ECOLOGICAL PLANNING FOR METROPOLITAN REGIONS

by Karl H. Hertz

In this paper I will try to establish three major points. The first involves our understanding of the human species as the culture-bearing species par excellence, and the consequences which this intensely (and, in many ways, uniquely) human activity has had for the precarious equilibrium of relationships among living forms of all kinds and, therefore, for human society. Second, the contemporary metropolitan region in all its ambiguity must be recognized as the central achievement of human creativity and the primary locus of the persistent interventions, which have not only seriously disrupted the reciprocities among living forms, but which also pose the very serious threat of extensive, perhaps fatal destruction.

Third, we have available the resources, particularly in technology and in the principles and processes of regional planning, to cope effectively with existing blight and potential disaster. An ecological strategy can do the job that needs doing. The central crisis of the city is not a crisis of technology but one of ideology and values. It is a crisis, not only because of the lack of a sufficient sense of the urgency of preventive action, but also because of the persistence of basic mind-sets which must be changed. We need a radically new way of looking at the world of living forms, the networks of reciprocity among them, and the inherent interdependence of human life with all living forms and with its environment.

Cultural and Material Transformation

If the explorers of man's earliest awareness of his humanity are right, the story begins somewhere in East Africa. The beginning was very simple, indeed almost imperceptible. The evidence is fragmentary, and more important for what it points to than for what it is in itself. How-

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ever, what happened was a creative act of the highest magnitude. Man began the transformation both of his environment and of himself.

Whether the beginning of culture, to use the anthropologist's word, was a matter of tools or weapons or speech, we may never determine. The consequences we know quite well. Man brought into being a whole new range of possibilities for his own existence and for his own nature. The cultural dimension of human society provided a new format for evolution, and one of its crucial characteristics was that it was man-made. The power for transformation of his own existence came into man's hands.

The dominant sociological view of what it means to be human sees personhood itself originating in social processes, and mediated through communication, linguistic and nonlinguistic. Within these processes, the transactions of one individual with another or with many others helped shape both the social world and the human personality. By acting together to carry out the tasks necessary for existence, the human species brought into being a new reality, social reality. In terms of this reality, human beings gave meaning to their own actions and imposed meaning on their surroundings. The apparently simple act of naming the animals, mentioned in Genesis, was much more than a piece of semantic labeling. Names, words, language became the spectacles through which humans saw animals as friends or foes, as totemic kin—supernatural assistants or powerful opponents to be appealed or outwitted. Consider the difference between a "game bird" and a "song bird" or between calling an animal a "predator" or a "necessary link in a food chain."

Similarly, the landscape and its resources took on emotional coloring and related qualities. This cultural transformation of environment into significant places—into friendly places and hostile ones, into routes of pilgrimage, trade, and conquest, or into boundaries defining properties and national sovereignties—has gone on from the earliest awakenings of human consciousness. This process, as well as all the other cultural innovations accompanying it, was simultaneously an evolutionary adaptation of far-reaching importance for survival, and the beginning of the construction of new realities—the realities of customs, mores, definitions of proper and improper, the prescribed and the proscribed, might and mercy, truth and falsity.

In carrying out the processes of shaping society—a network of established expectations of how each of us is to behave toward the other—man uses and changes the material resources and living forms in his environment. Some are used with relatively little change; others are

dramatically altered. The flora and fauna of the earth become defined as food or clothing, firewood or fetish, useful or dangerous, powerful or weak. Tools are fashioned; weapons for war and for hunting come into use. Territorial boundaries are set, kinship determined, and so on.

