

SOCIAL SCIENCE LITERATURE ON THE ENVIRONMENT:  
REVIEW AND PROSPECTS FOR ENERGY STUDIES

A PRELIMINARY LITERATURE SURVEY

Paul Sommers

---

Mapping Project on Energy and the Social Sciences  
Institution for Social and Policy Studies  
Yale University  
New Haven, Connecticut 06520

1975

**MASTER**

Prepared For

THE U.S. ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION  
UNDER CONTRACT NO. EE-77-S-02-4287.A000

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

## DISCLAIMER

**This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.**

## **DISCLAIMER**

**Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.**

SOCIAL SCIENCE LITERATURE ON THE ENVIRONMENT:

REVIEW AND PROSPECTS FOR ENERGY STUDIES

A PRELIMINARY LITERATURE SURVEY

Paul Sommers 1975

NOTICE

This report was prepared as an account of work sponsored by the United States Government. Neither the United States nor the United States Energy Research and Development Administration, nor any of their employees, nor any of their contractors, subcontractors, or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness or usefulness of any information, apparatus, product or process disclosed, or represents that its use would not infringe privately owned rights.

N O T I C E

This report was prepared as an account of work sponsored by the United States Government. Neither the United States nor the United States Energy Research and Development Administration, nor any of their employees, nor any of their contractors, subcontractors, or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness or any information, apparatus, product or process disclosed or represents that its use would not infringe privately owned rights.

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED *ef*

Table of Contents

	<u>Page</u>
Abstract	i
Sociology	1
Political Science	7
Legal Studies	12
Economics	13
Environmental Psychology	20
Attitudes	25

1

## Abstract

Social Science Literature on the Environment: Review and Prospects  
for Energy Studies  
A Preliminary Literature Survey (Paul Sommers, 1975)  
Mapping Project on Energy and the Social Sciences  
Institution for Social and Policy Studies  
Yale University

Much of the social science literature on environment is of recent origin and represents the response of the social science research community to a complex societal problem in which technology is a major factor. Energy represents another such problem to which the social science research community is now turning its attention. Because energy problems and environment problems have some similarities and because energy conversion processes have large effects on the environment, a review of the social science literature on environment was undertaken. The purposes of this review are as follows:

To study the possible utility in energy research of some of the concepts developed in social science research on the environment.

To study the possible utility in energy research of some of the methodologies utilized in social science research on the environment.

To study the extent to which the results of social science research on the environment have contributed to the development of policy.

The first two items above receive major attention in this preliminary literature survey. It is found that numerous concepts and methodologies from social science research on environment problems are relevant to energy problems. Among these are the following:

Studies of public opinion, public awareness, and public participation in policy development.

Studies of attitudes, beliefs, and behavior of individuals in environmental matters.

Studies of the roles of organizations (communities, interest groups, the media, scientists, government agencies, etc.) in policy development.

Comparisons between centralized and decentralized water management systems.

This study should be pursued further to determine which portions of the social science research effort on environment are most relevant to the development of policy in the field. The results of such a study should be helpful in the planning of social science research on energy problems.

The social science literature on the environment is vast. One notable bibliography of this literature contains nearly 5000 entries (Morrison, 1970). Thus this review will rely heavily on review articles, especially two volumes of reviews which contain many suggestions for further research (Downing, 1971; James, 1974). Review articles are inevitably out of date as soon as they are published. An attempt to bring the review up to date is made by discussing a selection of very recent works.

There exist many books of readings and research monographs on environmental questions. Few of the readers are policy oriented (c.f. Burch, Cheek and Taylor, 1972; Moos and Insel, 1974; Proshansky et al., 1970). All of these works fall into the category of "small think" social science. There also exist collections and original works with a grand, ecological, (and usually) doomsday perspective (Anderson, 1970; Goldsmith, 1972; Meadow et al. (1972); and Roos, 1971). These "big think" works are passed over in the discussion below.

Instead emphasis is placed on policy and research oriented works which generally assume an institutional and social context not too radically different from the present situation. The review will progress by discipline since this is how the review articles are organized.

### Sociology

The sociological research on air pollution has been reviewed by

Molotch and Follett (1971). Much of the sociological interest in environmental questions grew out of the human ecology tradition which flowered in the 1920's. This school views man in a physical habitat and associates patterns of human behavior with significant features of the habitat. Emphasis was usually placed on men's relationships with other men, and attention was given to the environment only as it affected human relationships. This conceptualization of the environment is essentially passive; the physical features channel behavior into particular locations.

Beginning with Duncan more attention was given to the environment itself as an important interrelated entity in the man-environment complex. Duncan views this complex as having four important aspects or categories by which events in the man-environment complex can be analysed: Population (P), Organization (O), Environment (E), and Technology (T). By means of arrows from one category to another, the dynamics of an event are indicated. An example given by Molotch and Follett (1971, p. 18) is that of the invention of the atomic bomb which made the previous organization of armed nation-states either obsolete, or a threat to the survival of the human species. That is,  $T \rightarrow O$ , or  $T \rightarrow E \rightarrow P$  are the two possible dynamic sequences. A less lethal source of air pollution, the automobile, can also be analysed in this way. More people results in more automobiles which further pollute the atmosphere ( $P \rightarrow T \rightarrow E$ ). The response to this pollution might be a curtailment of driving by legal means ( $\rightarrow O$ ) or the creation of new social institutions and new technology to control

pollution while allowing people to continue driving private vehicles ( $\leftrightarrow O \rightarrow T \rightarrow E \rightarrow P$ ). According to Duncan, the use of arrows linking categories is suggestive of cause, influence or response, and they indicate directions for future research.

