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CHAPTER 3 COMPREHENSIVE ENVIRONMENTAL PLANNING

Robert Kates
Clark University
Worcester, Massachusetts

INTRODUCTION

This chapter concerns the comprehensive planning of the environment, a goal only rarely stated and for which there is no enabling legislation, institutional arrangements or professional staff. Yet it is a goal toward which our society is moving and for which it is not too early to seek to train practitioners.

This chapter will attempt to examine the present scope and content of environmental planning and suggest a definition for comprehensive environmental planning; identify some unique aspects of environmental planning within the framework of the investment decision model; and discuss the intellectual care and feeding of comprehensive environmental planners.

THE SCOPE AND CONTENT OF ENVIRONMENTAL PLANNING

Comprehensive environmental planning today seems analogous, paradoxically, both to the state of the art of water resource planning in 1933 and to the multipurpose commitment of present-day water resource development. The original Tennessee Valley Authority legislation set forth three purposes of development: flood control, navigation, and power. More recent legislation for comprehensive river basin planning, exemplified by the acts setting up the Texas and Southeast River Basin Commissions, identified some eleven useful products and services of water resource development;[1]

provision was made to add others in the event that additional uses were found prior to completion of the study. In the course of thirty years, the purposes of comprehensive water resource planning had expanded fourfold, and one can assume that the collective skills and competence required from water resource planners had increased in some proportional measure.

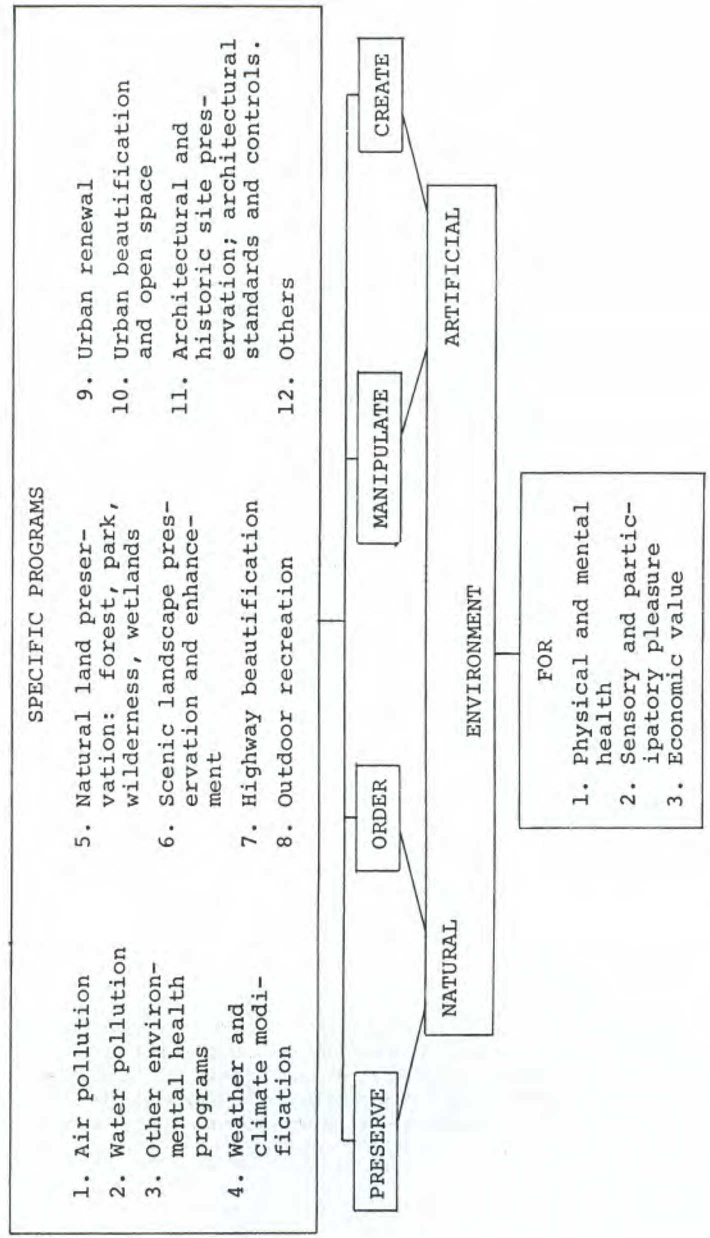
In terms of fundamental objectives, theories, and concepts, the field of environmental planning today is probably at the same level that water resource planning was in 1933. Yet the commitment and expectations evidenced by the environmental programs and policies in varying levels of government rival present goals of water resource development. Specific programs seem designed to either preserve, order, manipulate, or create aspects of the natural and artificial environment. The intent of each program is not difficult to identify. The more difficult task is to attempt to generalize these intents, forming objectives that can bring together isolated programs in a comprehensive planning framework.