Something of the scale of this achievement and an understanding of its significance—even of its cost in a human struggle against the continuing threat of defeat, destruction and death—has survived, I believe, in the ancient myth of Prometheus, to whom credit is given for bestowing upon mankind the gift of humanity. Aeschylus has Prometheus tell us the story:

> Listen to the sad story of mankind, who like children lived until I gave them understanding and a portion of reason; yet not in disparagement of men I speak, but meaning to set forth the greatness of my charity. For seeing they saw not, and hearing they understood not, but like as shapes in a dream they wrought all the days of their life in confusion. No houses of brick raised in the warmth of the sun they had, nor fabrics of wood, but like the little ants they dwelt underground in the sunless depths of caverns. No certain sign of approaching winter they knew, no harbinger of flowering spring or fruitful summer; ever they labored at random till I taught them to discern the seasons by the rising and the obscure setting of the stars. Numbers I invented for them, the chiefest of all discoveries. I taught them the grouping of letters, to be a memorial and a record of the past, the mistress of the arts and mother of the Muses. I first brought under the yoke beasts of burden, who by draft and carrying relieved men of their hardest labors; I yoked the proudest horse to the chariot, teaching him obedience to the reins, to be the adornment of wealth and luxury. I too contrived for the sailors sea-faring vessels with their flaxen wings.[1]

The recital goes on to include medicine and the arts of divination, as well as the use of minerals. The climax of the Promethean rebellion against Zeus was the gift of fire to man. Prometheus thus serves as the symbol of human achievement of everything we include as technology and art, science and literature, and of man's creation for himself of a "second nature" within which he finds his world to be meaningful. All of this is now so deeply embedded in habit and emotion that we find our cultural ways of doing and thinking to be "natural" and "human" and deny humanity to the enemy, the stranger, the one who acts and thinks in strikingly different ways.

Several different ways are available for analyzing cultures. For our purposes, it will be sufficient to distinguish between those ways which are primarily instrumental (roughly that which we call technology) and those ways which are primarily integrative (of which ceremonial obviously forms an important part). A Hopi rain dance probably serves

more effectively to maintain loyalty to Hopi ways than it does to secure rain. This integrative or ceremonial dimension of culture is thus a way of ordering relationships among members of a society. Order of some form is characteristic of all societies.

The technological refers to the vast range of tools and techniques, of machines and operating procedures that man has developed in the course of history—everything from the bone needle to the automatic drill press, from counting with knotted strings to the most sophisticated computer, from techniques of chipping flint to the grinding and polishing of lenses for modern telescopes, from how to snare a rabbit to how to compose a sonnet.

Ceremonial expresses the values of a culture. This includes such diverse rules as the proper use of knives and forks, of clothing and cocktails, even of prayer and imprecations. A style of dress may define an occupation or give proof of someone's status. A title may define a person of authority or inform us of the relationship between two persons. Some men will die to protect a flag, and others will go to jail rather than to salute one.

Given man's plasticity and his creative imagination, there seems to be little that he cannot do. The late John Von Neumann once said, "Whatever is technologically possible will be done." Here is one possible way of understanding the ecological crisis. It is not so much a matter of technology, however, as it is of man's understanding of when and how to use his technology; the crisis is not a problem in engineering, but in values, in morals and ethics, finally a problem in religion.

Man's abundant creativity has made him a transformer of the physical environment on a scale and with a persistence no other species has achieved; he has multiplied his powers and accelerated change not only in the social world but also in the physical world.

Man is not the only destroyer of the sometimes delicate balance of interdependence. Disturbances are always taking place on a variety of scales. The population of living forms in a biological community shows fluctuations in the frequency of species and in their variety, both in the short run and in the long run. All of these changes have their consequences for evolutionary change.

But evolutionary changes generally take long periods of time compared with the highly accelerated and persistent changes for which man is responsible. For this reason, humanly induced changes often break through existing ecological balances and result in totally different ecosystems, with a different distribution of flora and fauna, of air to breathe and food to eat, and the result for man may be disastrous,

if not fatal. Thus, fertile grazing land becomes barren, a river becomes an open sewer, or pollution in the air above some cities almost permanently blocks all sight of the stars.