Some of the research efforts reviewed by Molotch and Follett have addressed the question of what people want from the economy and from the environment. Gallup Opinion Polls in 1970 indicated that people were willing to pay higher taxes or reduce space, defense and foreign aid spending in order to increase spending on preservation of natural resources. Other research has found that people do not know how they could, or why they should, become personally involved in resource management or pollution control programs.

The annoyance and health effects of air pollution have been investigated in several communities. Molotch and Follett mention several studies. Extensive evidence comes from two recent efforts conducted in Manhattan, New York (McCarroll, et al., 1965; Cassell, et al., 1969) and from Nashville, Tennessee (Zeidberg, et al., 1961, 1964). Both of these multi-disciplinary efforts found evidence of higher incidence of certain respiratory diseases in highly polluted areas. Suggestions of higher incidence of cancer was found in the Nashville area, whose pollution problems stem from industrial and residential combustion of coal. Residents of the polluted areas seldom took direct corrective actions such as moving out of the area, however.

Molotch and Follett mention a study by Gold (1970) which

involved interviews with a random sample of Californians. Fifty-nine percent of the sample picked air pollution as one of the three most serious public problems; 63% picked crime in the streets. Thus air pollution is perceived as a quite serious problem by the residents of the Golden State.

Other studies suggest a link between social class and perception of air pollution as a problem. Professional, managerial and in general higher income persons are more likely to report that air pollution is a significant problem than other segments of the population.

Molotch and Follett make a number of suggestions for further research. Surveys are recommended to ascertain the characteristics of people who complain about air pollution, and the awareness of the public as to the nature and effects of air pollution. Studies of community organizations are recommended to find out what sorts of voluntary groups are effective in influencing legislation, mobilizing the public and changing polluters' behavior; and to discover what community strategies are effective in combating pollution. Studies of interest groups and power structures are needed. Regulatory agencies and administrative structures should be examined to chart the career routes of regulators, social processes of administration, and institutional structures.

Sociological research on water management is reviewed by Johnson (1974). The TVA was perhaps the first significant object of study by sociologists in the environmental field. Selznick's study of the TVA suggests that its success was due to its ability

to informally co-opt county agricultural extension service, city government and agricultural cooperative officials, thus gaining significant support from the communities it served. Other observers have concentrated on the large scale planning and coordination that characterized the TVA, and have lamented the fragmentation and overlapping of jurisdictions that exist in most other water management areas. Johnson notes some unsettled issues: What is the environmental effect of large scale centralized authorities over water systems versus small scale decentralized authorities? How can economic re-distribution to the poor take place within a large scale system? Is such a system more or less responsive to changing social needs than small, decentralized management authorities working closely with local governments?

Public participation in development of water resources has been stressed by many sociologists. Some have concluded that the general public is not very well informed about water or other natural resource problems. Public acceptance is more likely if the public is involved in the crucial decisions in the development of a water management system. Mass media campaigns are necessary to generate interest in a project. The local political structure and civic groups should be contacted. Key financial and political leaders must be consulted. These steps are necessary to secure referendum approval or elected officials' consent for a project.

Reservoir construction has a variety of effects on local residents. Some are forced to move because their homes are situated in

the lake-to-be. The psychological and economic disruption suffered by those forced to move their homes or businesses are seldom included in the cost-benefit calculations by which dam construction is typically rationalized. Local political structures may be affected over a long term, and permanent economic changes may result, especially if the towns in the area near the reservoir are small relative to the size of the dam work force and relative to the size of the local economic stimulus provided by the dam. Further research is needed to ascertain what types of inter- and intra-community organization facilitates or hinders integration and community development in response to construction of a water system.

Recreational uses of water have been studied recently. Boaters, campers, fishers and hunters have all been scrutinized by sociologists. Water recreation seems to be growing at a rate faster than the rate of population growth. Most participants in water recreation are from the middle and upper classes. Lower classes seem to more often patronize playgrounds, parks and amusement centers in urban centers. Fishermen tend to be more often married, older, better educated and from urban areas than hunters.

Water pollution is a recent concern of sociologists. Value systems of the public make pollution problems especially intractable. Many people think that air and water are no one's particular responsibility, and that each person has a right to use air and water. Private enterprise and private property are respected and protected, even when the enterprise pollutes or the property precludes public access to a natural resource. The value placed on freedom, practicability,

pecuniary worth, science and progress result in resentment of water use regulation according to Rabel Burdge (see Johnson, 1974, p. 186). The notion of progress needs to be revised if environmental pollution is to be stopped. Creative activities instead of material consumption activities need to be more highly valued by the population.

