmental field and at how SCOPE's work might develop after the completion of the Mid-term Programme.

The report is addressed in the first place to ICSU, as formality requires. Through ICSU, it can reach a substantial part of the world's scientific community, in and through scientific unions and national academies.

Detailed accounts of the Mid-term Programme projects will be published as they reach a conclusion. Such accounts, other documents of the Scientific Unions, and this report have the objective of helping scientists and those who support them to decide what research, on what problems, is pertinent to solving current and forecast environmental problems.

One widely held conclusion for which this report provides support is that it is of crucial importance that information flows freely amongst the scientific disciplines. Environmental problems are almost always multidisciplinary in nature. They demand an integration of biological, physical, chemical, and behavioural skills for their solution. Nationally and internationally, the efficient harnessing of a wide



range of scientific knowledge is vital. Communication problems are manifest amongst the sciences as well as between them and the non-scientific world. Specialists are well aware of advances being made around the world in their own disciplines: however, they are often unaware of progress in other disciplines even in their own country and some are too modest (or too erudite) to discuss their work with laymen by way of the news media.

This report also seeks a wider audience. Scientific information is essential if the world environment is to be wisely managed and actions accorded the right priority. Much has already been achieved, and more could be done with existing knowledge if there is the socio-political will and the opportunity to apply it and if it is presented in a mode useful to policy makers. More information may well be needed about these issues, but scientific knowledge is not the only kind of information required. Decision-makers in international agencies and individual countries have to blend scientific, economic, and social factors in the evaluations that lead to policy. Just, therefore, as there must be communication among the many scientific disciplines that are required for the proper understanding of environmental processes, so there must be communication between scientists and those on whom administrative responsibility rests. To achieve this communication, the scientist must consider not only what knowledge to acquire, but how to present it to others. He must, above all, have an outward-looking attitude and recognize that his duty to the community does not always end when he has presented the results of his work to his own colleagues.

This report could not have been compiled without the willing co-operation of the many participants in the seven projects of the Mid-term Programme (Appendix C). Members of the Steering Committee shared in preparing the draft which was then reviewed by members of SCOPE National Committees and International Unions prior to the Third General Assembly of SCOPE. Martin W. Holdgate prepared Chapters 1 and 2 drawing on texts by Victor A. Kovda, Thomas F. Malone and others. In Chapter 3, the discussion of climate was prepared by R. E. Munn. The review of nitrogen, phosphorus, and sulphur was drafted by Erik Eriksson, Lennart Granat, Rolf Hallberg, Henning Rodhe, and Thomas Rosswall; the carbon and oxygen discussion was drawn from papers by Erik Eriksson and George Woodwell; Gordon C. Butler prepared the text on pollutants in the environment; Ralph O. Slatyer prepared the discussion of successional change in terrestrial vegetation; and Mohamed Kassas and Gilbert F. White drew together the materials on arid land irrigation. In Chapter 4, the discussion of problem identification was prepared by Ian Burton in collaboration with Gordon T. Goodman and R. E. Munn; the monitoring section was written by Gordon T. Goodman; the review of modelling was prepared by Francois N. Frenkiel; Ian Burton wrote the section on risk estimation with the help of Gordon C. Butler and also drafted the section on evaluation and communication. The discussion of standard setting is drawn from a report by Akin Mabogunje. The summary of ICSU activities in Chapter 5 was compiled with the assistance of Paul Sanborn and Melinda Cain. Martin W. Holdgate prepared the first draft of the concluding chapter, including materials by Thomas F. Malone. William Robertson IV served as

secretary of the Steering Committee. Parts of the text will be published separately by the original authors under their own names.

The authors are indebted to many others in the member unions and committees of ICSU who have provided accounts of the activities of those bodies (Appendix B). The resulting report provides the first overview of the activities of ICSU in the field of environmental science. SCOPE thanks all those who have helped in the work of compilation.