Because we are aware of this possibility, we are trying to come to a better understanding of ecology. We may very well be a minority party within our communities and in the country as a whole. I remember a discussion of *The Silent Spring* over WOSU, the radio station of Ohio State University. Every scientist on the panel dismissed Rachel Carson as a sensationalist; one of them seriously challenged her credentials as a scientist. They granted that dangers existed, but—this is the important point—they believed we could always count on new drugs, new processes, new technologies to counteract any damage done by the old. Man could now shape the world as he wished; scientific research could always undo any momentary damage, repair injury before it went too far. Nature and its processes were now in man's hands.

Man had in effect himself become Prometheus. He had snatched the control of his destiny not only from the gods but also from the processes of nature to which he was once forced passively to submit. I do not wish to belittle human achievement. Indeed, unlike some of the prophets of ecological doom—these secular preachers of an impending final judgment—I would emphasize that we can act constructively and effectively in the present crisis, and I believe we will. But we must know the conditions for effective action; knowledge still remains a better antidote for disaster than fear; confidence in solving problems is better than despair about the human ability to respond.

But confidence in human knowledge includes an awareness that knowledge defines the limits of action as well as its possibilities. I want, therefore, to summarize this part of my paper with two propositions, one negative and one positive. Man the creator does not create *ex nihilo,* but only out of materials which must be given, materials which come from the physical world. Despite impressions to the contrary in science fiction and in some of the literature of the futurologists, the variability of human cultures is not without limits. Not everything is possible for man; clear limitations exist on what man can do in ordering his society and putting his tools to work. Man must take into account "the principle of limited possibilities."

Marital and kinship relations, for example, have limited possibilities. Given the basic biological conditions—two sexes, two parents, and a fairly equal sex ratio—we should not be surprised that the alternative possibilities for marriage are just four: monogamy (either fairly permanent or serial), two kinds of plural marriage, and a very rarely

observed form of group marriage. (The best documented example of group marriage is probably the settlement of the Oneida perfectionists in New York State in the last century.) One can run in a few changes on each of these basic categories, but even when marital relationships are combined with kinship systems, we end up with only eleven major forms clearly established in anthropological research.[2]

Similar comments could be made about systems of government, property systems, and other institutional structures. In the realm of technology, the suggestion has been made that three things are of paramount importance in determining the material level of well-being of a society—the types of cutting tools used, the methods for obtaining food, and the methods of transportation. If you will look carefully at each of these basic technologies, you will notice two facts. First, each relates man to his environment, both as a source for the materials (flint, metal, grain) and as that on which man acts with his technologies. Second, using these three technologies in varying degrees of simplicity and complexity, we can classify every human society from the early stone age to the present day.[3] No matter how simple or complex, technology is always there.

The principle of limited possibilities reminds us that man must work with what is given in his environment.

The second principle is that of reciprocity. In the creation of their second nature, in the shaping of social institutions, men must recognize that they stand in necessary relationships of interdependence and reciprocity. We cannot be human alone. Not only do we need our fellow human beings, we need the other species—animals and plants—and the materials of earth and atmosphere. The principle of reciprocity has long been known. In various forms it has occurred in all the high religions and in the norms of primitive societies: "Do unto others, as you would have them do unto you." Reciprocity is a recognition of mutual obligation. What ecology has done—or must do—is to force upon us the recognition that the scope of this principle is truly universal. Not just our next of kin, those who belong to our tribe, or social class, or nation, not even the human population as a whole, but all living things and the nonliving materials with which they must work, are bound together in a variety of bonds of mutual dependence.

The principle of reciprocity is also a way of looking at economic systems. An economic system can be looked at as an ecosystem of a particular kind. If we did this more effectively, we might be more aware that an economic system demands cooperation as well as competition. Exchange is a form of cooperation. The "trade-offs" to which

Dr. Joseph L. Fisher[4] referred help us to understand that many forms of reciprocity, in the marketplace or elsewhere, can be handled by means of rational calculation of advantage and disadvantage.[5]

Human cultural achievements must thus be seen as occurring within this context of interdependence. Ecologically, the effect of cultural change is to change the balance among living forms, but in the early centuries the changes came slowly and in cost-benefit terms the human population probably gained more than it lost.