Objectives of Environmental Planning

The objectives found in the specialized literature of individual programs when reduced to the smallest number of common denominators are (as shown in Figure 1) physical and mental health, sensory and participatory pleasure, and economic value. Programs are justified in terms of the prevention of sickness (as is pollution control) and the provision of pleasure--either through aesthetic stimulation of the senses (for example, highway beautification) or through providing opportunities for participating in pleasurable, environmentally oriented activities (for example, outdoor recreation). Economic value as a goal may take the form of preserving present values (for example, reducing corrosion-inducing pollutants in the atmosphere) or enhancement (for example, increasing the value of real property through architectural control). If these are the irreducible objectives of environmental planning, then the central obstacle to developing more comprehensive planning may be the lack of a common currency with which to mutually relate these objectives. In any event, a model of comprehensive planning will not spring easily from the matrix of single-purpose activities that is presently ingrained in our public life.

FIGURE 1

ENVIRONMENTAL PLANNING, 1966



Enclosed Space, a Model of Comprehensive Environmental Planning

However, a model does readily exist on a much reduced scale, and one needs but to look around the room, wherein almost all aspects of the physical environment have been manipulated and organized. The light, temperature, and even the content of the atmosphere have been ordered; the boundaries of space have been circumscribed and given color, and objects have been set within it, designed to facilitate one form of activity or another.

A room, with its traditional form and its well-defined function, is also a dynamic environmental system. If it is well designed, it should provide for incorporating its human occupants into the surroundings. As elements of the environment, some of its occupants give off smoke; all of them radiate heat, absorb and reflect light and sound, consume oxygen, and increase the carbon dioxide content. If it is planned well, the room will provide an environment capable of fulfilling its major function and of adjusting to a variety of stimuli as well.

The role of the planner of the larger environmental space is related to that of the planner of the more limited space. The room was designed for human and, hopefully, humane purposes. Its planner consciously organized and manipulated all aspects of the physical environment toward that purpose. By analogy, comprehensive environmental planning might be defined as planning, over extensive space, the conscious organization and manipulation of all aspects of the physical environment for human ends.

As one assesses the present scope and content of environmental planning, there is a sense of movement from individual, single-purpose programs to comprehensive programs. A central problem is how to relate the disparate objectives of health, wealth, and pleasure. A central need is to relate the process of environmental planning to the already ongoing programs in city planning, regional development, or natural resource management. The difficulties might best be explored by considering Hufschmidt's investment decision model presented in Chapter 2.

THE WHY AND HOW OF ENVIRONMENTAL PLANNING: THE INVESTMENT DECISION MODEL

The investment decision model provides for the statement of a single or multiple objective with a suitable set of constraints. To make these objectives operational, a set of design criteria is adopted that will translate objectives into a set of physical outputs through investment in productive inputs. These design criteria then lead to the formulation of alternative plans. The adequacy of each respective alternative is measured in terms of its efficacy in fulfilling the stated objective. To complete the cycle, the initial objectives are reconsidered in the light of this evaluation.[2]

In Chapter 2, Hufschmidt discussed the model in a broad context of applications. Rather than repeat that discussion, some of the special problems of applying the model to present and future environmental planning will be focused upon.

The Objective Function

The objectives of environmental planning to date have been concerned with physical and mental health, pleasure arising from both the senses and activities, and wealth--either from preservation of existing value or the creation of new value. However, in the broad context of activity related to city and regional planning, environmental programs are seldom stated as objectives; in the main, they serve as constraints. Although this broad intent of planning activities often is not clear, objectives frequently involve the maximization of national and regional income, accessibility, and the like. Environmental planning adds to these objectives the proviso, "subject to the constraint that you do not significantly harm humans, property values or aesthetic pleasure."