Research is needed on public attitudes toward pollution and polluters. What is the public willing to give up in order to get cleaner water? How can information about pollution and pollution control be disseminated to a relatively uninformed public? What ecologically compatible concepts are needed to replace the values currently placed on growth and progress? How can conflict between environmental interests and other values and goals of society be avoided or channeled into constructive ends?

Recent research that could be classified as either sociology or perhaps environmental psychology is reviewed below in the environmental psychology section. In particular, leisure activities research has been going forward at a great clip.

### Political Science

Loveridge (1971) found very little legitimate political science research on air pollution, i.e., serious research using established scientific methodology and conducted by persons with professional credentials in political science. In his estimation only one work stands out: Davies' (1970) primer on air pollution politics. It should be noted that even Davies fails Loveridge's requirement for

credentials; he is a former Bureau of the Budget examiner. According to the preface to Davies' book, it is an application of standard political science techniques to the pollution legislation and management questions at the national level. Note: a recent and concise history of water and air pollution legislation and enforcement experience can be found in Kneese and Schultze (1975).

According to Loveridge, policy analysis has contributed to the understanding of how pollution control legislation is initiated, passed and enforced. The structure within which U.S. environmental policy is formulated is important to bear in mind. Power is decentralized to a great extent; states, counties and municipalities share power with the federal government in environmental matters. Policy changes are almost always incremental and non-drastic as a result of this fragmentation of power. Culture also constrains policy. The population's significant values and attitudes may limit the range of policy approaches that can be considered.

Various types of participants in policy decisions have been identified. The general public is out there, somewhere, but as Loveridge says, "it consists of citizens who are neither well informed, nor deeply motivated, nor particularly active...Even if highly motivated, most citizens lack the wit and means to make the case for specific environmental policy programs" (Loveridge, 1971, pp. 52-53). Interest groups are widely recognized political entities. They include voluntary citizen's groups in local areas (Stamp Out Smog and Group Against Smog Pollution in Southern California),

national conservation groups (Sierra Club), professional and service groups (Tuberculosis Association, League of Women Voters), and business organizations. The effects of these groups on the policy process, if any, is a subject for further research. The characteristics of effective and ineffective groups need to be delineated, and the types of internal organizations utilized need to be studied.

The media certainly affect the policy process. In fact, some have said that the media are more important than interest groups in terms of impact on policy. Studies of the impact of media on environmental questions would be very helpful both to scientists and policy-makers.

Scientists themselves have often had an input into policy making. Loveridge suggests that little coordinated research is being done on environmental questions and that this limits the potential impact of scientists in the policy process. To be really effective participants in the policy process, scientists must make their findings understandable, coherent and politically relevant.

An example of the problems and shortcomings of scientific participation in policy making is provided by Nelkin (1971). The proposed construction of a nuclear power plant at Cayuga Lake in New York led to a variety of types of participation by the academic community of nearby Cornell University. The disagreements and conflict within the scientific community contributed to the community controversy over the plant, and confused and obfuscated the issues as much as contributing constructively to the discussion.

Finally government agencies administer policy and in so doing are crucial to the effectiveness of policy. Agencies have been extensively studied and their shortcomings are well known. Each has only a limited responsibility. They must bend with the political wind to insure survival. Each must compete with other agencies with whom they share responsibility at the same and other levels of government. Some may provide more benefits for the organizations they were set up to regulate and oversee than for the general public whose interests they are supposed to protect. Few become advocates of sweeping reform; most are supporters of creeping incrementalism no matter what the objective situation calls for.

These five types of policy participants suggest orientations for future research. The attitudes and responses of the public to air pollution could be more extensively investigated. The extent of public support for particular policies should be known to those responsible for legislating and implementing policy.

The effectiveness of control agencies needs further investigation. What are the effects of organizational characteristics on performance? What effect does the social and political environment have on agencies? Alternative control structures and methods need to be considered.

Hart's (1974) review of the interface between political science and water management classifies management systems by the type of decision process used. The Dahl-Lindblom categorization is used. The categories are market allocation, bargaining among

leaders, hierarchy, and polyarchy (control of leaders by non-leaders; through elected representatives).

Use of the market process is severely limited in water management due to the presence of pervasive externalities. Where externalities can be internalized by tax or subsidy schemes, market mechanisms may be possible and desirable in water management.

Bargaining processes are characteristic of most regulatory agencies. The agencies do not represent "a government of laws, not of men," but rather a bargaining process between the regulator and the regulated industries. Many kinds of bargains between industry and agency have been described (Hart, 1974, p. 133).

Early water resources research in the 1950's tended to recommend unified hierarchical management systems. The new interest in ecological issues has been accompanied by a waning of interest in hierarchy, which many political scientists thought to be an inappropriate structure for broad ecological management tasks. The study of roles, administrative careers and interpersonal relationships has been emphasized rather than the design of hierarchy in recent years. Associations among individuals or groups in an administrative agency may provide the key to understanding how organizations function and their relative effectiveness in managing natural resources.