Recently, not only because of accelerated change but also because of changed attitudes toward innovation, the effects of human action on ecological networks have increased in both tempo and scope. Human populations have had an increasingly destructive effect, often on key elements in the ecological network. Beyond certain rates and quantities of pollutants, for example, streams can no longer clean themselves. Consequently, other forms become dominant in a new ecological balance, and, from the human point of view, the new ecosystem may be much less desirable, if not actually dangerous.

Approach to Urban Problems: Ecological Planning

Man has one part in a network of interdependence. What this means for modern urban society is something that needs careful analysis and equally careful application. In our day, cities have become the foci of difficult problems—racial conflict, rising crime rates, extremes of poverty and wealth, political frustration, and environmental pollution.

Cities have always been regarded ambiguously. An old proverb says, "God created the countryside, but the devil invented the city." Cain, the first murderer, built the first city.

Today's problems are not so much the moral issues implicit in the questions we raise but primarily the basic ideological issues behind the moral questions. Urban civilization is itself an evolutionary adaptation; it is a way in which the human species has handled many problems not only of survival but of the quality of survival.

This prompts two questions. First, in dealing with long-range trends, can we confine ourselves to the simple technique of linear extrapolation? Herman Kahn and his associates do this when they project an increase in per capita production by a factor of ten in the twenty-first century.[6] When does quantitative change become qualitative change, and therefore need new means for coping with change?

Second, when does quantitative change trigger countervailing changes? Surely, this is what Calhoun's work[7] suggests or Hudson Hoagland's study of responses to stress.[8] Perhaps some of our urban

ailments should be seen as countervailing changes. Urban civilizations disrupt the recycling process. This can be documented easily; nonbiodegradable products are the prime example. But other transactions may also have broken down. The consequences of this breakdown may well be the emergence of countervailing forces.

The symbols of the city's failure are, therefore, not the huge amounts of garbage, the smog-laden air, but much more clearly the blighted residential neighborhoods, the broken human lives, the higher death rates—indeed, everything associated with the word "slum." Here living space is often minimal, while population is dense, the air foul, the sanitary system inadequate, and the protective services (by design or neglect) fall short of what is necessary.

Harvey Cox pinned on the secular city the laudatory label "Technopolis." But Technopolis is a misleading symbol, a symbol of Prometheus gone wild, forgetting that he is also dust of the ground. Technopolis ignores the organic context of all human existence; it also overlooks the demand for a human and humane scale or urban design. Cox was certainly right in insisting that we must recognize urbanization as a positive development in history, but this must not keep us from discovering where the sickness of modern urban society is to be found.

The approach to urban problems must be ecological; more specifically, ecological planning. Planning requires something better than the arbitrary criteria for land uses derived from real estate practices, restrictive zoning, and so on. These old controls are based on old assumptions of quantitative growth which no longer work. They do not take into account enough variables, especially the ecological need to bring input and output into better relationships. They rest essentially on the premises that we solve problems by extrapolation from the past.

Planning—especially ecological planning—is problem solving by anticipation.[9] It represents a new mode for linking ideas with action. In the evolutionary sequence, problem solving was originally by survival. This works well on the species level, especially if reproduction rates are high. Problem solving also takes place by learning; this is an improvement which works in situations where we can afford mistakes.

Problem solving by anticipation requires a new conceptual framework. Ecology provides that framework in two ways: (1) an ecological approach is fundamentally relational; it forces us to trace networks, linkages, and check consequences over a larger group of variables; and (2) ecological planning directs us to new values. Planning implies choices. That is what ethics is all about. Ecology suggests that diversity

is better than homogeneity, a mixture of uses better than segregation of uses. If nothing else, ecology forces us to reexamine planning criteria.

Ecology forces us to bring together elements long separated. Institutionally and ideologically, transportation planning (chiefly highways), housing (FHA criteria, subdivision regulations and public housing), and general planning functions have been split into three almost logic-tight compartments, with different professional organizations and different bureaucratic locations and political coalitions in government.[10]

These three must be brought together. An ecological approach demands this—the sooner the better. Anyone who has ever fought a highway department knows what I mean. Good planning must in addition be planning for larger units. It must be regional planning.