S. V. Ciriacy-Wantrup deals with the issue of conflicting objective functions and constraints.[3] As an example, one might note that 160-acre limitations on farm size serve as a constraint in an optimizing calculus for efficient irrigation development. But to many proponents of irrigation, the objective of the irrigation was not the contribution to national income but the constraint itself --that is, the encouragement and maintenance of family-size farms. A similar situation arises in dealing with the environment. Environmental objectives that are usually stated as constraints are becoming increasingly worthwhile in themselves. In a nation of affluence we will want to choose to maximize mental health or public beauty, for instance, and we will have difficulty in defining such objectives and even more difficulty in choosing between them.

Multiple Objective Functions

Arthur Maass has recently become more optimistic in this regard. He has pointed out that the single objective functions that are invariably used in the optimization calculus are inadequate today.[4] In a nation that indicates, by its political process, that it does not always want to maximize its income, the continuous use of this criterion leads to disparity between the theory and practice of investment decisions. Maass cites examples of the willingness of Congress to make choices appropriate to weighting multiple objectives. He notes that this has been done in areas in which benefit-cost analysis is not well defined (for example, in highways) and suggests that Congress might be willing to weight objectives in water resource development if it were asked to do so by the agency involved. With such weights, objectives can become interchangeable with constraints. However, though one is encouraged, if not fully convinced, by the examples he cites, the problem of income redistribution versus national income still deals in a common currency--dollars. How much more difficult is it to imagine the choice of weights for conflicting objective functions in the more imprecise worlds of mental health or beauty?

Constraints

Even in terms of constraints, the way in which environmental concerns are currently stated is troubling. What types of constraint, for example, should be placed on agriculture in its use of pesticides? Should the use of lead in ethyl gasoline be banned as soon as the first evidence suggests rapidly rising lead levels in the atmosphere? Should a constraint be placed on every one of the comprehensive river basin development plans to the effect that each must provide for at least one reach of wild river? Should formal constraints be

placed on the activities of the Federal Power Commission to encourage underground placement of high-voltage lines? Few, if any of us, could easily make such commitments, for in all of these cases, although the costs in terms of reduced production or foregone alternatives can be fairly well defined, the benefits are uncertain, vague, and elusive. And yet it is precisely in dealing with these kinds of questions that environmental planning becomes meaningful and relevant.

Design Criteria

If it is difficult to arrive at an objective function for environmental planning, it is probably even more difficult to translate a set of objectives into design criteria. There are few usable functional relationships. For example, in even the most heavily studied field, outdoor recreation, much is left to be desired. No consensus exists on how to value a visit to a park. We do not know what one additional part-per-million of oxygen in a given stream or estuary will bring in terms of increased activity related to waterborne recreation. We do not know either in terms of activity or pleasure, which yields greater returns in urban areas--many small, dispersed green spaces or fewer large, contiguous green spaces. More generally, there are probably no available input-output relationships dealing with environmental quality that will withstand any rigorous scrutiny. But these are researchable relationships and, in the long run, may prove less troublesome than the value judgments needed to discriminate between objective functions.

Plan Design

Environmental plan development, and particularly the choice of optimal designs, requires the definition of objectives and their translation into functional design criteria. Without this prerequisite, it is difficult to discuss the unique aspects of environmental plan design, other than to note that for a long time to come, we may be employing physical quantities exclusively--number of recreation days, parts-per-million oxygen content, miles of scenic corridor, square feet of open space.

Plan Evaluation

Without adequate benefit functions, evaluation of alternative designs for environmental quality will probably be made differently for benefits and for costs. Benefits will be subjective and uncertain, often defined in the political market place and in the world of ideas. Economic analysis will, and probably should, concentrate on the cost. Studies of alternative cost and cost effectiveness, although lacking the elegance of some of the water resource models, may serve best in dealing with situations where the costs always seem to be more clearly defined than the benefits.

The evaluation of benefits and costs in the investment decision model is essentially a paper-and-pencil evaluation made possible, of course, by simulation and the use of the computer. Environmental planning, at this stage of development, could profit by expanding the notion of plan evaluation to include empirical evaluation of planned environmental change. Again, this might be illustrated by referring to architecture.