Polyarchy became a relevant category in the late 1960's as greater citizen awareness of pollution problems began to result in Congressional action on sewer treatment plants and as the

Corps of Engineers faced increasingly stiff and effective opposition to the traditional dam and harbor construction projects.

Fluoridation has been studied in this context of citizen awareness and opposition to environmental management initiatives from leaders (see Crain et al., 1969; Crain, 1966). Study of the internal politics of Congressional committees and of the effect of the public on committees is important to understanding of polyarchical decisions; additional effort is needed in this area.

The increasing importance of polyarchical decisions as a result of an increasingly aware and aroused citizenry leads to a need for institutionalized polyarchical decision arenas. Congress is one such arena; other possible ones include water basin commissions or associations, metropolitan water authorities, and inter-governmental bodies carrying out nationally or regionally defined policies. Hart suggests that these candidate-arenas be examined for their responsiveness to their constituencies and their stability over time. The intensity and perseverance of public interest in pollution also needs to be evaluated, since it is this interest which leads to the necessity for additional decision arenas.

#### Legal Studies

Krier (1971) examines the legal environment of air pollution in detail. The interface between legal property rights and the economic analysis of air pollution is examined closely. There is a strong implication that any economic analysis of air pollution

must be aware both of the existing legal context, and of the effects of a change in that context. The legal environment is constantly changing; hence economists and legal scholars should deliberately consider alternative legal contexts in designing pollution control programs. The attractiveness of using a pricing program versus a regulatory approach depends on the legal context assumed, for example.

Recent legal research in the Natural Resources Journal has fulfilled many of the research suggestions outlined by Krier. One notable issue of this journal is the Coase Theorem Symposium (Natural Resources Journal, v. 13, 1973).

#### Economics

Anderson and Crocker (1971) begin their review of the economics of air pollution by noting two theoretical constructs often mentioned in relation to pollution problems. First, air quality is a superior good, i.e., as people become more affluent they tend to demand cleaner air. Air pollution is therefore likely to become increasingly important as a social problem in the future. Secondly, air pollution is a difficult problem for economists because it and its opposite, clean air, are public goods. Public goods are ones which no one can be prevented from consuming if produced. Public goods cause problems for theoreticians, especially if they are available to large numbers of people or constitute a significant proportion of a country's economic activity. No one individual has an incentive to contribute

towards the provision of a public good since if his neighbor bears the cost he will benefit anyway. A market system would consequently tend to provide too little of the public good. A government which undertakes to provide the good will face great difficulties in deciding what level or quantity of the good to produce.

Anderson and Crocker discuss the notion of informational, contractual and policing costs (ICP costs). These costs are distributed partially by means of the legal system and partly by economic characteristics of the situation (e.g., numbers of participants on each side of a market). ICP costs tend to be asymmetrically distributed between emitters and receptors of pollution. For example, a stationary river polluter may affect thousands of downstream river users who would face great costs in getting together to bargain with the polluter. On the other hand, automobiles number in the millions and pollution control agencies face formidable problems in enforcing continuous compliance with regulations affecting automobiles and their operation (in California smog devices are commonly disconnected by home mechanics to increase gas mileage and performance; the national 55 m.p.h. speed limit is currently ignored).

Research on air pollution control might proceed by considering the legal and social constraints on the economy, on pollution emitters and on pollution receptors. If alteration of these constraints by legal or other means is possible, and if such alteration could affect outcomes, for example, by re-distributing ICP costs, then lawyer-economist-sociologist teams could work together to find the

optimal set of constraints. The economists' preferred criterion for "optimal" would be minimization of the sum of social costs due to pollution damage, pollution control and resource use. The last item may cause some difficulty since there may well exist tradeoffs between minimizing the costs of pollution and minimizing the use of physically scarce resources, particularly where prices are regulated and cannot be depended on to allocate resources properly.

Use of some minimization criterion would at least allow the identification and elimination of socially inefficient programs with generally higher costs for a given standard of air quality. Some people have alleged that current regulatory programs would be eliminated by this type of criterion.

Studies of pollution emitters by engineers have focused on the capital costs of control or abatement, usually at the very end of the production process. One could attack this problem by considering input modification and alternative production processes and technologies. A synthesis of engineering studies is needed to generate the economists' favorite analytical tools, production functions and cost curves (c.f., Dorfman and Jacoby, 1971).

Studies of emitters are recommended in the following areas: effects of industrial structure on pollution behavior, determinants of a business's willingness to spend money on "non-productive" pollution control equipment, differential effects of subsidy, tax and regulatory programs, economics of recycling, effects of control efforts on structure of industries, human capital development

needed to implement control programs, emergence of pollution control consulting and equipment manufacture businesses, incidence of the burden of control on consumers and manufacturers, and inter-industry effects of control efforts.