Altogether too often the criteria used in making planning decisions are actually antiecological. In highway design, for example, the primary criterion is moving traffic in terms of favorable cost-benefit ratios. Many ecological costs, some of which arise from the relocation of population, others from the disruption of drainage patterns, and still others from the effects on the distribution of business and industry, are not included.[11] An entire residential and commercial complex may grow up around a traffic interchange with little attention, if any, given to the problems of handling routine services—water, sewage, police and fire protection, and so forth.

The interstate highway system, for example, has had, unintentionally I am sure, a major effect on these land uses; as a result in some areas so much traffic has been generated that the traffic jams are worse than before. The ecological cost has continued to skyrocket.

An ecological strategy is not a form of rural nostalgia, not a back-to-the-land movement. It aims to improve the quality of urban life. Nor is the strategy antitechnological. A shift of attitudes toward some technologies will be called for, but ecological planning also calls for new technologies to help solve certain problems, for example, in the handling of urban garbage, in recycling water, in handling air pollution.

The breakdown in many urban services is, I believe, simply a reflection of the fact that over a period of time antiecological trends (call them unbalanced trade-offs, disruptions of reciprocity, or inadequate recycling) generate countervailing forces. The breakdown of urban systems, in particular the property tax system, is a major indicator that land, as a major component in the ecosystem, has been handled in ways that have become increasingly disruptive of a smoothly functioning and humane urban social system. The support given to the malfunc-

tioning of the property tax system by the practices of the FHA mortgage insurance program, by thirty years of almost single-minded devotion to homogeneity rather than diversity, has had the effect in human society, as in animal and plant communities, of strengthening the forces making for instability rather than stability with far-reaching effects on schools, businesses, services, and churches.

What I am advocating obviously involves changes in public policy and in the ways we think about problems and about making decisions —that is, about ethics.

1. The complex network of metropolitan center, suburbs, satellites, and rural hinterlands belong together; they constitute a single ecocommunity. For most people, the definition of the community of obligation is smaller than this; I believe it must be at the very least this large. If this approach is valid, we will think differently about communities—about rural communities as well as urban communities.[12]

2. Each community must be studied in terms of its own set of relationships. This will, in effect, force a certain kind of decentralization in planning. Quite clearly, this implies taking into account the needs and functions of the diversity of living forms found in each ecocommunity; for example, we cannot ignore, as we so often do now, the need for the decomposers. We must be concerned that the recycling process is completed.

3. We recognized another issue when we questioned the right of the United States government to plan a project that would not only force an indigenous population to move but would force upon them in all probability the disintegration of their culture.[13] In planning we have begun to learn something about "participatory democracy." The black militants and others have taught us this much. This too may be a countervailing force—and one we must heed.

4. Basic ethical presuppositions are at issue, presuppositions about diversity, about the integrity of individual populations, about the scope of human accountability. The words of Aldo Leopold written over twenty years ago strike me as unusually appropriate: "Obligations have no meaning without conscience, and the problem we face is the extension of the social conscience from people to land."[14] We must learn how far the network of reciprocities reaches; we must develop a morality of interdependence going far beyond our present commitments.

In a technical sense, reciprocity expresses itself in many ways. It may mean not draining marshlands because they play a key role in recharging aquifers (water-bearing strata of rock, sand, or gravel). Reciprocity may mean increasing densities at certain points to free open

space elsewhere. (Planned unit developments and cluster developments do just this.) Reciprocity may mean placing interdependent functions close together; one major variable in our traffic jam is the increasing length of the journey to work because we have encouraged the segregation of residence and work. Many uses are actually compatible, and planning needs to give diversity priority over uniformity. We must also count the social cost of these segregations. The National Committee against Discrimination in Housing has shown in a recent study that the blacks and Puerto Ricans of New York's ghettos not only pay high transportation costs (in both time and money) to reach places of employment, but that future demands for labor will make such costs run even higher.[15]

To achieve ecological goals, we must apply ecological criteria in planning. Ian McHarg shows how this can be done in his book, *Design with Nature*.[16] By mapping the various features of an area and evaluating each area ecologically, he can establish types of recommended land uses. Thus aquifers need both to be protected and to be managed; all prospective uses must be evaluated in terms of their effect on the aquifer. In dealing with air pollution, particularly with the problem of inversion, McHarg suggests airsheds, corridors defined in terms of wind direction and kept free of polluting industries to insure that atmospheric dispersion of pollutants can take place.