Good architects know a great deal about human behavior, but most of this knowledge is intuitive. Only recently has there been an effort to order such knowledge.[5] It would appear that the most obvious type of study of the behavioral consequences of architectural design would be the careful survey of existing buildings to note how people modified or adjusted space in ways that the architect never intended. Campus dormitories are an example. In dormitories, one can find lounge areas, originally intended for conversation, that are now used for television viewing or solitary meditation, or which are just not used. Some windows are covered with posters. Dividers intended to provide privacy are never utilized, whereas elsewhere, artificial dividers are improvised to provide privacy. In short, it is possible to evaluate empirically and relatively quickly some behavioral consequences of the design by these simple surveys, although this is rarely done.

If this criticism of architecture makes city and regional planners feel somewhat smug, one might note the scarcity of reviews of their work; and nothing seems to be forgotten as quickly as last year's comprehensive urban plan. In any event, given the lack of functional relations between design, criteria, and behavioral consequences, the evaluation section of the investment decision model should be taken very literally. There is much to

be learned from careful follow-up in situations where scenic corridors, or additional parts-per-million of oxygen, or open space, are provided. The formal inclusion of empirical review in such programs should be encouraged; it might prove the least costly way of acquiring new data.

WHO SHOULD PLAN THE ENVIRONMENT?

The investment decision model provides a vehicle for exploring some of the questions related to the why and how of environmental planning. However, an additional question may be raised: Who should plan the environment comprehensively? The problem is not so serious when one deals with single-purpose environmental programs, for here a structure already exists--there are problems, funding agencies, professionals, and clientele. All the requirements for activity exist. But from what discipline will comprehensive environmental planners come?

There are three prospective academic godfathers of comprehensive environmental planning: the environmental science disciplines, the environmental design disciplines, and the social and behavioral sciences. Each set of disciplines and each discipline within any set has a traditional competence and approach to the environment. Although these competences contribute strength to development of a new planning specialization, the traditional approaches do not.

The Environmental Sciences

The term "environmental sciences" is, in itself, testimony both to society's heightened social concern with the environment and to the intellectual renewal that has taken place within the disciplines themselves. The core of the environmental sciences is made up of public health and sanitary engineering (although they compete with the earth sciences for use of the phrase). They first became environmental health disciplines and are now subsumed under the rubric of environmental sciences, reaching out in the meantime to encompass, in part, ecology, biomedical engineering, and other areas.

The record of the competence of these sciences is all around us. The public takes for granted its antiseptic society and is shocked by such minor episodes of failure as salmonella in the water of Riverside, California or tuberculosis contracted by a nursery school teacher in Detroit. But it is precisely this competence, so necessary in the historic struggle to protect men from filth and disease, that creates serious problems of approach in grappling with some of today's environmental quality problems. The historic firmness in dealing with well-understood communicable diseases often becomes today's dogma, when applied to highly uncertain and complex hazards--a kind of paternalistic "doctor knows best" attitude. A whole series of new environmental hazards are of this type: synthetic organic substances of all kinds, airborne pollutants, and radioactivity. For these, the chain of cause and effect is only inadequately understood; and although the dangers are highly suggestive, the evidence is small and scattered and the interpretation conflicting. These cases pose problems of decision often beyond the competence of the environmental scientist.

A second inadequacy of the environmental sciences lies in the fact that many aspects of maintaining the quality of the environment deal not with the stimulus properties, the physical-chemical nature of things, but in the symbolic qualities of the environment as well. In focusing on this critical relation between stimulus and symbol, I am deeply indebted to the work of Rene Dubos. In the 1965 Yale Silliman lectures, Man Adapting, he states:

> In obscure ways human life converts the physicochemical processes of purely biological existence into actions, representation, and aspirations which pose to the science of man problems not found in the same degree in the study of other living organisms.
>
> Mechanical stresses, irritating materials, radiations, and temperature act directly on the human fabric just as they do on other nonhuman structures of similar composition, whether these be monkeys, oaks, amoebas, viruses, or inanimate substances. But in addition to their direct effect on the constituents of the body machine, environmental forces also have indirect effects on living things. . . . This chain of indirect responses is of greatest importance in man because of his propensity to symbolize everything that happens to him, and then to react to the symbols as if they were actual environmental stimuli. . . . Thus, all the perceptions and interpretations of the mind become translated into organic processes. For this reason, the actual effects that the environment exerts on man commonly bear little if any resemblance to the direct effects that could have been expected from the physicochemical nature of the stimulus. The body machine reacts not only to the stimulus itself but also to all the symbols associated with the experiences of the past and the expectations of the future, symbols which are converted into effective stimuli by a particular event.[6]