A recent development in environmental economics is the use of quantitative macroeconomic models to simulate the effects of control strategies. This more general approach is desirable due to the possibilities for "passing the buck" in pollution control. Air pollution control efforts can result in water or thermal pollution as industries install scrubbers on smokestacks. Simply building a taller smokestack can transport the air pollution out of the regulated region sometimes. A control program can result in a net loss or gain in GNP or in local employment and income, and in net resource use in the economy. Two types of analyses have been conducted to control for such effects: input-output (I-O) studies and econometric forecasting models. Ayres and Kneese (1969) use the I-O approach. Rose (1970) uses the forecasting technique. An interesting but very complex effort by Hudson and Jorgenson (1974) suggests the possibility of combining these two approaches by linking an I-O model to a forecasting model. The I-O model provides the input to the forecasting model, which then generates the bill of final demands for the next round of the I-O model. Together they trace out a time path for several economic sectors. Hudson and Jorgenson deal with energy questions and the role of tax structures as they affect demand, but their approach seems like

a logical extension for the air and water pollution literature.

Legal systems as they affect the economics of pollution have been studied by political scientists, lawyers and economists. There is a suggestion for further research by Anderson and Crocker on the hypothesis that current pollution control laws and agencies provide emitters with advantages over receptors.

The use of effluent charges as a control instrument ignores the very real information constraints faced by control agencies. An optimal set of effluent charges may be impossible to devise when all costs and benefits are not known, including ICP costs. Typically many of the benefits and most of the ICP costs are unknown, posing a practical problem of great significance to control agencies.

Efforts using mathematical programming and combined meteorological-economic models are another recent development of note. Programming models of production and cost alternatives for air quality regions or control agencies have been developed. Meteorological models can predict the diffusion of a pollutant throughout a region and the costs of different air quality patterns can be assessed using such models to evaluate the effects of a control program. Most such models are for single pollutants; at least one effort has been made to use a multi-pollutant model. Anderson and Crocker feel that the linearity assumption imposed in both single and multi-pollutant models is a severe restriction in terms of empirical reasonability. The assumption is necessary, however, to make the problem computationally tractable.

Smith's (1974) article on economists' contributions to water

resource development first considers the notable theoretical and empirical developments. Briefly, the benefit-cost analysis was developed with notable contributions by Eckstein, Hirshleifer and associates, and Arrow and Kurz. Water system development and water quality problems have been dealt with extensively, especially by Kneese and associates. The interface between law and economics has been explored in relation to water management problems. A newly important analytic technique is I-O analysis, which has been used to analyse the effect of a water management program on economic activity in a large area.

Further research is recommended on production relationships. Environmental quality and other non-marketable concerns are of increasing importance, but are difficult to handle in either a benefit-cost or I-O framework. Further theoretical and empirical work is indicated in this area. Economic simulation studies need to be integrated with non-economic simulations (e.g., ecological, engineering) in the increasingly popular field of systems analysis.

A holistic approach is needed. Water management should not be considered in isolation from other resources, and from other national goals. River basins need to be considered as a whole. Individual dam projects have been the usual unit of analysis in the past, since economists were often used as in-house experts to justify the construction of a concrete edifice whose foundations had already been laid. A wider range of alternatives should be considered. Where a holistic analysis may have recommended purchase

of floodplain land in preference to dam construction, a narrow cost-benefit approach has often been used to justify building a dam.

Subsidizing an upstream factory to get it to change its production processes or its inputs may be preferable to building a municipal water treatment plant, even though the political climate may favor building the treatment plant. In evaluating a wider range of alternatives, economists should be aware of the need to integrate management systems so as to provide for many different uses of water, of newly discovered ecological constraints on resource use, and of new technological solutions to old problems.

Recent economic studies on environmental questions have emphasized the legal context of the problem (Tietenberg, 1974; Raymond, 1974) and the theoretical construct of externality (Kneese, 1970; Stroup and Baden, 1973). One article has considered the effectiveness of pollution taxes as an abatement mechanism. Dorsey (1973) notes the discrete nature of the technology for controlling water pollution. In a case study of the Wisconsin River he identifies four types of plants and four resulting levels of water quality which could be realized. This discreteness raises problems for effluent charge theories, since they must assume continuous response functions in order to analytically arrive at a least cost solution for a given level of water quality. It is likely that single effluent or zoned effluent charges would result in an inefficient, higher cost solution to the pollution control problem as a result of the discrete technology.

It should be noted that economic theorists do not assume single effluent or zoned effluent charges to be the theoretically desirable system of controlling pollution. Rather, charges should be tailored to each individual pollution emitter so as to equalize the marginal costs of removing the last bit of pollution (Kneese and Schultze, 1975, p. -). The information requirements and costs of devising such a complex list of charges for a river basin with many sources and kinds of water pollution are the formidable problems implying probable inefficiency in a tax scheme rather than the use of a single or zoned charge.

One method of arriving at an acceptable list of charges tailored to individual firms is to use game theory to systematize the bargaining process between industry and regulator. Bird and Kortanek (1974) recommend that regulator and industry representatives play an actual game with the goal of determining the least cost acceptable manner of achieving a given level of water or air quality. Using the results of the game as information about the willingness of each industry to pay for pollution abatement, the regulator could impose a solution acceptable to all.

