

AN ABSTRACT OF THE THESIS OF

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OF BIOTICALLY PRODUCTIVE LAND INTO IRREVERSIBLE
USES

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Abstract approved:

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Many of the natural resource problems facing man in the present era are so large and complicated that no one discipline provides an adequate approach for their solutions. As an example, the relationships of man to the land resource base can best be understood when they are considered holistically rather than in fragments. General systems analysis offers an appropriate scientific method to use when trying to solve these problems, for there are many variables which must be considered.

A systems model which can be used as a framework toward sound decision-making regarding land uses at all levels of government is presented in this thesis in order that several goals can be achieved: provision for keeping options open for as many choices as possible for land uses in the future; innovations and incremental decision-making to be contained within a large, long-term framework; and provision

for rational land uses--ecologically manageable, economically sound, and culturally permissible.

The first phase of the study entails a review of the literature on General System Theory, a theory based upon similarities in structure or organization of systems, not upon similarities of substantive matter. In addition, major land uses are described and placed in a continuum which ranges from the most reversible land uses (those which provide for biotic production) to those uses which are the most irreversible.

The second phase of the study is concerned with identifying the variables (inputs) which are considered in building the model and with understanding the relationships which exist between the variables. Each variable is placed within a subsystem, i. e., economic, political, geometric, land-capability, or behavioral. The relationships between other variables in its subsystem are ascertained for each input as well as its relationships with variables in other subsystems. Primacy is of great significance in systems analysis, and an important step is the determination of those variables which are of greatest concern in minimizing the flow of biotically productive land into irreversible uses.

The third phase comprises the building of the general model, the interlinking of all the variables from the five subsystems into one complex system; it is a unique system of its own and is termed the Man/Land system. The political and land-capability subsystems are pictured on the large model as they should be in order that land waste be

minimized, and the behavioral and economic systems are pictured as they exist right now. Thus, the model is not a description of the present state of affairs. Its purpose is to show the flows between the subsystems.

The final phase of the study is an analysis of the general model which suggests that there exists a hierarchy of subsystems within the Man/Land system--a priority listing--if the goal of man to conserve his biotically productive land is to be achieved. Finite space and land-capability impose a set of natural boundaries upon man and occupy first place in the hierarchy. Knowledge of man's physical and spatial world affects the behavioral subsystem, which occupies the second place in the hierarchy. Attitudes and customs which reflect that man is a part of nature rather than dominant over nature influence the political subsystem, third in the hierarchy. It, in turn, sets the limits within which the economic system can operate, a structure based upon conservation rather than exploitation. The entire system is based upon an ecosystem approach, for although there is a hierarchy of priorities for emphasis in decision making, all of the variables are interrelated. The foregoing hierarchy is a radical departure from American priorities at the present time.

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A Systems Analysis Model for Minimizing
the Flow of Biotically Productive Land
into Irreversible Uses

by

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A SYSTEMS ANALYSIS MODEL FOR MINIMIZING THE FLOW OF BIOTICALLY PRODUCTIVE LAND INTO IRREVERSIBLE USES

I. THE PROBLEM

Introduction

Many of the natural resource problems facing man in the present era are so large and complicated that no one discipline provides an adequate approach for their solutions. Moreover, the relationships of man to the land resource base are examples of phenomena that can best be understood when they are considered holistically rather than in fragments. In order to use the talents of many specialists and to arrive at some consensus among them as to the best ways to allocate resources, general systems analysis offers an appropriate scientific method to use when trying to solve these problems.

General System Theory is a recent addition to the methods of scientific thought and research (see definitions in Appendix I). For centuries scientists and philosophers have relied upon logic (inductive reasoning) or the accumulation of empirical data (deductive reasoning) to explain causality. The isolation and study of smaller and smaller parts of the universe has been the trend, and separate disciplines emerged for the purpose of specializing in a confined area of man's knowledge. The new method combines both logic and empirical research.

General System Theory is holistic and is based upon the concept that there are universal principles which are valid for 'systems' in general. A system is not merely an accumulation of small individual parts into a larger mass; there are relationships between the parts which comprise the system's framework. There can be several types or levels of subsystems within a system, and interrelationships exist within and between levels. Since the human being is a system within himself while also being a part of other systems, it can be seen that a theory which links subsystems to subsystems can be useful for analyzing complicated man/earth relationships.

Statement of the Problem

The management of the land resource base in the United States is in a state of need. Not enough attention has been paid to the fact that outdated modes for allocation of land uses are no longer appropriate. There seems to be a lack of concern for future demands for land, especially in the private economic sector. Prime land is being gobbled up indiscriminately, because it is the least expensive to develop.

Wasteful methods of allocating land are a result of the American heritage. For three centuries settlers and land developers have had a great deal of freedom in modifying the land base for whatever use they desired. Individual land ownership has been fostered, and the right to

use one's land in any way an owner wished has been accepted as an important part of the American property system. There has always been more room somewhere else, and one could 'move on' when he felt crowded or when a new opportunity in land development presented itself.

A serious problem has arisen, however, in many areas of the United States where highly desirable land is located. Especially in regions which combine biotic resource production and industry in their economic base is the problem of land allocation acute. For it is in these areas where a number of choices for land use exist and where the competition for land is greatest. Once land is covered with pavement, for example, it is unlikely to be redeveloped for biotic resource production.

This thesis is concerned with the development of a systems analysis model for minimizing the flow of biotically productive land into irreversible uses. The principles of General System Theory are applied in the construction of the model. The model, in turn, is constructed as an aid for decision-making in regard to the allocation of the land resource base. The model is based upon the following assumptions.

Assumptions

1. Land should remain for as long as possible in a state in which alternative uses are possible.
2. Societal control of the spatial allocation of land uses is necessary if we are to preserve flexible land for the future.
3. Land uses are constantly changing as man's needs change because of cultural, technological, economic, political, and ecological factors.
4. Man is irrational, a satisficer rather than an optimiser, and chooses a course of action which is 'good enough' and not necessarily the best in economically or ecologically rational terms.
5. There are several political levels which must be considered when planning for land uses, not only the local, but the state, national, and international levels.
6. The profit motive is a strong factor in decision making concerning land in private enterprise. However, externalities have become increasingly important in our society.

Goals

A systems model which can be used as a framework for sound decision-making regarding land uses at all levels of government is

presented in this thesis in order that the following goals can be achieved.

Keep Options Open

The primary goal is to provide for keeping options open for as many choices as possible for land use in the future. Since irreversible uses do not provide options for as many choices as possible, it would seem desirable to keep their spatial allotment at a minimum.

Innovations and Incremental Decision-making Within a Long-term Framework

Another goal is the provision for containing incremental decision-making and innovations within a larger long-term framework. There are several possible frameworks. The first is a specific plan for land use drawn up by planners and/or land-capability experts by county or relatively small homogeneous physical region such as a river basin. This kind of plan is usually based upon predictions for growth in the area calculated from the present-day economic base, existing technology, and population trends.

Another long-term framework might be described as a philosophical one in which citizens of an area decry waste and unnecessary exploitation of the land base as being detrimental to a high quality of human life. A built-in attitude of a desire for conservation of natural

resources for the future would exist and act as a social control over large-scale irreversible uses of productive land. Since a society like the one described does not exist, consideration of a philosophical framework is not yet practical except for use in education.

A third long-term framework for the preservation of flexible land is based on national and international considerations and involves the principle of 'optimum condition.' It would seem that this framework is the most appropriate for the world at the present time, for this is an era of increasing populations with rising expectations for economic well-being. Optimum food production can be carried out best in areas containing the most desirable environments for crop farming. Timber, animals, and fibers, in turn, can be produced in certain other areas. Should not prime biotically productive areas be reserved for those functions--at least until we have other alternatives to our present techniques of production? If such a premise is accepted, then our prime lands should not be 'devoured' by housing, highways, and industry and other irreversible uses.

Innovations and incremental decision-making within a larger long-term framework are possible only when the desired goals are clearly defined. It must also be a large framework with a long time span. Otherwise, there will not be room for flexibility. When a long-range goal is defined for a small region in which is stated its 'primary' raison d'etre or role in a much larger region, then that specific goal

is always in the background, and short-term decisions and innovations are made or tried out with it in mind. For instance, were one to state that the primary goal of the citizens of the Willamette Valley in Oregon is to maintain a prime biotically productive area, then the intrusion of industry, highways, etc. should necessarily be kept at a minimum. Priorities will be given to industries which support biotic production, not those which conflict with it.

The present model is designed for regions which are defined as biotically productive areas. Thus, a minimal flow of land into inflexible use is a desired goal, and all incremental decision-making and innovations will be considered within the long-term framework of maintaining as much flexible land as possible.

Rational Land Uses

A further goal to be achieved is the provision for rational land uses. They should be ecologically manageable, economically sound, and culturally permissible. Farming for farming's sake is not rational if the costs of production are too high to allow the farmer a profit. Land uses should be discouraged which are not compatible with the area's ecological system, i. e., water-loving crops in semi-arid zones without adequate long-term irrigation, row-crop farming in wet areas with severe land erosion problems, housing developments in areas with poor drainage and inadequate sewage capacity, and

industry which emits pollutants in areas with frequent air inversion.

Individualism Encouraged

A final goal to be achieved is that of encouraging individual human beings to innovate and achieve. Man should not be a cog in a machine, and cybernetic control of society must be avoided. As mentioned earlier in the description of the second goal, individualism and innovation can best be achieved within a large, well-defined framework. The more clearly defined the goals, the greater is the challenge to innovate. Far greater eccentricity exists among individuals in crowded Europe than in the United States. This has occurred in spite of the fact that zoning and land use laws in Europe are more strict than those in the United States.

Justification of Thesis

Finite Space

One of the main reasons for concern about the land resource base is that it is contained within finite space. Addition to the existing land areas is an impossibility, except on a very small scale, through land-fill on areas which are now covered with water. It is especially important to have concern for the more limited space of biotically 'productive' land, for that is the land with which man is

mainly concerned. Some non-productive lands may become productive in the future through more advanced technology, but until they do, it would be optimistic to count on it. Thus, we must be aware of the spatial limits of the land base and use it wisely.

Increasing Population and Demands

One of the demographic trends of the present era points to an increase in population in the effectively settled areas of the world rather than a diffusion of people to the remaining sparsely settled or vacant areas. Since world population is increasing, this means that presently settled areas will become more crowded.

A second demographic trend shows a migration of people from rural to urban areas. Urban areas are thus becoming increasingly larger. The pattern of urban growth has been one of sprawl rather than a tightly condensed agglomeration of people. The sprawl is possible and constantly accelerated because automobiles and excellent highways make it possible for people to live in one area and to work in another and to travel quickly and comfortably between them.

Because of the two demographic trends connected with an increasing population, the demands for land are increasing. More people will demand more living space, more food, more recreation space, more highways, and more industry, while at the same time the land base remains fixed.

Fear That Private Enterprise Will Consume Its Natural Resource Base

There is a tendency for private enterprise to be exploitative rather than conservation minded, for the highest profits are gained when the factors of production are at their lowest costs. In the past, land was exploited and then deserted when it became infertile, mines were abandoned when the most accessible ores were removed, and trees were cut down without being replaced. The natural resource base was often reduced in quality and in some instances destroyed.

Today, agricultural land in the United States is being diminished by one to two million acres per year. Although the agricultural land base is growing smaller, new technology in agriculture, so far, has kept pace with the demand for commodities. Decreases in acreage have not caused lower total output. In fact, higher and higher yields have provided farm surpluses for many years. But can this steady increase in technological know-how keep on? Until we achieve radical new breakthroughs in genetic potentials and methods of food, timber, and fiber production, we should conserve land for these activities to provide for population increases in the future.

Non-compatible Land Uses in Proximity

When a region becomes effectively settled, there is a tendency for non-compatible land uses to come into existence beside each other.

There is usually no longer room for odoriferous activities to be completely isolated, or there are subdivisions next to farm lands which might be sprayed with dangerous insecticides. Incompatibility decreases the worth of each individual enterprise, and development of incompatible uses should be minimized through the rational allocation of land uses.

Public Concern About Open Space and Environmental Quality

Attitudes vary in different regions regarding the optimum environment of man. Some societies are cooperative and group oriented, while others foster an individualistic approach to living. The American has always been an individualist. He has wanted to be free to do whatever he wished with his privately owned land. Recently, however, his concern for the quality of the environment has made him more aware of group actions and responsibilities. Because many citizens seem to want a higher quality environment and conservation of natural resources, the present decade is a propitious time for inaugurating new approaches to land resource allocation and management.

The Necessity for Establishing Priorities When a Resource Becomes Scarce

When a resource becomes scarce, it is no longer possible to treat it in the same way as when it is ubiquitous or plentiful. It

becomes a scarce and thus precious factor. The resource can be used for some things only, not all things, and therefore priorities for use need to be established. These will usually be based upon expected monetary returns to private enterprise or on future benefits desired for society as a whole.

Since the resource of biotically productive land is becoming scarce in some regions, it is now desirable to establish priorities for land use. Long-range plans which will permit maximum flexibility for land uses in the future would favor allocating land to those uses which are the most reversible, i. e., agriculture, timber production, fiber production, and recreation; they should receive priority over irreversible uses such as transportation systems, housing, and industry.

Method of Approach

The first phase of the study entails a review of the literature on General System Theory. It is necessary to absorb the principles thoroughly so as to be able to perceive and structure the land-use problem in its own terms, for General System Theory is based upon similarities in structure or organization of systems, not on similarities of substantive matter.

The second phase of the study is concerned with identifying the variables (inputs) which are considered in building the model and with

understanding the relationships which exist between the variables.

Each variable is clearly described. Its intrinsic qualities or characteristics may not be so important as its relationships with other variables, especially wherever there is feedback involved. Each variable is placed within a subsystem, i. e., geometric, economic, political, land-capability, or behavioral. The relationships between other variables in its subsystem are ascertained for each input as well as its relationships with variables in other subsystems.

The identification and an understanding of the relationships of the variables were sought and developed through literary research and interviews. There are several considerations and steps involved:

1. In the process of identifying variables, the total system is considered at all times, i. e., the dynamics are emphasized, not merely the variables of the present state of affairs.

Care is taken not to allow a structure, or system, analyzed as a reference point for change, to become the structure (normative) of a system. For such a framework would make it difficult to account for variant, deviant, or alternative structures or subcultures that constitute part of a complex social system.

2. The total number of variables selected for analysis have been divided into subsystems or sets. Economic, political, quantitative spatial, qualitative spatial, and behavioral

variables (model inputs) are as follows:

A. Economic Variables (economic subsystem)

1. Demand for housing, industrial space, highways, recreation, and biotic production
2. Profit motive
 - a. 'highest and best use' approach
 - b. the growth syndrome
3. Externalities

B. Political Variables (political subsystem)

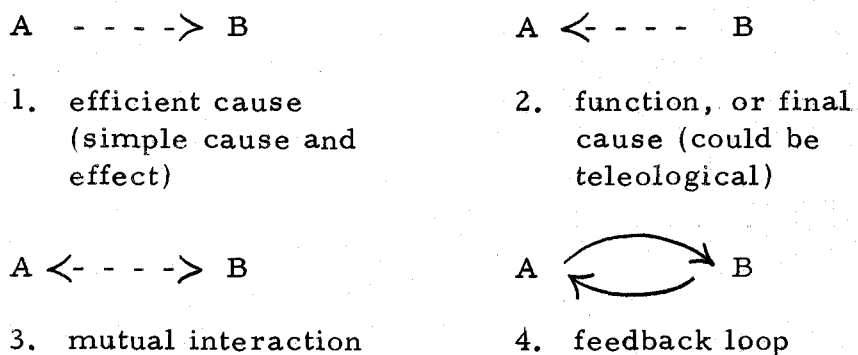
1. Demands and support of the land-use power structure
 - a. Citizen groups
 - b. Jealous bureaucracy
 - c. Large landowners
 - d. Overlapping governments
 1. Municipal
 2. Metropolitan or regional
 3. State
 4. Federal
2. Political tools for guiding land development
 - a. Zoning
 - b. Tax policies
 - c. Use rights
 - d. Land purchases
 - e. Eminent domain

C. Quantitative Spatial Variables (geometric subsystem)

1. Finite space - Euclidian
2. Psychological space
3. Health and sanitation space

4. Empty urban space
 5. Multiple-use space
- D. Qualitative Spatial Variables (land-capability system)
1. The ecosystem
 - a. Functions
 - b. Damaging factors
 2. Ecological Planning
 - a. The ecological approach
 - b. An ecological value system
 - c. Human values
 - d. A protection ethic
 3. Carrying Capacity
 - a. Numbers of persons
 - b. Consumption patterns
 - c. Human values
 4. Problems of Non-compatible Land Uses
 - a. Agriculture
 - b. Air corridors
 - c. Litigation over land uses
 5. The politics of Ecology
 - a. National and state policies
 - b. Broad government powers
 - c. Citizens' groups
- E. Behavioral Variables (behavioral subsystem)
1. Attitudes (overt)
 - a. A wasteful use syndrome
 - b. The concept of freedom - individualism
versus the group
 - c. Detachment - "It is fine for others, but
not for me."

- d. Reservation - clinging to space by a select group
- e. Apathy
- 2. Customs
 - a. Customary space, i.e., backyards in suburbs or front yards in cities
 - b. Customary economic, political, and personal decision-making
 - c. Customary educational systems
- 3. Aesthetics (sensuous perception)
 - a. Beauty
 - b. Tranquillity
 - c. Solitude
 - d. Stimulation
- 3. An important step in the construction of the model is the determination of the relationship between variables, not only within subsystems but between subsystems. Several kinds of relationships are considered, i.e., simple cause and effect (historical and efficient causes), mutual interaction, terminal or final cause (teleological), and feedback loops. They may be explained by the following diagrams:



(After Buckley, 1967, p. 70)

Figure 1. Relationships between Variables

Diagrams appear from time to time in the chapter on variables and subsystems (Chapter IV) which show the relationships between only a few variables as they are discussed in the text. Primacy variables are crosshatched. There is included in each subsystem segment of the chapter a drawing showing the relationships of all the variables in that subsystem - except for the behavioral subsystem. The General Model is a large drawing which combines all the variables of all the subsystems; it is discussed in Chapter V.

4. Primacy is of great significance in systems analysis, and the next step is the determination of variables and/or relationships which are of primary importance, i. e., the ones that are of greatest concern in minimizing the flow of biotically productive land into irreversible uses or those

which are most responsible for land waste. The identification and an understanding of the dynamics of the primary variables are two of the foremost requirements for the building of the model.

The third phase of the study is the building of the General Model (Chapter V). This is accomplished by linking together the five subsystems into one complex system. The general model becomes more than the sum of its five components; it is a unique system in itself.

The fourth phase involves analyzing the changes in the system that are necessary in order to slow down the process of land conversion to irreversible uses. The system is examined carefully for points where these new changes could be initiated. Recommendations are made not only in regard to individual variable changes which are needed but, in addition, for the outlook required if the entire man/land system is to function on a basis which leads to conservation rather than exploitation.

II. GENERAL SYSTEM THEORY

Definition

General System Theory, as pioneered by von Bertalanffy, Boulding et al., deals with generalized systems. Its subject matter is the derivation and formulation of those universal principles which are valid for 'systems' in general, not a unique system." . . . there exist models, principles, and laws that apply to generalized systems or their subclasses, irrespective of their particular kind, the nature of their component elements, and the relations of 'forces' between them" (Bertalanffy, 1957, p. 1).

The tendency towards generalized systems of scientific laws is based upon the insight that important developments frequently arise on the borderlines of disciplines and by way of a synthesis of formerly unconnected fields. Although General System Theory exists in many different fields, it has a structural similarity wherever it is used. It is an excellent tool for providing models which can be transferred from one field to another, and it can help in the organization of extremely complex variables. It is not pure mathematics, but mathematics, especially differential equations, can be used in model building.

Some other related modern system approaches are information

theory; cybernetics; game, decision, and net theories; stochastic models; and operations research. Concepts like those of wholeness, self-regulation, directiveness, and control are indispensable for dealing with social groups. Classical science did not provide us with theories dealing with a general theory of organization for such concepts, although it successfully developed theories of unorganized or disorganized complexity which stem from statistics, the laws of chance, and the second law of thermodynamics.

General System Theory is a theory of organization especially suitable for the biological, behavioral, and social sciences. In principle, it is capable of giving exact definitions to systems concepts and, wherever suitable, of putting them to quantitative analysis.

Kinds of Systems

The growth of general systems research, cybernetics, and information or communication theory marks a transition from a concern for eternal substance and the dynamics of energy transformation to a focus on organization and its dynamics, based on the 'triggering' effects of information transmission (Buckley, 1967, p. 2).

It is important to distinguish between mechanical, organic, and sociocultural systems, for mechanical and organic models are not appropriate for the study of sociocultural (human society) systems. An isolated physical system (mechanical) typically proceeds to its most

probable state of minimal organization (equilibrium and maximum entropy); an organismic system characteristically works to maintain a specific genetically given structure within fairly definite limits (homeostasis); and systems on the higher psychological, phylogenetic, and sociocultural levels are characterized primarily by their morphogenic properties (Buckley, 1967, p. 5). The latter systems do not minimize organization or preserve a given fixed structure; instead, they create, elaborate, or change structure as a prerequisite to remaining viable, as ongoing systems (Buckley, 1967, p. 5). The figure below illustrates the relationships and levels of organization in the three types of systems.

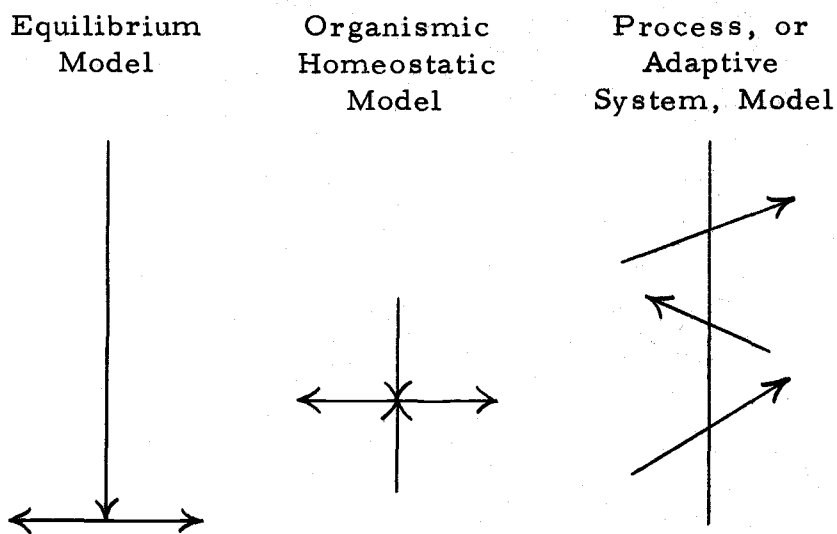


Figure 2. Levels of Organization and Types of Systems
(after Buckley, 1967, p. 40)

Especially in the sociocultural realm, the following scientific problems are being studied by means of General System Theory:

. . . wholes and how to deal with them as such; the general analysis of organization--the complex and dynamic relations of parts, especially when the parts themselves are complex and changing and the relationships are non-rigid, symbolically mediated, often circular, and with many degrees of freedom; problems of intimate interchange with an environment, of goal seeking, of continual elaboration and creation of structure, or more or less adaptive evolution; the mechanics of 'control,' of self-regulation or self-direction (Buckley, 1967, p. 2).

Hall and Fagen explain that the systems variables or components may be relatively simple and stable, or complex and changing; they may vary in only one or two properties or take on many different states. The interrelationships between them may be mutual or unidirectional, linear, nonlinear or intermittent, and varying in degrees of causal efficacy or priority (Hall and Fagen, 1967).

Buckley (1968) discusses the fact that two kinds of processes are found together in complex systems which deal with the human psychological individual and his sociocultural organization and environment. There are the self-regulating systems that are essentially conserving, acting to regulate so as to keep within relatively narrow, viable limits certain characteristics and essential features of the system's given structure and processes. Homeostasis is the classic example. At the same time, there are self-directing systems containing a class of processes whose effect is to direct not only the system's behavior but

also the very nature of its structure in new, often 'higher,' directions-- that is, to change or elaborate its given structure into a significantly different one. Evolution is the general example of this process. Thus, there are stabilizing, structure-maintaining processes inherent in personality and society, and there are also immanent unstabilizing and structure-changing processes. The latter processes are generally moving in the direction of greater complexity (Buckley, 1968, p. 220).

Deutsch (1968) defines society as an open, adaptive, self-directing system, not an equilibrial or organismic system. It is endowed with the possibility of relatively free transfer and recombinations into new patterns of activity. Societal systems can thus be seen to fit into the complex mold of morphogenic systems and must be dealt with as such, not as 'organisms.' Bertalanffy (1951) claims that the human being is not a mere cell of a social organism (p. 308).

Deutsch (1968) also states that:

The more complex and readjustable the constituent parts of a society become, the greater the coherence and freedom of its subassemblies, the greater should be the society's possibilities of itself achieving greater coherence and freedom in the course of its history. Learning nets and societies do not grow best by simplifying or rigidly subordinating their parts or members, but rather with the complexity and freedom of these members, so long as they succeed in maintaining or increasing mutual communication (p. 399).

The Ecosystem

Much of the early work in general systems analysis was done in the field of Biology. Especially important was that of Ludwig von Bertalanffy who coined the term 'General System Theory.' But another significant general system idea, the concept of the ecosystem, had been stated by the biologist, Tansley, in 1935, in connection with plants. The idea transcends biology, however, and is used by many disciplines as a holistic concept containing organization levels, energy flows through the system, and the relationships between structure and function. The ecosystem is generally held to be an organismic system, one which seeks to maintain balance in an open system (homeostasis). It loses some of its validity when transferred from the natural world to the man-made world, but it is used as an analytical tool in many fields.

Howard Odum (1967), a community ecologist who has dealt with agricultural systems, uses an analog approach and likens the ecosystem concept of energy flow and exchange to electric circuitry. He places man within the system as a link in the food chain. Man's labor and dollars are inputs in the total man/earth system.

Another way of looking at the ecosystem is the concept of man's being independent of it, i. e., a planning agent, researcher, or philosopher. It thus becomes the physical environment of man or a

subsystem along with other subsystems in the total man/earth system.

An example of using this concept is that of Walter Isard, et al. (1968) who designate the natural environment as an ecologic system and link it to the social system through input-output analysis whereby one system's imports and exports are the other system's exports and imports, respectively.

Walter Firey (1960) also divorces the ecological system from the economic and cultural systems in his book Man, Mind and Land. In this way he analyzes what is possible ecologically, what is gainful economically, and what is adoptable culturally as far as land uses for any given society in its particular natural environment.

No matter which approach is used as an analytical tool, it is to be recognized that man is in reality a dependent link in the earth's ecosystem. The energy from the sun is the input into the open system which allows it to function in an organized manner with constant inflow and outflow and to achieve homeostasis. At the same time, man has the ability to detach himself from the system in an abstract manner, to destroy it through actions based on faulty reasoning, or to organize it in a different way. It is this dualism which separates man from plants and animals. In the present general systems analysis of the man/land relationship, man and the ecosystem will be considered in both of the forementioned contexts.

Organization Theory and the 'Theory of Organization'

Organization Theory is a branch of General System Theory which deals with general and abstract organizational principles; it applies to any system which exhibits 'organized complexity.' According to Rapaport and Horvath (1960), the concept of organized complexity is exemplified by a living organism or any 'organized' collection of entities interconnected by a complex net of relations. Organized complexity differs markedly from (1) organized simplicity and (2) chaotic complexity and falls somewhere between these two extremes.

'Organized simplicity' pertains to a system without closed loops in the causal chain. Examples are strict sequential or linear additivity systems. At the other extreme is 'chaotic complexity' where the number of entities involved is so vast that the interactions can be described in terms of continuously distributed quantities or gradients, i. e., do not need to be specifically identified with regard to the individual entities (Rapaport and Horvath, 1960, p. 73).

'Organized complexity' is concerned with two classes of concepts, according to Rapaport and Horvath (1960), both of which were derived from Biology--namely teleology and taxonomy. Teleology in its modern form refers to 'goal-seeking' behavior of mechanisms. Taxonomy refers to qualitative identification of systems, i. e., a system must be identified as one with or without feedback (one without

is cycle free). This concept is a topological one--qualitative rather than quantitative--and resembles classification rather than computation.

Cybernetics has shown that a teleological way of thinking is not incompatible with the metaphysics of physical determinism; topology has shown that a taxonomic way of thinking is not inconsistent with mathematical sophistication. The two systems are related: cybernetics is a dynamics superimposed on a topology (Rapaport and Horvath, 1960, p. 74).

The 'theory of organization' purports to be a social science. It puts real human organizations at the center of interest and is concerned with decision-making. Such a theory involves examining a state of affairs and the range of possible outcomes when certain choices are made; it is based on teleological principles (Rapaport and Horvath, 1960, p. 75).

Institutionalization and Social Structure

Institutionalization is an ongoing, circular, systemic process, and not an open-ended chain of events with clear-cut antecedents and consequences. From a systems view, it might be seen as a feedback, or pseudo-feedback, process that contains both negative (stabilizing or rigidifying) elements and positive (structure-elaborating, or increasingly disorganizing) features (Buckley, 1967, p. 137).

There are many diverse variables in such a system, and tension in the system keeps it viable. Selection processes are always at work,

while at the same time there is perpetuation and transmission of some stabilities. Perhaps at the basis of stability during a time of conflict, ambiguity, and change are the concepts of formality and legality along with customary physical and ecological arrangements.

Max Weber defines social structure as an inherent polarity between a variety of alternatives of action, on the one hand, and the structural constraints that nevertheless limit this variety, on the other (Buckley, 1967, p. 132). Adaptive social processes or dynamics occur in such a structure.

Advantages of General System Theory

General System Theory allows logico-mathematical definitions of many ill-defined and much disputed concepts such as those of wholeness, summativity, emergent and resultant evolution, progressive segregation, mechanization and centralization, individuality, hierarchical order, controlling parts, trigger action, competition, finality and equi-finality, physical and biological time, and so forth (Bertalanffy, 1951, p. 304-305). Traditional analysis is inadequate to deal with the foregoing phenomena or with purpose, goal seeking, or self-regulating behavior. Systems analysis can cope with the problems of primacy and the varying degrees of connectedness of some parts of the system to others.

In summation . . . only the modern systems approach promises to get at the full complexity of the interacting phenomena - to see not only the causes acting on the phenomena under study, the possible consequences of the phenomena, and the possible mutual interactions of some of these factors, but also to see the total emergent processes as a function of possible positive and/or negative feedbacks mediated by the selective decisions, or 'choices' of the individuals and groups directly or indirectly involved (Buckley, 1967, p. 80).

Descriptions of General System Theory Concepts and Elements

General System Theory has its own sets of concepts and elements, which are explained below. The basic functions of both closed and open systems are described. Short definitions of the following terms appear in Appendix 1.

