1 Field Study of Impact Redeployment

1-1 Introduction to field model

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

Critical attention was directed at new trends in techniques and considerations that are more methodological in their nature.

1-1.1 National Environmental Policy Act

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.

1-2 Symposium focus

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.

1-3 Summary of contributors

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

a. Given the wide range of topics chosen by the authors, there is no attempt to synthesize the various ideas into a

central theme.

b. 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.

This was a symposium, not a workshop. 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. 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.

1-3.1

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.

While many of the papers in this symposium address specific methodology questions, present cases studies, or discuss individual monitoring problems, this first group of papers sets a perspective for the whole assessment process because that 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:

® Sander'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.

1-4 Chalmers on socioeconomics

® Presidential consultant, Chris Chalmers' Ph.D. states, "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.

1-5 Ecological damage

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.

1-5.1 Michigan Environmental Review Board

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.

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. Several precedents were set in the post-NEPA 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, (b) alternatives were treated as strawmen, and (c) the process was regarded as something to be overcome rather than as an aid in planning. 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.

1-6 Advent of new policy

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:

a. terrestrial,

b. freshwater,

c. and marine ecosystems.

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.

1-6.1 Resources consumed

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.

- 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. 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.

1-6.2 Equipment needs detailed

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.

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. For over two years the scientists on this Committee have continued to debate the rationale of the baseline study approach with seemingly little agreement.[1] 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

1 ·Many of these discussions are documented in the minutes of the Department of the Interior's OSC Environmental Studies.

evaluation of power plant impact in such coastal systems as Chesapeake Bay and the Hudson River Estuary continues to be questioned.

® 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.

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

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

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

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

1-7 Role of baseline studies

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."

1-7.1 Ocean baseline 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."

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…"

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.

1-8 Ecological Characterization

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. This includes such features as the biological resources important to man (e.g., fish, bird and mammal populations, endangered species) and particularly important components of their habitat (e.g., breeding, spawning and migratory areas). It includes identification of key biological processes such as climatic conditions and transport mechanisms. 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:

a. physiography and geology;

b. climate;

c. physical transport mechanisms such as hydrology, sediment flux, physical oceanography (in the case of marine systems), and

d. 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.

® Population estimates can be approximate but they should attempt to address the extent and cause of natural variability.

The characterization should describe: ecological processes, such as trophic relationships, food chains, and energy flows, particularly those considered to be or known to be controlling.

It should describe social and economic features of the area (e.g., population distribution, land use, industrial development), and address significant man-induced or natural influences on the ecosystem such as successional processes, existing man-made modifications and extent of pollution.

The characterization should also address transboundary effects—that is the relationship of influences outside the ecosystem on the system itself. Ecological classification systems based on common 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.

Introduction

Environmental problems result from man-made insults associated with the design and management of synthetic, engineered systems nested within the natural ecosystems.

Legislative Standards:

As a "bug picking zoologist," my understanding has come not from formal academic education, but rather from the empirical experience as chairman of the Michigan Environmental Review Board of the State of Michigan. Currently, there exists three alternative mechanisms to resolve environmental conflicts in our state. For those classes of environmental issues where the mechanisms are known and stimulus-response curves have been scientifically established, rules and regulations can be embodied in legislation and enforced by traditional activities. In general, damage functions must be directly observable and easily measured. Legislation was adopted in 1971 through the efforts of Dr. Joseph Sax, law professor, and Tom Anderson, state legislator, that makes it legal for a citizen to sue any federal, state, industry, municipality or other individual for something called "unreasonable pollution." Furthermore, "unreasonable pollution" was purposefully not defined.

If formal standards do exist, they can be utilized as baseline measurements of reasonable behavior, otherwise the judge may set standards based on social necessity. The wet

lands were classified into types, mapped and areal extents determined. Total vegetated wetlands in Willapa Bay and its contiguous drainage area were estimated to be about 6,000 hectares. Of this total, about 2,500 hectares have been diked for various purposes. Some of the diked areas remain as agricultural grasslands still under some tidal influence, while others have been filled to become uplands. All are partially or even wholly removed form directly interacting as a part of the estuarine ecosystem. For more information , refer to Table 1 regarding Elements of Environmental Impact located on page 9.

Projections in Table 2 were developed directly in response to pressures to quantify impacts on natural systems.

Lack of specific information and hesitancy to project or extrapolate data is easily interpreted as a lack of real significance by the non-biologist. The complexity and interrelatedness of a natural system cannot be conveyed easily in the context of a typical study exercise. This last question is exemplified in the above table of biomass data. The next question we will have to deal with requires contrasting the relative amount of affected biota to that of unaffected biota. Loss of several thousand Dungeness crabs to a hopper dredge in an embalmment during one day's dredging should sound significant.

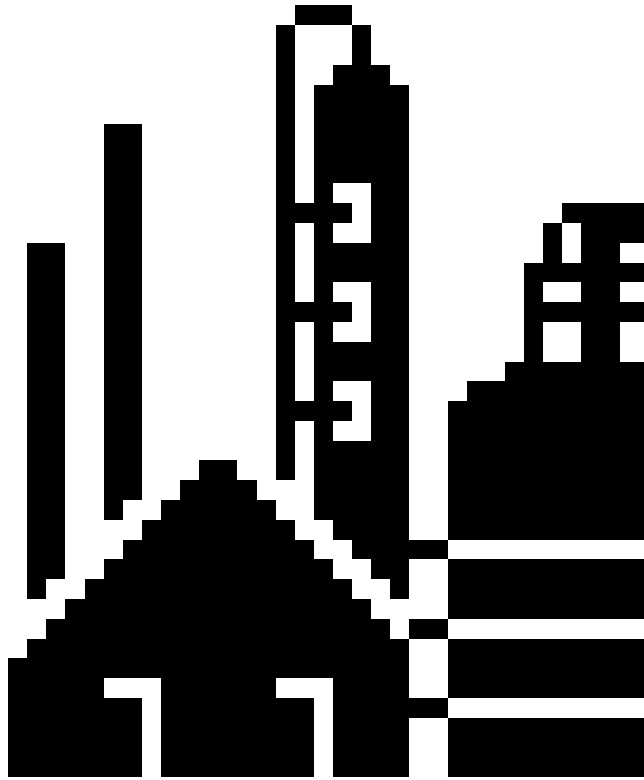

Table 1 Elements of Environmental Impact