

INTER-OFFICE CORRESPONDENCE

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Environmental
Science

FROM: CW

DATE: April 30, 1973

TO:

SW		Adh
RWR		pro

COMMENTS:

Good
The time never came to introduce this into this deliberations of the QE Program Committee. I hope it may still be of some use to you.
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SUBJECT: The Importance of Concepts and Principles to the Quality of the Environment

Status and Needs of Environmental Concerns

The following observations extend my remarks at the 13 April 1973 meeting of the QE Program Committee. Their purpose is to encourage discussion of the assumptions underlying the Program Statement and to anticipate the need to encourage development of significant environmental concepts and principles in parallel with efforts addressed to specific problems and issues.

The draft QE program statement (10 April 1973) focuses attention on environmental problems and their solution or avoidance through the full use of technical knowledge. The word "problems" is used about twenty times. In addition to specific illustrations, there are general references to environmental correction, protection, difficulties, vulnerabilities, abuses, and pollutants. There are about five references to environmental issues, with particular reference to environmental as opposed to developmental interests, and to the general problem of resolving environmental conflicts. Although the third paragraph of the Statement mentions "improved understanding of the

causes and nature of environmental difficulties" as a principal program aim, there is no other reference to the need to develop environmental principles or concepts , to clarify related measures of quality, or to understand factors and processes governing environmentally significant relationships.

unless
It seems to me that, underlying principles and factors are taken more fully into account by researchers, action agencies, and regulatory bodies, then attempted solutions to environmental problems are likely to be superficial and limited, if not misguided, in scope and general applicability.

The RF has a unique opportunity to give substance and precision to a range of concepts associated with Environmental Quality and to translate them into enduring social policies, institutions and actions. What is needed is a set of working definitions that draw upon a store of scientific knowledge and encourage useful comparisons among environments. Human and social interests, perceptions, and values constitute another important dimension of environmental concern likely to require new forms of reconciliation and choice which relate them to the physical realities of particular environments, whether these be primarily natural or man-made.

In so far as the QE Program takes account of these needs, it differs significantly from RF Programs which are relatively less concerned with problems of definition and fundamental social inquiry and more concerned with the application of available knowledge or well-disciplined inquiry to achieve well-defined objectives.

The effort to give added meaning and coherence to the concept of environmental quality is made more difficult and urgent by the fact that the word environment is now used in many different senses by the scientific and engineering community as well as the media. Established disciplines, professions, and agencies differ markedly in their usage, but in each situation there is a notable absence of organizing principles that would give coherence and meaning to notions of environment.* Moreover, environmental impact and other concepts have already acquired legal status. Certain kinds of social confusion will increase and become more serious so long as the work of private organizations, action agencies, and regulatory bodies are based on ideas and concepts that may be inherently contradictory and lack sound intellectual underpinnings.

Prospects for Environmental Sciences

An environmental focus creates some basic new challenges for our legal system and for modern science in so far as the sciences put a premium on identifying the universal aspects of natural processes that are relatively independent of the particular spatial and temporal

* NSF's definition of environmental sciences covers the atmospheric and geological sciences and oceanography, but excludes the life sciences, including ecology, and the social sciences.

A publication of the Federation of American Societies for Experimental Biology describes environmental biology as concerned with the impact on life processes of various external factors (e.g. temperature, radiant energy, vibrations, gravity, the atmosphere and pollutants, water and solutes, and Circadian rhythms) but, evidently, not with more complex ecological and other relationships involving biological activities, especially as they are influenced by economic and social patterns of human activity. Environmental medicine is concerned with the subclass of factors which affect the health of human beings.

Typically, governmental units that have assumed responsibilities for the environment are composed of an aggregation of prior concerns related for example, to air or water quality or to the uses of land and natural resources. As yet there is remarkably little integration or assimilation of these disparate concerns.

factors that tend to characterize an environment. As yet, sciences of the environment lack coherence and our system of law has particular difficulty in establishing guidelines for environmental management. Environmental studies, let alone environmental sciences, depend upon scientific knowledge and analysis and yet they cannot be identified in advance with any particular mix of existing scientific disciplines or professions.

