2 A Natural Source of Products

Most tropical forests form a green band around the earth's center extending roughly 10 degrees north and south of the Equator. Amazing as it may seem, these forests occupy less than eight percent of the Earth's entire land mass, yet they account for nearly half of all the growing wood on the planet and are the home for two fifths of Earth's animal and plant species. It is because of the amazing diversity of species that the rain forests are so important to humans, for we rely on these for agriculture, medicine, and industry.

2 Impact Assessment Study Process

The symposium on Biological Evaluation of Environmental Impact, was organized by the President's Council on Environmental Quality (CEQ) and hosted by the Ecological Society American Institute of Biological Sciences in June 1976 at Tulane University.

The symposium on Biological Evaluation of Environmental Impact, was organized by the President's Council on Environmental Quality (CEQ).

Critical attention was directed at new trends in techniques.

2.1 Ecologists Voice Views

This symposium focused on how the biological significance of environmental impacts can be both evaluated by ecologists and described to decision-makers in the environmental impact assessment process.

- Perhaps the two most difficult questions that biologists repeatedly face in assessing environmental impact are also the two most important:
- How can the biological significance of environmental perturbations be evaluated?

How can these evaluations be meaningfully described in order to enlighten and influence public decision-makers in the environmental impact assessment process?

The National Environmental Policy Act of 1969 (NEPA) and similar laws and regulations in many states established the process of environmental impact assessment as a significant factor in public decision-making.

2.2 Overview of Concerns

The importance and value of this process, as well as its points of weakness, are well-known to the nation's ecologists—a sizable number of whom have participated in it. The symposium permitted ecologists to voice their views on improving the process.

The difficulty to these questions (as well as their scope) is intimidating on both conceptual and practical grounds. Yet the development of new concepts and methods for evaluating and describing ecological responses to environmental damage is occurring at a rapid pace.

2.3 Authors with Diverse Views

This summary attempts to bring together some of the main ideas of the various contributors.

- Given the wide range of topics chosen by the authors, there is no attempt to synthesize the various ideas into a central theme.
- Also, since the various authors frequently disagreed in their points of view, it seemed unfair to pull together a set of recommendations from the individual papers, since it would not permit contributing authors with differing perspectives to rebut the collective result.

2.4 Current Thinking on Council

There were several goals to this symposium. The first was to facilitate the immediate exchange of information concerning the present state of impact assessment. This was accomplished at the 1976 AIBS meeting. Primarily, it aimed to present this state-of-the-art thinking to persons not then present. That is the purpose of these Proceedings. And thirdly, the CEQ staff wished to avail itself of the best current thinking on the topic for the Council's work on environmental assessment and monitoring.

The summarized concepts presented below do not constitute am endorsement of the ideas of the individual authors, but rather are offered as a means of stimulating further discussion and improvement

in our ability to evaluate environmental impacts.

Recent legislation regarding the discarding of toxic wastes has forecast an increase in budgets for studies like the offshore baseline study.

2.5 Philosophical Overview

The environmental movement is an expression of social consciousness. An outgrowth of this movement has been a variety of environmental laws and regulations as well as a recognition that for long-term planning and policy formulation, long-term tracking of environmental trends is needed. Environmental assessment programs seek to satisfy these needs.

- Many of the papers in this symposium address specific methodology questions.
- Present cases studies, often discuss individual monitoring problems. This first group of papers sets a perspective for the whole assessment process.
- The authors place the technical process of data collection in the context of the scientific and societal framework from which the process sprang.

The conceptual basis for assessment is evolving. Several of the papers summarize earlier efforts. For example:

- Hinckley's contribution growing out of the Institute of Ecology's Environmental Impact Assessment Project is based on the assumptions that the principles and methods of ecological analysis are valuable for the assessment of technological impacts, and that a summary of ecological analysis methods may increase their application under the provisions of NEPA.
- What he states is needed is impact assessment at the ecosystem and regional level, with biotic diversity treated as a nonrenewable resource, rather than an analysis that consists of little more than a species list.
- However even though ecological analysis can help predict adverse impacts to human health and welfare, the prediction cannot be complete because of insufficient baseline information, the stochastic nature of ecological change, and the imperfect link between ecological effects and their socioeconomic consequences.

2.6 Contemporary Techniques

They call for the use of contemporary ecological techniques and complex models. Ecologists will have to fill gaps both on the applied and basic research level to meet the needs society has asked them to satisfy. They especially emphasize the relationship of health hazard levels of pollution to ecological damage as a subject demanding more exploration. They also call for a reexamination of the indicator concept, although perhaps at the community levels. In this regard they decry the presence of large species lists in EISs and call for adoption of a format which will be read by decision-makers so that environmental considerations enter into the planning process.

2.7 Model on State Level

The State of Michigan in an attempt to perform such an integration has several avenues to resolve environmental conflicts: legislated standards, the Environmental Protection Act, and the Michigan Environmental Review Board. Cooper uses his experience as Chairman of this Review Board in providing his views on environmental assessment. This Board's recommendations, which arise from review of impact statements, directly enter the administrative structure via the Governor's office.