A crucial step in planning decisions that must be taken is to expand the customary cost-benefit formulas by the inclusion of ecological costs and benefits, even when no price tags can be placed on these. All design criteria must be reviewed in the light of ecological considerations. This means that some criteria now accepted in determining buildable land, industrial locations, transportation routes, and so on must be rejected as inadequate.

There is one further condition for successful ecological planning. Zero population growth or its near approximation is essential. The continued growth of population places demands at the most critical point in the ecosystem, the great metropolitan areas. If urban growth continues, it may be impossible to cope with problems of water supply, power demands, garbage disposal, transportation, and so on, and maintain the level of quality of urban life. I suspect that for many urban residents the quality of life in 1970 is already lower than in 1960 or 1950. Journeys to work take longer, cost more in energy, physical and psychic, than ever before. The noise level has become worse. In many neighborhoods, almost every errand must be undertaken in increasingly

worse traffic situations. Urban schools are in chronic trouble, even in the smaller cities.

A Crisis of Ideology and Values

Ecological planning is not the magic cure-all for every urban ill. But it is a critical ingredient. The problem is one of priorities, of world views, and finally of values. Anyone who listens to the rhetoric on public ceremonial occasions knows very soon that our basic values are anti-ecological. Even the symbols that Harvey Cox uses are questionable; instead of the computer and the cloverleaf, I would suggest Rockefeller Center—an example of urban architecture that aims at humaneness, that concerns itself with quality of life—and the Bay Area Rapid Transit system. The values we bring to the building and rebuilding of our metropolitan areas will be determinative for the quality of life in the future.

If ecological planning is to be more than preventive action; if it is to be a positive step in making the quality of life, in a comprehensive sense, a determining value in planning; then a basic shift in our ways of thinking and of making decisions must occur. This is, I believe, what Aldo Leopold meant by "an extension of the social conscience."

This is a theological and religious task, as much as it is an ethical task, for it involves our understanding of what it means to be one species—even though in some ways unique—in an interdependent network of life.

We can deal with this question sentimentally—and some of our concerns for the simple rural community or for untouched wilderness are a form of pastoral romanticism. We can also pretend that realism and ruthlessness are somehow identical, or we can be technological romantics. I think the job is much harder. The reason why it is harder is inherent in the ecological approach: each ecocommunity must be studied in terms of its particular constellation of reciprocities, in terms of the effects of intervention, in terms of "acceptable" levels of disruption. In effect, none of us can escape participating in these decisions.

It is one thing to do the preventive job, to ward off disaster—to ban DDT or control automobile exhausts; it will be quite another problem to change basic styles of life. The present styles of life, rightly or wrongly, are deeply embedded in what Robert Bellah has called American civil religion,[17] to which the public ceremonial of certain national holidays is directed; these styles are just as deeply embedded in those forms of American piety we associate with the churches. Land is a

commodity; utility determines goodness. Individual success, especially in terms of wealth, is to be acclaimed as a great moral achievement.

The ethic of utility, as it has developed in America—sanctified in a variety of versions in the dominant religious tradition—has formed a set of attitudes toward land, recreation, nature, that legitimate practices that are ecologically destructive. One may question whether these attitudes are the only way to read the Judeo-Christian understanding of nature, especially after recognizing how some West European countries have managed land and resources, but one cannot question that American Protestantism, especially the frontier variety, puts its stamp of approval on these practices.