The traditional strength of the environmental sciences lies in their ability to analyze the physicochemical nature of stimuli arising from natural phenomena: biological clocks, climatology, microorganisms, geophysical hazards; and artificial phenomena: the irritants placed in air and water, the rising noise levels and compacted space of urban environments, and the monotony of the world of both nature and man. But for many of these stimuli, it may not be the number of decibels, coliforms, or degrees Celsius that are critical to human beings, but symbolic qualities. As one advertising agency shrewdly perceives, it is not the waste content but the symbolic quality of "using second-hand water" that limits the use of its client's waste treatment process.

Even in dealing with the stimulus qualities of the environment, most of the studies in environmental science treat these qualities as single factors. A major exception is found in ecology, which is deeply concerned with the multifactorial aspects of the environment. Ecological studies commonly contain observations of all the many environmental variables found to affect plant and animal communities.[7] However, it is precisely this relation of ecology to plant and animal study that renders ecology much less promising for anthropocentric planning of the environment. Moreover, many ecologists seem to share a sense of threat from human activity. They see population growth and urban sprawl leading inevitably to the destruction of their prized plant and animal communities. It would seem to be metaphorically proper to note that ecology has yet to accept the notion of the human climax.

Environmental Design Disciplines

In contrast to the environmental science disciplines stand the environmental design disciplines. They, too, have been undergoing metamorphosis and change. They are less design-oriented and somewhat more behaviorally oriented. Yet there still seems to be a cohesive set of disciplines stressing design, ranging from the microspaces of architecture through landscape architecture to the macrospace of city and regional planning.

In basic contrast to the environmental science disciplines, the design disciplines abound in symbol. They are veritable symbol-makers. The challenge to the designer is to create a design that fulfills some function and also proclaims symbolically some deeper meaning in building, garden, concrete, or spatial arrangement. This tension between the need to enclose, house, or site human activities --and at the same time to create symbolic meanings in their own right--has not been an equitable one. Although much design seems mediocre and fails in both its form and function, the attention of the most talented designers has been directed to the aesthetic expression of the total design, not to the behavioral consequences of their work.

Probably this is nowhere more true than in the case of architecture. Although there is a stirring toward a systems analytic approach called "environmental programming,"[8] this is not really relevant to the present discussion of the planning of extensive space. What is relevant is that the artistic symbol fares poorly when designed by computer or committee, and probably even more poorly when designed by an interagency committee. The architect rightly strives for a single vision. If he is honest to his craft, there would seem to be few opportunities for trade-offs, loss functions, and discount rates. If we desire a structure that will do more than house or enclose us, we must commit ourselves to his skill and vision. But can we commit an entire city to him? Are the symbolic qualities enhanced by great architecture additive, and can good, individually designed architecture produce a great city or region?

City planners, too, have long visualized cities and city spaces as symbolic forms, as they peered down on their maps, models, and aerial photographs. The patterning of the city with planned areas bound together by a network of arterials is deeply and symbolically ingrained in their work. But to study the sense of relatedness and identity that Ian Nairn suggests is characteristic of the humane townscape,[9] one must leave the bird's-eye view and visit the paths and action spaces of the inhabitants. It is this image of the city, and this view from the road, which is relevant.[10]

Stuart Chapin, in the latest edition of his text,[11] makes an eloquent plea for environmental quality in city planning and for a sense of the aesthetic. He notes that the inherently fugitive character of norms as they apply to aesthetics and their difficulty in application are perhaps responsible for the workaday avoidance of aesthetics in planning. This situation is probably exacerbated by the plan view; the neat, orderly op art found in the cartographer's patterns suggests, with each professional viewing, that the city looks orderly and neat and that things are not as ugly as they are reported to be.