Closed System - A closed system is a system which possesses clearly defined boundaries across which no imports of material or energy can occur. The laws of thermodynamics apply to closed systems, and the second law, in particular, states that entropy must increase to a maximum and eventually come to a stop at a state of equilibrium. If entropy is a measure of probability, it will tend to a state of most probable distribution, which is maximum disorder.

Open System - An open system maintains itself in a continuous inflow and outflow through the importation of an outside energy supply for maintenance and preservation. While components and variables are continually built up and broken down, the system tends toward

homeostasis or a steady state, not a state of equilibrium as found in a closed system. A living system, maintaining itself in a steady state, can avoid an increase in entropy and may even develop towards states of increased order and organization. Thus, in closed systems entropy is always positive, while in open systems entropy is positive and/or negative.

Information - Information is movement toward negative entropy or an increase in order which results from an improbable state. In this way, information theory comes close to the theory of open or adaptive systems, which may increase in order. Information can also be considered a measure of decisions. Frick maintains that all information-conveying processes are basically selection processes (Frick, 1959, p. 614).

Buckley (1967) defines information as a relationship between sets or variables of structured variety (p. 47). It deals with events between a signal source and a receiver, but not with the nature of these termini themselves and the conditions under which the signals transmitted between them become 'meaningful' information.

Entropy - Entropy is a measurement of or a tendency toward disorder or randomness. Maximum entropy (complete randomness) is the most probable state of a closed system. Negative entropy or information increases order and thus reduces entropy. Open systems are characterized by less entropy than closed ones.

Equilibrium - This is the state towards which an isolated physical (mechanical) system proceeds and is associated with maximum entropy (disorder or randomness). The term is used in connection with a closed system.

Homeostasis - Homeostasis differs from equilibrium in that it usually refers to maintenance of balance in an organic (open) system. It is commonly used in discussions of the ecosystem, an organismic system which characteristically works to maintain a specific genetically given structure within fairly definite limits. Inputs and outputs of energy and/or material are involved in the system.

Steady State - Steady state is a systems analysis term used to connote stability in an open system, especially in the socio-cultural sphere. It is used rather than homeostasis in social systems, because a steady state is not identified with a particular structure of a system. A social system may have to change in order that a steady state can be maintained; in other words, morphogenesis is the stable situation rather than homeostasis in most social systems.

On the sociocultural level, there is no specific structure that is alone viable and normal for every society. Such systems can embrace wide diversities and incompatibilities, while remaining persistent over long periods of time.

Isomorphism - Isomorphism is a formal correspondence of general principles or even laws among different phenomena. A law of

physics can apply to human society, i. e. , gravity theory, in which the amount of pull between two masses is contingent upon their respective sizes and is diminished as distances between them grow larger. Another example of isomorphism is the second law of thermodynamics (physics) as applied to any isolated physical system (closed). It states that entropy will increase until equilibrium is reached. General Systems Theory is based upon isomorphism, for its general principles extend to many different kinds of systems or phenomena.

Reductionism - Reductionism refers to the concept of reducing everything to the constructs and laws of physics. It has been a common scientific procedure for many centuries but has proven inadequate for the study of high-level social systems. General systems analysis recognizes that there are many kinds of systems with varying levels of complexity. It is no longer necessary to try to reduce them all to the physical level.

Perspectivism - This term refers to the process of finding constructs and possibly laws within individual levels, i. e. , the physical, the biological, the social, and the moral universe. Thus, the constructs would not have to fit more than one kind of system. For example, simple mechanical laws could apply to an isolated physical system but would be inadequate to explain a complicated social system.

Heteromorphic - A heteromorphic system is capable of maintaining its continuity and integrity by changing essential aspects of its

structure or organization. It is morphogenic and usually changes toward a structure of greater complexity. Such a system contains deviation-amplifying mutual causal processes which are opposed to those processes which lead to homeostasis. Instead, they amplify an insignificant or accidental initial kick, build up deviation, and diverge from the initial condition (Maruyama, 1963, p. 304). The deviation-amplifying system has mutual positive feedbacks between the elements in it, while its counterpart, the deviation-counteracting system, has mutual negative feedbacks between its elements.

Examples of a heteromorphic system are: the rise of cultures of various types, evolution of living organisms, accumulation of capital in industry, interpersonal processes which produce mental illness, and international conflicts (Maruyama, 1963, p. 304). The complicated social system concerned with land use is a heteromorphic system.

Components - A component can either be a variable or a subsystem, depending upon the author's intent. For the purposes of this study components shall be subsystems, i.e., economic, geometric, land-capability, political, and behavioral. In turn, each of these subsystems can have several subsystems of its own, and these, too, are components. All of the components shall be carefully identified, and component relationships will be studied.

Variables - Variables are specific parts of subsystems, i.e.,

the smallest units of the entire man/land system. The relationships between variables within subsystems will be ascertained as well as the relationships of variables between the various subsystems.

Environment - The environment is the larger system to which a subsystem belongs. Thus, the economic environment is the system in which are found the subsystems of demand and supply and externalities. It, in turn, is a subsystem of the larger man/earth system, its environment.

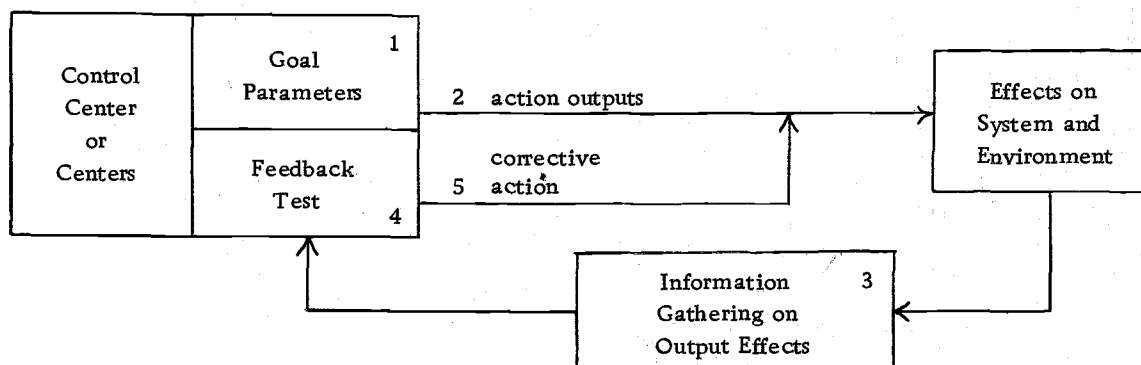
Feedback - All general systems do not follow the feedback scheme, which presupposes structural arrangements containing receptors, control apparatus, and effectors. For feedback is information about one stage of a process which is returned to an earlier stage's controlling device, i. e. , some of the output energy of an apparatus is returned as an input. At first, systems are governed by dynamic interaction of their components; later on, fixed arrangements and conditions of constraint are established which render the system and its parts more efficient. This is the special nature of feedback.

'Purposeful behavior' involves true feedback loops, not pseudo loops (circular causal chains). These true feedback loops are self-regulating and underlie the complex organization and dynamics of higher level adaptive systems. Complex organization and dynamics are involved with some degree of learning, purpose, goal seeking,

elaboration of organization, or evolution in general (Buckley, 1967, p. 70).

Pseudo feedback (circular causal chains) occurs when the effect of an event or variable returns indirectly to influence the original event itself by way of one or more intermediate events or variables. There is no 'control' in this pseudo feedback system, only a blind reaction of the original variable to the forces it has helped to create and which are now reacting back on it (Buckley, 1967, p. 69).

Cybernetics - Cybernetics is the scientific analysis and control of animate or inanimate systems, based upon their methods of communication. It emphasizes the unity of all systems and stresses such functional parallels as neural networks and electronic circuits. Comparisons are made between similar structures of man, machine, and society--especially through the study of their control and communication facilities. Thus, the feedback principle is of paramount importance in cybernetics.



(After Maruyama, 1963, p. 304)

Figure 3. A Real Feedback Model (a social system)

Is the feedback model only relevant to societies or organizations with a high degree of centralized planning? If not, Buckley (1967) asks where is the centralized control in a less planned society that affects the state of the system or its environment (p. 173). Administration may be inadequate for the role of control center. Time lag is a problem in social systems, for full knowledge or results may not be known or may not be known until much later. The choosing of feedback information might not be objective, and corrective action may involve social upheaval if certain goals are to be achieved (Buckley, 1967, p. 174-176).

'Values' will be involved in social decision making, i. e., what will get high priority? Indecision may result if too many alternatives are available, while jamming (deadlock) may result if too few channels are available. The field of cybernetics in complicated human systems is at the experimental stage.

Oscillations - Oscillations refer to fluctuations between conditions or variations in attitudes, policies, or purposes. Oscillations occur especially in those social systems where mutual interaction exists.

. . . many ecologists consider that an ecology cannot be considered to have reached optimal conditions while considerable oscillation of more or less random patterns continues in the subpopulations of the system. Evidently, as ecologies become more mature, then the magnitude of oscillatory behavior decreases (Milsom, 1968, p. 44).

Discontinuity - Discontinuity is the term for a state where there occurs an emergent level of organization with novel features.

Control - Control is an attribute of a system when used as a name for 'connectiveness.' Wiener (1954) implies connectiveness when he defines control as the sending of messages which effectively change the behavior of the recipient (p. 8).

Mutual Causation - Mutual causation exists when the size of influence in one direction has an effect on the size of influence in the other direction. Such relationships can be defined between more than two elements. In a loop, each element has an influence on all other elements either directly or indirectly, and each element influences itself through other elements (Maruyama, 1963, p. 312). There is no hierarchical causal priority in any of the elements. Loops can contain negative and/or positive influences. In general, a loop with an even number of negative influences is deviation-amplifying, and a loop with an odd number of negative influences is deviation-counteracting.

Parts of society are not typically independent but are mutually interrelated and constitute a whole. This fact necessitates functional analysis, not merely a study of collection of parts. General System Theory is an objective approach.

Efficient Cause and Historical Cause - "The most common method of analyzing a given phenomena X has been to relate it to

prior phenomena or 'causes,' a, b, c . . . , in a one-way causal linkage. If the prior events are proximal to the event being explained, we speak of 'efficient causes;' if more distant, we speak of 'historical causes'" (Buckley, 1967, p. 68).

Teleology or Final Cause - An event X is analyzed in terms of its relation to future events (or goals, purposes, functions, or consequences). In systems analysis, the concepts of purpose and teleology have been made precise by putting them into specifiable mechanisms involving feedback in order that certain goals can be reached. Teleological principles are especially important in 'cybernetics.'

Primacy - Some variables or subsystems are more significant than others in a process and thus have 'primacy.' These primary variables must be ascertained within a system and weighted according to their importance. One of the main goals to be reached through systems analysis is the identification and understanding of the influences of these primary variables and subsystems, because not all of the extant variables are important in functional analysis. Perhaps a variable or subsystem with greatest primacy might be described as that part of the system which gives the maximum over-all change in system performance for the smallest change in sub-assembly structure. But another meaning is the identification of variables which are most closely connected with the goals or purposes desired for the

system. Both ideas shall be examined in this study.

Buffer Mechanisms - These mechanisms delay the effects of a variable until some later point in a process.

Step Function - A step function is connected with a variable which has no appreciable effect on others until its value has increased or decreased by some minimal increment. Consequently, research may fail to disclose any significant relationships for such a variable even though a large potential interaction is in fact building up. Minimal increments contributing to step functions should be searched for and accurately identified whenever possible.

Equifinality - The state of equifinality is reached whenever different initial conditions lead to similar end effects. The concept of 'climax' in plant communities is an excellent example. The same climax formation may be reached after a long period of time by several subcommunities which started out with different environments, i. e. , edaphic, marine or land, or microclimatic,

Multifinality - The state of multifinality is reached whenever similar initial conditions lead to different end effects, i. e. , different cultures emerging from similar physical environments.

P. P. B. S. - The initials stand for Planning-Programming-Budgeting System, a part of General Systems Theory in wide use by the United State Government. A fundamental concept of the P. P. B. S. is that of formulating a program (of at least five years' duration)

expressing the goals desired by an organization or system (Hartley, 1968, p. 150). The extension of the time horizon is a way of attempting to exert control over the future instead of merely reacting to it and being controlled by it.

III. LAND USES - A CONTINUUM

Introduction

The meaning of the terms, irreversibility or reversibility of land uses, is related to the biotic productivity of land. The degree to which any given land use is reversible to or irreversible from optimum biotic production capability determines its place in the continuum.

The most reversible land is that land in a state which is easily converted to biotic production. The most irreversible land is that land in a state which would be extremely costly or technically difficult to return to a biotic state. In addition to biotic production capability, economic, political, and behavioral variables are factors in determining the reversibility of land uses. Economic and political variables are discussed below. Variables from the behavioral subsystem are reflected through the author's own attitudes in regard to the placement of various land uses in the continuum (see Table 1).

Description of the Land Uses

Crop agricultural land is land presently in use for annual, perennial, and orchard crops and is thus being utilized for biotic production. Economic factors enter into the choices of particular crops. Land used for annual crops is the most reversible since the

Table 1. Major Land Uses - A Continuum

Reversible ↑	Crop agriculture
	annual crops
	perennial crops
	orchards
	Grazing
	Private timber lands (economic and corporate irreversibility)
	National Forest timber
	Camping and hiking areas
	private forests
	public forests
Irreversible ↓	wilderness areas
	Power line rights-of-way
	Golf courses
	Public playgrounds and parks (including National Parks)
	Designated wilderness areas (political irreversibility)
	Mining claims (political irreversibility)
	Waste disposal areas
	Single-unit housing
	Small reservoirs
	Country roads
	Railroad tracks
	Drive-in theaters
	Parking lots
	Tennis courts and swimming pools
	Single-unit housing complex
	Multiple unit housing
	Public educational institutions
	Government buildings
	Business establishments
	Light industry complex
	Heavy industry complex
	Airports - paved
	Freeways
	Large reservoirs

crop commitment is on an annual basis only and can be changed each year. Land being used for perennial crops is less reversible than that used for annual crops because the economic commitment in a perennial crop produces a demand that the land stay in that use for more than a year. Land being used for orchard crops is still less reversible, again because the economic commitment for establishment and production from orchard crops is for at least several years and, in order to secure optimum return to the orchardist, would normally be in terms of anywhere from a ten to thirty-year use commitment.

Grazing land is land being used for forage for the grazing of animals. Such land can have natural stands of forage plants growing on it, or it can be land which has been seeded to forage plants to create or increase an animal carrying capacity. Some forest or timber land also has the capability of supporting the growth of forage plants in addition to trees. A small percentage of grazing lands are convertible to annual, perennial, and/or orchard crop production, and thus are high on the scale of reversibility. Economic variables can exist which affect the reversibility of such lands as well as their basic biotic productivity.

Private timber lands have a high degree of economic and corporate irreversibility because by their nature they have been chosen by private individuals or corporations to be managed as timber producing areas over a long time period. They are high on the scale of

biotic productivity when used and managed for timber production and, in some cases, for grazing.

Public forest timber land is land on which timber is growing under the control of the Forest Service or other public agencies. Such land is being utilized in its most biotically productive way under present timber management practices and most of this type of land is not suitable for agricultural uses even were it to be cleared of timber. As observed in the preceding paragraphs, some National Forest land can and does support animal grazing in addition to timber. National Forest timber lands have a high degree of political irreversibility.

Camping and hiking areas - private and national forest areas used for camping and hiking (recreational uses) retain a high degree of biotic productivity as timber areas while providing a recreational opportunity for people. Wilderness areas provide the same recreational opportunity for campers and hikers willing to spend the extra energy to reach them. However, they cannot be considered biotically productive, because they are reserved (politically) as wilderness. Wilderness areas are politically irreversible mainly because of the pressures of conservation groups.

Power line rights-of-way, while highly irreversible economically and politically, do have a reversibility characteristic in areas where the land used for them has a high biotic capability. The Forest Service has a reseeding program under way on many rights-of-way.

The land is seeded to grasses and clovers which provide grazing capability. In Southern California, metropolitan areas' rights-of-way are being used by private individuals (by renting or leasing from power companies) for production of high value agricultural products.

Golf Courses - Land used for golf courses usually has a high biotic productive capacity because good land is necessary to grow the grasses needed for the required turf. Such land could be returned to agricultural use by abandoning it for recreational use and ploughing and planting it to crops. The portions of such land used for clubhouses, tennis courts, swimming pools, and toolsheds would be highly irreversible because construction materials would destroy the biotic productivity capability.

Public playgrounds and parks - Playgrounds are highly irreversible because, even if they have not been paved or black-topped, the compaction of the soil caused by playground use would make it difficult to return the land to biotic production. Parks, including National Parks, are reversible as far as land capability is concerned, but along with playgrounds, they have a high degree of political irreversibility due to public pressures.

Designated wilderness areas - While providing a reserve of biotic productivity in terms of timber reserves, wilderness areas are highly irreversible politically, due to pressures of conservation groups.

Mining claims - Land used for mining has a high degree of

political irreversibility under the mining laws. Additionally, mining operations usually render any biotically productive land surrounding the area of the actual mining and processing plants unproductive because of dumps, tailing piles, and buildings used in connection with mining operations. The additional acres of land which may exist under the claim, but not be directly involved in mining activities, can constitute a reserve of biotically productive land.

Waste disposal areas - Areas committed to permanent waste disposal functions, such as sewage treatment plants and settling ponds, are highly irreversible, because such installations render the land useless for biotic production. Areas used for dumps for trash and solid wastes can be made productive if swamp and tidal basin areas are selected and the dumps used as fill which can be covered by soil layers which are hauled in. However, some dump areas are located on biotically productive lands which are being covered up by dumping of solid wastes; such areas are highly irreversible.

Single-unit housing - Even though the land areas used for single housing units often have biotic production capabilities, and removal of the dwelling could enable the land to be returned to biotic production, housing is an irreversible land use because of economic factors. Long-term investments are necessary.

Small reservoirs - Land used for small reservoirs is fairly reversible; however, economic considerations indicate such use to be

near irreversibility. These kinds of reservoirs usually are constructed with a small earth-fill dam in a swale or ravine to help control erosion, while providing a pond area usable for stock water, irrigation, fish culture, and in some cases, culinary water. Although the land area is not usually materially altered and therefore retains its biotic production capability which could be used if the dam were removed, the cost of building the dam is large enough to place this land-use in an irreversible category.

Country roads - Land used for country roads is highly irreversible not only because of the political commitment, but also because the materials used in roadway construction and the compaction of the soil caused by vehicular traffic render the land biotically unproductive.

Railroad tracks - Land used for railroad tracks is highly irreversible because of the political and economic commitment and, also, as in the case of country roads, because construction materials used in roadbed preparation destroy the biotic productivity capability of the land. Railroad tracks normally do contain some land in the rights-of-way which could be reversible because not all of the right-of-way is used for the roadbed. Such land, however, is quite often committed to other irreversible uses such as warehouses and manufacturing establishments.

Drive-in theatres can be classified either reversible or irreversible. If located on land not covered with asphalt or other

paving material, the land could be returned to biotic production, although the compaction caused by vehicles would temporarily reduce the land's productive capability. Where the land has been paved, it becomes practically irreversible for biotic production; it could be converted to other irreversible uses, however.

Parking lots - A few parking lots in suburban or rural areas have grass surfaces, and their use is reversible. In metropolitan areas, however, parking lots are usually on land which has been made highly irreversible to biotic production because of paving. They can be used as space for the construction of buildings, but this would only increase the irreversibility.

Tennis courts are constructed with turf, clay, asphalt, or concrete surfaces. When constructed of turf or clay, the land could be returned to biotic production and thus has some degree of reversibility. Most often, tennis courts are constructed of asphalt or concrete, and the land is highly irreversible to biotic production. It could be used for the construction of buildings, which would make it even more irreversible.

Swimming pools render the land used for them totally irreversible for biotic production since they are constructed of concrete and are very permanent in nature.

Single-unit housing complex - Land used for complexes of single-unit housing is not considered to be reversible, even though it

is often biotically productive land which could be returned to production were the construction to be razed. Economically, such land is highly irreversible, because the investment in construction is amortized over 20 to 30 periods.

Multiple-unit housing - Land used for this purpose is irreversible for physical and economic reasons. Multiple-story units require extensive foundations which greatly alter the land base. Economically, the land used in this way is highly irreversible because of the long-term financing which is involved.

Public educational institutions - Land occupied by public educational institutions can be both reversible and irreversible. Politically, all such land is highly irreversible. However, some institutions occupy land in part on which no construction has been made and which retains its biotic productivity and therefore has some reversibility capability. The land occupied by buildings of these institutions is highly to totally irreversible due to the nature of construction which destroys the biotic productivity capability of the land on which it is situated. Economically, land used for buildings is highly irreversible because of the long-term financing involved in purchase and construction.

Government buildings - Land used for government buildings may be considered totally irreversible politically; and because of the nature of the construction of most such buildings, the biotic capability of the land is destroyed. Economically, land used in this way is highly

irreversible because construction financing covers long periods of time--as much as 50 years.

Business establishments - Land occupied by business establishments can vary somewhat in reversibility depending on the nature of the establishment and the type of construction used. A temporary produce market in a farming area is reversible, whereas a permanent store in a downtown business district or suburban shopping center is highly irreversible due to long-term financing commitments and costly construction materials. The business establishments considered for the continuum are of the latter type.

Light-industry complex - Land used for light industry complexes is highly irreversible. Construction methods usually destroy biotic capability, and the economic investment commits the land to industry use for very long periods of time.

Heavy industry complex - Land used for heavy industry complexes may be considered almost totally irreversible. Aside from the destruction of biotic capability by construction methods and materials, the economic commitment of land to this use involves long-term financing.

Paved airports - Land covered by pavement for runways, taxi strips, and aircraft parking areas as well as that occupied by hangers, maintenance shops, and terminal buildings can be considered totally irreversible, because the construction materials and methods destroy

the biotic capability of the land. In some cases, biotic productivity capability is conserved in areas not paved between runways and taxi strips and in surrounding areas. In fact, there are cases where such land is used for agriculture. An example occurs at the Fresno Municipal Airport in California where cotton is grown on land in between runways. In Pocatello, Idaho, areas between and surrounding runways for many years produced grass seed.

Freeways - The land area occupied by the actual pavement of freeways can be considered totally irreversible because construction materials and methods destroy its biotic capability. Additionally, the political and economic commitments contribute heavily to the irreversibility. Fortunately, for aesthetic reasons, many freeways are landscaped with median strips and rights-of-way planted to turf grasses, shrubs, and perennial flowers and bulbs.

Large reservoirs - Land occupied by large reservoirs and the dams which create them can be considered totally irreversible. In construction of the dams, large-scale reshaping of the land is employed and large areas are permanently covered with concrete and/or rock fill. Economically, an amortization period of 50 years is common and requires a long-range economic commitment. Though the land covered by the reservoir might have some reversibility capability, the permanent nature of the dam would offset this capability.

IV. MODEL INPUTS AND SUBSYSTEM MODELS

Economic Variables - Economic Subsystem

Introduction

Kenneth Boulding calls Economics a generalized theory of 'choice.' The price system is simply one reflection of the general problem of 'scarcity.'

Value, in the sense of what we have to give up of one thing in order to get a unit of another--i.e., as a 'transformation ratio'--is a phenomenon we meet in every conceivable branch of human activity, for wherever there is limitation, wherever there is choice, wherever we cannot have our cake and eat it, there the value phenomenon pops up (Boulding, 1968, p. 6).

Thus, wherever natural resources are scarce, choice is necessary, and the question of values arises. Economic theory is one of the tools which aids in the decision-making leading to the allocation of those scarce resources.

The problem of making rational decisions for the whole society requires that the 'less wanted' be given up in favor of the 'more wanted.' An important difference between the individual decision and the social decision is that in the former the alternatives are arrayed in a single-preference ordering, whereas the latter must formulate some kind of summation, average, compromise, or other compounding of many preference orderings, unless one dictator or planning agency

makes the decisions for all of society.

The private economic system operates within a framework of rules provided by the government, for the 'market system' cannot decide the proper allocation of the total national income between public and private goods and cannot make its own rules about property rights or how all of its transactions are to be carried out. The market system itself cannot determine, either, that land should be privately or publicly owned, although private ownership is practiced in most such systems and is normally assumed to be part of the market process.

Private enterprise makes a collective decision by means of a sort of mass bargaining, which is a series of transactions, between the consumer and producer phases of the same group of people. The whole system is a network of decisions and has many 'cross' relationships between factors and products. Money benefits and non-money costs and benefits are considered.

Kuhn suggests that an

. . . aggregative decision in which the market system shows weakness is that between the relative importance of present wants and those of a generation or two hence. To what extent, for instance, should the settlers of a hundred years ago have increased their costs by being less profligate with timber resources, so that we would now have better lumber at lower cost? How much cost should the current generation incur to secure parks and forests for our great-grandchildren? This is a difficult choice at best, requiring both intertemporal and interpersonal comparisons of utility, among other things (Kuhn, 1963, p. 590).

In general, demand arises in a region because of an increasing population, a rising standard-of-living, the availability of money, and effective selling, but an individual good or service is demanded for more specific reasons. The following demand variables in the economic subsystem which affect the land resource base will be described and analyzed: demand for new housing, demand for industrial space, demand for highways, demand for recreation space, and demand for biotic production space.

Demand for New Housing

Types of Housing. The single-family dwelling is traditional in the United States, especially for families with children. Apartment living has been favored only by some persons in very large cities, by some of the elderly, by single persons, or by young married couples. There are several reasons for a preference for single-family dwellings in America:

1. Individualism - The United States cultural tradition favors individualism rather than the group, and this extends to housing arrangements. Only houses are considered to be individualistic in our society.
2. Privacy - The factor of privacy is important in the American culture. Whenever possible, a person has a room of his own, and a family has a home of its own. A communal living

organization is very rare in the United States. Apartments are considered to lack privacy.

3. Private property - The owning of property is connected with the capitalist economic system. Tradition favors owning a home rather than paying rent for a house or apartment. Paying rent is usually considered as unsound economically, for a family is not building up its capital by investing in the purchase of a home.
4. A place for children to play. - The notion that children need their own yards in which to play is prevalent in the United States and is responsible for many families' moving to the suburbs.
5. A belief that plenty of land exists - Most Americans appear to be unaware that there is developing a scarcity of prime biotic production land in our country, and they are unconcerned, therefore, about conserving it.

Ironically, several of the above reasons for owning one's own home are no longer valid, especially in areas of rapid urban development. Often, privacy can be obtained much more easily in a large, well-built apartment house than in a housing development with small lots whose houses have large picture windows. Noise in the suburbs is becoming a problem because of gas and electric lawnmowers, electric hedge clippers, motorbikes, and automobiles. Building lots

are not large enough to provide for many outdoor activities, either. A large city park near an apartment house might provide for more activities for both adults and children.

Because of the need for suburbanites to commute to work and other activities, there is the strain of coping with automobile traffic and noise. Privacy is lacking in this activity, perhaps more than when one can walk to work or to shop. Real 'space and quiet' can be bought only by people with wealth and/or time to commute in non-rush hours. New communities that provide multiple dwellings along with large recreational and walking spaces are probably more quiet and private than the typical sprawling United States suburb with 60-foot plus lots and picture-window houses.

Types of housing are demanded because of certain behavioral aspects of our culture and will be discussed in greater detail under the behavioral subsystem.

Population Increase. An important factor connected with a demand for new housing is a population increase, whether through in-migration into a region or through natural increase. In the United States, the population is increasing at a rate of about 1.3 percent a year (from 1960 to 1969) (U. S. Dept. of Commerce/Bureau of the Census, 1970a). The rate of increase differs from region to region.

At the same time population is increasing in the United States at uneven rates in various regions, it is also increasing unevenly

within each region; urban populations increase at the same time rural populations decline. This means that population densities are shifting and are becoming higher in the urban areas and lower in rural areas.

The relationship between a population increase and the demand for housing is a direct cause and effect relationship--more people need more housing. Two factors which contribute to migration into a region are the 'growth syndrome' and a desirable environment-for-living (see Figure 4).

The Growth Syndrome. The 'growth syndrome' stems from economics and is the belief that a region will suffer an economic decline unless it is growing (see Figure 5). There is no room in such a theory for homeostasis. Instead, stability is to be achieved only when the region is constantly changing through growth. A region with a 'growth syndrome' has an active promotion organization which contrives to attract new industry to extend its economic base, sometimes at a cost of impairing the natural environment. This factor is a direct cause of in-migration into a region and has the effect of increasing the demand for housing due to an increased population (see Figure 4). If less promotion takes place, there will be less in-migration.