Several precedents were set in the catchup phase for projects initiated but not completed prior to passage of the act:

a. the EIS was used to justify a decision already made,

a. alternatives were treated as strawmen, and

b. the process was regarded as something to be overcome rather than as an aid in planning.

At a federal level many of the difficulties of the EIS process discussed by the authors of this symposium are a historical outgrowth of the initial implementation of the National Environmental Policy Act. Smythe and Flamm of CEQ review this history, pointing out both past progress and future potential. During the first two years of NEPA, the courts emphasized procedural rather than substantive issues, as a partial result of which the bloated EIS originated as a defensive reaction to these decisions.

2.8 Cross Agency Studies

With the advent of the environmental movement, and particularly in response to the National Environmental Policy Act and other legislation, the environmental baseline study has become an accepted element of many federal resource development and environmental protection programs.

Currently, baseline studies conducted by various governmental agencies or required by regulations address a wide range of environments, resource developments and potential impacts. They include: terrestrial, freshwater, and marine ecosystems.

2.9 An Accelerated Program

As part of an accelerated program to develop geothermal resources in the western United States, U.S. Geological Survey regulations require a one-year environmental baseline study prior to initiation of geothermal production from federal leases. Bureau of Land Management lease stipulations governing a prototype oil shale development program in Colorado and Utah require the lessees to conduct two-year environmental baseline and monitoring studies prior to initiation of development. The Department of the Interior has initiated an accelerated program to lease and develop Outer Continental Shelf oil and gas reserves in response to national energy needs. During the last two years, as part of that program, the Department's Bureau of Land Management has funded a wide ranging series of marine environmental baseline studies extending around the coasts of the United States from the Beaufort Sea in Arctic Alaska to the South Atlantic.

2.10 Continental Shelf Studies

An Environmental Protection Agency program to regulate ocean dumping of wastes has generated baseline surveys of various dump sites ranging from locations on the Outer Continental Shelf to a deep water dump site at the edge of the mid-Atlantic Continental Slope at depths extending to almost 3000 meters. The State of Washington is undertaking a program of baseline studies of Puget Sound in advance of transshipment of Alaskan oil.

2.11 Objectives of SCEP Study

The 1970 Study of Critical Environmental Problems (SCEP) was a pioneering effort to focus interdisciplinary attention on problems of measuring wide-scale environmental change. The Conference's Work Group on Monitoring discussed baselines as follows: "... our report is concerned not only with monitoring in its sense of providing warnings of critical changes but also with measurements of the present state of the system (the 'baseline')..."

The report stated, "We recommend early implementation of a set of ecological baseline stations in remote areas that would provide both specific monitoring of the effects of known problems and

warnings of unsuspected effects."

2.12 Components of Sampling Program

In describing the components of a proposed ocean baseline sampling program as a precursor of a monitoring program to detect long-term oceanic changes the report stated, "... both one tome and continuing surveys are needed: these surveys will help us establish a baseline for analysis." Program components reviewed

Major resources are being committed to such investigations. For example, the fiscal year 1977 budget of the Department of the Interior requests $55 million for the Bureau of Land Management's Outer Continental Shelf study program described above.

a. The costs of establishing baselines for prototype oil shale development programs have been estimated at between $12 and $18 million.

a. A conservative estimate perhaps $10 to $15 million has been spent by the electric utility industry in collecting baseline and related environmental data on the Hudson River Estuary.

Large numbers of scientists in many disciplines are involved in baseline studies. In Alaska the magnitude of federally sponsored marine baseline studies seems to be straining the supply of qualified personnel and suitable research vessels.

2.13 Heisenberg Principle

In some areas on the Northern Great Plains, so many scientists are crisscrossing the land in pursuit of baseline data that local ranchers have invoked the Heisenberg Principle, observing that the studies may create more environmental disturbance than the projected coal mining.

- In short, the environmental baseline study has assumed major importance. Heavy reliance is being placed upon baseline studies to help decision-makers meet the intent of NEPA and other environmental regulations.
- These programs are being justified as necessary to prove understandings which can help minimize environmental impact of various developments and reconcile the inherent conflict between environmental protection and economic development that has become a major public policy issue in recent years.

2.14 Freeze on Fisheries Stick

In addition, for many of the large ecosystems under study, such as remote marine areas whose investigation requires expensive equipment and logistic support, current support for baseline study programs represents an unprecedented opportunity to develop synoptic, interdisciplinary approaches which can add to our fund of information and understanding.

Thus, at a time when usual federal sources of research support are relatively limited, these study efforts are of added importance to ecologists.

2.15 Legal Lures for Local Grants

At the same time, there is considerable evidence of concern about the utility of the baseline study approach. For example, the Department of the Interior has established an Outer Continental Shelf Environmental Studies Advisory Committee to provide scientific advice concerning its environmental studies program.