The Behavioral and Social Sciences

These sciences--anthropology, economics, political science, geography, psychology, and sociology--have long concerned themselves with both the stimulus and the symbolic aspects of human behavior. Unfortunately, a review of the dominant strands of the social and behavioral sciences suggests that the environment does not fare well in the research questions of each discipline.

For economics, environment is traditionally viewed as land--a member of the trinity of productive inputs, and an input the importance of which declines with increased industrialization.[12] In anthropology, environment is especially important as a setting for primitive cultures. But more often than not it proclaims the triumph of culture over a single physical setting.[13] Sociology, even in its most physically oriented subdiscipline, human ecology, sees the physical city as the dependent entity, a function of social organization and change.[14] For many psychologists, the environment is but neutral stuff that must patiently await form and meaning obtained only through the mind and senses.[15] Even in geography, with its tradition of man-environment interests, the study of environment calls for apologetics.[16] In all the social sciences, "the proper study of mankind is man."

These attitudes toward the study of environment will probably be dominant in the social and behavioral sciences possibly for all time. But this does not preclude substantial and significant research contributions from these areas. Such contributions are already at hand. Orris Herfindahl and Allen Kneese provide economists' insights into problems of environmental planning.[17] Lytton Caldwell was well received by public administrators and political scientists when he suggested development of environmental administration.[18] The work by geographers on natural hazards,[19] landscape perception[20] and decision-making[21] has led to a growing dialogue related to the behavioral consequences of space-adjustment and space-modifying practices. Psychology, for the first time, is entering earnestly into the conversation.[22]

Hopefully, by now the arguments advanced in this chapter have become rather transparent and this critical analysis of science, design, and the social and behavioral sciences has recalled C. P. Snow's two cultures.[23] The answer to the question of who should do the planning is simply that the comprehensive environmental planner of the future must feel at home in both a science and art that are bridged judiciously by the social and behavioral sciences.

TOWARD A THEORY OF ENVIRONMENT

If the behavioral and social sciences are to serve as a bridge between environmental sciences and design, then one should expect an appropriate set of theoretical statements to serve as its foundation. Several of these have been selected, but all are theories of the middle range and are not intended to

illuminate the grand design. Yet exposure to the grand theories of the environment (notions and models of man that seem to account for man-environment systems in the broadest sense) is fundamental to a curriculum for comprehensive environmental planners. In descending order of universality, four sets of theoretical notions are suggested: theories of evolution, general systems theory, theories of environmental causation, and the search for the environmental optimum.

Theories of Evolution

Future environmental tinkerers should be faced with the need to ponder the fundamental purpose and intent of their actions. There is need to do more than respond to the "alarums and excursions" of the day. Modern restatements of Darwinian evolution may serve to provide a teleological foundation to our labors, to allow us to share in Teilhard de Chardin's vision of "man the ascending arrow of the great biological synthesis." At the very least, all comprehensive manipulators of environment should be aware of the complex interrelationship between nature, nurture, and culture. It is most fortunate in this regard that the Yale Silliman lectures have now provided two appropriate volumes: Theodosius Dobzhansky's Mankind Evolving,[24] which discusses the interplay between genetic endowment and environment, and Rene Dubos' Man Adapting,[25] which focuses on the adaptive problems of a single individual.

General Systems Theory

In practice, most people will deal with the cross sections of evolutionary time called the here and now. There is probably no better theoretical framework for describing man-environmental systems than the theories of systems themselves. Systems concepts are found in many places--for example, the equilibrium of price theory, the steady state of ecosystems, and the open system of drainage development in geomorphology. The broadest expression is general systems theory.

An appropriate introductory statement is the one that Ludwig von Bertalanffy initially made in the 1956 Yearbook of the Society for General Systems Research.[26] The environmental planner will seldom be confronted with the situation in which he must deal with the total interaction between man and the environment. But his training should be enriched with the knowledge of the holistic, organismic, Gestalt systems approach. The planner should be aware of the models of closed and open systems, the meaning of entropy, feedback, information, and homeostasis, and the important ideas that can assist in ordering complex interacting relationships.