A Desirable Environment for Living. A desirable environment-for-living also causes in-migration into a region, i. e., the warm,

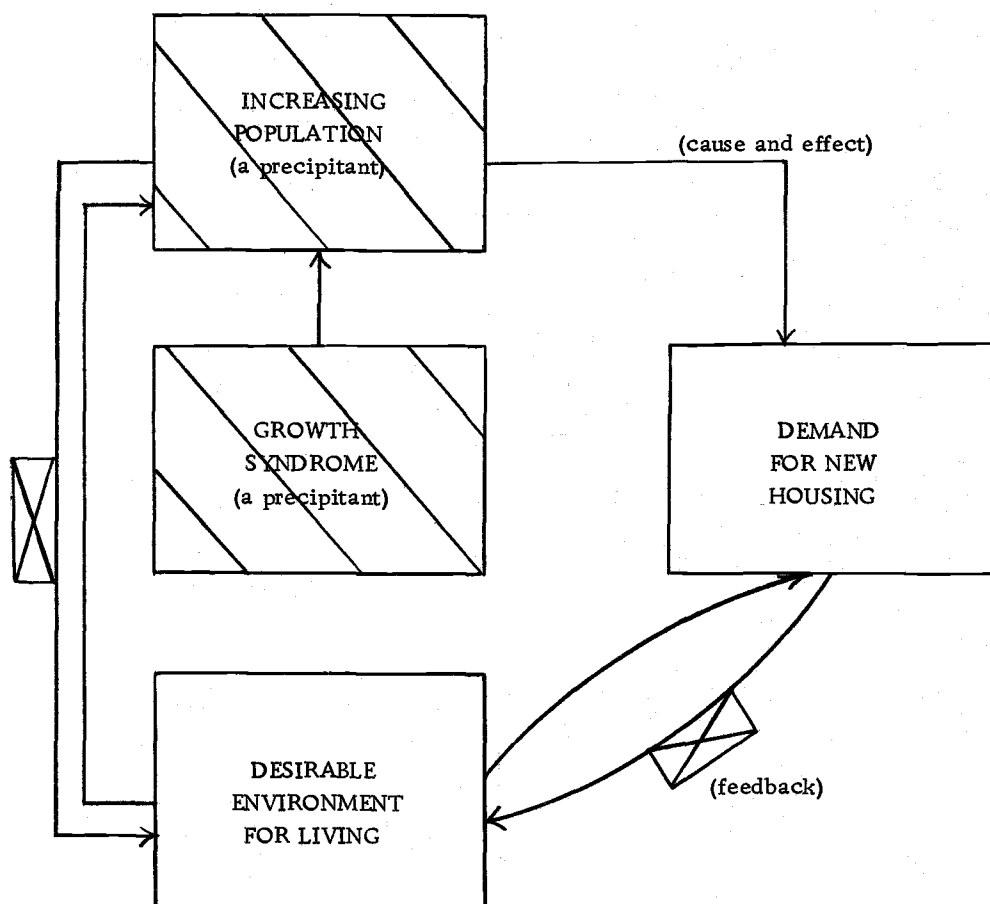


Figure 4. In-migration into a Region

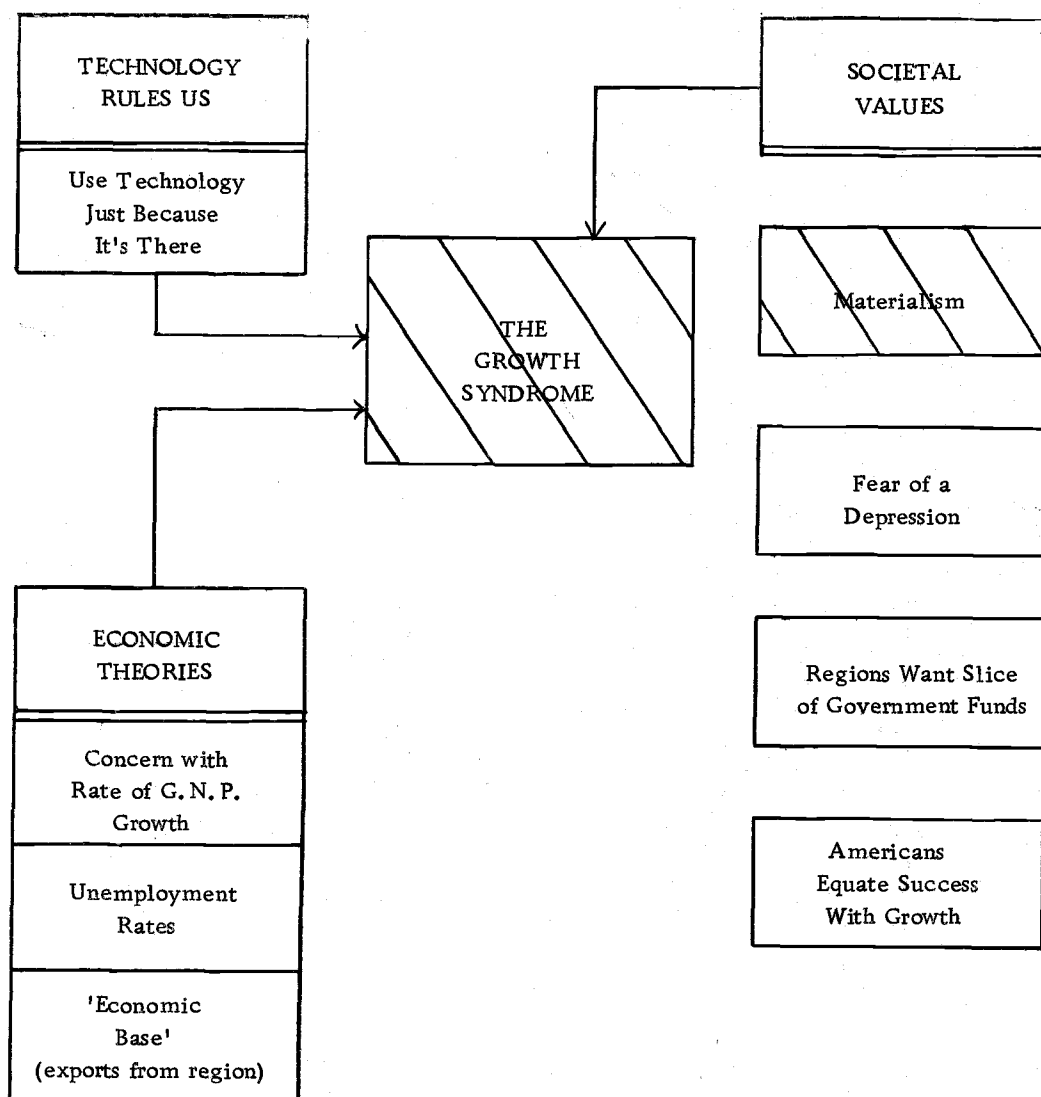


Figure 5. Economic Growth Syndrome

sunny areas of Arizona and California (see Figure 4). However, if the region becomes over-crowded and unattractive, it may become undesirable; if this information is available, potential migrants may perceive that the environment is not so attractive after all and perhaps will not migrate. Such a situation involves feedback of information about the living conditions to the brain of the person considering the move to the area which can trigger a decision not to migrate. An example is the slowing down of the rate of migration to California (Rose, 1970).

Availability of Money. Another important factor which contributes to the demand for new housing in a region is the availability of money, usually at a fairly low interest rate. Even though people might be migrating into an area, if interest rates are very high, there will be a tendency for migrants to choose old houses or existing apartments for the short run rather than new dwellings. The availability of money is thus an effector that triggers the demand for new housing. Either a buyer builds his home himself or a developer builds homes on speculation and attempts to sell them.

The supply of money for housing is an economic phenomenon in that it greatly affects the housing market system. It is, however, sometimes handled in the political sphere, i. e. , Congress raises taxes or lowers taxes independently of the actions of the Federal Reserve Board. The control of the money supply by the national

government for economic stability is still an inexact science which is subject to political pressures.

The supply-of-money variable is an important one affecting the amount of demand for new housing in the short-run. Over the long-run, the housing demanded would be provided regardless of the interest rate. For long-range planning it cannot be considered a variable with primacy and will not be given such recognition in the present analysis of the demands on the land resource base.

The 'Housing Developer.' The housing developer who builds a group of homes in an undeveloped area is one of the agents causing urban sprawl and its subsequent problems. He has been nearly free in our society to go anywhere and has often picked parcels of land just beyond the ecumene of a city, where land prices and property taxes are relatively low. This phenomenon, commonly called 'leap frogging,' is a sandwiching of residential areas between farm areas, which leads to non-compatible land uses in proximity to each other and an unstable property-tax situation.

The housing developer is not entirely to blame for his often indiscriminate use of prime biotically productive land. He is a product of a society with a profit-motive economic system and a penchant for short-term gain which both cause waste. The zoning laws in some cities, especially residential suburbs, sometimes prevent the developer from building multiple-use dwellings on high-cost

land within the town or city, and he is forced to go where the land and taxes cost less in order to build at all (Babcock, 1966). In many cases in the suburbs, the present residents of suburbia wish to 'reserve' their space and single dwellings rather than to become a more mature agglomeration containing several types of dwellings and activities.

Summary

The demand for housing is influenced by a large number of variables in the economic subsystem, as shown in Figure 6. There are also many variables in other subsystems which are connected, either directly or indirectly, to the demand for housing variable. The diagram on page 64 (Figure 7) lists some of the subsystem interconnections.

Demand for Industrial Space

The 'Growth Syndrome.' There is a great deal of competition between regions in the United States to attract industry to their particular areas. Active promotion to entice new plants is related to the 'growth syndrome' so prevalent in the country. Economic base studies and input/output analysis are being used to measure present and potential export and service industries in various regions. Especially important are the 'multipliers,' which indicate the amount of additional industry and business which will result from the

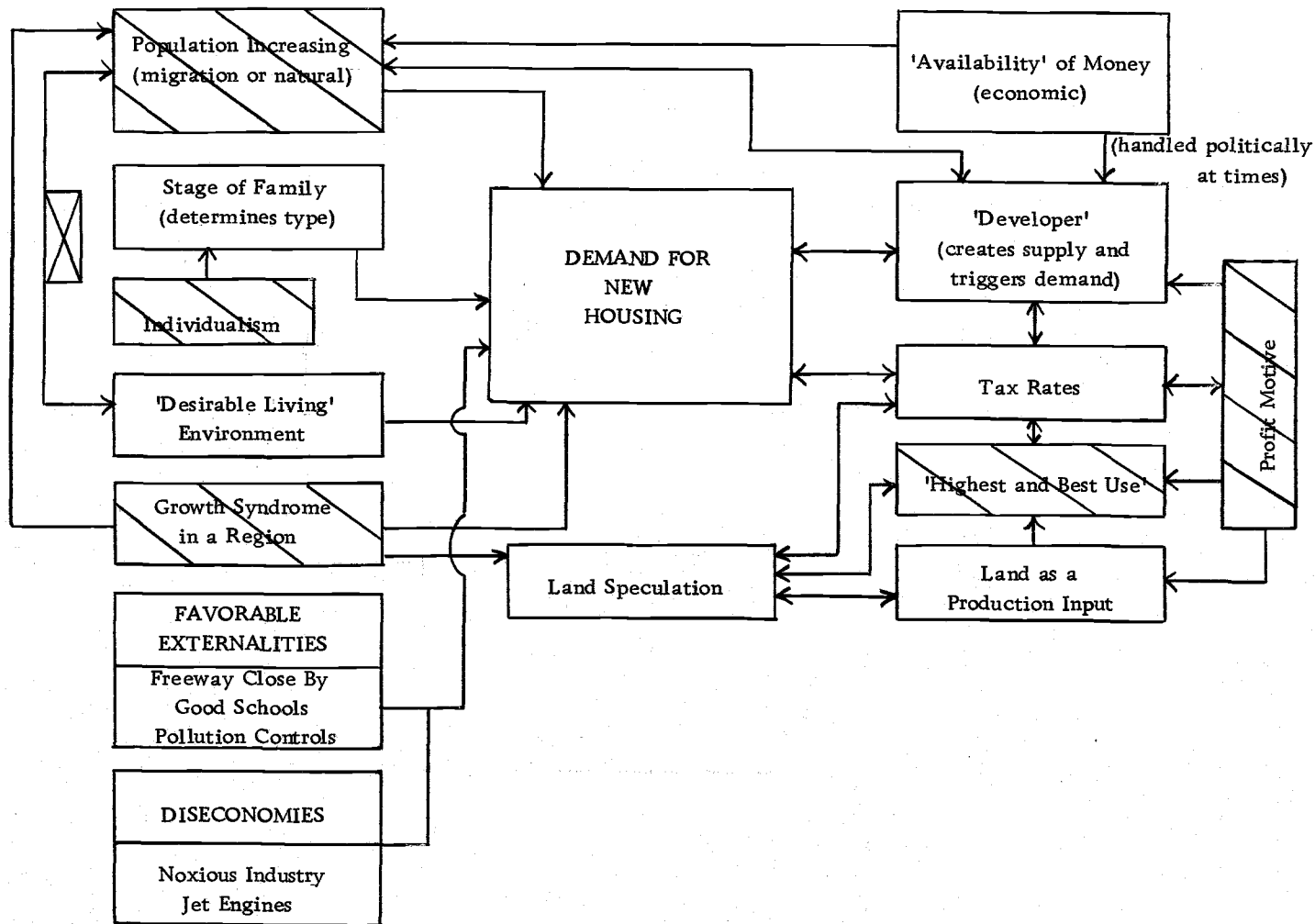


Figure 6. Demand for New Housing

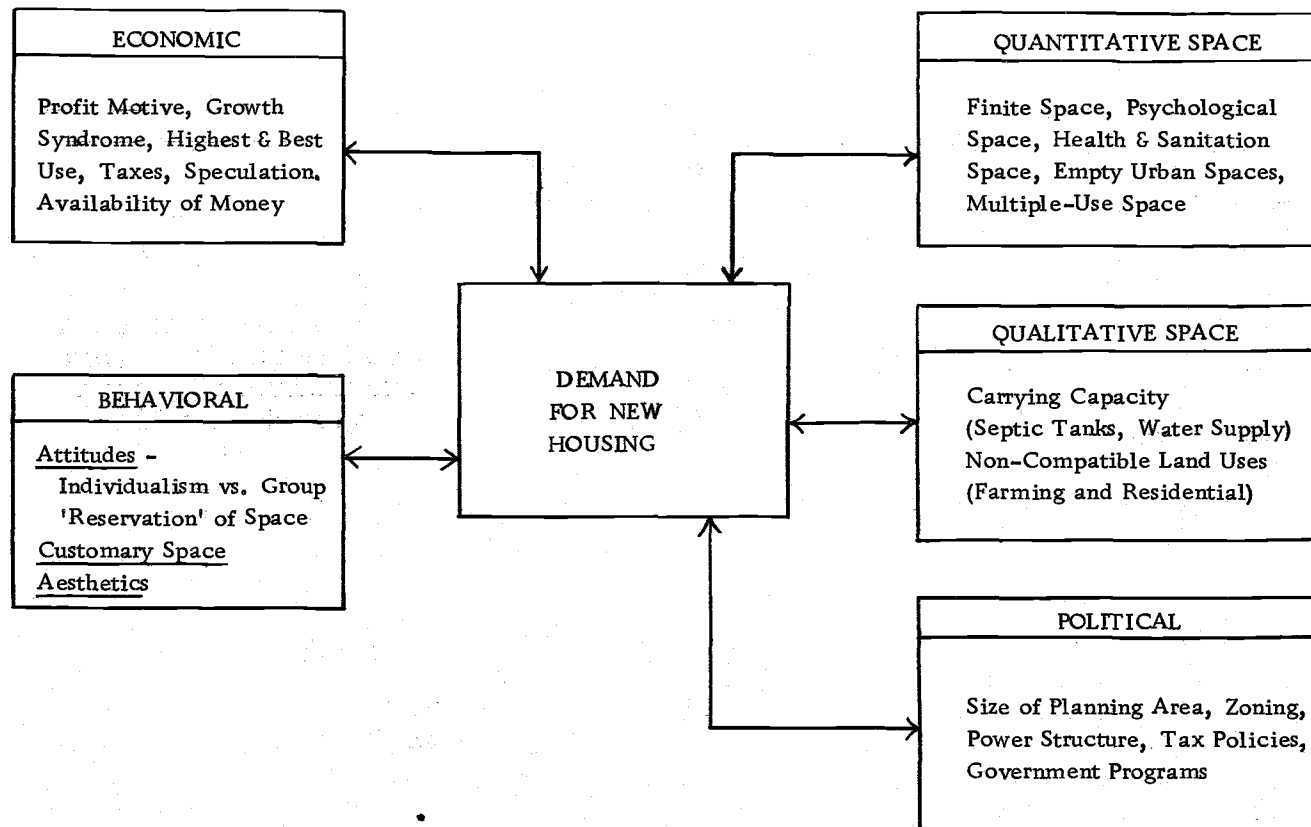


Figure 7. Demand for New Housing - Variables in Subsystem Interconnections

establishment of one basic industry.

Because of the preoccupation with growth, cities and regions did not formerly discriminate against industries which caused severe pollution or were noxious. The important thing was the new jobs which the industry would bring to an area. The total costs to a region were often overlooked, i. e., things such as a need for new roads, new schools for employees' children, additional fire and police protection, etc. Only recently have some communities discovered that perhaps the social and monetary costs were greater than the gains from a new industry.

Until the strongly entrenched growth syndrome is replaced by some kind of theory of equilibrium, many planning regions will continue to promote and accept industrial expansion, even though some kinds of industry will not fit well into the total ecological system. The 'growth syndrome' is a direct cause of in-migration, which increases the demand for industrial space; it is a primary factor involved in industry's need for land in a region. It will thus be given a primacy rating in the evaluation of the importance of the causes which lead to the demand for space (see Figure 8).

Location Theory. Industry is not located in a haphazard manner. Even though favorable tax benefits or other concessions may tempt industrial planners to consider locating their new plants in certain areas, only 'footloose' industries are free to locate just

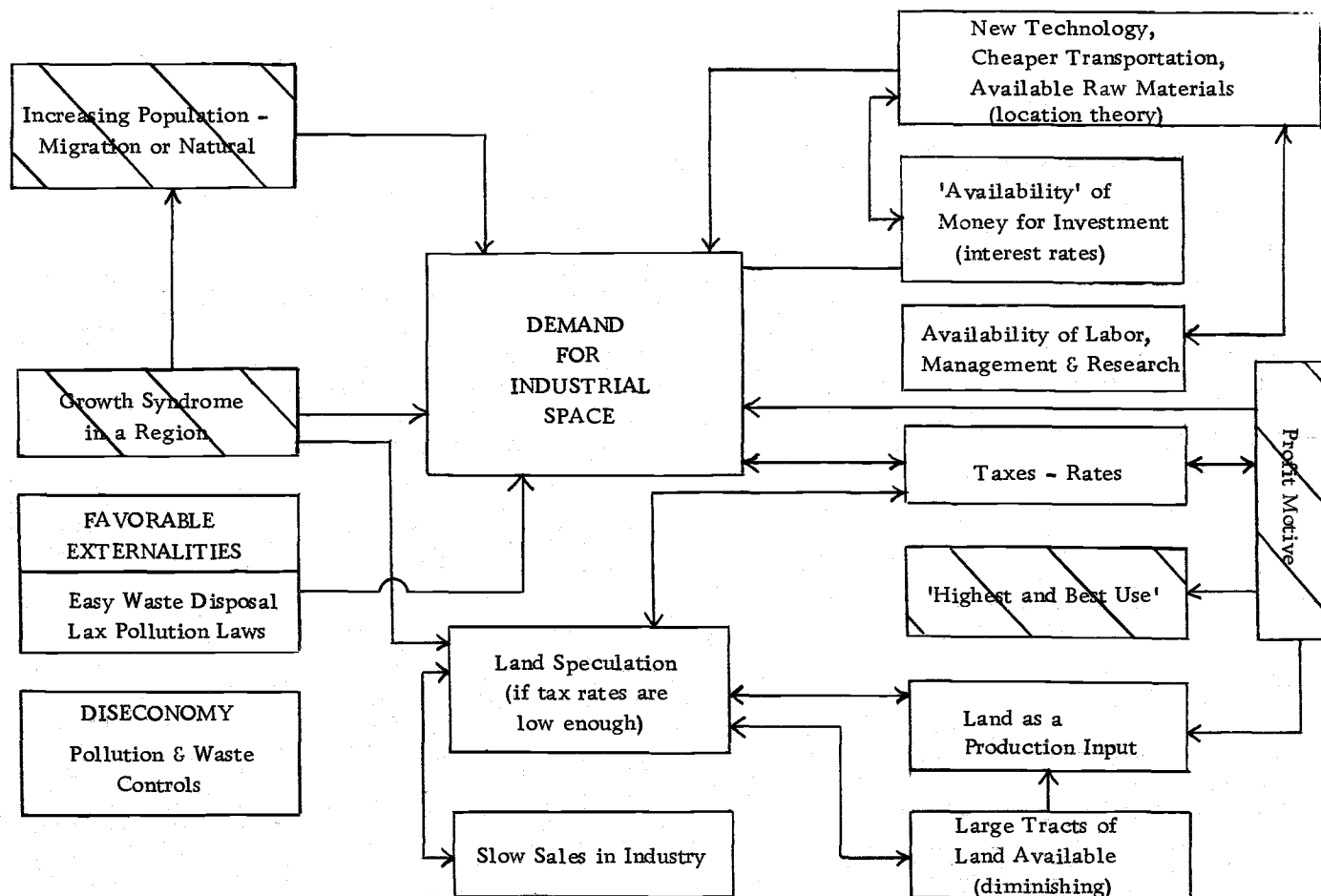


Figure 8. Demand for Industrial Space

anywhere. Industries must consider transportation costs connected with obtaining their raw materials or with marketing their finished product. They locate near their raw materials if they are materials-oriented and near the market if they are market-oriented. It is essential that they locate where their costs are low enough for them to remain in a competitive position. In addition to transportation costs, firms consider the advantages of locating near an agglomeration of similar or related industries, for in these areas are found such things as industry services, skilled labor, a management pool, etc.

One of the problems connected with planning for industry is that technology is changing very quickly. New raw materials, new manufacturing processes, and cheaper transportation can alter an industrial pattern of location within a few years. It will be increasingly difficult to plan for industrial land needs in the future because of the above reasons.

Demand for Highways and Highway Space

The highway-space demand variable in the economic subsystem is perhaps a more complicated one than those of housing and industrial space demand. It, also, is connected with a rising population and the 'growth syndrome,' but these two primary factors are not the only factors of primacy rating which are determinants in the creation of new and bigger highway systems in the United States. Other important

factors are those of urban sprawl (Figure 9), 'automobile takeover,' and affluence and wasteful use (Figure 10). Also contributing to the demand for highways are such factors as governmental rights of eminent domain, poor rapid-transit facilities (public transportation), and the 'speed syndrome.'

Urban Sprawl. Urban sprawl is responsible for much of the recent highway building in the United States, but it, in turn, is facilitated by the very highways which it demands. Often, the sprawl is greatly accentuated by highways, for new highways (especially free-ways) enable people to live farther and farther from work. 'Strip' development along freeways and especially at the main interchanges is a common phenomenon in our country. Urban sprawl and the highways associated with it form a self-perpetuating system with the undesirable effects of 'leap-frogging' and the consumption of many acres of land for each mile of freeway (70 acres per mile of right of way (S. C. S., 1969).

What is actually responsible for continued urban sprawl? What 'feeds' it in addition to an increasing population in an area? Several factors were discussed in the section on demand for housing space, i. e., the speculative housing developer, a desire on the part of people to own their own homes, a desire for suburban living, and an unawareness that a scarcity of land is developing in the United States. There are also the factors of affluence and wasteful use, 'automobile

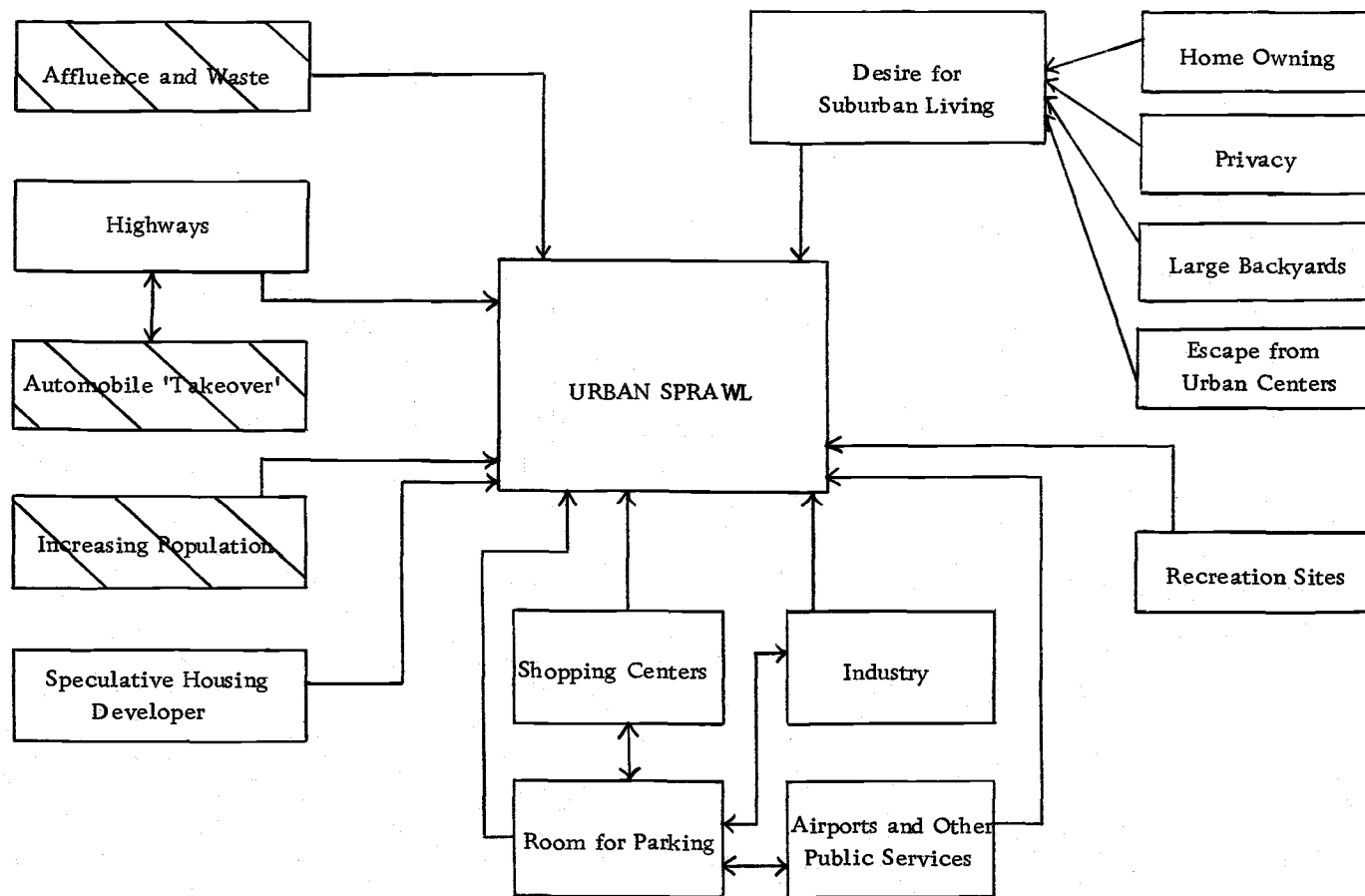


Figure 9. Urban Sprawl

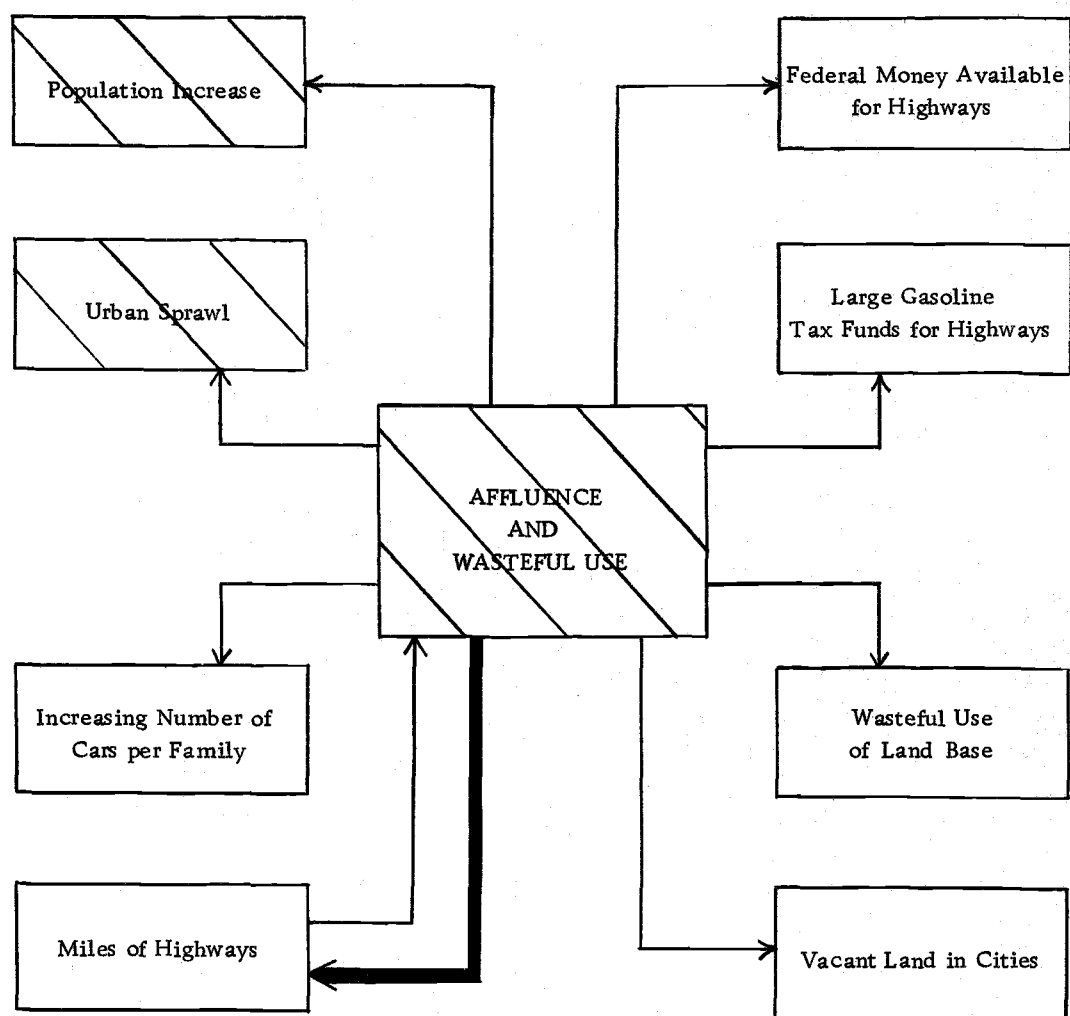


Figure 10. Affluence and Waste - Highways

takeover,' and the trait of individualism (see Figure 9).

Affluence and Wasteful Use. Affluence is an economic phenomenon in the United States which leads to the cultural trait of waste. Both work together to cause urban sprawl, to increase the number of cars per family, to set aside enormous gasoline tax funds earmarked for highways only, and to use the land base as if it were an inexhaustible resource (see Figure 10). This country has been affluent and wasteful from its inception, and these factors are deeply ingrained in the American character, in our way of life, and in our economic system. An example of wasteful use is the fact that 20 percent of the land in many American cities is vacant (Northam, 1969). No provisions have ever been made to use this land first, before moving farther outward onto undeveloped lands in rural areas. Such a wasteful procedure is but one of those contributing to urban sprawl and all of the above-mentioned activities (see Figure 10).

Affluence and wasteful use can be categorized as being effectors of the demand for highway space and are given 'primacy' rating. There is a mutual causation between affluence and wasteful use and the highway system. Affluence demands highways, and because highways serve our economic system as transportation and communication inputs, they make the economy more prosperous. The wasteful use variable is related to highway overbuilding and the realities of highway planning which results in highways being located in the middle

of some of our 'best' biotically productive lands.

Since affluence affects the highway system much more than the highway system affects affluence, the mutual causation between the two is lopsided (see Figure 11). This is because many factors other than highways are involved in producing the affluence which the United States enjoys.

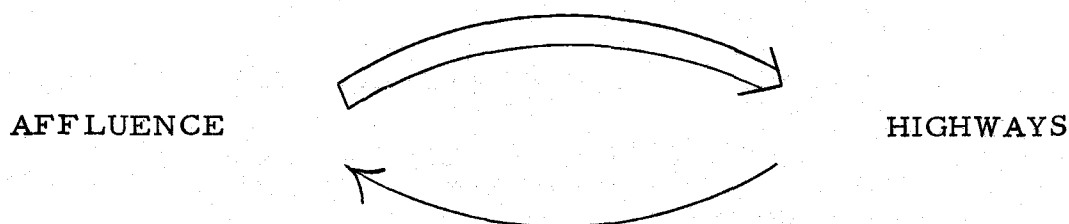


Figure 11. Mutual Causation Between Affluence and Highway Demand

When an increase in the size of a secondary variable such as highways is caused by an increase in the size of a primary variable such as affluence, and then, in return, the secondary variable causes the primary one to increase, but in a smaller amount, there is a kind of mutual causation which can be called an unequal mutual causation. It is usually found when relationships between unlike variables are analyzed.