### Environmental Psychology

Significant reviews of the field of environmental psychology are those of Craik (1970, 1973) and Wohlwill (1970). Wohlwill distinguishes three forms of behavior-environment interrelationships. Behavior always occurs in a particular environmental context, such

as a man-made space, a backyard or a forest. Second, qualities of the environment may affect broad patterns of behavior. Crowded urban conditions are associated with brusqueness and impersonality. Stormy climates may stimulate work productivity (c.f., Huntington, 1945; Mills, 1934). Finally, behavior may be directed at particular features of the environment. People take vacations in the country, go swimming in the summer, put on heavier clothing in the winter, etc.

The first interrelationship has received the most attention from psychologists according to Wohlwill. Roger Barker's work on behavior settings is an example. Behavior settings are ecological units consisting of regular locations, times and types of behavior conducted by a more or less constant group of people. Both the setting and the people are considered to be part of the behavior setting. Proxemics, or the use of space, have been studied by Robert Sommer and by Hall (who invented the term proxemics). Mental images of cities have been studied by Lynch and others.

The second interrelationship has been neglected by psychologists. In addition to Huntington and Mills, only a handful of other scholars have considered the effects of the physical environment on national character, aggression, work productivity and other variables.

The third interrelationship has received much attention. Wohlwill distinguishes three sub-facets: affective and attitudinal responses, approach and avoidance responses, and adaptations. These sub-facets have been extensively studied by researchers in a variety of fields: recreation studies, experimental and social psychology;

by thermal comfort engineers, epidemiologists, psychiatrists and others.

Wohlwill also notes the many environmental problems that cannot be analysed without giving attention to economic, political and social factors. He cites urban renewal as an instance of this, but the point is equally well taken with respect to other environmental alteration projects. The danger in such projects usually is in the other direction; environmental psychology has seldom had an input into reservoir construction projects, pollution control efforts, or for that matter, urban renewal. Environmental impact studies should certainly include attitudinal and behavioral studies of affected populations to determine the extent of community support for a project, the possible disruption of existing life styles, and the possibilities for constructive modes of adaptation to the inevitable changes caused by an environmental alteration project.

Craik (1973) provides an extensive review of environmental psychology and an impressive bibliography. The more policy-oriented efforts he mentions include studies of the relationships between observer characteristics, environmental events and the perception of natural hazards, the relationship of personality to environmental perceptions, environmental decision-making and behavior settings. Craik points to the need for a conceptual and theoretical base to unify the field of environmental psychology. The present state of the field is a variety of studies of specific situations and of varying methodology and conceptual orientation. As Craik says, it is an open

question "whether environmental psychology will function narrowly and usefully as a chapter title for disparate but related topics, or will instead come to signify a coherent theoretical framework (Craik, 1973, p. 412).

A review of some of the very recent research on environmental questions follows. It should be noted that some of the authors cited may not consider themselves environmental psychologists; the field is such that researchers from many disciplines have contributed work which might be classified as environmental psychology.

Studies of preferences for various types of leisure activities have been popular. Scott (1974) suggests that studies of peoples' needs for particular types of wilderness experiences be conducted, and the degree of environmental degradation consistent with fulfillment of these needs be delineated. Craik (1970) suggests that the values and preferences of environmental decision-makers be studied.

McKechnie (1974) developed a scale called the Leisure Activities Blank (LAB) which samples past leisure behavior. A sample of Marin County Californians was used to develop six dimensions of leisure activity. McKechnie suggests that the LAB could be used to study personality and social correlates of past leisure activity. The effects of energy shortages on leisure activity could also be studied with this or similar activity sampling scales.

Hendee and Burdge (1974) interviewed metropolitan Pittsburgh residents about their leisure activities. Factor analysis produced

five distinct clusters of activities: cultural hobbies, organized competition, domestic maintenance, social leisure and outdoor activities. Activities within the same cluster may be substitutes for one another in terms of the satisfactions produced. If this is the case, lower cost alternatives for the provision of publicly constructed recreation facilities could be identified from within clusters of activities. Construction of a pool might substitute for the acquisition of additional public seashore for example. Again, the relevance to energy shortages is obvious. Substitutes requiring lower community energy use could be favored over higher energy consuming possibilities.

Pendse and Wyckoff (1974) suggest another way to determine the preferences people have for various combinations of environmental situations, and a means of evaluating the strength of such preferences. Their Primary Evaluator approach simulates the decisions made in marketplaces in situations where no market exists. They use the example of the construction of a shopping mall which will have the following diverse effects: (1) Lower parking meter revenues to the city, (2) Increased walking time for shoppers, (3) Reduction in automobile noise and air pollution, (4) Increased safety for pedestrians, and (5) General beautification of the area. In order to decide whether to build such a mall, decision-makers need to be aware of the complicated interrelations of preferences for walking, driving, clean air, quiet, and trees. This can be determined by asking a sample of city residents to choose combinations of environmental

characteristics and costs, subject to a fixed budget, from an array of cards depicting such combinations (10¢ cost/ a 10 minute walk/ more trees/ quiet, or 5¢ cost/ a 5 minute walk/ no trees/ heavy traffic, etc.). The sample could be first asked to describe current conditions, then to pick an optimal alternative situation with a fixed budgetary limit. Pendse and Wyckoff then develop methods of analysing the results of such interviews so as to evaluate the community's expressed tradeoffs between present and alternative situations. Using this tradeoff information, the decision-makers can make an intelligent decision as to whether the benefits of the mall will justify the cost of building it.