Theories of Environmental Causation

To move down still another rung, the neophyte environmentalist ought to be familiar with the theoretical debate on the role of environment and human behavior. Within the framework of systems theory analysis, it would be useful to examine the theories of environmental causation: determinism, probabilism, possibilism. The debates of yesteryear are summarized in the existing geographic literature.[27] It may not seem relevant, but all should ponder the following question: If comprehensive environmental planning involves the organization and manipulation of the physical environment for human ends, just what is the nature of the relationship that allows one to expect changes in the environment to affect human behavior?

The Search for the Environmental Optimum

In answer to the previous question, many would offer some notion of environmental causation, although this may be grand or limited, deterministic or stochastic. This, then, raises a more specialized question: Is there an environmental optimum for human beings? There are few well-structured answers to this question, but there are many individual approaches. Arnold Toynbee might answer the question by suggesting that the environment that posed challenge but not total destruction was the one most conducive to human development.[28] Ellsworth Huntington, as Rene Dubos notes, might locate the optimum specifically in New Haven, Connecticut.[29] On quite a different tack, the ecological concepts of ecosystem, community, and climax might be construed as statements of the requirements for an environmental optimum.[30] Even the demographic-economic approach to the question of optimal population can be viewed as leading toward a spatial definition of an environmental optimum.[31] Psychology, both through psychological ecology[32] and through theories of stimulation,[33] might suggest, in general terms, the requirements for such an optimum (or more probably, optima). Most rewarding because of its theoretical framework would be Walter Firey's search for the optimal resource management system within a set theoretic framework.[34]

Utility, Stimulation, and Decision

Three less embracive theories seem appropriate for comprehensive environmental planning: utility, stimulation and activation, and political decision-making.

Utility Theory

In substituting utility for money, economics reaches out to the other social and behavioral sciences and seeks to expand powerful economic theories to include phenomena whose ordering and preference relationships are generally unknown. One link has been extended to psychology and social psychology, and there is a very lively literature related to the problem of obtaining subjective measures of utility and including such measures in decision models.[35] An empirical search for individual and collective orderings of health and pleasure should be encouraged along similar lines. It would seem appropriate that, as an extension of the empirical search for the utility of the environment, a beginning should be made in the development of research instruments similar to standard psychological and sociological tests but related to environmental perception and attitudes.[36]

Psychological Theories of Stimulation

The search for subjective personal utility is one approach to introducing the disparate objectives of environmental planning into a single analytical framework. But the derivation of preference orderings still does not tell much about the underlying causes of such preferences. One useful direction lies in the area of psychological theories of stimulation and activation and what have been called hedonic theories of motivation,[37] which seek to identify a level of stimulation in the environment to which an individual is adapted, and suggest that minor variations from that level might bring comfort or pleasure, whereas substantial variations from those levels might bring discomfort or pain. The stimuli themselves could be ordered by such factors as intensity, novelty, complexity, temporal change, surprise, and incongruity. These factors provide ways of describing a whole variety of phenomena on a fundamental set of scales independently of whether they emanate from an urban street, a pastoral country scene, or the interior of a living room.[38]

Somewhat related to this model is the formulation of stress and its opposite, slack, as generated by both the social and physical environment and as transformed into strain and its opposite, some form of pleasure. The particular types of transformations may be highly personalized and subjective, but at least one worker has developed a beginning of a systems analytic model employing this format and with potential for dealing with the complex interactions between man and his environment.[39]

Political Theory and Decision-Making

Despite advances that might be made in ordering the environment on general scales and eliciting individual and group preferences, choice, in dealing with the environment, will continue to come from the political process for a long time to come. The trinity of health, pleasure, and economic value will not be easily bridged except through the trade-offs in the political market place. Moreover, successful comprehensive environmental planning is going to call for new sets of institutions and administrative devices.

For evidence that such a development is under way, one could turn to the State of Vermont. Having decided that continued maintenance of its unique scenic resources is vital to its future, Vermont embarked on programs that require whole new sets of institutional relationships. The environmental setting of Vermont scenic resources is unique. There are mountains and forests, but these are most frequently seen as background to a landscape of agricultural occupancy, with its fabled red barns and pastoral scenes. The juxtaposition of man and nature provides an attractive scenic view, not found, for example, in the environmentally similar area of the Massachusetts Berkshires, where farming has practically disappeared and second growth is the rule. Thus, Vermont seeks to maintain its agriculture, not for the purposes of agricultural income but for the value that mowed or pastured fields provide in creating these special scenic resources.