Increasing Number of Automobiles Per Family. In 1964, 55.5 percent of all U. S. families owned one car, and 22.1 percent owned two or more. In 1967, 52.8 percent of all families owned one car, and the percent owning two or more cars had risen to 25.3 percent

(1968 Automobile facts, p. 43). Unless excellent public transportation is somehow provided and accepted in this country, the number of automobiles per family will continue to rise as the standard-of-living is increased.

The increasing number of automobiles per family is a resultant variable, i. e. , it is the end result of several other variables (see Figure 12), affluence and wasteful use, 'automobile takeover,' individualism in our society, and the 'speed syndrome.' A fifth influence, poor public transportation, causes more cars to be owned per family, but it is also the result of our relying so heavily upon the automobile for transportation. Thus, the first four influences are simply cause and effect, and the last one is a mutual causation relationship. Individualism and a 'speed syndrome' in our society contribute to the lack of good public transportation as well as to the increasing number of automobiles per family.

Automobile Takeover. 'Automobile takeover' is the cultural phenomenon which has resulted because of the great popularity enjoyed by the automobile in the United States. The safer, the faster, the more comfortable the automobile becomes, the more it is desired. It provides the ultimate flexibility in short-distance transportation and has become a major convenience desired by most everyone.

Because of the great variety of automobiles made possible by the private enterprise system, the automobile is also a status symbol.

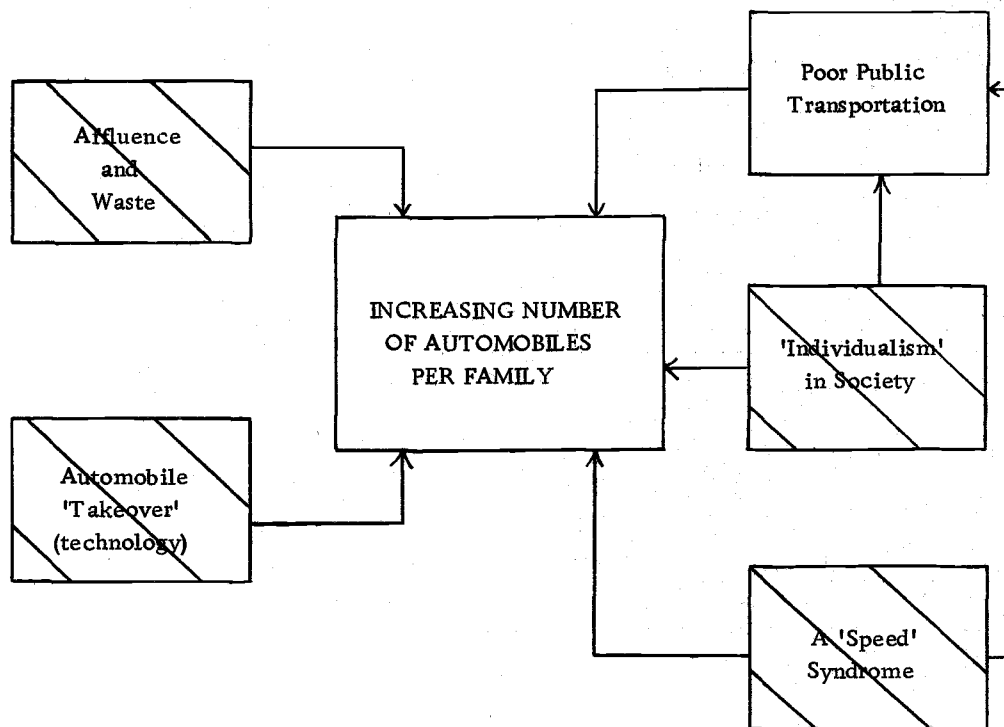


Figure 12. An Increasing Number of Automobiles per Family

It has become one of the most important reflections of the buyer's personality and economic status, and people consider the purchase of an automobile to be an important event. The automobile is also a source of pleasure for many people. The feeling of control and power which one enjoys while at the wheel of a car can be a source of satisfaction when driving conditions are safe and pleasant.

All of the forementioned reasons have given the automobile an exalted position in our culture. Is it possible that we have reached the point where this machine is ruling us and our activities rather than being our servant? Our desire for faster, safer highways and the convenience of driving to the heart of the city has meant that we are sacrificing land which could be used for other purposes--perhaps much more important in the long run--to ribbons of concrete. Such other purposes could include the beautification of waterfronts, the creation of downtown areas where no automobiles are allowed so that people may walk, sit, and shop in pleasant, quiet surroundings, and the cessation of the building of so much parking space on prime urban land. The automobile is becoming a monster at the same time that it is so satisfying to its owner. It is an example of the fact that technology rather than ethics tends to rule a society (Gouldner and Peterson, 1962). Indeed, the automobile tends to rule American life.

Eminent Domain. The institution of 'eminent domain,' the right of the government to hold supreme power over land and to acquire

it for the public good by compensating the owner, has made the building of our huge highway system possible. Until very recently, the power held by county, state, and federal highway departments was little questioned. The rule by which most departments operated was to build highways as inexpensively as possible, and this meant that the shortest distance over the most level land would achieve that goal. There was little or no attention paid to the ruination of superb agricultural lands, virgin forests, or special scenic areas. It will suffice in this section to give the 'right of eminent domain' the role of effector in the highway part of the economic subsystem, for it makes the location of highways on lands used for other purposes possible. The political powers connected with it will be discussed in a later section.

Available Funds for Highways. Because of government policy initiated in 1954 under President Eisenhower, vast sums of money (a \$41,000,000,000 project) were made available to improve the United States Interstate Highway System and raise the quality of the main highways to freeway status. The Federal Government provides 90 percent of the funds, and the states provide the other 10 percent. Even though some isolated areas do not need four-lane freeways, they are built anyway, because rural areas want their 'share' of federal funds (Friedlaender, 1965, p. 3).

Conclusions. The demand for highways is a complicated variable in the man/land system. A summary drawing of this variable

and the other variables which affect it is shown in Figure 13.

Demand for Recreation Land

One of the fastest growing demands for land is for recreation. Large-scale demand is a recent phenomenon and is connected with affluence and leisure time provided by our mature economy. In addition, there is an increased desire by people to escape periodically from the smog, congestion, and noise of our cities. This is accompanied by a new appreciation for the 'wilderness.' The wilderness used to be considered as an undesirable part of the landscape--forbidding and hostile. Now, it is held to be beautiful, serene, and beneficial to mental health. People's perception of the wilderness varies widely, however, and it will become increasingly difficult to provide remote wilderness areas for the person who desires absolute quiet and privacy.

Affluence and Leisure Time. 'Affluence' is a primary effector of the demand for recreation land, just as it is for highways and new housing (see Figure 14). In addition to affluence, 'time' is a necessary factor for the pursuit of recreational activities. The work force in the United States has reached the point where it has secured much leisure time. This condition will no doubt remain in our society, for productivity per person is still increasing due to automation and increased technological advances in business and industry.

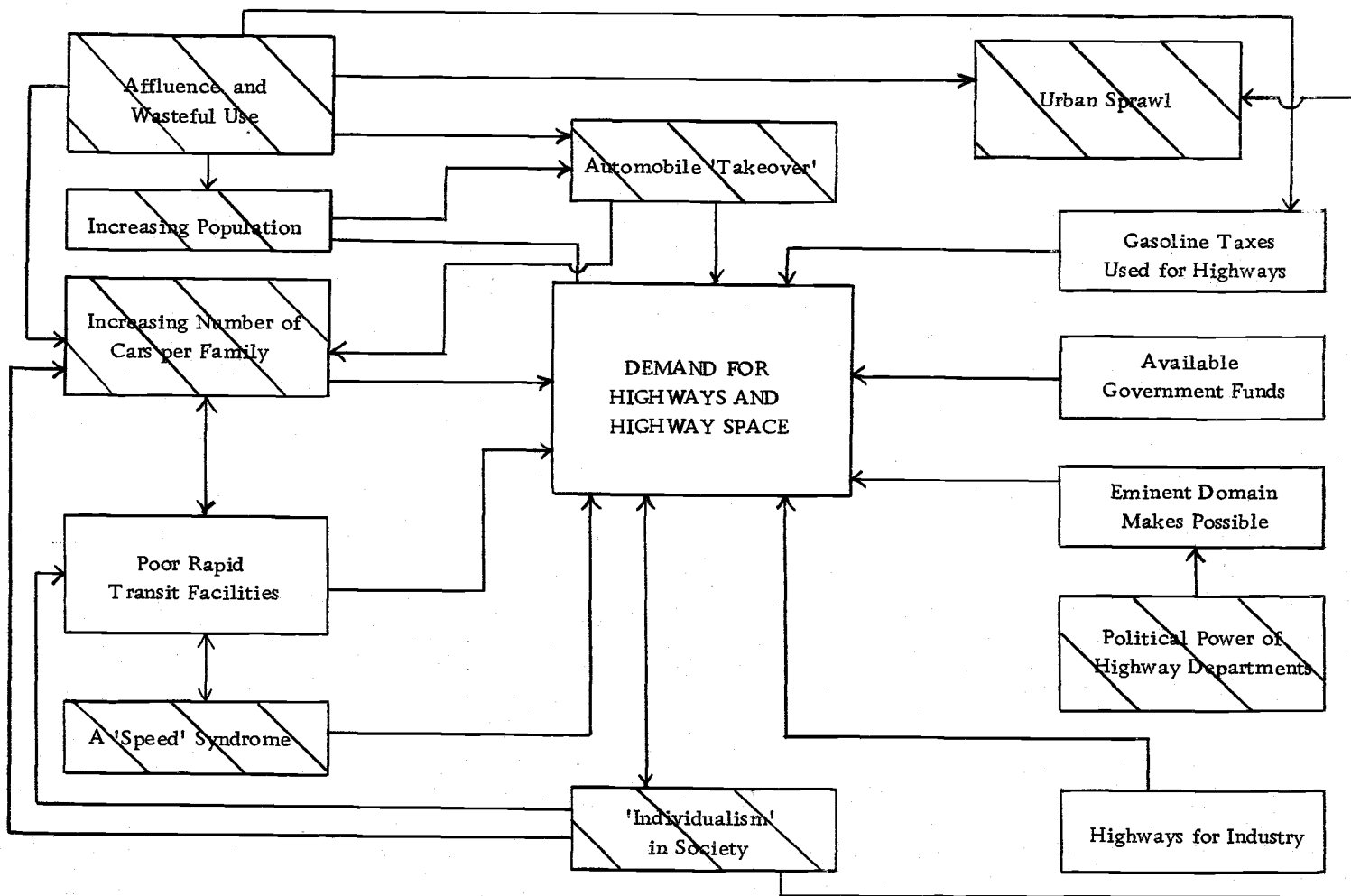


Figure 13. Demand for Highways and Highway Space

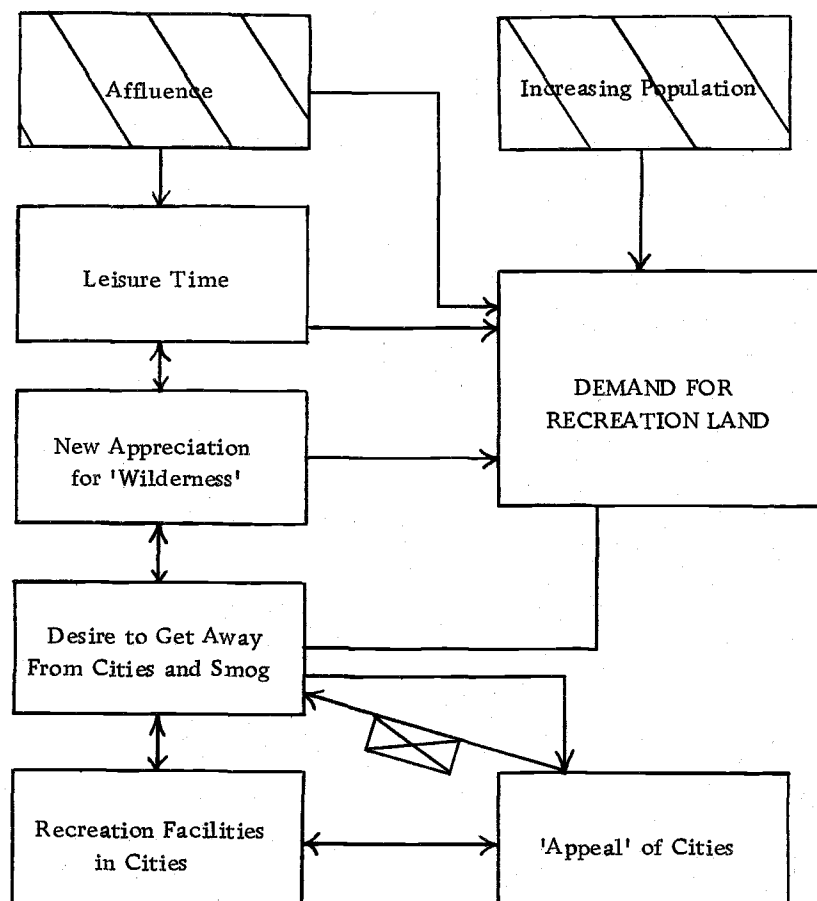


Figure 14. Demand for Recreation Land

There is a direct cause and effect relationship between the two variables 'affluence and time' and the demand for recreational space. And since our economy is expected to maintain its present affluence, which buys us time, recreation space will be demanded from the land resource base in increasing amounts.

Increasing Population. An increasing population is also a primary effector of the demand for recreation land, especially when the phenomenon is accompanied by affluence and leisure time. Since our population is expected to grow during the next several decades, this variable is of considerable importance in analyzing land needs.

'Appeal' of Cities and/or the Desire to Get Away from Them.

The desire to get away from cities to visit rural recreation areas (ranging from close-by rural areas to wilderness areas) is directly related to the condition of United States' cities. Smog, noise, and congestion are driving people away from cities on weekends and accentuating the new appreciation for wilderness in the country. Not only do smog, noise and congestion drive people out of the city; there are also the factors of ugliness, a lack of urban parks and recreation facilities, a lack of 'community' such as one finds in Europe around a plaza, and a lack of attractive and safe places for long, quiet walks or bicycling. The automobile has been greatly responsible for the unattractive cities in America. Perhaps one can get out of the city, so he does not care about the quality of his cities.

It is the author's opinion that if American cities were to satisfy human needs, people would not feel such a great need to flee them on weekends, and there would not be such a great demand for rural recreational space and more highways to transport people to the country. The lack of appeal of our cities is a direct cause of the rising demand for new recreation lands outside the cities, but the cause is dependent on conditions that can change. This variable could be lessened in its degree of importance if cities were encouraged and helped to be more attractive and more recreational activities, perhaps on vacant lands, were provided in the city proper.

The appeal or lack of appeal of our cities and the demand for recreation land have a mutual cause and effect relationship involving feedback. The control center is the human brain, and the communication system involved is that of the senses, i. e. , the person 'perceives' his environment and either wants to stay in it (if it is pleasing) or to leave it every weekend.

Demand for Biotic Production Land

An Increasing Population. An increasing demand for biotic production land depends largely upon an increasing population, both in the United States and abroad (see Figure 15). If we base future land requirements upon an expected increase of population and hold the 'state of technology' as a constant, then it is logical to assume that

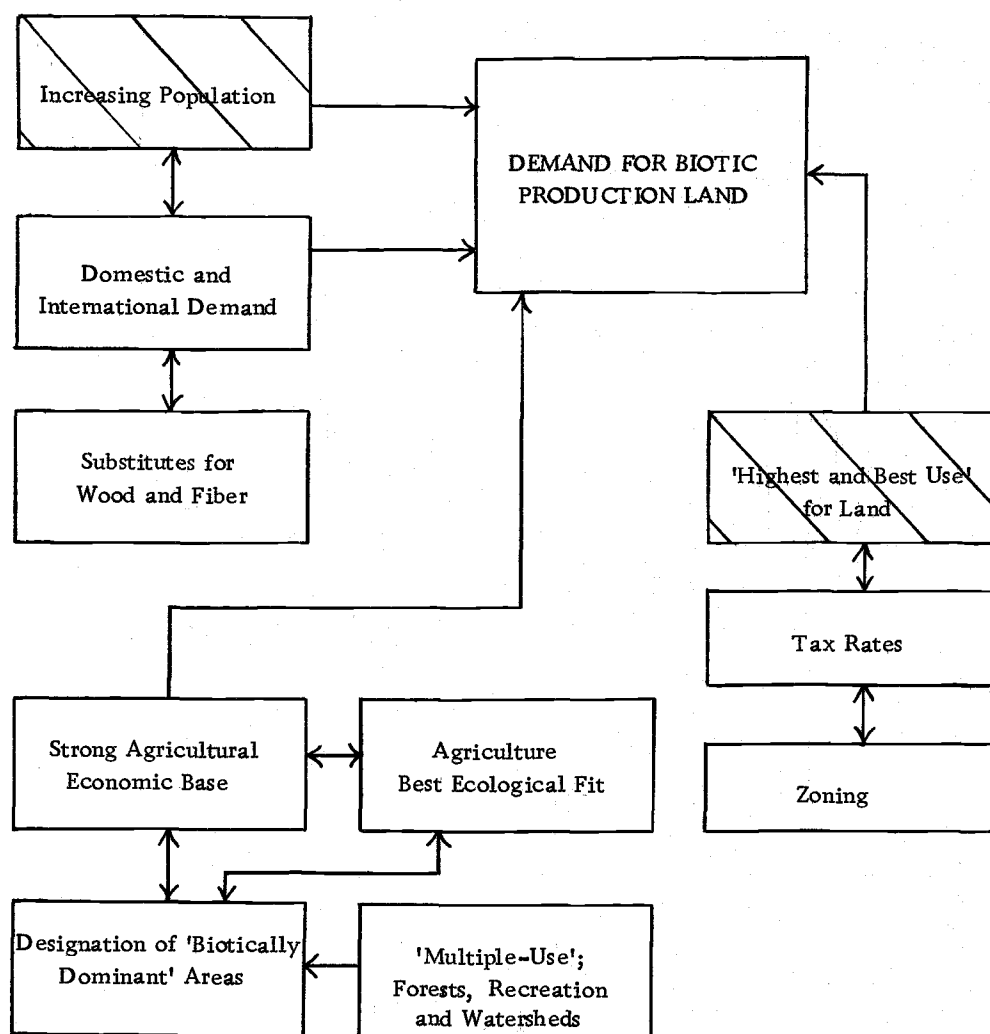


Figure 15. Demand for Biotic Production Land

our present biotic production lands will be needed for agriculture, grazing, timber, and fiber production. The population of the United States is expected to reach 300,000,000 people in the year 2,000 A.D. as compared to 204,844,000 in 1970 (U. S. Dept. of Commerce/Bureau of the Census, 1970b). World population is expected to increase at a greater rate than that of the United States. Since the United States is a surplus producer of food, the size of the world market is indeed a factor, for it can be expected that the export of biotic products will continue at an increasing rate.

Because the state of farm and other biotic products' technology cannot now be foreseen for the year 2,000 A.D., the variable of a population increase assumes a major role in determining the amount of land needed for future production. Even though new technology might allow providing for everyone in the future on today's acreages, or even less, it will be assumed that more land will be needed for biotic production as the population increases. Thus, an increasing population is a direct cause of a further demand for biotic production land and receives a primacy rating.

Existing and Future Biotically Productive Lands. It is not necessary to designate all biotically productive land for specific future uses. Rather, it is required that prime areas be so designated and that other land be held in a state of 'reversibility,' i. e., so that it can easily be converted to farm, timber, grazing, or fiber production in

the future, if necessary. In order to accomplish this, there must be incentives for people to retain their land in a convertible state, not further incentives to cover it with irreversible uses. Preferential taxes, biotic-production priority-use legislation, voluntary contracts with governments for certain uses (Snyder, 1968), education regarding the ecological limitations of areas, the allowing of voters to designate certain areas for reversible and irreversible uses (Schmid, 1968), and zoning are all methods for slowing down the process of land development for non-biotic uses. To conclude, the demand for biotic-production land, based upon the present state of technology, will be directly influenced by an increase in population.

Additional Demands for Land

Demands for additional withdrawals from biotically productive land are likely because of the need for airports, gravel pits, solid-waste disposal areas, sewage treatment plants, reservoirs, mining, power line right-of-ways, drive-in theaters, railroad tracks, parking lots, educational and governmental institutions, and business establishments. An increase in population is largely responsible for an increase in the demand for land for the above activities. The 'reversibility' or 'irreversibility' of each of the above activities is arranged in a continuum along with housing, recreation, industry, highways, and biotic production in the discussion of land uses in

Chapter III (see Table 1). It is logical to assume that the more irreversible the activity, the greater should be the concern for its location.

The Profit Motive

The profit motive is an important economic variable affecting the specific demands for land in various regions. In other words, it commonly determines how land is used in certain places and in what amounts. It is both a quantitative and a qualitative variable. Since profit is a basic concept in the American economic system, every effort is made by individuals and firms to maximize profits (if they are operating as rational economic man).

Highest and Best Use. 'Highest and best' use is a term which refers to the most intensive or productive use for which a parcel of land can be used at any one time. It also implies that the use will bring the highest gain for the individual investor, i. e., the highest profits in the short-term. In urban areas, examples of 'high' uses are industry, commercial activities, and residential. In rural areas, 'high' uses are intensive, high-value agriculture and residential development.

Land is commonly thought of as being a 'factor of production,' not merely a site for an activity. Its 'highest and best' use is thus sought by its entrepreneur or owner, especially if the land is of high

value in the market place and is a costly factor of production. In seeking to maximize his profits, the owner either develops his land, holds his land and speculates that a different use in the future will maximize his profits, or rents his land to someone else to develop. He is alert to possible new opportunities to maximize his profits and will usually change his land use if the anticipated profits are high enough and if he has had access to enough information on which to base his decision. Economic analysis helps in the decision-making and can involve such techniques as factor-product analysis, factor-factor-analysis, product-product analysis, and benefit/cost analysis.

The manufacturer, housing developer, businessman, and the farmer all use the above economic tools in evaluating the use to which their land is being put. Often, the farmer will block attempts to preserve his land from more intensive, non-farm development, because he hopes to be one of the 'lucky' ones whose land will be demanded for a 'higher' activity. He wants to be able to make a big profit on his earlier investment in his land and has long believed, as have others, in Adam Smith's invisible hand, a system whereby the best economic decisions for individuals would automatically ensure that society as a whole would receive maximum benefits. This belief, of course, has been discredited. Because many farmers near urban areas hope to make a large profit on their land by selling it for a 'higher' use such as housing, they are often inclined to be inefficient

and unwilling to further develop their farming techniques.

A solution to the dilemma is the designation of 'priority use' areas by state legislatures, based on careful planning. Then, in an agricultural area, the 'highest and best' agricultural use would be sought, a use that was automatically compatible with other agriculture in the area. Parcels of land in industrial areas would be evaluated for their highest and best industrial use, and the same would hold true for areas for other activities.

In summation, under an unplanned, highly individualistic economic system, the concept of 'highest and best' use can lead to a wasteful allocation of the land-resource base. It encourages speculation, leap-frogging, quick profits, and urban sprawl and is very costly to society as a whole. A carefully planned arrangement, such as priority use zoning for certain economic activities, could lead to greater efficiencies than in the past, both for the individual and for society. More intensive use of the land would be furthered in areas designated for specific activities.

The Factor of 'Growth.' The 'growth syndrome' has been mentioned earlier under the discussions on the demand for new housing and industrial space (see Figure 5). It is basic to the economic policies of the United States and is closely related to the profit motive. Growth is assumed to be of paramount importance in maintaining free enterprise, and because of this fact our economic system is not a

homeostatic one but one with the properties of a steady state, a condition which needs growth in order to remain in that steady state. The 'growth syndrome' thus is closely connected with a desire for an increasing population and in fact encourages migration into a region.

Economic base studies are concerned with the consequences of the growth of basic industry upon a region and reinforce the idea that new basic industry is good for a region because it, in turn, leads to increased service industries and thus more growth. But, what about the cost of growth? The costs of growth are both monetary and qualitative, i. e. , the deterioration of the environment in which we live--such things as crowding, pollution, ugliness, etc. The monetary costs of growth which often are not carefully considered, are such things as the necessity for more and more public services, i. e. , schools, police, sanitation, county roads, etc. These services must be paid for and necessitate higher and higher taxes. In the long run, perhaps growth costs more than the benefits which it brings to a region.

To conclude, the profit motive, 'highest and best' use, and the 'growth syndrome' are socio-economic variables deeply rooted in the value system of the United States citizens. They are primary variables which lead to the fast exploitation of biotically productive land into irreversible uses, if allowed to operate without social controls (see Figure 16). If controlled, they can lead to efficiency rather

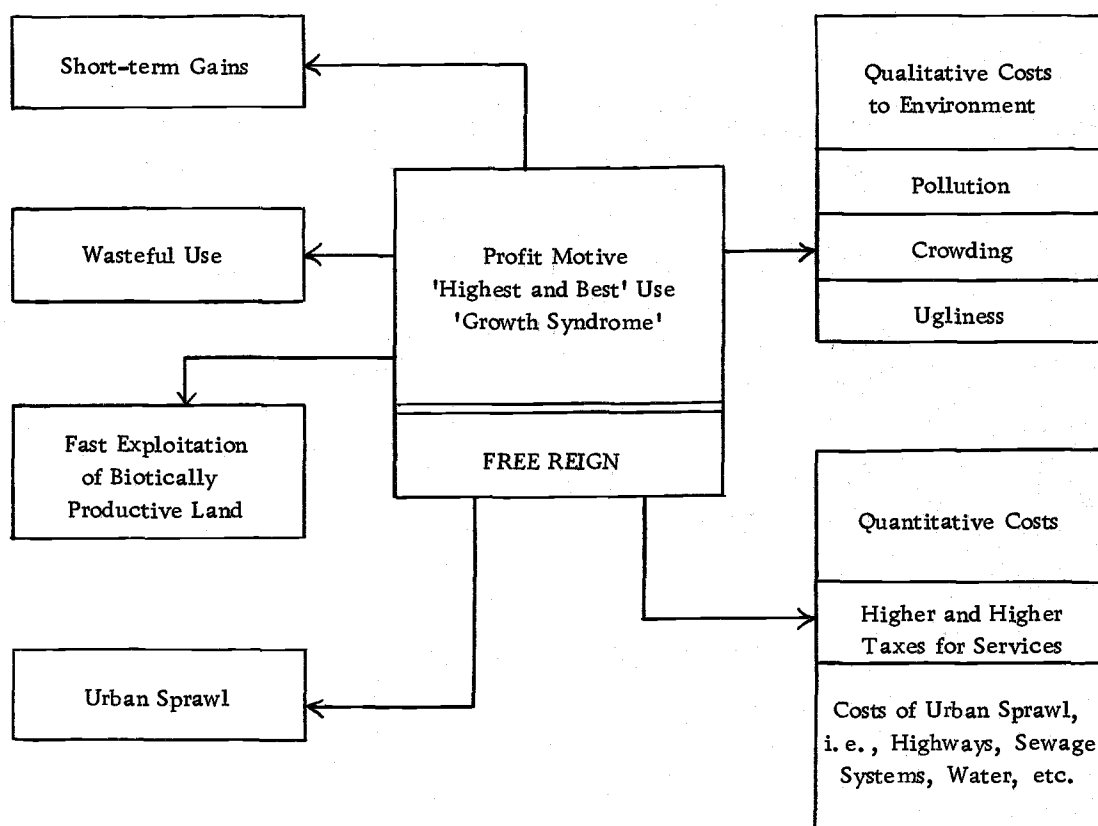


Figure 16. Socio-economic Variables Leading to Land Exploitation

than waste (see Figure 17). These variables are 'learned,' and they can be changed as well as adapted to various political environments. It would seem that the concepts of 'highest and best' use and the profit motive should be practiced in a more restricted setting than that in which they now operate. They do not need to be changed so much as adapted to a new economic environment, which would lead to greater efficiency in the use of our land resource base.

The 'growth syndrome' is a questionable characteristic of our socio-economic system, and the costs of growth must be examined along with the benefits. For the present era, the 'growth syndrome' has to be considered as a primary variable affecting the fast exploitation of biotically productive lands. The best that can be done in the immediate future is to control the growth, i.e., priority zoning, tax policies, regional planning, etc. in an effort to minimize the flow of biotically productive lands into irreversible uses.

Externalities

Externalities are institutionally or privately invoked factors which hinder or aid the pursuit of profit. An example of a favorable externality is the existence of a freeway near a manufacturing plant. Well-developed transportation is so desirable for many plants that their owners are willing to pay a higher price for land if it is located near a freeway than if it is not (Joun and Beaton, 1969, p. 72). Other

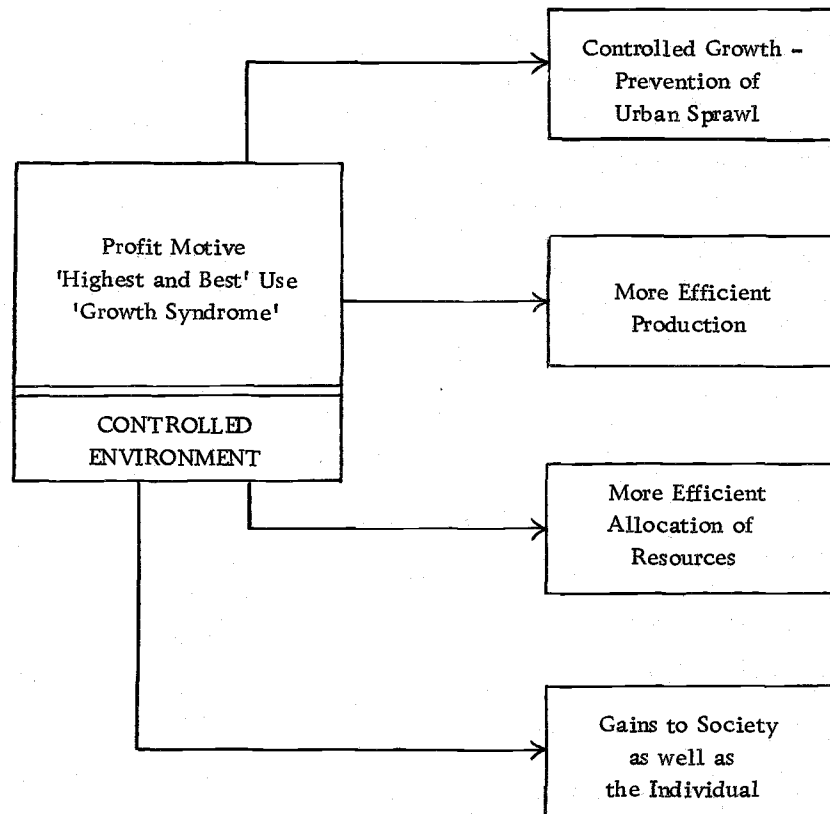


Figure 17. Socio-economic Variables Leading to Land-use Efficiency under a Controlled Environment

examples of externalities favorable to industry are lax pollution laws and easy waste disposal facilities. They cost little. Externalities favorable to housing and, hence, which would increase the value of such property, are the existence of good schools close by, area pollution controls, and a well-developed transportation system.