Economists' cost-benefit studies have often been criticized for their failure to properly evaluate the benefits of environmental projects. Pendse and Wyckoff offer an interesting method of evaluating these benefits which should be further explored.

#### Attitudes

Attitude research is a favorite occupation of psychologists, sociologists, educators and others. Studies of environmental attitudes are numerous. The few mentioned below are chosen for their recent vintages and for their illustration of some of the pitfalls of this line of inquiry.

Metz (1966) analysed attitudes toward fluoridation. Demographic variables were used to construct an index which predicts fluoridation attitudes. Higher income, lower age, and more children are associated with more favorable attitudes toward fluoridation.

Correct knowledge about fluoridation is an intervening variable which positively affects attitude towards fluoridation.

Stamm and Bowes (1972) developed two scales for measuring environmental attitudes. The reversal of trends scale indicates preference for reversing any tendency toward scarcity of an environmental feature or resource. The functional substitution scale indicates preference for replacing scarce resources with substitutes. The scales were used to study attitudes in a community about to experience construction of a flood control system by the Corps of Engineers. Persons who scored high on reversal of trends tended to express less support for the Corps and persons who scored high on functional substitution showed higher support for the Corps. This indicates some generalization of attitudes or affect from functional considerations to the organization responsible for environmental changes.

Bruvold (1971, 1972) studied attitudes toward reclaimed water and explored the relationship between attitudes and behavior. Bruvold's scale for measuring environmental attitudes is the most carefully developed of those in this group of studies and should be a useful model for further efforts in scale construction (Bruvold, 1971). As for behavior, swimming pool users in one of the studied communities swam in reclaimed water. These swimmers tended to have more positive attitudes toward reclaimed water than people who had not experienced this direct physical contact with reclaimed water. The difference was not, however, statistically significant.

This result is not too surprising. It is difficult to demonstrate a clear link between attitudes and behavior empirically. For example, Bart (1972, p. 10) cites a study of littering in which over 90% of the sample expressed support for strong anti-littering laws, but substantially higher proportions of the sample actually did litter anyway.

Wall (1973) conducted a survey study in three English towns affected by air pollution from coal mining, processing and combustion. The survey asked for definitions of pollution, sources of pollution, the person's assessment of the severity of the pollution problem in their area and their responses and adjustments to this pollution. Responses and adjustments mentioned included staying indoors, closing windows, wearing a mask, not hanging out wash, and complaining to an authority.

Further studies along the lines of Wall's community survey could use larger samples and make use of attitude scales and actual behavioral observations as well as doorstep interviews. This type of study could identify the types of persons likely to perceive pollution problems, the differential effects on, and adjustment mechanisms of, different sub-groups of the population.

Bart's (1972) attempt to uncover a hierarchy of attitudes towards the environment uses ordering theory to suggest casual chains amongst attitudes. An attitude at the top of a hierarchical tree must be held by a person if attitudes at the bottom are expressed. For example, favoring more expensive non-leaded gas to leaded gas is a "prerequisite"

to the opinion that leaves and refuse should not be burned according to Bart's results.

Bart's goal is to determine hierarchies among environmental attitudes in order to manipulate those attitudes through educational processes. If an attitude at the top of the hierarchy could be induced through an educational campaign, then a desired attitude at the bottom of the chain may result. This overt manipulative goal raises many ethical questions and is a far cry from the uses of attitude scales envisaged by the other authors mentioned. Determination of attitudes can be used as a basis for conflict resolution attempts without raising these ethical issues (see Willhite et al., 1973).

This small sample of studies indicates many of the difficulties of demonstrating empirical links between people's attitudes and their behavior. The data collecting effort required is large, actual behavioral observations are seldom possible, and usually only one member of a household can be interviewed. Such evidence as is available suggests that one will seldom find a simple unitary link between attitudes and behavior. Ethical difficulties abound.

Yet the attractions of attitude research are also apparent. If one could only demonstrate links between attitudes and behavior, the behavioral response to an environmental event could be predicted from a relatively simple attitude survey. Observation of certain behaviors would alert the researcher to the significant attitudes and values of the population. This information has long been sought by sociologists and political scientists working in the environmental field.