A second characteristic of the scenic resource is the long view. There is increasing evidence that when traveling in cars, the long or horizon view, rather than the view adjacent to the road, is probably the most fixated. The maintenance of these long views, scenic corridors, and vistas, requires a whole new level of state control; thus one finds that in a state with a conservative tradition such as Vermont, the Governor recently asked for a variety of legislation to administer and protect scenic resources. If granted, these powers will probably be unique among state governments.

That the scenic resources of Vermont should differ significantly from those of Massachusetts points to a need for decentralized problem-solving and innovation. A related observation leading to a similar conclusion is that our environment deteriorates most often by the cumulative effect of many individual and highly localized decisions. Thus, some aspects of environmental planning seem to lend themselves to large-scale regional approaches, and many others seem to require localized solutions. There is need for a widespread network of environmental guardians and for the development of institutions whereby architects, historians, naturalists, and others might serve as the conscience of the community.

The theory and methods of public administration and political science should provide help in devising new governmental arrangements for environmental control, as well as new insights for the problem of creating environmental guardianship at the local level. One familiar set of theoretical work and empirical experience related to this area is the so-called pluralist approach to political power.[40] These case studies of decision-making on the city and town level, in which specialized groups and individuals can wield great power in the limited fields that interest them, are most suggestive as to the potential strengths of environmental guardians.

DOOMSDAY THEORY

To this discussion of grand theory and three critical middle-range theoretical areas, will be added still another theoretical notion, one of my own contrivance.

This is called Doomsday theory (or how I stopped worrying about the bomb because I found better things to worry about). According to this theory, there is, in any system, a relatively fixed amount of variation from an equilibrium or steady state position. One of the cumulative effects of environmental planning and management is an attempt to iron out the minor variations of the environmental system. If there is any direction to many of the single-purpose activities that people undertake, it is that trend. A few examples should suffice.

Great pains are taken to maintain fairly constant temperatures, and the amount of exposure to extreme temperature for large populations probably decreases year by year. In agriculture, through use of a variety of chemicals, we seek to rule out normal variability and, in fact, we have been so successful that a blemish on a piece of fruit is cause to disqualify it from sale. We are unhappy with extreme stream flows, so we seek to eliminate these through flood control works. In the attempt to rationalize production of electricity by making individual systems less susceptible to fluctuations in production and consumption, we develop a system of interlocking grids.

But in Doomsday theory, there is a law for the conservation of variance; and the variance that is eliminated from day-to-day, month-to-month, even year-to-year activities piles up, creating a virtual sword of Damocles and increasing the catastrophic potential. Dependence upon a constant temperature presumably makes us dangerously susceptible to rare situations in which extreme temperatures are encountered without the usual environmental controls. Attempts to regulate a steady flow of uniform, low-cost agricultural produce may have increased our susceptibility to the accumulation of synthetic organic pesticides and herbicides. In the course of controlling the more common excess flows of streams, we have demonstrably increased the catastrophic potential of extreme high floods. In the recent blackout in the Northeast, electric power system interties that should have provided protection for the system seemed to drain the system of its energy. It would seem that optimizing procedures never allow for one possibility--the complete and total failure of the system. The system that should fail safe, fails unsafe. Although Doomsday theory is spoken of here with tongue in cheek, the suggestion is made quite seriously that comprehensive environmental planning must involve the rational consideration of catastrophe as a possibility in the continued and intricate management of the environment.

CONCLUSION

This chapter has presented a number of different issues that relate to the specialized problems of environmental planning. These problems arise out of the complications of an untidy world, and they are exacerbated by the difficulty in relating the disparate objectives of environmental planning and by the traditional split between science and design. However, to summarize it is useful to return again to the water resource analogue. For reasons that bespeak more chance than design, the development of the economics of public investment and the marriage of engineering and economics were deeply stimulated by water resource development. In like fashion, the linkage of science and art by way of the social and behavioral sciences may be greatly accelerated by work in the field of comprehensive environmental planning. This will come about not from the intrinsic rationale of this particular field but because sensitive men seek to find and create order, meaning, and purpose in the world around them.

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CHALLENGE AND PROSPECTS

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