Diseconomies are unfavorable externalities and can occur for industry when conditions such as severe pollution and waste-disposal controls exist, thus increasing operating costs. They can occur in residential areas if noxious industry is located close by, if jet engines from a nearby airport make a great deal of noise, or if agricultural spraying contaminates the air.

An argument in favor of separating various economic activities is that diseconomies caused by a conflict of interests will be minimized. The granting of 'priority use' to an area for a certain activity will discourage the location of other (non-compatible) land uses in that same area, for diseconomies decrease profits.

Conclusions

The economic subsystem is illustrated in its entirety in Figure 18. The central point of the system is the variable of urban sprawl. All the other variables somehow affect it, either directly or indirectly. The economic system is depicted as it exists at this time (1970).

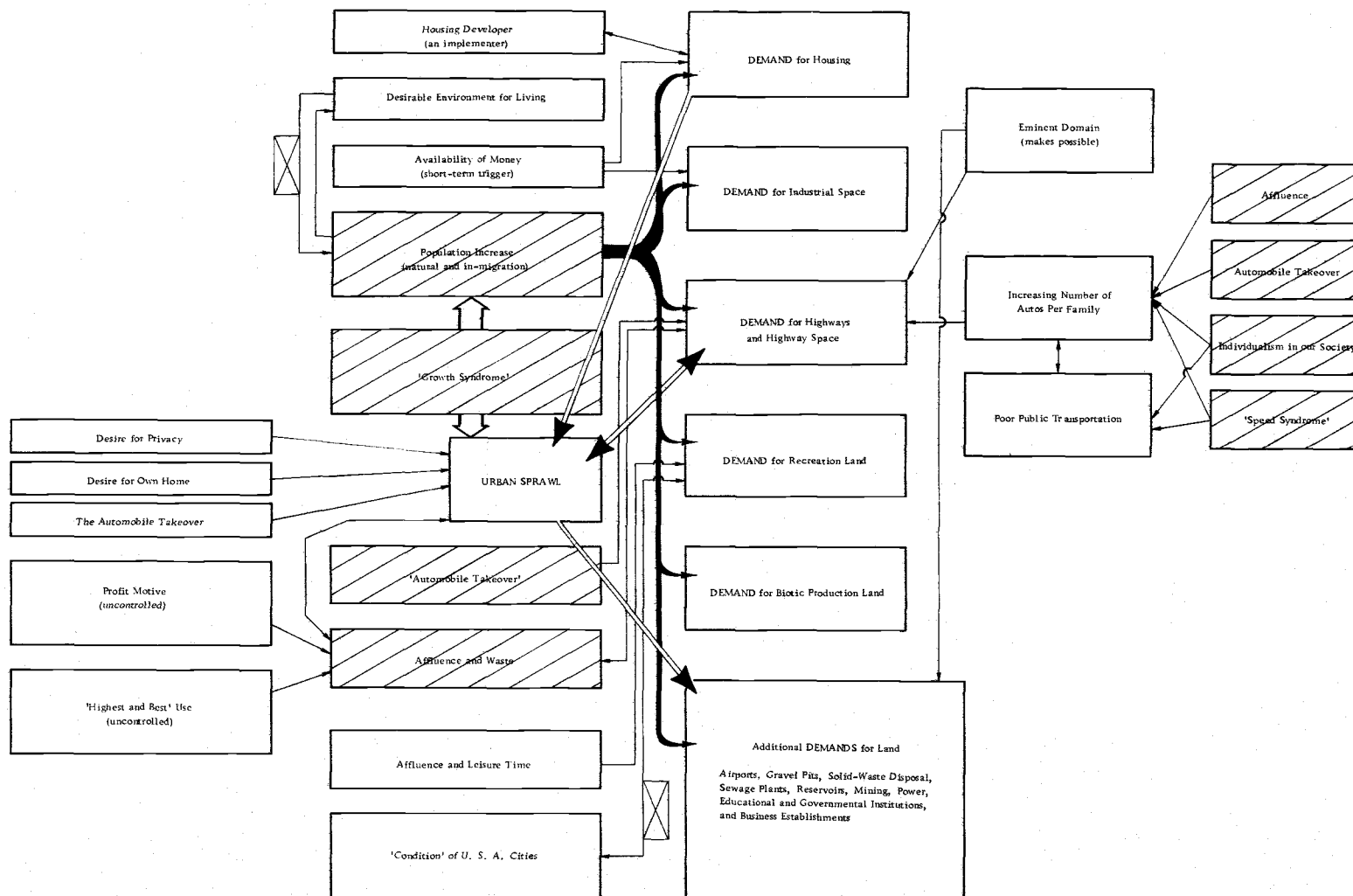


Figure 18. Economic Subsystem

Political Variables - Political Subsystem

Introduction

The study of political life as contrasted with economic, religious, or other aspects of life reveals it as a set of social interactions between individuals or groups. Interaction is the key concept, and structure is secondary. Political interactions are predominantly oriented toward the authoritative allocation of values for a society. An allocation may deprive a person of a valued thing already possessed. It may obstruct the obtainment of values which would otherwise have been obtained, or it may give some persons access to values and deny them to others. An allocation is authoritative when the persons oriented to it consider that they are bound by it (Easton, 1965a, p. 50).

A fundamental fact confronting all society is that scarcity of some valued things prevails. This leads to disputes over allocations. Many of the conflicting demands over scarce things will be settled within small groups (para-political systems), and society will not be expected to intervene. But if society is affected adversely, every society provides for processes through which special structures either aid in achieving some regulation of the differences or impose a settlement.

Geofrey Vickers describes a political system as constituted by

those relations that a society seeks to regulate by the exercise of public power. Every political activity is directed to the regulation of some set of on-going relations, whether internal to the system controlled by the regulator or external between that system and other systems (Vickers, 1967a, p. 59).

A goal of political analysis is to understand how political systems manage to persist through time. What happens to a political system, its stability or change, will depend primarily upon the function of internal variables. However, the way in which they function, the stresses imposed upon them, and the ways in which they respond to those stresses will also be a product of what takes place in the total environment of the political system. Thus, a political system is an open one, in the sense that it is exposed to the events which take place in its environment as well as internally.

The content of our political system, i. e. , the sum of relationships which we aspire to regulate, has grown and is growing in volume, and the standards to be attained have risen and are rising. The action needed to attain and hold these standards requires more massive operations supported by greater consensus over far longer periods of time than in the past. On the other hand, the situations which demand regulations arise with ever shorter warning and become less predictable as the rate of change accelerates and the interacting variables multiply. Clearly the task of the political regulator becomes

more exacting (Vickers, 1967a, p. 60).

Political systems, through their own responding actions, are able to persist even in a world of rapid change. If a system is to persist, it must be able to change or adapt itself to fluctuating circumstances. It cannot expect to fend off all disturbances. Self-regulation by the members of a political system, even to the point of self-transformation in structure and goals, represents critical capabilities of all social systems. There are variable means for persistence. This means that there is no one way in order to achieve it.

Two essential variables or sets of variables, the behavior related to the capacity to make decisions for the society and the probability of their frequent acceptance by most members as authoritative, distinguish political systems from all other types of social systems. What political systems possess uniquely, when compared to both biological and mechanical systems, is the capacity to transform themselves, their goals, practices, and the very structure of their internal organization. Not only is there freedom to select from a range of alternative strategies, but in many systems members may consciously set out to develop new methods for meeting new or old crises. In this event, they will be adding to their store of responses through innovation (Easton, 1965a, p. 99).

How organizations should be structured and how information

should be gathered and circulated is important, in order to give the best chance of the right decisions. All decisions are a result of a political process of compromise; there is a union of economics, political science, and sociology (Boulding, 1968, p. 39).

Stress on a political system may occur because too many demands may be made, or their variety and content may be such that the conflict they stimulate requires an excessive amount of time to process. In either case, it would be a matter of the system not having enough time to process the demands, assuming that demands cannot wait indefinitely before being met. This condition of stress can be described as demand-input overload (Easton, 1965a, p. 120). Regardless of the degree of the structural differentiation and specialization in a system, no system is endowed with so many channels that it has an infinite capacity to carry demands.

If the career or progress of a demand within a system were to be traced, it would be found that even before it becomes a demand, it appears in the form of a social want, preference, hope, expectation, or desire. With respect to these, some one or some group feels that action on the part of the authorities might be appropriate. It is only at that time, when hopes or wants are voiced as proposals for decision and action on the part of the authorities, that they can be labelled as political demands. It is at this point of conversion into a political proposal for action that the first kind of important regulation

of the volume and variety of demands may take place. Not all members of a society are equally likely to give voice to a demand. Because of their general social status, some individuals or groups are more inclined to feel efficacious enough to articulate a political demand. If this is so, persons who occupy such a role in the social and political structure will have an important control over the number of demands put into the system. They can be called structural regulators (Easton, 1965a, p. 122), those who control volume. In modern societies, they are identified as interest groups, parties, and opinion leaders.

Each system generates cultural restraints that help to keep the number of demands under leash. Parties, interest groups, and opinion leaders in modern societies perform this function. The processes reduce the volume and variety by combining two or more demands into one. This involves synthesis and homogenization of demands so that a workable and simplified program of action is developed, and at the same time the base of support for the group or individual is broadened.

In general terms, the capacity of the system to respond to stress will derive from two central processes found within it--feedback and response. Information about the state of the system and its environment can be communicated back to the authorities. Through their actions, the system is able to act so as to attempt to change or to maintain any given situation in which the system is apt to find itself. It is through the combination of these properties, feedback and

response, that a system is able to make some effort to regulate stresses upon it by modifying or redirecting its own behavior.

The identification of inputs, outputs, and feedback loops and the indication of the functions that they play in relating a system to its environment, as well as to sources of stress generated within the system, permits the definition of the interactions that constitute a political system. The inputs of a system are the raw materials from which the outputs are manufactured. From among the variety of demands presented in a political system, its members, particularly those who have particular responsibilities of leadership, must select a few of the demands as the goals or objectives of the system and commit the limited resources of the society to their realization. If the resources are largely material, they may be obtained through outputs that take the form of taxation, commands, levees, or expropriations. If they are human, they may result in the organization and mobilization of human groups to ensure their support for the system as a whole or for specific goals. The whole system is a vast conversion process. In it, the inputs of demand and support are acted upon in such a way that it is possible for the system to persist and to produce outputs meeting the demands for at least some of the members and retaining the support of most. The political system is a way of translating these demands and support of its members into authoritative allocation.

The resolution of conflicts over open space and the assignment

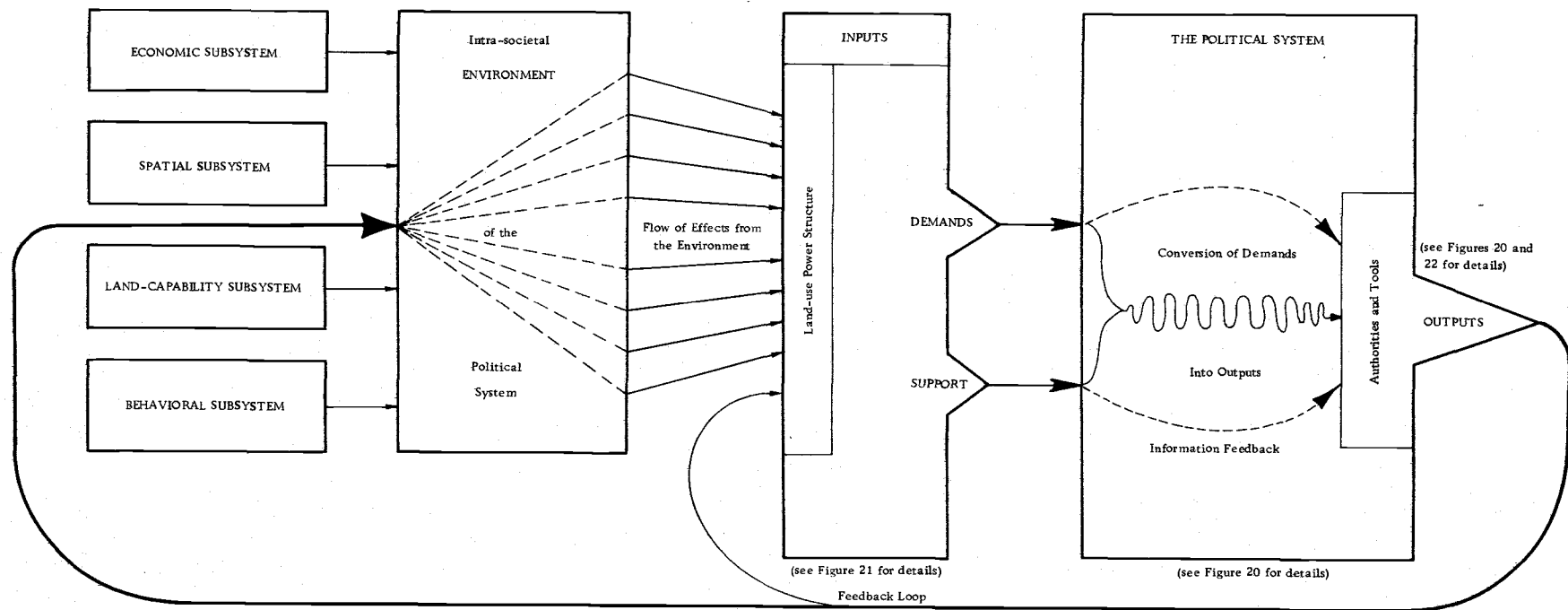
priorities are political responsibilities. Governmental authority to impose land use regulations is known as 'police power.' Evaluation of the social worth of the various aims--in terms of economic advantage or benefit to physical and mental health, education, and public safety--is the province of experts in those fields (Herring, 1965, p. 1).

Inputs of the Political Subsystem

Inputs into that part of the total United States political system which concerns itself with land use consist of the demands and support of the power structure controlling land use as it is affected by its intra-societal environment. The extra-societal environment (the international society) is not at the present time involved with domestic land use to a significant degree.

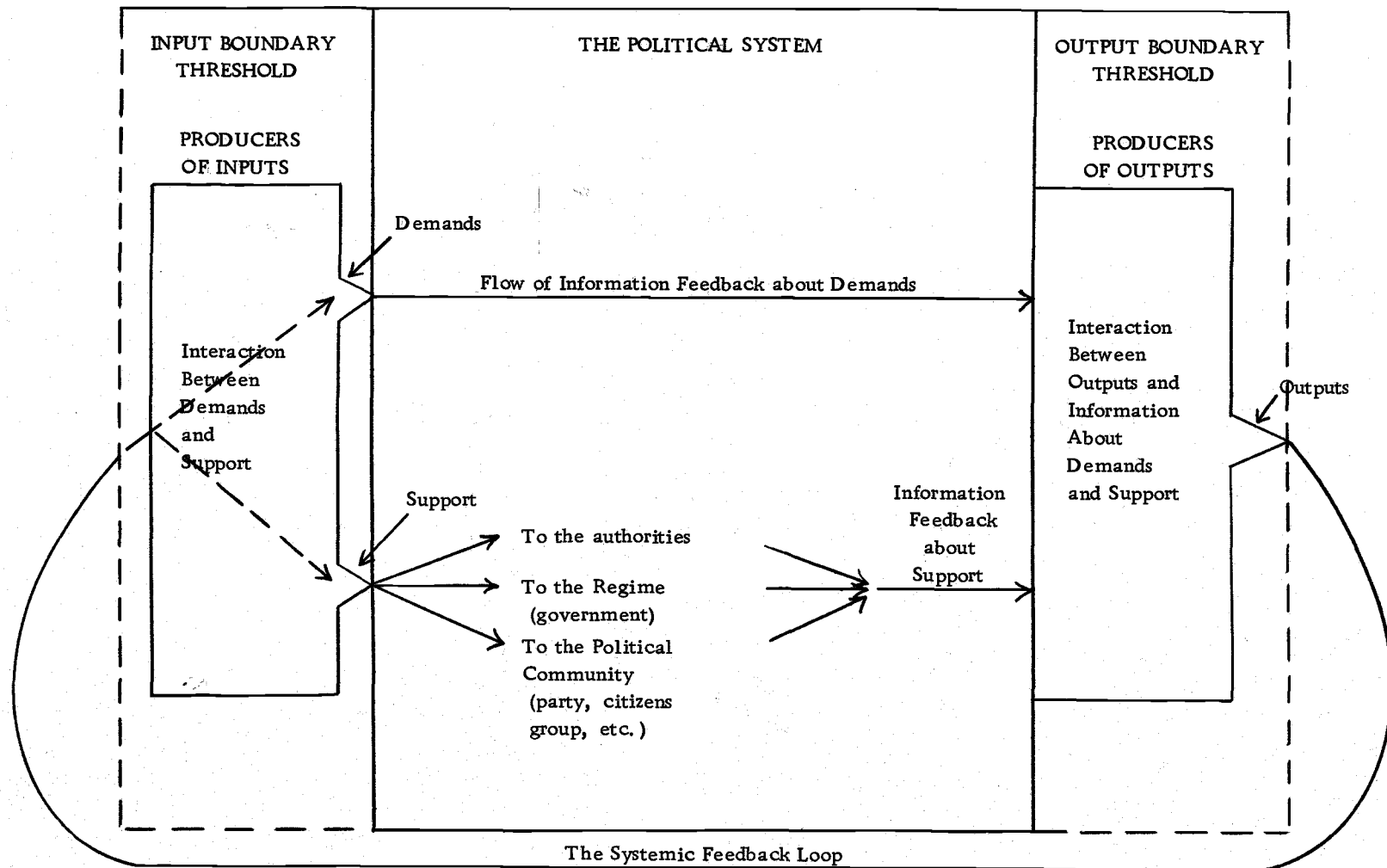
The intra-societal environment of the political system includes all the other subsystems of this study, i. e. , economic, spatial, land-capability, and behavioral (see Figure 19).

The power structure includes citizen groups, a jealous bureaucracy, large landowners, and overlapping governments (see Figure 21).



In Part After David Easton, 1965a, p. 110.

Figure 19. A Dynamic Response Model of the Land-use Political System



(after Easton, 1965b, p. 378)

Figure 20. The Political System.
Detail of Figure 19.

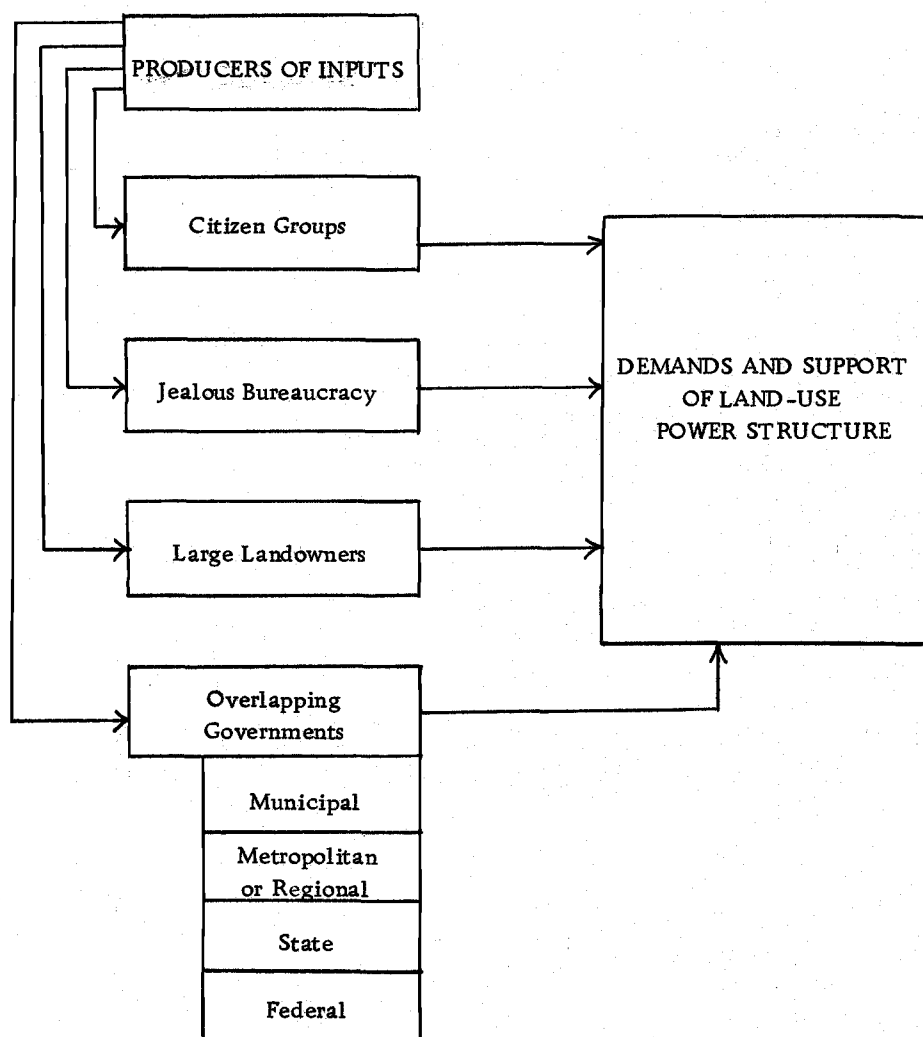


Figure 21. Political System Inputs - Demands and Support of Land-use Power Structure. Detail of Figure 19.

Citizen Groups

Because the power of an individual to institute change is becoming increasingly limited in our complex society, the banding together of people with similar goals into citizen groups for political action has become popular. The political power of an individual is increased enormously when his group can act for him.

Citizen groups' demands and support are influenced by such things as quality of the environment; i. e. , pollution, conservation of open space, traffic problems, and aesthetic matters; tax burdens; zoning laws, etc. An example of group action is the role which the Sierra Club has assumed in influencing legislation, in questioning the right of eminent domain, etc. in dealing with the conservation of open space. Anti-pollution groups, anti-highway groups, and anti-Army Engineer dams groups are other examples of citizen power groups which are concerned with conserving land or preserving an unpolluted environment.

If the foregoing matters are deemed to be unsatisfactory in a municipality or region, citizen groups will demand action to correct the conditions. But if the situation is thought to be satisfactory, these same citizen groups will give the political system their support, either by apathy or overt approval. Thus, both demands and support can be considered to be inputs into the land-use political system.

Citizen groups confront bureaucracy, large landowners or developers, and overlapping governments--the other participants in the land-use political system inputs. Their goal is often one of cutting through red tape and impatiently demanding actions which will speed up conservation of land and preservation of its quality. If the demands are not backed up by carefully prepared documented arguments against the present policies or by rational new proposals, they are likely to be ignored and regarded purely as emotional outbursts. But, if they are backed up and are consistently exposed through channels of public hearings, letters to legislators and administrators, and lawsuits, then the demands have a chance of being considered and possibly met, either entirely or perhaps in a modified form--that is, if they are reasonable in the first place. Citizen group action is assuming more and more importance in the United States political system.

The government processes the demands through hearings, legislation, judicial decisions, etc. and converts them into outputs which take the form of new laws, new plans, new regional boundaries, etc.. In the case of support, the outputs will remain the same in principle but will be reinforced in fact. The entire process of the conversion of inputs into outputs is a dynamic one and involves a constant supply of new variables, i. e. , new demands and voices of support.

The efficacy of a political system relies on information, not the amount of data stored or transmitted, but a deep understanding on the

part of the governed and those who govern as to the problems which must be solved and the processes by which they can be solved.

Citizen groups can gain support through educating fellow citizens about processes of government as well as specific needs or problems which must be processed, i. e. , explaining to citizens how one testifies at public hearings, contacts his Congressman most effectively, or circulates petitions to secure legal signatures. The mass media are making it possible for citizen groups to enlarge their political role at a fast pace.

Jealous Bureaucracy

This term refers to the tendency on the part of some government employees to resist change or to practice favoritism if it means retaining the status quo and their jobs (Blau, 1955). They are influenced mainly by the economic and behavioral subsystems, for their salaries and social status are at stake.

It is especially difficult for a parochial small-town bureaucrat to accept change, for he cannot or will not see himself as only a small part of a much larger system. His decisions and duties in his municipality assume great importance (Babcock, 1966). The region or metropolitan area of which he is a part seems to be an alien world of which to be suspicious. He makes zoning regulations and establishes tax rates which react against this larger system, rather than with it, as

long as such actions are possible within his state political system, for he wishes to preserve rather than conserve through change.

There are citizen groups working both for him and against him, depending upon how parochial or broad are their interests in land use. Wealthy landowners are usually on his side, for they can sometimes persuade him to show them favoritism in matters of zoning and taxation rates.

In the future, the small-town bureaucrat will be more and more controlled by state regulations in matters of legal procedures involving land use (Babcock, 1966). State judicial systems and land-use review boards will require more uniform practices throughout all communities in regard to equal treatment of parties concerned with land-use litigation, the general welfare, and public health measures connected with zoning and planning. The welfare of the region will replace the welfare of the municipality. In time, the welfare of the state and/or the nation and/or the world will supersede that of the region. Bureaucrats will be required to understand their functions in very large systems. Autonomy will exist only in connection with decisions of a purely local nature.

Large, Private Landowners

Large landowners or owners of high-value property in strategic locations, possess bargaining power with which they can control the

pattern of land-use development. Because of the size of their land holdings, large landowners are in a position to donate land to a municipality or a state if that government will allow them to develop their remaining land in a certain way. An example is the Irvine ranch in Southern California where land was donated to the State of California for a university and where the university provides a cultural nucleus for an enormous integrated village development. The land next to the donated land was greatly increased in value because of the university; thus the donation paid for itself many times over.

A donation for a park increases the value of residential property near it, possibly owned by the same person who donated the park. Large landowners also contribute a big share of the tax base in small communities and can exert influence on the levels of their tax assessments and assignments of land-use categories. They are often members of planning commissions, city councils, and the state legislature, because they can afford the time which these political posts require and because they have a vested interest in all the proceedings which take place with regard to the allocation of land uses.

The aforementioned power held by large landowners diminishes as the size of the planning area increases. Whereas a landowner in a municipality might have a great deal of power in his local area to dictate land uses, his wishes would receive far less consideration in a large region. In actuality, the regional allocation of land uses is no

doubt more democratic than is the allocation achieved on a parochial village level. The welfare of the group prevails under a regional system, not the welfare of the large landowners.

Because large landowners are shown favoritism under parochial governments, they are apt to demand and support municipal powers. They will be closely allied with bureaucrats who may also wish to preserve the status quo. Citizens and governments with wider interests will often conflict with the large landowner and bureaucrat in both demands and support.

Overlapping Governments

The problem of overlapping governments occurs most vividly in the case of the small suburban municipality and its relationships with its nearby metropolitan area, its region, and its state.

The Small Suburban Municipality. States have traditionally given to municipalities the right to legislate regulations which are concerned with land use. It is the community's responsibility to protect its citizens' health, property, and the general welfare and to settle any litigation arising over land uses. The municipality writes its own zoning code and administers it.

Single-family housing is considered to be the 'highest and best' use for land in the suburbs, and it is this type of housing that is fiercely protected by most suburban zoning codes. Each suburb thus

becomes an enclave, especially if its acreage restrictions are large, for higher-density housing is forced to move beyond the suburb. Multiple-family dwellings (duplexes and apartment houses) are often banned in the suburbs.

Suburbs are only too happy, however, to accept services from other governments in the hierarchy, and this produces a paradox. For the metropolitan region as a whole, suburban municipal zoning is detrimental. Low density housing means an eventual increase in the costs for sewage disposal, water services, transportation facilities, and education when the suburb becomes a part of the metropolitan area and has lost its self-sufficient rural aspects.

The Metropolitan Area. The metropolitan area needs the right to control the degree of housing densities in its suburbs if it is to be efficient in providing the services required for all of its citizens and to control the amount of rural land which is brought into urban uses each year. Very low housing densities, i. e. , one to three-acre lots per dwelling, increase the cost of providing for educational facilities, school busing, water, electricity, clean air, sewage (after the septic tank stage), fire and police protection, and highways and streets all out of proportion to the number of people served as compared to city dwellers. Suburban dwellers thus may receive the services and privileges of a metropolitan center without assuming the full cost of their low-density living.

Babcock (1966) suggests that regional planning should take preference over the small suburban municipality and that the housing densities of suburbs should be changed as the suburb becomes an integral part of the metropolitan center. Apartments and duplexes should be allowed at that time so that leap frogging and urban sprawl are minimized. The suburb could continue to regulate purely local matters such as amounts of setbacks, square footage of homes, etc. and thus retain a 'local flavor' if the villagers desired.

In addition, the metropolitan region should control the planning of lands for industry and recreation for the entire region to fit in with overall regional needs and costs of services. Thus, in disputes over land uses, regional interests would take precedence over purely parochial ones. Statutes at the state level are required to empower metropolitan regions with such priorities, and dynamic regional planning is necessary so that citizens can know what to expect regarding the future zoning of their land (Babcock, 1966).

The State. The state should (and undoubtedly will) increasingly influence decisions on private land use where major public services are involved, although municipalities will probably continue the role of initial decision makers. Even if most decision making remains local, the criteria for decisions should be consistent with the region. The inadequacy in zoning today is that the criteria are local, even when the interests are regional.

Babcock suggests that reform in current land-use policy be initiated through a substantial change in our state enabling acts along three lines:

- (1) more detailed statutory prescription of the required administrative procedure at the local level;
- (2) a statutory restatement of the major substantive criteria by which the reasonableness of local decision-making is measured;
- (3) the creation of a statewide administrative agency to review the decisions of local authorities in land-use matters, with final appeal to an appellate court.

These reforms require that a distinction be made between procedural matters and those of substance; between control over the manner in which decisions on land use are made and the basis of the decisions themselves (Babcock, 1966, p. 153-154).

Regional government is not required for administering such a program. Instead, the legislative standards are changed, i. e., the frame of reference, both procedural and substantive, by which the validity of these local decisions is judged.

The pressures for such regional reforms are coming about mainly from the federal government in the form of economic incentives. Federal funds are available for planning programs, grants-in-aid for open space, hospitals, airports, sewage disposal, air and water pollution control, urban renewal, etc. mainly to municipalities which are concerned with metropolitan or regional interests.

It will be up to the state courts, however, to effectuate the change from parochialism to regionalism in land-use disputes. The more

restrictive the local practices, the more the judiciary will have to ask whether each village can define the public welfare in its own image, irrespective of the public costs in a region.

Conclusion. The lack of control of suburban development seems to be the impediment to orderly growth of metropolitan areas. The parochial zoning laws are anti-metropolitan and/or anti-regional. They seem to be based on social influences rather than economic considerations and are negative or exclusionary in an era of rapid growth and development. Federal funds which require a more regional outlook will no doubt break down this parochialism more than will any other factor.

Regional interests will dictate that higher density housing be allowed as suburbs find themselves in the path of urban expansion. Comprehensive regional planning will provide for more efficient services in the entire metropolitan area. The judiciary (at the state level) will be called upon to hand down decisions on land-use disputes which favor the general welfare of the region rather than the municipality, except in cases of a purely local nature.