An evaluation of baseline data being collected on the prototype oil shale leases has pointed to the need for more precise data guidelines to assure that a scientifically sound program will emerge for monitoring potential environmental changes (Fish and Wildlife Service 1976)

The adequacy and value of extensive baseline studies conducted for evaluation of power plant impact in such coastal systems as Chesapeake Bay and the Hudson River Estuary[1] continues to be questioned. For over two years the scientists on this Committee have continued to debate the rationale of the baseline study approach with seemingly little agreement.

- Clark and Brownell (1973) for example, state that large sums of money have been wasted on power plant baseline studies.

A recent editorial in Science (Schindler 1976), while not referring specifically to baseline studies, decries the ineffective design and execution of many environmental impact studies, citing an emphasis on indigestible descriptive data.

- Several key issues underlie these debated and criticisms. They are:

a. What role should baseline studies play in the evaluation of environmental impact?

1 ·Refer to the Chesapeake Bay and the Hudson River Estuary reports of 1978 through 1989

a. What are some important considerations governing the design of baseline studies?

b. How should baseline studies relate to some of the other approaches to evaluation of environmental impact?

Subsequently, the need or establishment of environmental baselines has received attention at the 1972 United Nations Conference on the Human Environment and follow-up efforts to implement a Global Environmental Monitoring System (NAS 1976).

This concept of baseline studies has also been incorporated in various federal documents and requirements. The Coast Guard's 1975 "Guide to Preparation of Environmental Analyses for Deepwater Ports," for example, refers to "...comprehensive information on the basic human and natural conditions which constitute the area's 'pre-deepwater port' environment. Baseline environmental information must be provided for the area which may be affected by the deepwater port project to establish existing background levels and conditions so that future changes can be ascertained."

The Bureau of Land Management's Oil Shale Lease (1974) states: "The lessee shall compile data to determine the conditions existing prior to any development operations under the lease and shall, except as provided below, conduct a monitoring program before, during and subsequent to development operations. The Lessee shall conduct the monitoring program to provide a record of changes form conditions existing prior to development operations, as established by the collection of baseline data..."

2.16 Proposed revisions

Proposed revisions to Environmental Protection Agency Ocean Dumping Regulations and Criteria (1976) currently undergoing review describe baseline surveys of ocean disposal sites as follows:

"The purpose of a baseline or trend assessment survey is to determine the physical, chemical, geological, and biological structure of a proposed or existing disposal site at the time of the survey. A baseline or trend assessment survey is to be regarded as a comprehensive synoptic and representative picture of existing conditions; each such survey is to be planned as part of a continual monitoring program through which changes in conditions at a disposal site can be documented and assessed."

I have been unable to find a relevant dictionary definition of the word "baseline." However, a reasonable definition of the baseline concept as used by the highly qualified SCEP scientist and as reflected in a number of federal guidelines would be, "A description of conditions existing at a point in time against which subsequent changes can be detected through

Descriptive information is required for both predictive and post hoc assessments, but the attributes of the information needed for each purpose are somewhat different. I believe that many descriptive studies of large scale ecosystems conducted under the broad aegis of "baseline" address neither set of attributes well. Therefore, it may be useful to distinguish between two interrelated but distinct study approaches conducted for the purpose of describing ecosystems subject of impact: (1) ecological characterization, and (2) baseline and monitoring studies.

2.17 Key biological processes

Clearly, as an early step in the environmental impact assessment process, efforts must be made to understand the most salient features of the ecosystem involved. Brown concludes that identification of key biological processes such as climatic conditions and transport mechanisms, and environmental hazards such as storms, floods or earthquakes should also be assessed.

This kind of information will provide at least an initial basis for predicting some of the anticipated impacts of development. For example, in its Outer Continental Shelf Oil and Gas Leasing Program, the Department of the Interior is currently using information on distribution of important biota; prevailing wind and current patterns; and probability of storms, earthquakes or other spill-inducing hazards in risk analyses which can be used to exclude particularly hazardous tracts from development.

The need for good reconnaissance information of this type is well-recognized. However, descriptive information on large-scale ecosystems could prove more meaningful if structured to accomplish what I will term "ecological characterization." An ecological characterization is a description of the important components and processes comprising an ecosystem and an understanding of their functional relationships.

The characterization should address such major elements as:

- physiography and geology
- climate
- physical transport mechanisms such as hydrology, sediment flux, physical oceanography (in the case of marine systems)
- atmospheric transport

It should describe: the important species, and communities and populations in the study area, with

particular emphasis on those organisms perceived as being of importance to man or critical to the functioning of the ecosystem.

2.18 Elements of Impact Assessment

The characterization should also address trans-boundary effects—that is the relationship of influences outside the ecosystem on the system itself. Ecological classification systems bases on hierarchical concepts, combined with conceptual ecosystem modeling, should help provide a more structured approach to the definition of reasonable study boundaries. Some of the follow-up studies required after the initial characterization may be straightforward inventories, needed to fill gaps in descriptive information. Frequently, more dynamic study approaches will be indicated. For example, this may involve development and verification of functional predictive models for specific system interactions or controlled ecosystems experiments. As studies such as these are completed, the initial characterization can be upgraded and refined.