I do not want to downgrade the role of science and engineering in solving our problems. We need their dedication and know-how. But the professional ethics of engineering, at its very best, is still limited if the clients have only a narrow view of the task to be carried out. Engineers cannot by themselves call into question the American preoccupation with continued growth in the number of automobiles, or the many other quantitative indices of progress we constantly use. I do not suggest that progress and growth are dirty words, but they must be qualitatively redefined.

Man is preeminently an interventionist species. This is the price we pay for "culture." The interventions can have fatal effects, but they need not. To prevent our continuing to move in a direction in which our culture becomes in effect the cause of our possible extinction, we must see ourselves more clearly within the limits that ecosystems must observe in order to operate without self-destruction.

The basic structure of our relationships to the world must be reordered. Our core values must be questioned in terms of the wider insights which ecology can give into the ethical consequences of our action. This, it seems to me, is preeminently a theological task. Only when our basic values direct us toward a new understanding of what community can be, will we move from prevention to affirmation, to fashioning cities and regions where the quality of all life, including human life, will be enriched.

NOTES

1. *Prometheus Bound,* trans. Paul Elmer More, in *Complete Greek Drama,* ed. Whitney J. Oates and Eugene O'Neill, Jr., 2 vols. (New York: Random House, 1938), 1:140.

2. George P. Murdock, *Social Structure* (New York: Macmillan Co., 1949), chap. 8, esp. table 60, p. 224.

3. E. D. Chapple and C. S. Coon, *Principles of Anthropology* (New York: Henry H. Holt & Co., 1942), chap. 10.

4. In his address, "Dimensions of the Ecological Crisis," Seventeenth Summer Conference, Institute on Religion in an Age of Science, Star Island, New Hampshire, July 25–August 1, 1970; it also appears elsewhere in this issue of *Zygon* under the title "Dimensions of the Environmental Crisis."

5. Kenneth Boulding has consistently used an ecological approach in economic analysis. See *Beyond Economics* (Ann Arbor: University of Michigan Press, 1968).

6. Herman Kahn and Anthony J. Wiener, "Faustian Powers and Human Choices," in *Environment and Change: The Next Fifty Years*, ed. William R. Ewald, Jr. (Bloomington: Indiana University Press, 1968), pp. 101–31. About environmental pollution Kahn and Wiener say, " 'Only money' is needed to control contamination and degradation of the environment" (p. 111).

7. J. B. Calhoun, "Population Density and Social Pathology," *Scientific American* 206 (1962):139–49.

8. Hudson Hoagland, "Mechanisms of Population Control," *Daedalus* 93 (1964): 812–29.

9. John R. Platt distinguishes these three forms of problem-solving in "Life Where Science Flows," in *Environment and Change*, p. 78 (see n. 6, above).

10. For a general discussion and critical evaluation of planning accomplishments see Carl Feiss, "Taking Stock: A Resume of Planning Accomplishments in the United States," in *Environment and Change*, pp. 214–36 (see n. 6, above).

11. What is here applied to highway planning can be generalized to all engineering projects using cost-benefit analysis. Ecological cost must be included.

12. Paul Goodman raises the question about rural reconstruction in "Two Points of Philosophy and an Example," in *The Fitness of Man's Environment*, Smithsonian Annual 2 (Washington, D.C.: Smithsonian Institution Press, 1968), pp. 25–38.

13. The reference is to the plan for a sea-level canal in Dr. William E. Martin's address, "Industrial and Legal Problems in Ecology," Seventeenth Summer Conference, Institute on Religion in an Age of Science, Star Island, New Hampshire, July 25–August 1, 1970, also published in this issue of *Zygon* under the title "Simple Concepts of Complex Ecological Problems."

14. *A Sand County Almanac* (New York: Oxford University Press, 1968), p. 209.

15. *Trends in Housing* 14, no. 4 (1970):8.

16. Ian McHarg, *Design with Nature* (New York: Natural History Press, 1969). This is a pioneering demonstration of ecological planning.

17. "Civil Religion in America," *Daedalus* 96 (1967):1–21.