Outputs of the Political System

Outputs of the political system which are concerned with land use are derived through a conversion process whereby governmental authorities make new regulations, hand down judicial decisions, or

administer laws in ways which respond to the demands and support (inputs) of the citizens within the power structure. The phenomenon of feedback is of extreme importance, for it is the information which reaches the authorities regarding their previous actions on matters relating to the regulation of land uses which will tell them whether to continue present methods of handling land-use disputes or whether new kinds of political tools are necessary.

Thus, the outputs of the system may be defined as the political tools which are used for slowing down the conversion of biotically productive land into irreversible uses. The tools to be discussed below are as follows: (see Figure 22).

1. Zoning
2. Tax policies
3. Use rights purchased by governments
4. Land purchases by governments
5. Eminent domain

Zoning

Land-use zoning involves statutes which regulate the use of land. Zoning is a means of avoiding disputes over competing demands for the use of private land and includes administration and judicial review. In America, zoning takes place in a society based upon the belief in private property and the mobility of the individual.

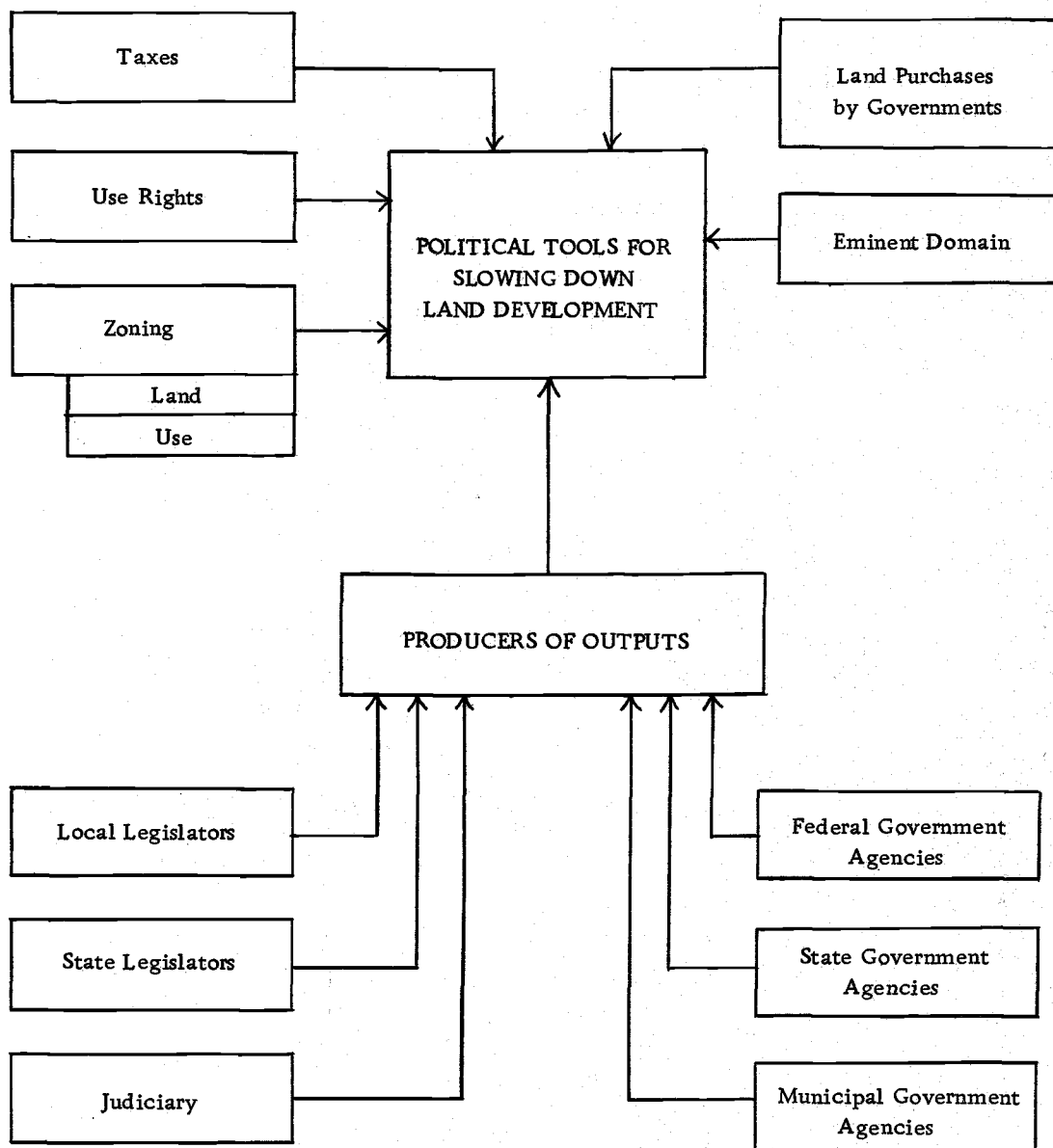


Figure 22. Political System Outputs.
Detail of Figure 19.

Purpose of Zoning

Zoning arose primarily as an effective technique to protect the single-family house neighborhood. It works best in the suburbs as a means of securing a small-scale protected environment in a municipality and goes along with the kind of planning which is intended to achieve certain social and political objectives as well as physical amenities. It has been successful on a small-scale municipal basis to preserve the status-quo, and the suburbanites like it. But zoning which is used as an implement of planning based on objective standards for physical environment alone has not been entirely successful. Too many erosions occur in the interests of special groups (see Figure 23).

Principles of Zoning

Zoning or "districting" is only a technique, not a principle.

Principles of zoning include:

1. Equal protection for all parties.
2. Providing for the general welfare of citizens.
3. Procedural due process.
4. Appropriate boundaries of the police power and the power of eminent domain.

A test of principles is whether like situations are treated alike.

Fair procedure is also a principle. A comprehensive municipal and/or

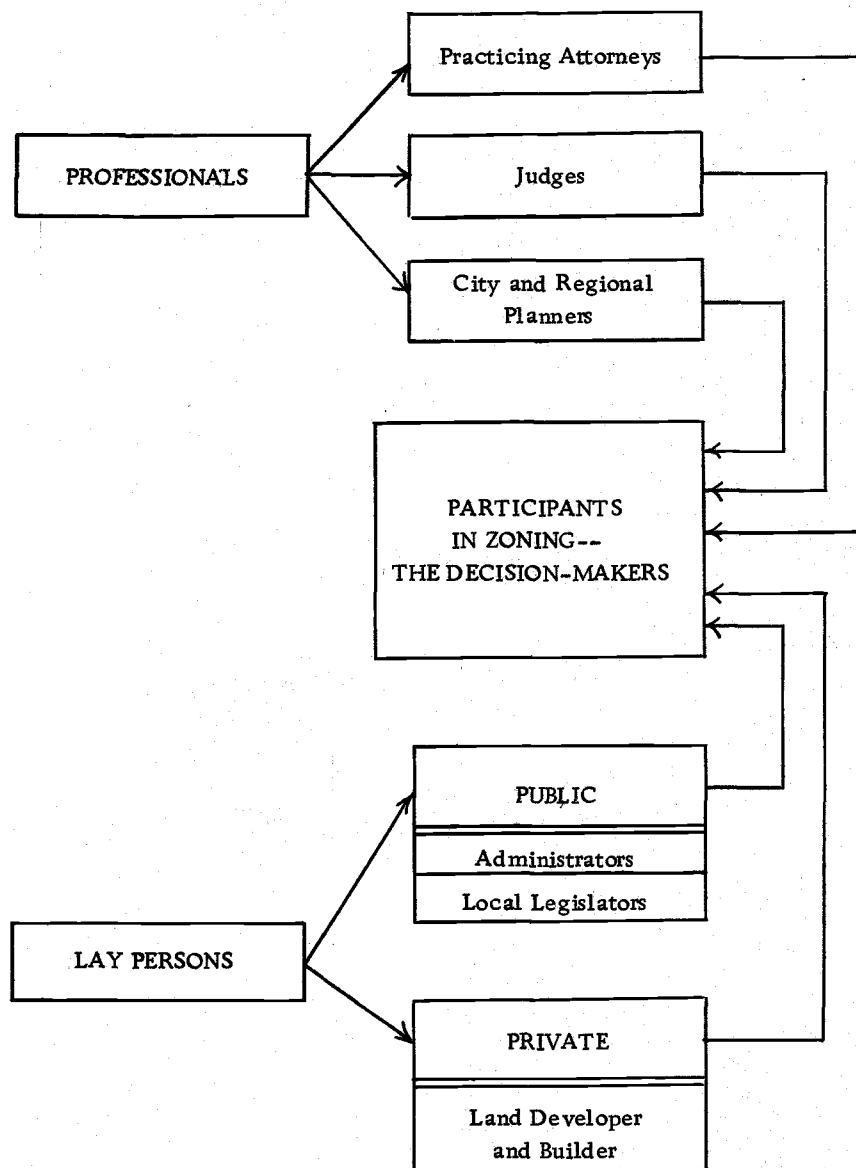


Figure 23. Participants in Zoning - The Decision-makers

regional plan is a useful technique for predicting public reaction to private acts connected with land use and for evaluating fairness in dealing with them. A limit upon private decisions is justifiable only when the general welfare requires it. But the general welfare for an entire region may differ from that for a small community, and for this reason comprehensive regional plans are desirable.

The interested parties usually involved in land-use litigation are: the landowner, the neighbor, the municipality, and the metropolis or region. Landowner-neighbor disputes and landowner-municipality disputes are often of a parochial nature and can be settled with no regional considerations in mind. However, such is not always the case, and judges and attorneys should take pains to apprise themselves of regional goals which may be in existence.

A major revision of state legislation in the field of land-use regulation is needed to protect the interests of the metropolis or region (Babcock, 1966, p. 152). For who can represent the metropolis in lawsuits between neighbor and landowner or landowner and municipality? There are the interests of three or four parties to be considered in today's complicated land-use litigation. Under present laws the metropolis is represented only occasionally (and usually indirectly) by a farsighted lawyer or judge or building developer with a broad view of society's needs.

Zoning is more and more losing favor as the foremost way to

regulate land use. Some criticisms are as follows:

1. Zoning is an instrument of special favor--those with power accomplish selfish purposes regardless of public good.
2. Zoning is approached emotionally, not with reason. It is based on what is popular, not what is right.
3. Zoning is used as leverage for bargaining.
4. The protection of health, safety and the general welfare is forgotten in the desire to control competition, keep out foreigners, favor special interests, obtain public right of way for free, zone tax-users out and high tax-payers in (Babcock, 1966, p. 89-91).

In conclusion, it is to be remembered that zoning is only one technique of regulating land use. Its usefulness must be critically examined (see Figure 24).

Types of Zoning

There are two types of land-use zoning. The first is that which designates that the land be used for a specified activity or specified activities and which allows that only those specified activities be carried out unless a variance or other deviation is allowed by governmental authorities. The second is zoning (usually at a state level) which designates that a certain use is to receive priority, but other

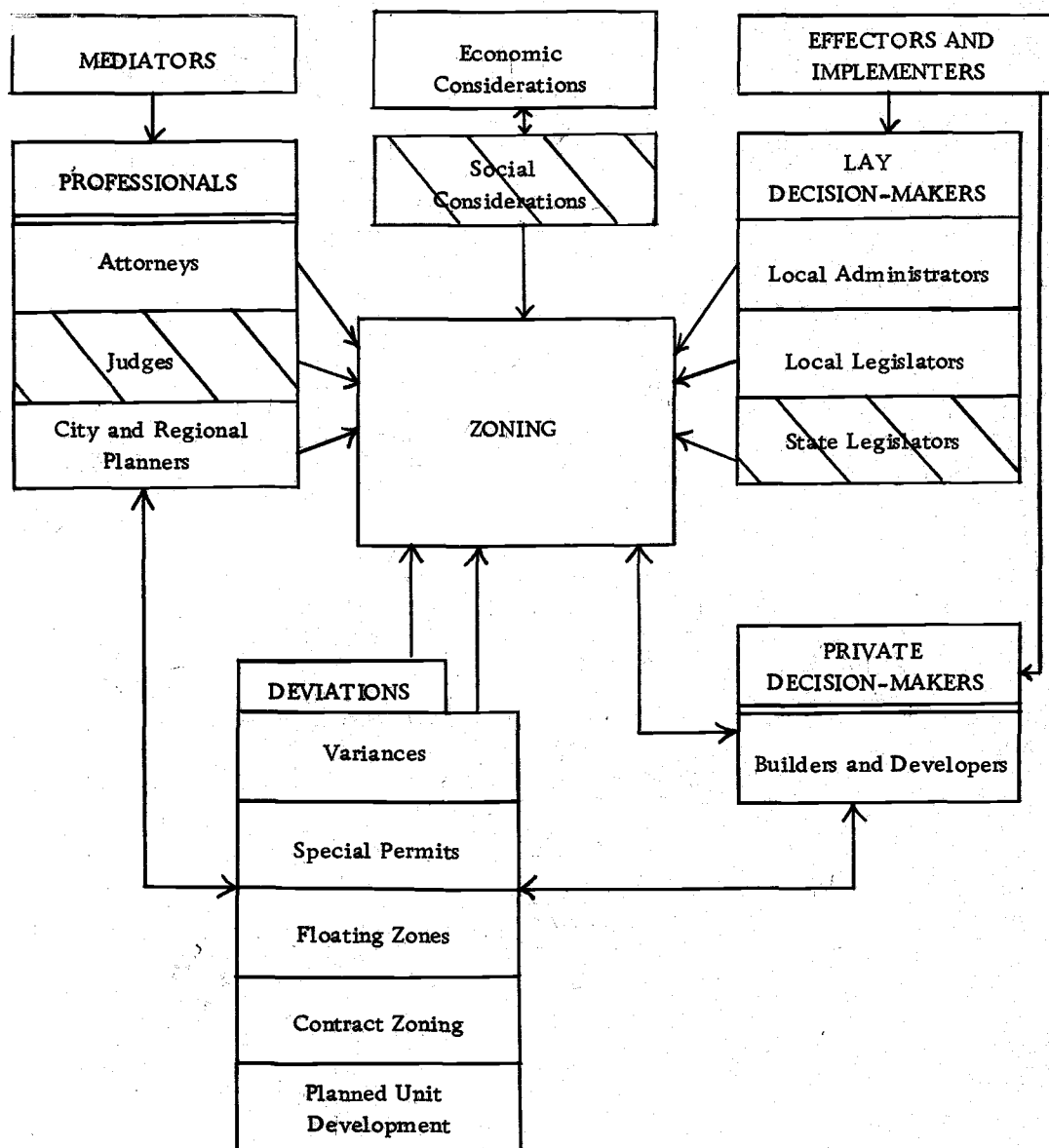


Figure 24. Zoning

uses are not excluded, i. e. , agriculture receives priority, and large noisy machinery, pesticides, high animal densities, etc. are allowed and protected because they are essential to modern agriculture. Other types of land uses in such an area would have to adjust to the farmers' needs rather than try to change the environment to fit their own requirements (as is done in so many new suburbs and is detrimental to farming). Thus, a use receives priority but is not exclusive.

The first type of zoning, i. e. , in which the land parcel is zoned for a specific use or uses, is the kind of zoning now existing in most areas of the United States. Because it is exclusive and rigid, there have evolved several kinds of zoning deviations which are permitted in special cases. They are:

Variance - an authorization to deviate from the terms of an ordinance if unnecessary hardship is inflicted on a party because of that ordinance.

Special permit (special use, conditional use, special exception) - A few uses are listed in an ordinance which would be permitted at the discretion of the local authority. This is done in anticipation of proposals which might arise and raise a problem.

Floating zone - This type of zone was established after World War II to take care of large housing developments such as Levittowns. A floating zone can be put anywhere (usually a garden apartment type of development) and thus endanger villages

zoned for single-family dwellings.

Contract zoning - No deviation intentions are pre-announced in a municipality's ordinance. The zoning map is straightforward and certain. No floating zones or special permits mentioned. A private contract is made between a developer and a public body authorizing only one new use. This does not establish precedent for future deviations from the original zoning (Babcock, 1966, p. 10-11).

Planned unit development - This is contract zoning on a more sophisticated level and involves large parcels of land. Each proposal is judged on its specific merits and actually supplants pre-existing zoning. The developer and municipality bargain over easements and regulations (Babcock, 1966, p. 11).

Taxation Policies

The power of taxation is one of the powerful tools for land allocation. For example, open space could undoubtedly be more easily preserved if property taxes were greatly reduced or eliminated on all undeveloped property near urban areas. Serious practical problems would arise, however. Local governmental units which are predominantly rural would be deprived of their tax bases. The California Constitution, as an example, prohibits such favoritism and requires that all property subject to taxation be assessed at its full cash value

(Herring, 1965, p. 55).

Local Property Taxes. Traditionally, the municipality has been empowered by state legislatures to levy property taxes on land and the improvements on it against all property owners in order to secure revenue for schools and municipal services. If a great deal of land in any locality were exempt from taxes, the municipality would be greatly handicapped in its providing of services for its citizens.

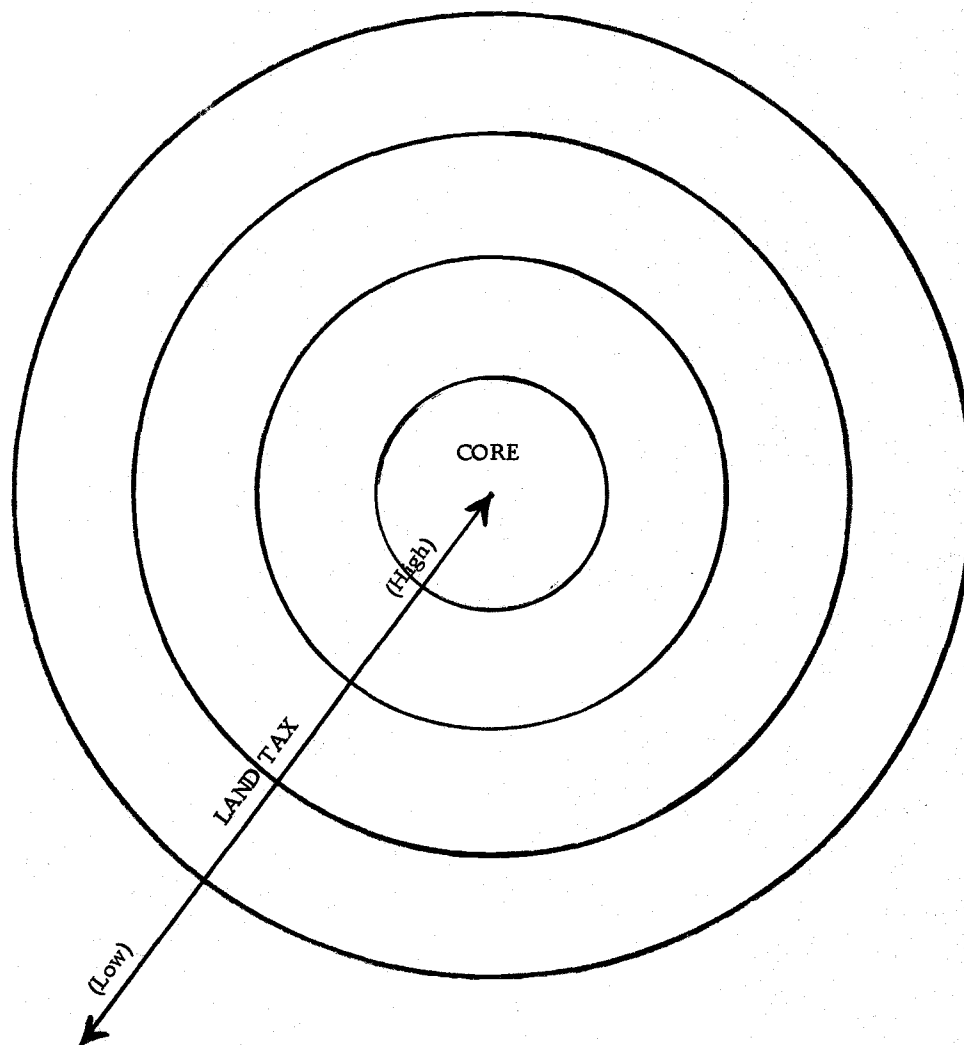
Since municipalities usually assess property at its full value, such a tax policy does not lead to the preservation of open land. Only if a state law provides for agricultural or other open-land zoning with its accompanying lower rates of taxation will municipalities zone for present use rather than highest and best use. Some municipalities have even forced suburban housing development by establishing prematurely high tax rates based on a future use in order to broaden their tax bases. Such a practice is risky except in a region of rapid growth. It is often wasteful, in any case, for it is based upon speculation, not sound planning.

Local property taxes are proving to be inadequate to provide for the myriad of services required in today's complex society, both in urban and suburban areas. Services are overlapping and very costly. How can local taxes be supplemented or supplanted so that regional interests will be served rather than local ones? And how would such alternatives aid in the conservation of biotically productive land?

Regional Taxes. Regional taxes would spread the tax base over a much larger area than a municipality and would counteract disparities in revenue-producing properties. For instance, industrial areas with a large tax base could balance the lower tax bases of municipalities of a rural nature or areas of the region that planners wished to set aside for future development. All taxes would go into one fund and would then be used for the welfare of the entire region.

A 'Land' Tax. A 'land' tax refers to the principle of taxing the land itself, not the land and its use or development. By taxing the land in a metropolitan area according to its location, with the land in a core area taxed at the highest rate, development of that land would be forced before development in the suburban areas would proceed. Vacant land in the city which remains undeveloped would become a thing of the past, and leap-frogging would be greatly minimized (see Figure 25).

State and Federal Income Taxes. Another alternative or supplement to local property taxes is the practice of giving rebates to local or regional areas from state and federal income taxes. These are based upon population and need and are a means for equalizing incomes and taxes. Federal educational allotments work under this kind of plan already, and many urban and regional planners feel that such a tax system is necessary for metropolitan areas. Suburban citizens use metropolitan services without paying their share for them,



Vacant land to be taxed at the same rate as developed land

Figure 25. Diagram for a Land Tax

and cities can no longer shoulder the burden.

Conclusions. Private-property taxation seems to have reached a saturation point in the United States. Citizens' groups are reacting unfavorably to additional levees in many communities. A supplement or alternative to this parochial method of financing community services is now warranted, for many community services are now of a regional nature. Low taxes on open land will be a practical technique for conserving biotically productive land only when present property taxes are supplemented or supplanted by income tax rebates, regional property taxes or 'land' taxes (see Figures 26 and 27).

Use Rights

Another political tool which can be used for slowing down the development of biotically productive land is the purchase of use rights by governments--municipal, metropolitan, state, or federal. This practice involves the purchase of a use, not the land itself, and requires that the landowner maintain that use as long as the purchased right is in effect. In other words, it is a contract between the landowner and a government in which the landowner is compensated for preserving a use which benefits the entire community or region. The use purchased can range from an aesthetic one, such as the preservation of a viewpoint, to maintaining farm land in its present state.

Governments cannot afford to purchase use rights in areas that

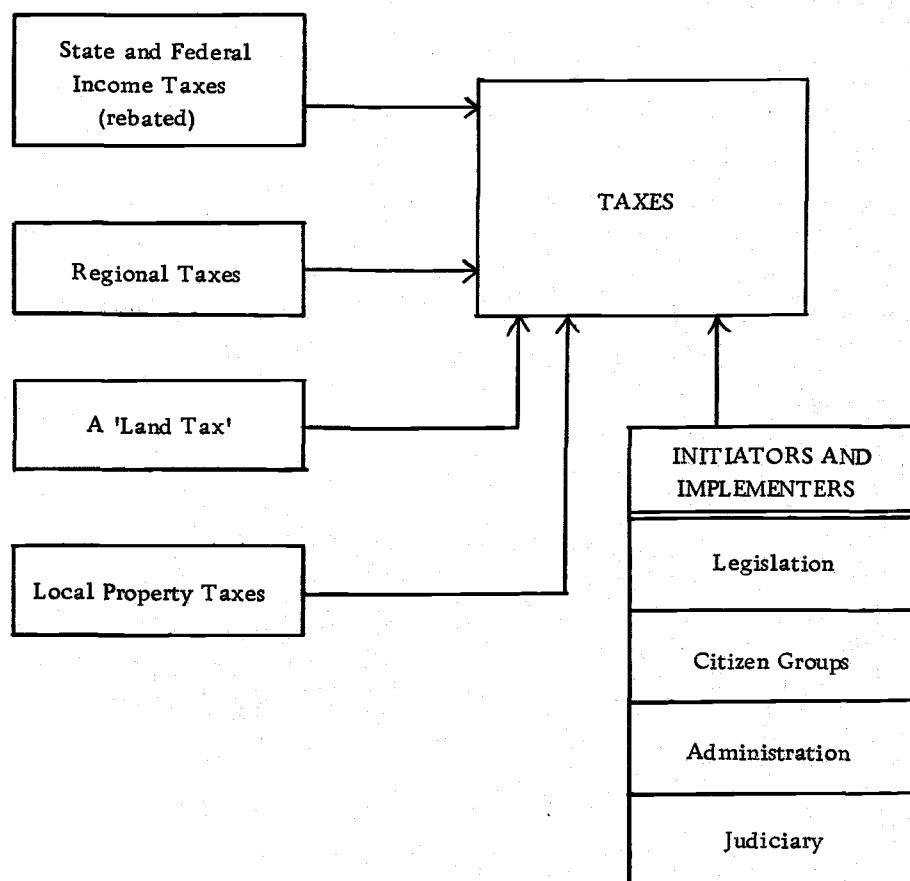


Figure 26. Taxes - Political Action

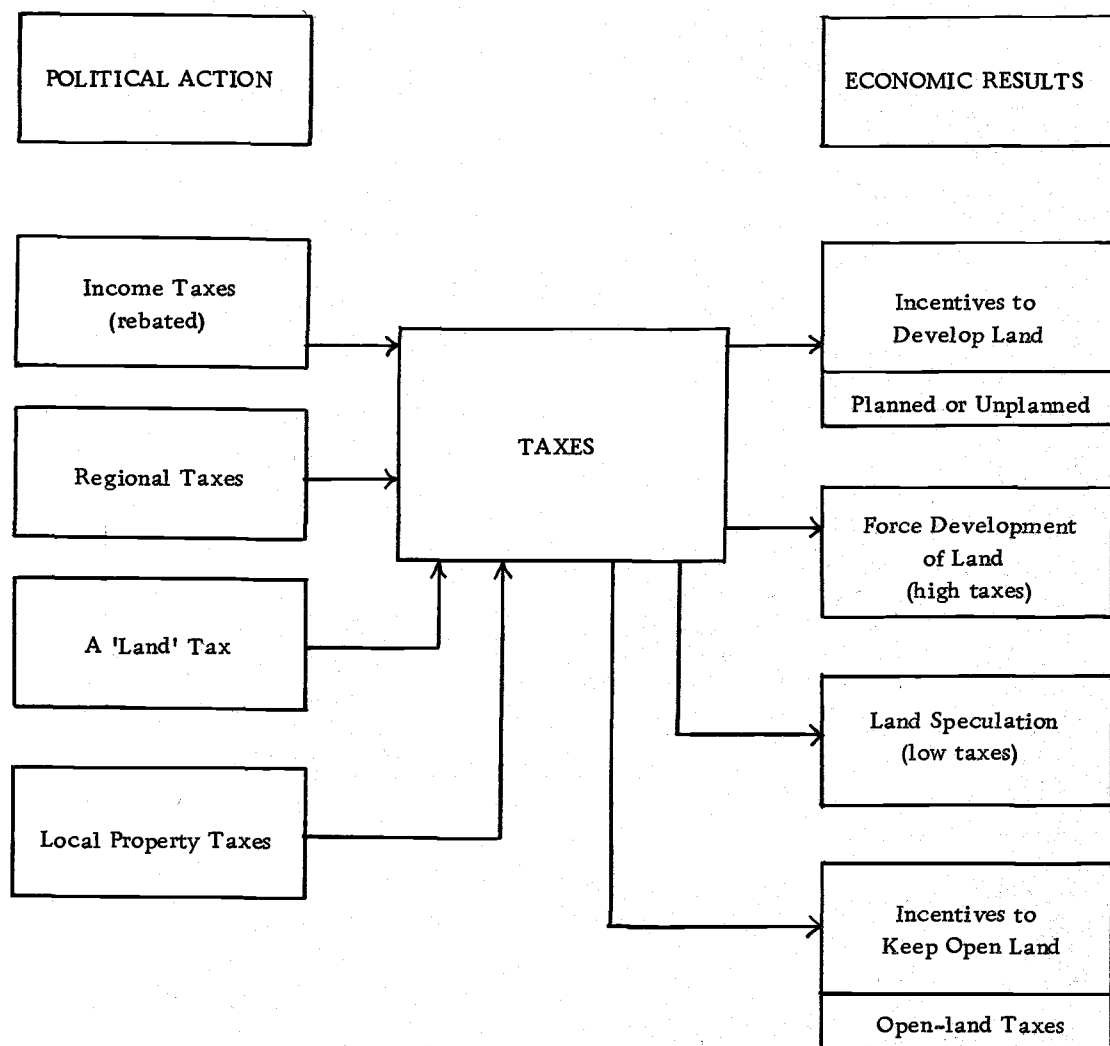


Figure 27. Taxes - Political and Economic

are already caught up in a metropolitan development boom, for the values of land parcels are already inflated. The use rights in such areas would be almost as costly as the land itself. Far-sighted planning is a prerequisite for the use-rights tools for open land conservation, for governments must purchase use rights before land values are inflated.

Land Purchases

Perhaps the best way to minimize the speed with which biotically productive lands are being converted into irreversible uses is for governments to purchase lands to be held for future development. Only through direct ownership of land can land uses be permanently controlled by the government. Our national parks and national forests are an example of government ownership and its subsequent long-range control over land uses. Private lands which are located next to them are subject to many non-compatible uses, often of an irreversible nature and show a marked contrast between public and private ownership of land.

If regional, metropolitan, or municipal governments could buy land and hold it until the proper time for development, such development could be handled in an orderly way. The property could be leased or sold for specific development projects. In this way, the costs of the land could be recovered by the government.

The smaller the governmental unit, however, the more likely that personal greed and favoritism would enter the picture. Metropolitan or regional areas would be in a position to use this tool more fairly than municipalities, for the welfare of the region would be more likely to prevail over that of a few wealthy landowners or developers.

The biggest deterrent to using the tool of land purchase to slow down the disappearance of open space is a paucity of government funds to purchase undeveloped land. Most metropolitan areas lack enough for services, let alone land purchases. However, federal funds can become more available to regions or to state land development agencies for this purpose. President Johnson proposed such a plan in his 1965 Congressional Message on Cities (Congressional Record 3812, daily ed., March 2, 1965)). State agencies for public land development would be established under state laws for the purposes of acquiring land, installing basic facilities, and then reselling the improved land to private builders for the construction of suburbs or of entirely new communities.

It was also proposed in 1965 that federal grants to public bodies for recreation, conservation, and other needed public uses would be raised from 30 to 40 percent where they are part of an area-wide plan, and from 20 to 30 percent in other cases. Grants of up to 40 percent would also be available for acquiring land in built-up areas and its clearance for small parks, squares, malls, playgrounds, waterfront

areas, and so on--in other words, to encourage more open spaces in cities (Herring, 1965, p. 131-132).