## BIBLIOGRAPHY

1. Anderson, R.J. & Crocker, T.D. The economics of air pollution: A literature assessment. In P.B. Downing (Ed.), Air pollution and the social sciences: Formulating and implementing control programs. Praeger, New York, 1971, pp. 133-165.
2. Anderson, W. (Ed.) Politics and environment: A reader in ecological crisis. Goodyear Publishing Co., Pacific Palisades, California, 1970.
3. Bart, W.M. A hierarchy among attitudes toward the environment. The Journal of Environmental Education, 4(1): 10-14, 1972.
4. Bird, C.G. & Kortanek, K.O. Game theoretic approaches to some air pollution regulation problems. Socio-Economic Planning Science, 8: 141-147, 1974.
5. Bruvold, W.H. Affective response toward uses of reclaimed water. Journal of Applied Psychology, 55: 28-33, 1971.
6. Bruvold, W.H. Consistency among attitudes, beliefs and behavior. The Journal of Social Psychology, 86: 127-134, 1972.
7. Burch, W.R., Cheek, N.H. & Taylor, L. (Eds.) Social behavior, natural resources, and the environment. Harper and Row, New York, 1972.
8. Cassell, E.J., Lebowitz, M.D., Mountain, I.M., Lee, H.T., Thompson, D.J., Wolter, D.W. & McCarroll, J.R. Air pollution, weather, and illness in a New York population. Archives of Environmental Health, 18: 523-530, 1969.
9. Craik, K.H. Environmental psychology. In New Directions in Psychology, vol. 4, Holt, Rinehart and Winston, New York, 1970a.
10. Craik, K.H. The environmental dispositions of environmental decision-makers. Annals of the American Academy of Political and Social Science, 389: 87-94, 1970b.
11. Craik, K.H. Environmental psychology. Annual Review of Psychology, 24: 403-422, 1973.
12. Crain, R.L. Fluoridation: The diffusion of an innovation among cities. Social Forces, 44(4): 467-476, 1966.

13. Crain, R.L., Katz, E. & Rosenthal, D.B. The politics of community conflict: The fluoridation decision. Bobbs-Merrill Co., New York, 1969.
14. Davies, J.C. The politics of pollution. Pegasus, New York, 1970.
15. Dorsey, A.H.J. Effluent charges, information generation and bargaining behavior. Natural Resources Journal, 13: 118-133, 1973.
16. Dorfman, R. & Jacoby, H. A model of public decisions illustrated by a water pollution policy problem. In L.L. Roos (Ed.), The politics of ecosuicide, Holt, Rinehart and Winston, New York, 1971.
17. Downing, P.B. (Ed.) Air pollution and the social sciences: Formulating and implementing control programs. Praeger, New York, 1971.
18. Gold, D. Public concern and beliefs about air pollution in California: A statewide survey. Research Project S-11, Vol. 3, Project Clean Air, University of California, Riverside, 1970.
19. Goldsmith, E. et al. Blueprint for survival. Houghton Mifflin, Boston, 1972.
20. Hart, H.C. Toward a political science of water resources management. In James, op cit., pp. 122-163.
21. Hendee, J.C. & Burdge, R.J. The substitutibility concept: Implications for recreation research and management. Journal of Leisure Research, 6: 157-162, 1974.
22. Hudson, E.A. & Jorgenson, D.W. U.S. energy policy and economic growth, 1975-2000. The Bell Journal of Economics and Management Science, 5(2): 461-514, 1974.
23. Huntington, E. Mainsprings of civilization. Wiley, New York, 1945.
24. James, D.L. (Ed.) Man and water: The social sciences in management of water resources. The University of Kentucky Press, Lexington, 1974.
25. Johnson, S. Recent sociological contributions to water resource management and development. In James, op cit., pp. 164-199.
26. Kneese, A.V. & Schultze, C.L. Pollution, prices, and public policy. The Brookings Institution, Washington, D.C., 1975.
27. Krier, J.E. Air pollution and legal institutions: An overview. In Downing, op cit., pp. 87-132.

28. Loveridge, R.O. Political science and air pollution: A review and assessment of the literature. In Downing, op cit., pp. 45-85.
29. McCarroll, J.R., Cassell, E.J., Ingram, W. & Wolter, D. Health and the urban environment. Air pollution and family illness: 1. Design for study. Archives of Environmental Health, 10: 357-363, 1965.
30. Meadows, D. et al. The limits of growth. Universe Books, New York, 1972.
31. Mills, C. Living with the weather. Caxton Press, Cincinnati, 1934.
32. Molotch, H. & Follett, R.C. Air pollution as a problem for sociological research. In Downing, op cit., pp. 15-36.
33. Moos, R.H. & Insel, P. (Eds.) Issues in social ecology: Human milieus. National Press Books, Palo Alto, California, 1974.
34. Morrison, D.E. et al. Environment: Bibliography of social science and related literature. Office of Research and Development, Environmental Protection Agency, Washington, D.C., 1974.
35. Nelkin, D. Scientists in an environmental controversy. Science Studies, 1: 245-261, 1971.
36. Pendse, D. & Wyckoff, J.B. Environmental goods: Determination of preferences and trade-off values. Journal of Leisure Research, 6: 64-76, 1974.
37. Proshansky, H., Ittelson, W. & Rivlin, L. (Eds.) Environmental psychology: Man and his physical setting. Holt, Rinehart, and Winston, New York, 1970.
38. Raymond, R. The impact of federal financing provisions in the Federal Water Pollution Control Act Amendments of 1972. Public Policy, 22(1): 109-119, 1974.
39. Roos, L.L. (Ed.) The politics of ecosuicide. Holt, Rinehart and Winston, New York, 1971.
40. Rose, S. The economics of environmental quality. Fortune, 81: 120-123+, 1970.
41. Scott, N.R. Toward a psychology of wilderness experience. Natural Resources Journal, 14(2): 231-237, 1974.