Some established disciplines may be more helpful than others. Geography is not a particularly popular discipline today, but it may very well provide an important disciplinary base for environmental studies. In practice as well as in theory it is obviously not sufficient, even though recent exploration into "theoretical geography" and "regional science" are particularly helpful to environmental studies. Because history as a discipline seeks to identify the uniquenesses of any particular event as well as similarities among events, economic and social history and the history of technology may also become basic disciplinary tools for environmental studies. In any case, the key problem is to identify the environmental relevance of scientific knowledge as it emerges from geography, history, or the more exact sciences.

Because the dominant elements in any environment tend to be location specific, the sciences of the environment will have to develop from orderly comparisons among regions, starting - as must every science - with attempts to classify the dominant or characteristic systems operative in different environments in terms of some basic concepts or principles.

A concentration on particular symptoms and environmental problems is likely to be of limited general utility, no matter how important and attractive it may be in the short run.

Some Concepts and Principles

The following items suggest various kinds of concepts and related principles likely to be of particular importance to environmental science. Their development as useful tools of analysis and planning will, however, require special attention and cannot be taken for granted.

1. Regional differentiation is at least as important in environmental terms as are regional similarities, because of differences in social organization and perceptions as well as physical differences.
2. Factors of scale. In environmental terms, the physical scale of a system or process is as fundamental to any measure of the quality and viability of that environment as is its specific geographical location.
3. Boundaries and limits. While an interest in "boundary conditions" is by no means unfamiliar in the established sciences, the various kinds of physical boundaries- whether natural or socially enforced- and limits to physical growth or change associated with environmental systems are likely to be of central importance to the understanding of these systems.
4. Distribution and juxtaposition of activities and resources has environmental significance not reflected in studies of absolute quantities or the statistics collected for such studies. For instance, the environmental and developmental consequences of increases in population often may depend more on the distribution of these populations than on their total amount. In general, the potential conflicts and complementarities between environmental and developmental concerns should be viewed in terms of patterns of distribution and interaction.
5. Rationing of limited resources is a fundamental aspect of environmental quality, whether the rationing is done by natural physical or economic means or by some other man-made procedures. Increases in the demand for certain kinds

of potential resources limited by the nature of the given environment cannot be met by increased production or effective substitution. Thus, economic mechanisms which effectively allocate resources and encourage substitutions among man-made products are not necessarily adequate to the management of environmental resources associated with massive increases in population and urbanization.

6. Knowledge and values. In the complex environments of particular interest to man, the interaction between natural processes and human interests is critical. Thus, problems of human choice, perception, and aesthetic appreciation, and of conflict resolution become of fundamental importance. They require a kind of interdisciplinary and inter-professional analysis which is not particularly congenial to the advancement of science within disciplined bounds. Of key importance is the development of a capacity to recognize both the need for particular expertise and disciplined knowledge and its limitations, depending on the context and the major problems or issues of the moment.

Some Programmatic Implications of Regional and Integrative Approaches to Environmental Quality

The proposed QE program emphasis on problems of^a regional nature and the comprehensive study of a defined region offers a very good opportunity for contributing substantially to fundamental understanding of environmental systems and principles in these terms.

Development of useful indicators of environmental quality and their intellectual underpinings will require specific encouragement.

Institutional mechanisms are needed that will facilitate interdisciplinary exchange and the modulation of disciplined knowledge in terms of environmental characteristics and conditions. Useful knowledge of the characteristic features of environments and man's interests in them illustrated above cannot just be drawn in an ad hoc manner. from existing disciplines and professions. A

central problem for environmental studies will be to involve disciplined talents without being diverted by the interests of anyone of them. Some effective interdisciplinary links must be established. In a sense the problem is one of re-establishing such links since many of the emerging interests and concerns relating to the environment today have their antecedents in less highly disciplined and less specialized 19th century interests in natural history, natural philosophy, and political economy. Even the debates of that time which pitted science against theology have their counterparts in present concerns about the extent to which the values attributed to an environment must be constrained by technical scientific or economic imperatives. It may not be sufficient just to strengthen existing disciplines and academic institutions in order for them to make substantial contributions to environmental understanding. The very fact that environmental considerations must cut across the intellectual base of different disciplines and the competences and responsibilities of different professions creates the need for skills as an expert generalist, as distinct from those of any expert specialist, in order to manage both environmentally relevant knowledge and environmentally significant activities requiring the orderly involvement of different competences.