Eminent Domain (as a tool for conserving open land)

Eminent domain is another tool to guide land development; it is the right of a government to condemn privately owned land if it is needed for the public welfare. In this way, it is possible for highways, schools, power lines, etc. to be constructed without the interference of a citizen who might refuse to sell his land or who would charge an exorbitant price for it. Compensation (a fair price) is made to the owner for his land.

The federal rights of eminent domain are paramount.

. . . whether the purchase is 'necessary or proper' to further general functions or is an expenditure in the 'general welfare,' the federal government may exercise eminent domain within the states, irrespective of the wishes of the state or of the individual owner. Federal eminent domain power has been sustained for the purpose of national parks, national seashores, historical sites and monuments, reclamation and stream development, multiple-purpose resource development and conservation, housing and redevelopment, recreation, forests, wildlife programs, and to protect other federal projects (Herring, 1965, p. 36).

States are often enabled to exercise eminent domain on behalf of the federal government for all public uses authorized by the federal government (Herring, 1965, p. 36). If the federal government were to indicate that the conservation of open space were a necessary public

use of land, then states could go ahead and condemn land for conservation and convey to the federal government.

The most practical way for states to exercise the right of eminent domain for the purpose of conserving biotically productive lands, however, is through statutes enacted by state legislatures defining the public uses for which the state, counties, and municipalities may condemn land and including the preservation of open spaces in these uses. Then, that specific use is authorized by state law, and there are not so many legal hassles over definitions of public use and welfare and the use to which the condemned land will actually be put (Herring, 1965, p. 37-38). In general, state legislatures also have the right to grant or to withhold from state agencies, local governments, or quasi-public utilities the right to exercise eminent domain over various types of land rights and also to determine whether only some rights, or the whole estate may be acquired.

There is a trend toward the expansion of the concept of what is necessary for public health and welfare, and this enlarges the area within which police power lies. It is likely that the public agencies will seek to take as much land for the appraised value as possible for the general welfare. The private landowner will resist and will initiate litigation for the purpose of having the courts define what is just compensation for his land or for defining precisely what is general welfare and whether the government has the right to condemn his land. As in

the legal disputes over zoning, the judiciary will be called upon to resolve the differences and in so doing will direct the trend of the right of eminent domain as a tool for controlling the pace of the development of biotically productive lands for irreversible uses.

Eminent Domain as a Destructive Tool in Land Development

In the past, the right of eminent domain has always been accepted by the general public as a police power unquestioned by those who weren't directly affected. It is still accepted as a necessary power of governments, but questions are arising among some citizens concerning the criteria by which public agencies select lands to be condemned for the public welfare.

The power of eminent domain is directly related to one of the most serious problems connected with land-use allocation. It is the practice of choosing undeveloped lands for public purposes because they are the least expensive and the easiest to develop. Because undeveloped lands are the most vulnerable to condemnation, sometimes they are developed more quickly by their owners than they should be for the good of society as a whole. In other words, development can be forced because of the prospects of condemnation, just as development is often forced because of high taxation policies.

An excellent example of the erosional effects of eminent domain upon undeveloped lands has occurred at Stanford University in

in California. The continued threat of condemnation may force Stanford into premature development of its remaining open lands. It is only one example among many such institutions that have land endowments. Because of the founders' wishes, Stanford University cannot sell its land (8,000 acres), but the land is subject to condemnation just as are any other private lands. In its first half century, the university lost little more than 100 acres through land condemnation for schools, a hospital, highways, etc., but in the last two decades Stanford has lost another 600 acres. An additional 2,000 acres could be affected by other outside plans (Noble, 1967).

The slow, carefully planned land development of the original endowment is being jeopardized; much of it is still open land. Two cities, six communities, two counties, the State of California, and the Federal Government are all making demands on these remaining undeveloped areas at Stanford; these lands are chosen because they are bare of improvements. Should not more attention be paid to lands on which development has deteriorated? Must open lands always be the first target for condemnation?

Not only the pressures of eminent domain, but the taxes levied against the university lands which are based on highest and best use rather than present use may force the University to develop its lands for irreversible uses at a much faster rate than its founders anticipated and its present-day trustees desire. Of the two variables forcing

premature development--taxation or the prospects of condemnation-- it is the latter which is the more serious threat to Stanford.

As mentioned above, undeveloped lands are usually chosen for condemnation. In addition, the best undeveloped lands are usually picked, i. e. , those with the highest land-capability classification (level, well-drained, etc.). It so happens that lands falling into this category are often our finest agricultural lands. The agencies most responsible for eroding these prime lands are the highway departments at all levels of government. Their philosophy has always been to build the lowest-cost highways possible, i. e. , the shortest and straightest routes.

The irony of such a philosophy is that it may be more costly in the long run, for the location of freeways upon open, flat land sets into motion a spiral of urban sprawl and strip development which will call for more and more highways. If freeways are located, instead, upon the hills next to flat valleys, they would function more as transportation arteries, not as a framework for quickly developing urbanization.

A wise choice has been made for the new U. S. Route 5 freeway in the San Joaquin Valley in California. It is located at the western edge of that fertile valley. A poor choice was made for Route 5 in the Willamette Valley in Oregon. It cuts through the middle of the valley floor and bi-sects some of the United States' best farmland. An urban

strip development is resulting in a further erosion of the farm areas for the entire length of the valley.

New York State's Commission on Preservation of Agricultural Land recommended in its report to Governor Rockefeller in 1968 that an Agricultural Resources Commission be formed to work with planning bodies and government agencies to set statewide policies on how and where to retain land in agriculture (Billings, 1968, p. 16). Before agencies condemn land, the Commission would work with them--highway departments, educational institutions and boards, the Water Resources Commission, etc.--to advise and persuade them regarding the preservation of prime agricultural lands. This would force governmental agencies to take a closer look at their condemnation policies and change their criteria to fit in with the general welfare rather than the agencies' welfare.

Planning on a statewide level seems to be necessary in order to control the premature development of prime biotically productive lands because of the threats of eminent domain or of the actual practice itself. This important police power of condemnation must be exercised for the general welfare of the public, not for the agency involved.

Conclusions

The political tools for slowing down the process of converting biotically productive lands into irreversible uses consist of two classes--those tools that can be either positive or negative (tax policies, zoning, eminent domain, and municipal planning) or those that are wholly positive (regional planning, land purchased by governments for future development, and the purchase of use rights). It seems that the most effective tools would be the wholly positive ones.

Quantitative Spatial Variables - Geometric Subsystem

Introduction

Land exists in a fixed amount on the earth's surface, with slight possibility for addition, i. e. , delta growth and land fill. Because of the severe constraints of space, other systems must adapt to the spatial system. "Undeveloped" lands abound on the earth's surface, but most are unattractive areas to man and, in some cases, perhaps uninhabitable. The "developed" lands comprise a small fraction of the earth's surface; they are the most fertile and accessible areas. It is usually economically more feasible to further develop the developed lands than to open up new lands in the undeveloped areas.

The problems of reserving high quality biotically productive lands for the future and of retaining "open spaces" of various types

have been generated because of the great increase in the human population (a variable factor in the man/earth system). The number of people and their distribution determine both how much and where open space will be needed. Without the population increase there would be little need for concern about preserving open space, for population and space are reciprocal. If space is to be retained, population must be limited, or rising densities must be anticipated and certain areas reserved for future development.

E. Stanley Weissburg defines "open space" as

. . . all forms of land and water areas within or around a metropolitan region, which are retained in essentially undeveloped state on a permanent or semi-permanent basis. It ranges from lawns surrounding a dwelling to regional, state, and national parks and unspoiled wilderness. It includes landscaped rooftops in mid-city, pedestrian malls in a city center, farms and greenbelts at the periphery, picnic spots at the roadside, beaches and reservoirs, wildlife refuges, swamps, rivers, mountains, and valleys. In short, the term encompasses any space which allows contact with nature, though it may serve, as well, other more utilitarian functions such as conservation or postponement of urban development (Herring, 1965, p. 1).

This study deals mainly with the conservation of rural open space or postponement of urban development, but this can be achieved more easily if all types of open space as described by Weissburg are retained wherever possible. Attractive open spaces in the city will alleviate the rush to the suburbs. Consideration must also be given to the 'perception' of space. What may be intolerable crowding or

pollution to one person may be quite acceptable to another.

The geometric subsystem is concerned with finite space, psychological space, health and sanitation space, empty urban space, and multiple-use space (see Figure 28). Finite space encompasses the other four kinds of space, but the four subsidiary spatial types are discussed separately as examples of the kinds of spatial requirements which must be perceived and/or measured along with land-use spatial requirements in the allocation of land.

Finite Space

The earth's quantitative spatial system consists of two large subsystems, the rural landbase and urban space. Blumenfeld (1969) prefers the term urban space to urban land because it emphasizes the three-dimensional use characteristics of land in the city. The reality of rural land use is two-dimensional.

Another reason for dividing land space into two categories is that with respect to land, one may consider general regional planning to be locational and metropolitan and city planning to be allocational. Land is treated as a scarce resource in small areas but not in large ones. It is difficult to fuse the two ideas (B. Harris, 1968, p. 14).

The greatest problem area in the location and allocation of earth surface space for man's activities occurs where rural land and urban space meet, i. e., the "urban fringe," suburbia, the rural-urban

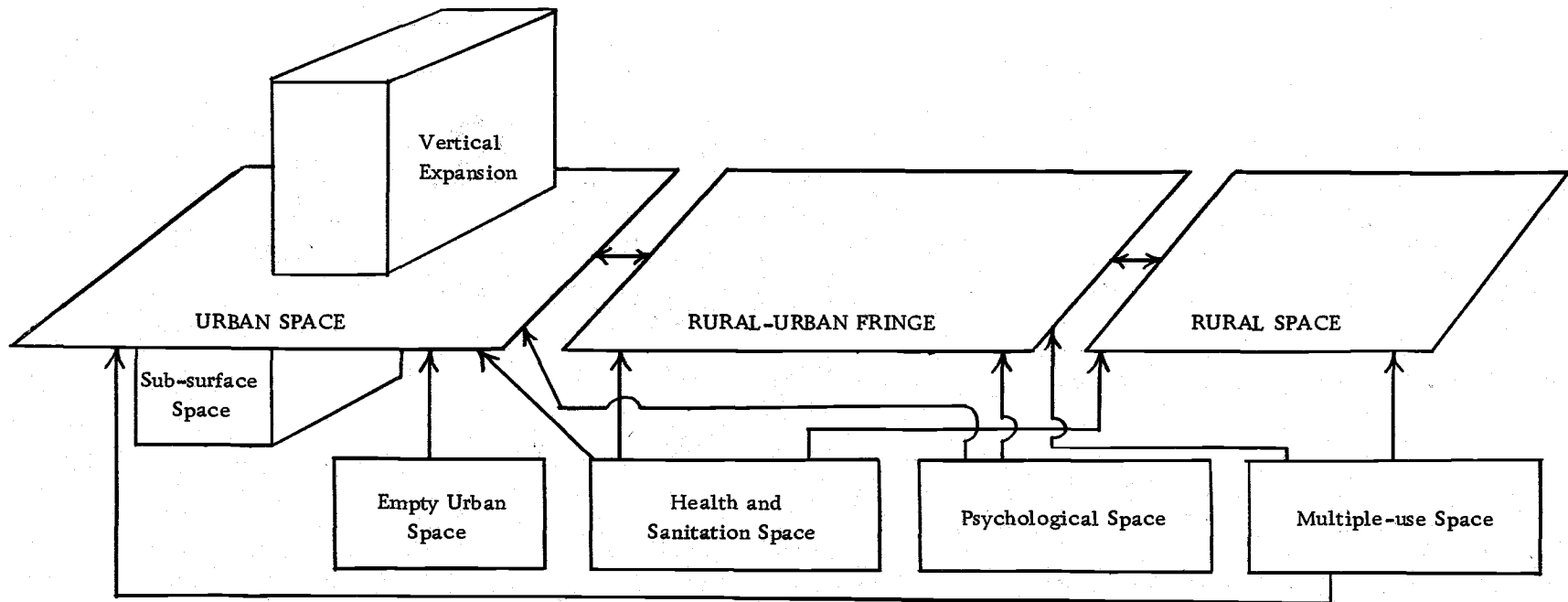


Figure 28. Geometric Subsystem

transition zone, or the area of greatest urban sprawl. It is characterized by low densities of an urbanized population, and it is the zone where the greatest waste of prime biotically productive land occurs.

Important land uses (demands for space) in rural areas are: agriculture, grazing, forestry, highways, mining, dams, and recreation. Those in urban areas are: housing, business, industry, highways and streets, automobile parking, waste disposal, and recreation (see Figure 29). The uses are often not compatible if located close together on the urban fringe.

The phenomenon of urban sprawl is relatively new and is caused primarily by the automobile and affluence. The densities of 140 urbanized areas in the United States changed from 5,408 persons per square mile in 1950 to 3,752 persons per square mile in 1960 (Doxiadis, 1968, p. 377). Another contribution to urban sprawl and waste is the establishment of "urban corridors" or a linear metropolis or megalopolis. Such urban corridors are related to the behavioral concept of "least effort" (after Zipf) (Whebell, 1969, p. 2). Wood (1969) feels that we must have a massive federal program to save urban regions and the countryside nearby just as we have had rural development programs in the past.

Urban Space

Before top-rate planning and large amounts of federal help for urban areas can be implemented, it will be necessary to have the results of much more public and private research on such things as determining favorable densities of urban populations, ways to achieve variety in urban dwellings, how much room space is needed per person for good mental health, how much green space people need in order to satisfy a craving for open space (and if, indeed, this is a real need), and ways to keep the automobile from destroying urban living. Experiments are a prerequisite for such research, such as the experimental city envisaged by Spilhaus (1967) and his group at the University of Minnesota.

The planners of Stockholm, however, always emphasize that it is not their superior ability, but public land ownership that enabled them to make Stockholm a model for other cities. In Stockholm, the policy of public land ownership was established more than 50 years ago (Blumenfeld, 1969, p. 273). Public land ownership, metropolitan-wide government, and adequate financial resources were the three main tools to bring about a rational use of urban space in Stockholm.

Doxiadis (1968 and 1969) writes often about freeing the surface of the land for people and advocates the use of much more underground

space for such activities as transportation, water mains, telephone wires, electricity, parking, and shopping malls. He feels that people should be able to walk to their activities from their homes or from rapid transit stations in about 10 minutes time, just as they did in ancient times, and that cities should be given back to the pedestrian.

The use of more air space in cities is recommended by many architects and planners, i. e. , high-rise apartments and office buildings, with open spaces at frequent intervals. However, high-rise buildings are more expensive per square foot than low buildings, and it is difficult for private enterprise to build this type of housing for low-income and even middle-income groups in our cities. And many Americans are not amenable to apartment-house living. The single-family dwelling is most often preferred in all sizes of cities, except perhaps in New York.

Air space must be used in a way that will not break down the urban ecosystem. Some areas with poor air circulation or frequent air inversions might not be able to support large numbers of high-rise buildings without a great and perhaps adverse change in the micro-climate. Much more ecological research is needed to determine by measurements the carrying capacities of urban areas.

Urban Transportation. A modern metropolitan region is characterized by a continued population increase, decentralization of industry and commerce, a change in the relative usage of mass

transport (in most cases), and a relative (sometimes absolute) decline in central business district attraction.

The resulting diffusion of urban travel patterns creates an urgent need for both regional and centrally-oriented transport facilities. These trends suggest that the urban transport system must be designed increasingly to serve non-downtown trips, as well as the downtown ones. Thus, downtown travel needs must be viewed in a regional context.

In discussing urban transportation, Hooper (1969) feels that mobility, expressed in activity-option terms, is one measure of merit to be used in evaluation of urban environment quality. Thus, access to activities must be provided to a much greater degree than the minimum required to meet essential needs (p. 83). Mobility is a joint product of the transportation system, the land-use system, and the operational aspects of associated urban social systems. Unsafe streets or racial discrimination can reduce mobility in an urban center just as easily as spatial and land factors. Transportation should be safe, attractive, and convenient.

Streets and highways cover 20 percent or more of the land in urban areas in California. Transportation arteries comprise the greatest single land resource use in developed areas (Patri, 1968, p. 14). In the central business district of Detroit, 74 percent of the land area has been taken over by parking, highways and streets.

Some highways in Detroit are 10 times wider than originally planned (Doxiadis, 1969). Sixty percent of automobile trips in the U. S. are less than five miles (1968 Automobile Facts, p. 62), and 80 percent of commuting workers use autos for transport (Auto Facts 1968, p. 64). These figures illustrate that the automobile is the favorite mode of travel in urban areas. Not only do automobiles require much space for travel, they must be parked during the time they are not being used downtown (90 percent of the time per day).

In the West-side downtown business district of Portland, Oregon, an area of approximately 740 acres, 30 percent of the usable 350 acres (after streets and parks are subtracted from total space) is devoted to parking (Pintarich, 1970, p. 10). The city caters to the automobile and so far has relied heavily on parking lots rather than parking buildings and has done little toward developing a satisfactory public transit system. If urban areas are not to be completely choked by the automobile, there must be alternatives to its increased use.

Stanford Research Institute has developed a transportation system for the U. S. Department of Housing and Urban Development which takes into account existing anticipated modes of urban transportation--high-speed trains, automated freeways, dial-buses, mini-cars, coin-operated autos, elephant trains, moving sidewalks, etc. (Patri, 1968, p. 15). It recognizes that Americans will demand the flexibility and convenience in public transportation (when and if it

comes) that they have enjoyed in their private automobiles.

The immense cost of good public transportation is an inhibiting factor in its development. Dorais feels that agencies need a continuous source of funds for rapid transit just as have highways. He advocates tapping gasoline tax funds in California (Dorais, 1969, p. 24-25). He reasons that 80 percent of Californians are motorists and that the gas tax is an equable source of financing for transportation, more so than the sales tax.

At the present time, California law (Article XXVI of the State Constitution) prohibits the use of state gas-tax funds for anything but highways (Dorais, 1969, p. 24). It is estimated that the State Highway Fund will take in \$900,000,000 in 1970 (Dorais, 1969, p. 25). Thus, freeway building is continuous, for huge sums of money are available every year. Contrast this state of affairs to the Bay Area Rapid Transit System (B. A. R. T.) which has been plagued by a lack of funds since its inception. It seems inequable that all the gas tax funds go for highways alone in California when good rapid transit systems could alleviate highway congestion.

Conclusions. Land space is three-dimensional, not merely areal. The third dimension can be projected either above or below the ground or both at the same time (see Figure 28, p. 140). Urban land uses mainly comprise housing, business, industry, transportation, waste disposal, recreation, and automobile parking. These activities

should be planned in conjunction with one another, for they are all intricately related.

Public ownership may be necessary, along with large sums of federal money, to create attractive cities and provide for a rational use of the land base in urban areas and prevent urban sprawl. The ever increasing population is a very important variable. It is the primary factor affecting the urbanization boom and the resulting waste and confusion. Without an increasing population, we could solve our urban problems much more easily.

Rural Lands

The realities of modern use of rural land may be considered as two-dimensional or areal, except for mining; rural land exists in a far greater amount than urban space. It is on these rural lands that the biotic resources of a nation are produced, that mining activities are carried out, that watersheds exist, and that many recreational activities occur, etc. Many rural areas are not suitable for urbanization because of inaccessibility, lack of water, poor drainage, or a poor natural resource base. Unfortunately, however, many of the prime biotically productive areas in the United States are also in demand for urban activities. How should these lands be allocated?

As mentioned earlier, rural land uses may be considered as locational and urban land uses as allocational, for space in urban

areas is scarce. Is it not time to think of all prime land as being scarce, whether it is urban or rural? Would it not be in the national, if not world, interest to allocate uses to those lands for which they are best suited in order to provide for the increasing population of the United States and the world? New urban areas should be chosen so as not to conflict with the production of biotic needs.

Psychological Space

Psychological space refers to those spatial requirements of man which are related to his emotional needs. There is a wide variety of these needs among individuals; for instance, one person may not feel at all crowded in a small big-city apartment, whereas another person can be comfortable only in the suburbs or in the country.

The 'population increase' is the primary factor which is affecting psychological space. Along with this variable goes the phenomenon of increasing urbanization. Together, they are the cause of: crowding, which perhaps induces stress upon individuals; noise, which accentuates the effects of crowding; and a need for open space to combat the first two phenomena. It is likely that crowding and noise decrease Euclidian space by a geometric progression rather than an arithmetic one.

Crowding. Crowding is an urban phenomenon which dates back many years. Ancient Rome was crowded, and so was Elizabethan

London. But the crowding stopped abruptly at the edge of the city, and citizens could walk to the countryside. Today's crowding is of a different nature, for it occurs over large areas of land in a metropolis or conurbation. A citizen cannot walk to the countryside; instead, he often has to drive many miles to reach it. The city streets and suburban highways are jammed with cars during the rush hours, and a motorist is literally trapped among thousands of cars. The effects of such stress are being studied, and preliminary results show that driving is extremely stressful in crowded conditions.

Rosenberg (1968) feels that room densities are more important to humans than site densities, i. e. , large rooms in a high-rise apartment are preferable to crowded small rooms in buildings covering more geometric space (p. 425-427). Thus, being in a 'spread-out' housing development may not be the best answer for people who want space if they have to share small rooms.

Noise. Noise may be one of the worst offenders of modern life (more research is needed on the effects of noise on human beings). If large cities were quiet, they would not seem nearly so crowded. Suburbs are beginning to be less quiet than before because of large numbers of electric and gasoline lawnmowers, hedge clippers, loud radios and hi-fis, and squealing motorbikes and automobiles. Indeed, a sound-proofed apartment is likely to be much more quiet than the average suburban housing tract. Society may have to go to work on

quieting down its cities and villages in order to relieve the stress caused by noise.

A Need for Open Space. Designers are advocating open and/or green spaces more and more, for they believe that they may alleviate the stresses caused by crowding and noise. Experiments with new developments of high-rise apartments surrounded by green space may throw some light on whether a human need for open space actually exists. Residents who have lived in various environments can make comparisons concerning their well-being in each environment.

Walking Space. Doxiadis (1968, and 1969) advocates a division of walking and automobile traffic so that people can feel more free in an urban environment and seem less crowded. He also feels that human contacts are important in urban areas, for even if people are crowded, they may be lonely. Walking to activity areas rather than driving provides more contact opportunities.

Segregation. Segregation is a psychological spatial phenomenon, for it separates people even though they may be in a crowded areal space. The artist, Mike Russo, says that "Zoning regulates and promotes segregation" (Bullard, 1969, p. 8). Probably, one of the most difficult human emotions with which to deal is loneliness in big cities (Jacobs, 1961). It is most pronounced in the United States where segregation exists between races, income groups, and age groups on a large scale.

Pollution. Air and water pollution contribute to the phenomenon of geometric space's appearing to be less than it used to be. A crowded city on a clear, crisp day seems much less crowded than such a city on a smoggy, oppressive day. A day on a beach next to polluted water probably does not provide one with much of a feeling of an open-space experience. Clean cities, air, and water are therefore all important in the maintenance of geometric space and psychological space, for space deteriorates rapidly with pollution.

Perception. Psychological spatial needs vary widely among individuals. Each human being perceives his environment in his own way. Because this is true, there should be a large variety of living environments within a city and among cities and suburbs. The average citizen is limited in his experiences of residing in various environments. He does not really know what he likes or needs spatially. Instead, he is likely to rush to the suburbs because all of his friends are doing it, or he sacrifices room space for open space. He may discover too late that a large room fits his needs better than a small lawn outside his house.

Conclusions. Psychological space will become more and more important as cities and suburbs increase their populations (see Figure 30). Perhaps big cities should not be allowed to grow ever larger. Maybe it is time to set up satellite cities such as those found in Sweden and Finland and connect them with rapid transit. Perhaps

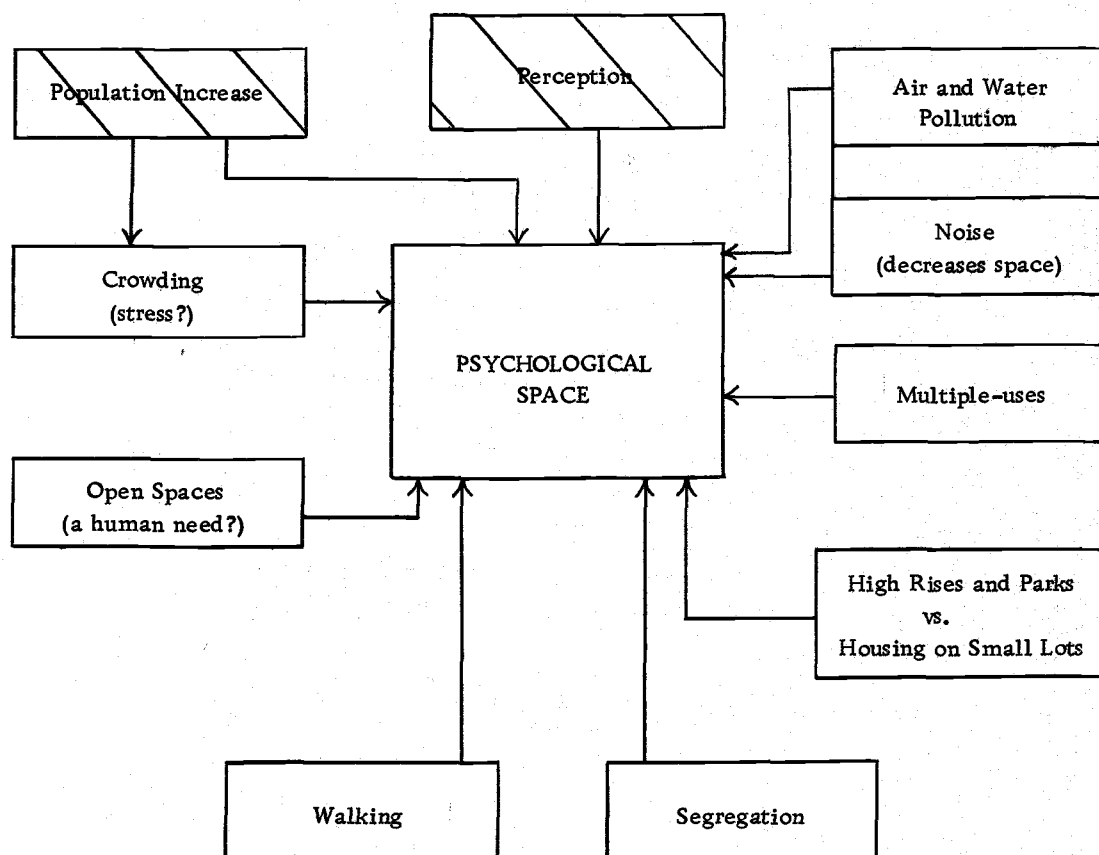


Figure 30. Psychological Space

human beings will not be able to continue living under great stresses of crowding and noise indefinitely. Much more research and experimentation are needed on the subject of psychological space.

Health and Sanitation Space

Land use is a key factor in public health, according to Prindle (1968, p. 429-430). Sanitation and disease problems are created by unwise uses of land space in both the city and countryside, and stress is particularly important in cities. As mentioned earlier, noise, crowding, and pollution all contribute to this. Stress is a public health matter as well as a private one.

Customary Health Space. Customary health space, i.e., size of house lots, apartment house densities, setbacks from the street, etc., often dates from the era of open sewers and epidemics. Are they relevant today? For many years the American Public Health Association has specified that there should be at least 600 square feet of floor space in a house per occupant for reasonable health (Babcock, 1966, p. 16). New Zealanders consider 300-400 square feet per person as adequate (Rosenberg, 1968, p. 425).

What about the effects of air conditioning which purifies the air or of electric dishwashers which scald dishes in reducing the transfer of contagious illnesses? Is less space necessary for controlling illnesses today but more space needed to relieve stress? Building

codes need to be renovated. Perhaps more experimentation in housing is in order now that we no longer have severe epidemics in our cities but have more noise and crowding.

Land-Capability. State sanitary authorities have powers to regulate land uses which are a public health hazard. As an example, the Department of Environmental Quality in Oregon has prohibited further building permits to be issued in Washington County until better provisions are made for sewage disposal in that county (1969-70). Unplanned urban sprawl, with its heavy reliance on septic tanks, has caused a serious health hazard. In addition to providing adequate sewage pipes and treatment plants, the area's local governments need to clean up polluted streams and rivers.

Air pollution contributes greatly to public health problems and is directly related to the 'carrying capacity' of an area just as are sewage measures and water pollution. All of these will be discussed in detail in the next chapter. See Figure 31 for drawing on health and sanitation space.

Empty Urban Space

Empty urban space represents a waste of space in urban areas, for it is land which lies idle. It does not refer to park lands or recreation lands but to land which is undeveloped in any way. As much as 20 percent of the land in large cities in the United States is

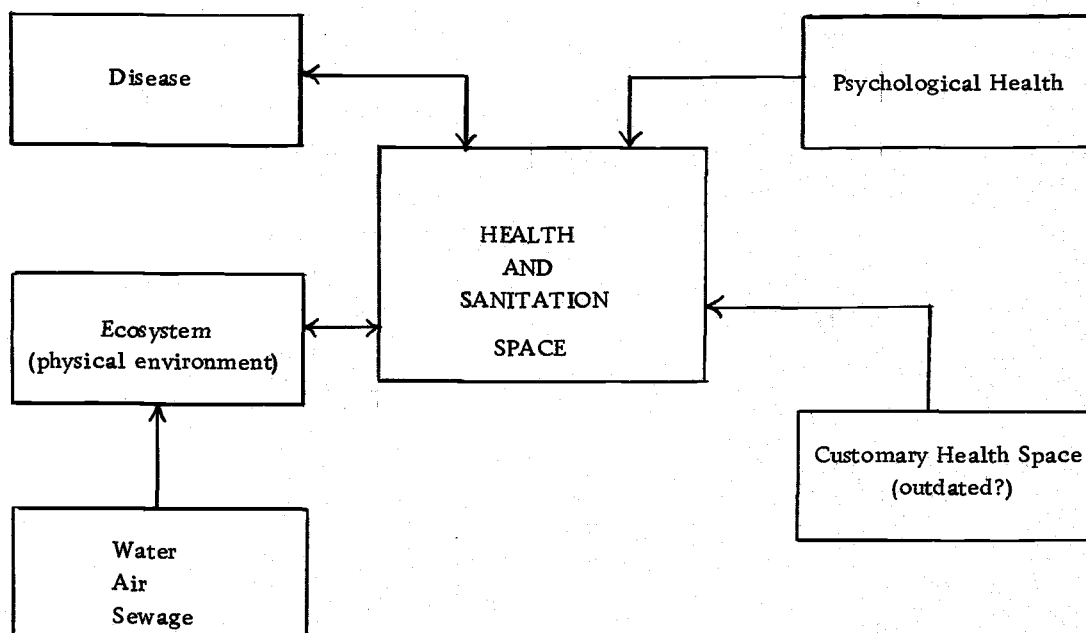


Figure 31. Health and Sanitation Space

empty (Northam, 1969). The phenomenon is caused by such things as tax policies (high taxes on developed land), rapid development, lack of planning, leap-frogging, zoning laws, and poor transportation facilities (see Figure 32).

High land taxes could force development of unused urban lands, especially those near the core where land taxes would be highest. Gifts to cities of land for small parks should be encouraged and recognized. Often, cities are reluctant to accept gifts, for they prefer the land to remain as taxable. Perhaps the time has come when open spaces which can be used for recreation are more important for maintaining a city's quality than the revenue from a few more acres of land.

Multiple-use Space

A greater emphasis on multiple-use space is now a necessity, both in urban and rural areas (see Figure 33). A thorough knowledge of a region's ecosystem will be required in order that the multiple activities of people do not place too much strain on their environment and on each other. Examples of rural and urban multiple-use spaces are the following:

Farmland. Farmland should no longer be thought of as merely agricultural land but as open space--having the factor of reversibility--which can provide for many kinds of land uses in the future.

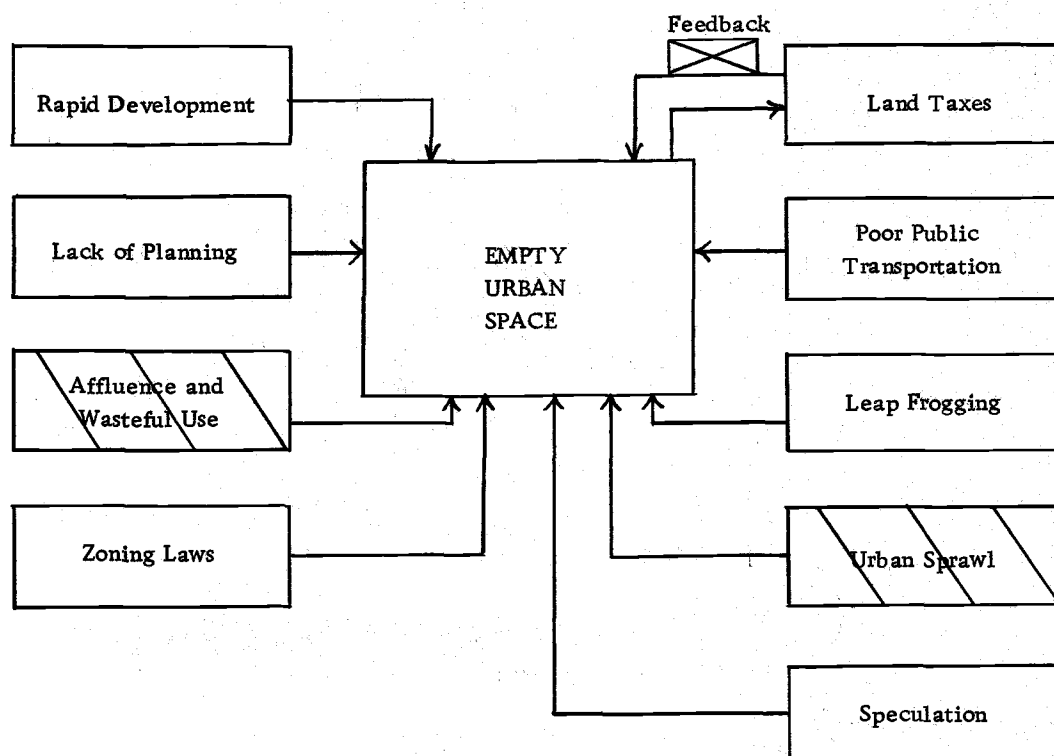


Figure 32. Empty Urban Space

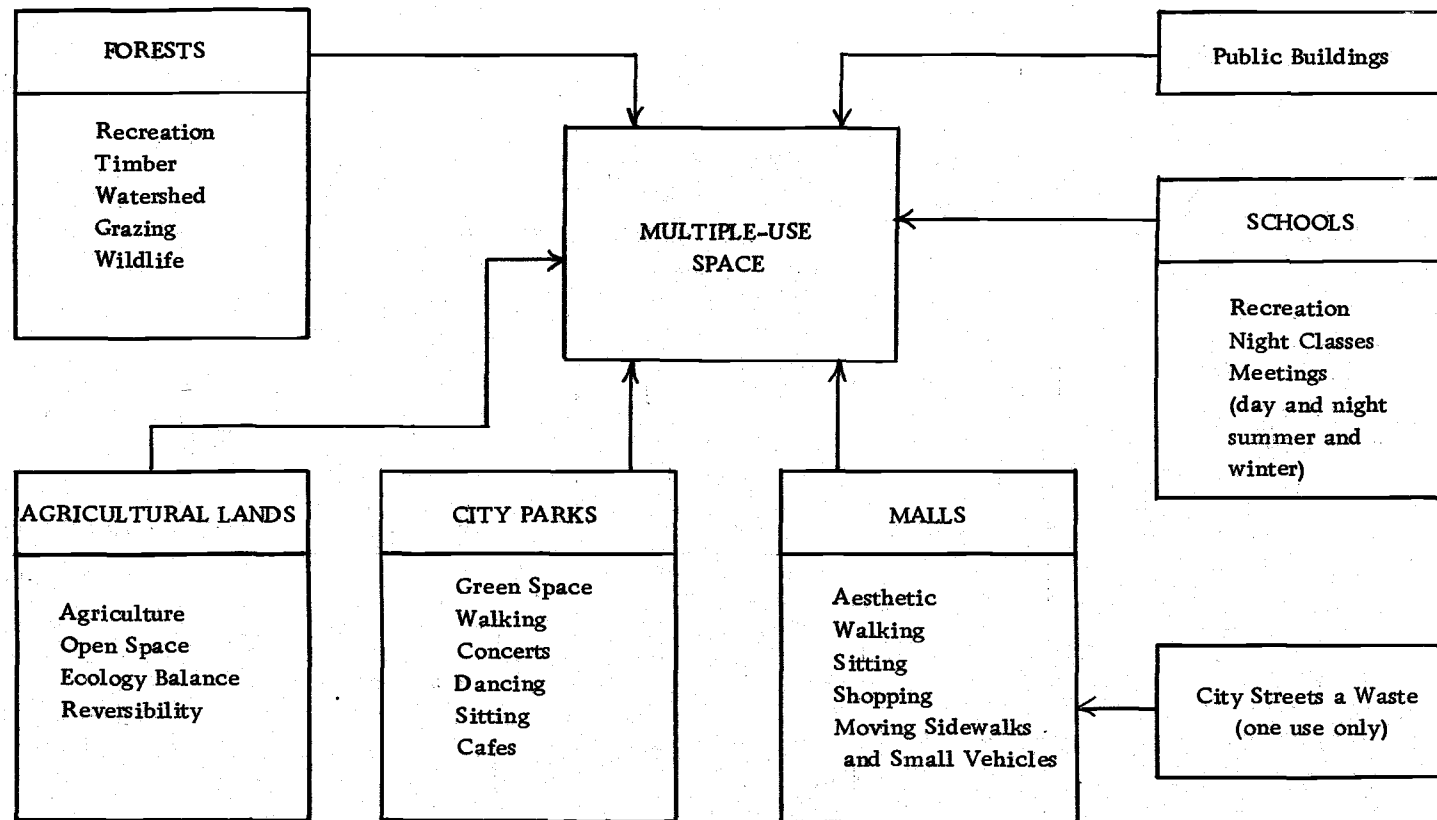


Figure 33. Multiple-use Space

This kind of land will also provide aesthetically pleasing open spaces, some of which will be protected by contracts or easements. Farmland should also be designated in certain areas for the purpose of maintaining balance in a regional ecosystem, i. e. , green belts may be found to be absolutely necessary for the production of adequate oxygen in a highly industrialized society.

Forests. The United States Forest Service is involved in a multiple-use program for its forests which includes the activities of timber production, grazing, wildlife protection, watershed control, and recreation.

Golf Courses. Golf courses are another example of multiple-use space. They provide for such functions as reserves of biotically productive land, recreational facilities, wildlife habitats, and open spaces.

City Parks. In the future, city parks should provide many more activities than they do now, i. e. , based on some of the experiments in Central Park in New York City. Not only can there be open, green spaces for walking, but there can be provisions for concerts, outside dancing, exhibits, sitting, games, sidewalk cafes, etc. Parks could be much more utilitarian and function as important recreation areas.

Shopping Malls. Shopping malls are far more versatile than city streets in that they can be used for several activities, not just transportation by car or bus. They are also far safer and more

pleasurable for pedestrians. Shoppers can walk, sit, watch art exhibits, enjoy flowers and shrubs, and eat outdoors in between shopping errands. In the future, there will be moving sidewalks and very small vehicles or elephant trains for people who can't walk very far. Automobiles commonly are and should be eliminated from such areas entirely.

Public Buildings. Public buildings, such as schools, should be available for much use by the community, day and night and winter and summer. Auditoriums and gymnasiums can be used for concerts, family recreation programs, political forums, dances, lectures, etc. on a larger scale than in the past.

Conclusions

The geometric subsystem is characterized by finite space. Within its boundaries are other kinds of space which are modified by man's perception of his spatial environment. The three spatial areas--urban, rural, and rural-urban fringe--differ in their three-dimensional aspects. The quantitative spatial subsystem is shown in Figure 28, p. 140.

Qualitative Spatial Variables - Land-Capability Subsystem

Introduction

The quality of living space depends upon the ways in which man's environment is treated. Formerly, the two seemed to have been divided in man's mind. His living space could be separated from that part of the environment which was his 'supply depot'--minerals, agriculture, industry, etc. (E. Odum, 1970). This is no longer possible because of man's increasing numbers and his advancing technology. The house and the supply depot are one and the same and, along with man and all other living things, comprise the earth's ecosystem.

The Ecosystem

There is a need for an ecological approach regarding the man/earth relationship, for without a perception of the environment in its interrelated totality, neither electorates, nor party leaders, nor government administrators give serious attention to the over-all effect of government actions upon environmental changes. The same holds true in the economic sphere, for economic determinism is an imperfect evaluation of the biophysical world. In America, man exploits nature rather than lives as part of it.

Perhaps the greatest conceptual contribution of the ecological

view is the perception of the world and evolution as a creative process. All physical and living processes are arresting energy on its path to entropy and, in so doing, are creating a self-perpetuating and evolving system (McHarg, 1969, p. 53).

An ecosystem, or ecological system, functions as an interacting whole in nature. It is an open-energy system in which solar energy is incorporated into organic compounds through the photosynthetic process in green plants. Energy circulates within the plant, from plant to animal, from animal to animal, and finally through decomposing organisms, such as fungi and bacteria. In this process, the original potential energy in plants is degraded from concentrated form to greater and greater dispersion as unavailable heat energy, until all of it is lost to the living system. Maintaining the ecosystem requires a constant input of energy, for the energy which moves through the system is eventually lost to the system. The sun's light supplies this energy to the earth ecosystem. Through feedback mechanisms, i. e., nutrient cycling, the system maintains a certain degree of stability in what is known as a steady state or homeostasis.

It is important to recognize that human beings are an integral part of the earth's ecosystem. Man is a part of nature, not a separate and divine creation acting as an outside influence on the natural environment. However, man can reason and has the capability of examining his environment and changing it for better or for worse. He also has

developed powerful tools for modifying the environment, i. e. , bulldozers, tractors, etc. The impact of man upon natural systems is mediated through human societies, by means of their institutions, attitudes, and values.

Land-use in Terms of the Ecosystem. An approach to land use in terms of the whole ecosystem is very practical. Such matters as the determination of the degree of stability or instability of existing ecosystems, the determination of causes of instability, and the prediction of courses of change in unstable ecosystems should be fundamental to all economic and community planning, as well as to the planning of most other public and private enterprises. This should be equally so whether planning is on a local or national, or perhaps especially, on a world level.

Instability, especially induced instability, in ecosystems seems to be at the root of most of the economic loss, political disturbance, and social unrest in the world. With adequate understanding of the nature of the ecosystems concerned, disturbance of inherently unstable but satisfactorily functioning systems may be avoided. More intelligent manipulation of the environment could replace exploitative methods of development.

We should be able to say:

To put ten more houses here will effectively cut the bird population which will in turn affect the insect migrations and destroy our adjacent food production lands (or cause

us to poison for control, which then affects our air and water). or

You happen to be on the primary dune, which will affect all the build-up of soil in the region. or

This land happens to be subject to flooding every nine years, so we can't let you build there. or

This land is more valuable for food production (DeDeurwaerder, 1969, p. 13).

Exact measurements of the processes of the ecosystem are not yet available for most areas, but they are not absolutely essential for regional planning. An understanding of the workings of the system and awareness that man is a part of it are necessary, however. Basic processes such as photosynthesis, the food chain, cycling of nutrients, and decomposition must be appreciated, along with the important concepts of energy flows and storage of energy.

The hydrologic cycle is another important aspect of man's physical environment which must be taken into account in order that land may be used wisely, for the percolation of water down to water tables and aquifers must be provided for. Measurements of the hydrology of regions are becoming available through the acquiring of data for simulation models for water management. In addition, an appreciation of natural phenomena like estuaries, sand dune formations, flood plains, hurricane areas, and earthquake faults is important in land-use planning.

There is an urgency to ecological problems, yet many of their worst aspects result from rushing into the use of promising substances

or techniques before their long-range effects can be understood. Solutions such as DDT, detergents, pesticides, nuclear fallout, automobile emissions, and miles of more super highways were thought at one time not to pose special problems to human beings or to their environment. In each case, the risk was taken before it was understood. The American 'crisis mentality' was at work.

"New" resources include urban land, open space, air, and waterways and are integral parts of our national wealth (Perloff, 1967, p. 792-793). They are becoming extremely valuable and should be viewed as such. Conservationists feel that, until more ecological answers are really known, judgments regarding all natural resources, old and new, should not be made that will affect posterity and that will be irreversible.

All environmental factors are related, and the alleviation of pollution in one sphere will help another. Thus, a decrease in air pollution and the ugliness of cities can help to decrease land pollution (urban sprawl), for there won't be such a need for people to seek fresh air and beauty in the countryside. Similarly, a decrease in the building of highways all over the countryside and an increase in clean urban rapid transit will reduce loss of valuable farm land. A decrease in water pollution will increase the livability of areas alongside rivers and lakes and oceans.

Since it appears that land can be more easily preserved when air

and water pollution are controlled, perhaps air and water should be thought of as factors of production to be paid for just as are labor, land, and machinery. Then the costs of pollution would be internalized into the price system. The polluter would have to pay for effluents and would seek to cut them down to a minimum. As the situation now stands, society pays for pollution by being forced to live in a degraded, unhealthy environment, especially in large cities.

Carrying Capacity. Carrying capacity can be stated in general terms as "the level of population at which a steady state is possible in a given ecosystem" (Fosberg, 1963, p. 5). Today in America, achieving a steady state involves much more than a stable human population. There is the matter of our 'pattern of consumption,' the ways in which we handle our technology and economy. As an example, New York City's population has not increased during the last ten years, but the consumption of electricity has doubled, necessitating large increases in thermal electricity production. This phenomenon of consumption degenerates the environment as much or more than an increasing population.

In Murdock's description of human influences on island ecosystems, he emphasizes that extreme increases in instability and entropy did not occur until Western man arrived with his advanced technology and civilization (Murdock, 1963, p. 152). Earlier encroachments by human beings may even have strengthened the system, for

new crops were brought to the various islands and added diversity. It was controlled diversity, for domesticated crops are not so apt to run wild and take over prevailing original vegetation.

New Zealand provides an interesting study in the problems encountered as man changes the physical environment in a radical way through introducing many exotic plants and animals for reasons of economic exploitation. This was a case of uncontrolled diversity. There was a profound disruption of the environment, deliberate, and accomplished by advanced techniques ruthlessly applied. At one time, it appeared that an environmental disaster might follow the disruption, but because of government controls, there had emerged by 1961 a situation in which the ecosystem was not seriously unbalanced and in which man had learned to live with the nature which contained him (Cumberland, 1963).

This balance was achieved, however, in a primarily agricultural nation. The past decade has seen a rising population and a demand for industrialization to provide jobs (Franklin, 1967). The whole balance could be upset again. An important factor in control will be New Zealand's awareness of the ecological system.

The concept of 'carrying capacity' must include even more than the notions of numbers and consumption patterns when it is applied to communities of human beings. There must be an awareness that man passively accepts conditions which really are not desirable for him.

Human beings are so adaptable that they can adjust to conditions and habitats that will eventually destroy the values most characteristic of human life, i. e. , they accept the stench of automobile exhaust or the ugliness of urban sprawl. The lowest common denominators of existence tend to become the accepted criteria. The ideal environment tends to become one in which man is physically comfortable, but in which he appears to forget the values that constitute the unique qualities of human life. The biological view of adaptation is inadequate for human life, because neither survival of the body, nor of the species, nor fitness to the present, suffice to encompass the richness of man's nature (DuBos, 1965, p. 278-279). The variable of 'human adaptability' is a buffer mechanism, for it delays the effects of environmental decay upon man.

Ian McHarg (1969) discusses the capacity of the land to carry people, and he would place people in concentrated clusters upon flat uplands not considered as prime agricultural lands. Industry would have to be located near water and transportation on land not involved in important ecological functions. Apartment houses and large office buildings must be located on top of solid bedrock formations. McHarg fits man to the land base in a functional way rather than in a specified man/land ratio based upon numbers. Each area or state would differ greatly in its capacity to include large numbers of people into its ecosystem.

Conclusions

Systems analysis points out in a clear way the virtual irrelevance of 'good intentions' in determining the consequences of altering the ecosystem. Every change has its price, and we can never do merely one thing (Hardin, 1963, p. 80). Wishing to kill insects, we may also kill birds. Wishing to 'get there faster,' we create great amounts of smog and cover prime lands with highways. Freedom from disease causes an increase in population. Since we can never do merely one thing, we must do several in order that we may bring into being a new system. If birth control goes along with disease control, then there can be stability in spite of change.

Ecological Planning

The Ecological Approach. It is logical, both on practical and philosophical grounds, to consider the manageable unit of human, cultural, and natural resources as an ecosystem. The question of how to manage the system must be resolved.

Any place, large or small, is the sum of historical, physical, and biological processes. These are dynamic, and they include social values. Environmental designers or regional economists can ask for guidance on the biological effects of each of their proposals and for advice in the construction and management of man-made buildings,

dams, roads, etc. as they wish to modify the human and physical environment of places. They would hope that some of this information can be provided by analogy with existing habitats or that new applied research can be used (Herbert, 1967, p. 252).

But unless the development plan covers a very large area and is truly comprehensive, the full range of interrelationships cannot be discovered, for there can be no logical natural boundaries set up to define the ecosystem in question. Biological advice on piecemeal development projects is therefore not suitable.

Ian McHarg (1969) suggests a planning approach which is essentially based upon an evaluation of the physical environment. It is not for those who want crash programs or instant solutions. It is a method concerned with the natural phenomena at the earth's surface, a method which will allow man to use the physical environment to good advantage rather than damage it. As many persons can be contained in a specified area with ecological planning as with the means used by our present uncontrolled urban development, but the results prove to be infinitely superior.

McHarg feels that natural phenomena are dynamic interacting processes, responsive to laws, and that these proffer opportunities and limitations to human use. They can therefore be evaluated--each area of land or water has an intrinsic suitability for certain single or multiple land uses and a rank order within these use categories

(McHarg, 1969, p. 79). These 'natural-process' lands must be reserved and their development regulated in order to capture their value. There is still enough land left in metropolitan regions to employ such plans (McHarg, 1969, p. 56-7).

The identification of the lands is achieved through the study of their natural features: bedrock geology, surficial geology, slope, hydrology, soil, climate, plant associations, wildlife communities, mineral resources, accessibility, and unique historical and recreation qualities.

McHarg selects eight dominant aspects of natural process and ranks them in an order of both value and intolerance to human use and then reverses the order to find a gross hierarchy of urban suitability.

<u>Natural-process Value:</u> <u>Degree of Intolerance</u>	<u>Intrinsic Suitability</u> <u>for Urban Use</u>
Surface water	Flat land
Marshes	Forest, woodlands
Floodplains	Steep slopes
Aquifer recharge areas	Aquifers
Aquifers	Aquifer recharge areas
Steep slopes	Floodplains
Forests, woodlands	Marshes
Flat land	Surface water

(McHarg, 1969, p. 57)

There is an obvious conflict in this hierarchy. The flat land is often as suitable for agriculture as it is for urbanization. So prime

agricultural land is identified as being intolerant to urbanization and as containing a high social value. All other flat land is assumed to have a low value in the natural-process scale and a high value for urban suitability (McHarg, 1969, p. 57).

An even more complete study would involve identifying natural processes that "performed work for man, those which offered protection or were hostile, those which were unique or especially precious, and those which were vulnerable" (McHarg, 1969, p. 57). In the first category are found such things as natural water purification, atmospheric pollution dispersal, climatic modifiers, water storage, flood, drought, and erosion control, topsoil accumulation, and forest and wildlife inventory aids. Estuarine marshes and floodplains are examples of areas that provide protection or are dangerous. The unique and precious category could be represented by areas of geological, ecological, and historic interest. Beach dunes, spawning and breeding grounds, and water catchment areas would be included in the category of vulnerable areas.

An Ecological Value System. McHarg's approach is actually an ecological value system in which the currency is energy. It is an inventory of matter, life forms, fitness, apperceptive powers, roles, adaptations, symbioses, and genetic potential (McHarg, 1969, p. 197). Consumption optimally involves the employment of energy in the raising of levels of matter. Matter is not consumed but merely

cycled. When not employed in the cycle, it assumes the role of a reserve. Given a uniform source of energy, a period of entrapment is essential for an increase in creativity--coal represents long-term entrapment, fresh vegetables only short-term. Moreover, the entrapped energy must be transferred through successive levels of organisms, each level sustaining higher levels.

It would be necessary to look carefully at the geology and hydrology of areas to make sure that energy was not being wasted, i. e., a planner would not locate cities on prime coal deposits, aquifer recharge areas, the best soils for agriculture, excellent sand and gravel deposits, etc. At the same time, all of the above mentioned ecological functions would be considered in locating human activities. Attention would have to be given to preserving decomposers and autotrophs so that the huge recycling process which distributes energy throughout the ecosystem would not be too much tampered with.

McHarg, along with many other ecologists, suggests that it is time for the United States and the rest of the world to set up ecological inventories, the data to be accumulated by space satellites capable of gathering data on soils, hydrology, geomorphology, climate, vegetation, etc. Then, it would be easier to fit land uses to the environment in a wiser manner than that which is now employed.

The inventories would constitute a detailed description of the world, continent, or ecosystem under study "as phenomena, as

interacting processes, as a value system, as a range of environments exhibiting degrees of fitness for organisms, men and land use" (McHarg, 1969, p. 197). The description would exhibit intrinsic form and could be seen to describe degrees of health and pathology. The inventories would include human artifacts as well as natural processes.

The ecological planning method described by Ian McHarg is rational. The evidence is derived mainly from exact sciences, such as geology, hydrology, soils, climatology, plant ecology, and studies of wildlife. This also holds true for atmospheric pollution studies, tidal inundation, rocks in terms of compressive strength, soil drainage, etc.

In addition to being rational, the method is explicit. A community or region could employ its own value system, based upon facts. Those places, buildings, or spaces that it cherishes can be so identified and incorporated into the value system of the method. Today, many planning processes, notably highway planning, too seldom incorporate the value system of the community to be transected into their own values.

Human Values. The foregoing ecological planning method is based upon the philosophy that man is involved in a long-term stewardship, that he is a trustee who holds the land for future generations, and that he uses the land for its best uses--those which are based on an intrinsic suitability. Such a philosophy is opposed to the short-term

economic gains which have been sought heretofore by the developers of land in and near urban areas and by many government agencies which are entrusted to build roads, build dams, provide for irrigation, etc. It is more nearly related to the rural farmer's respect for his land or to the land ethic of the American Indian. Conservation, rather than exploitation, is the attitude required--a protection ethic.

In addition, aesthetic human values are important for an appreciation of the costs incurred when short-run economic gains are allowed to overrule long-term trusteeship. Poets are needed to express the beauties of nature and to remind people that the earth is our 'home,' that places like the Willamette Valley are a 'garden,' and that our lives will be enriched through living in beauty rather than in urban sprawl ugliness (Lovinger, 1970).

There is reason to think that there is a human need to preserve rural forests and farm lands at the edge of our cities. These hinterlands contribute clean air to counteract polluted city air. They contribute to a more temperate summer climate. The forest is valuable as a filter of noise, sights, and smells of civilization (Spurr, 1962, p. 16-21). Odum (1970) suggests that forests be left at the boundaries of airports and industries and used as sound filters. In other words, housing should not be located near noisy activities.

There is also a human need to preserve certain historical sites, lands for ecological laboratories, areas of unique scenic beauty, and

to provide for many kinds of recreation. Rural hinterlands, whether farm lands or forests, provide open space and beauty.

All of the foregoing human values can be incorporated into ecological planning. They demand that open space be conserved, that we not use our land for irreversible activities unless we must, even if it is suitable for building. The intrinsic suitability idea put forth by McHarg is an excellent approach to land-use planning, but it must always be incorporated into a larger value system based upon man's needs for beauty, quiet, and open space and upon the ethic that man must be steward of the land for the benefit of future generations and preserve much of it in a natural state.

Obstacles to Ecological Planning

Inadequacy of Information. Caldwell wrote in 1966 that the least of the obstacles to an effective applied ecology was the inadequacy of ecological information and analysis, even though ecology encompasses a complexity of alarming proportions (p. 524). Remote sensing will provide the means for an ecological data bank. Information concerning geological features, soil attributes, vegetation, climate, wildlife, hydrology, oceanography, highway engineering, land-uses, and agriculture has already been gathered in some areas (Colwell, 1968).

United States Congressman John Dingell (Dem. Michigan) (1970) proposes that the information be housed at the Smithsonian Institution

in Washington, D. C., that it also be analyzed there by experts, and that it be available to everyone. Another possibility for an ecological data bank is a proposal to establish an ecological survey as an agency within the Department of the Interior. The United States would be divided into specific zones for the purpose of collecting and analyzing data. The Nature Conservancy has already been established in Great Britain as part of a new National Environmental Research Council (Darling, 1967, p. 1009). It is compiling ecological data in that country.

Faulty Perception. At the root of man's mismanagement of his environment are inadequate assumptions regarding his relationship to it. These assumptions were less harmful when there were only a small number of men and when their technical ability to manipulate the environment was relatively limited. The faulty assumptions are based upon our Judaic-Christian heritage which advises men to multiple and conquer nature.¹ Thus, man was made separate from his natural environment. A modern interpretation of the earth as a man/environment system in which each living being is related to every other being and to the environment in an ecological web is required if Western man is to be able to manage his natural resources in an enlightened fashion from this time on. The oriental religions do not advocate the

¹The Bible - Genesis 1:22 and 26. Genesis 35:11.

dichotomy whereby man and nature are separated; it is necessary for the entire world again to operate under such a philosophy.

Public Institutions. Another obstacle to the application of ecological planning is that our public institutions are poorly designed for ecological concepts. On the contrary, agencies such as the Corps of Engineers, the Bureau of Reclamation, the Bureau of Public Roads, and the Federal Power Commission have been developed for specialized purposes, often rigidly specified by law. The history of their activities contributes to their resistance to thinking ecologically.

Inadequate Operational Tools. There is an inadequacy of operational tools for applying ecological concepts to public policy problems. Because decisions will have to be made by so many persons who are not ecologists, there is a need for more and better tools for decision-making and public information. Caldwell (1966) suggests that check-lists, guidebooks, balance sheets, and models be set up for the purpose of implementing ecological concepts (p. 524-5). Training in ecological surveys will also be needed in many disciplines in order to give a notion of 'carrying capacity' in the analysis of data (Darling, 1969, p. 1016).

Problems of Non-compatible Land Uses

Agriculture. Lack of planning can interfere with agriculture through allowing non-compatible land uses to develop side-by-side.

Scattered houses and subdivisions in rural areas hinder the productivity of the farms next to them through the prohibition of many kinds of sprays and the limitation of methods by which insecticides may be applied. Noise, odors, and dust often bother home owners, and unless a farming area is given 'primary-use' zoning, other activities usually get their way in reducing the farmers' rights to create the noises, odors, and dust connected with modern, mechanical agriculture.

The other side of the picture is that the practice of modern agriculture consists, essentially, of the simplification of ecosystems. As an example, in most temperate farm areas the cultivation of land involves the replacement of a plant community that includes a dozen or more species with a single crop--a monoculture (Kennedy, 1970, p. 3). The substituted plants require a level of artificial protection against their environment and their pests that was never needed by the natural community that preceded them. Unfortunately, farm ecosystems have no walls, and the effects of the pesticides, herbicides, etc. that farmers use spill over into areas where they damage other systems. The effects are complex--"you can never do just one thing." There is a need to invent and apply ways to meet man's needs that are more in harmony with known and yet-to-be discovered ecological principles. The obstacles will be mainly economic.

Modern farming should be located on the best soils in each of the agricultural regions and perhaps separated from the cities by

forests or grazing lands. Thus, the primary effects of industrial farming would not be inflicted on the urban population. Another possible trend being studied is a return to the rotation of crops as a replacement for monoculture. This would reduce the dangers which result from over-simplifying an ecosystem, both from a plant disease viewpoint and from the necessity of using so many pesticides and herbicides to maintain monoculture.

Air Corridors. In a further effort to reduce land-use conflicts, careful study of air corridors in areas to be developed should be undertaken during the planning stages. It would be foolish to locate new housing downwind from an odoriferous or smokey industry. In the future, it may be advisable to insist upon industry that is so clean that housing could exist close by, and employees could walk to work from their homes. Zoning would not be necessary in such urban areas. The movements of people to the outlying areas for 'fresh' air could perhaps be greatly minimized.

Litigation Over Land-uses. Land-use conflicts can be very costly if they result in lengthy litigation in the courts. At the present time, there is not enough information available for good decisions, and most governments at the local level don't have enough money available for ecological studies of their areas to determine the best uses of land on an intrinsic suitability basis. Thus, the more powerful economic or political interest is apt to win the case.

Many local people have always tended to place a high value upon activities which will provide employment. They have welcomed industry even though it polluted their area. In locations that are suitable for recreation and agriculture as well as industry, those land-owners who wish to preserve the land have often been at a disadvantage, for they are usually in the minority.

Reducing Conflicts. Ecological surveys at a state level are desirable so that the best uses can be identified for all of the lands in the state. The state can provide the necessary funds better than local municipalities or counties, perhaps with federal aid. Since local autonomy is also desirable, county or community zoning rights might be maintained, and both governments could try for agreement on good use. The state's broad interests and the local area's interests would be based on reason applied after knowledge was gained from the ecological surveys. Information is expensive, but it is the key to preventing lengthy court cases which are a result of poor planning or zoning or selfish private interests. If all sides have access to complete information at the outset, there should not be so many conflicts. Knowledge is the key to cooperation between parties.

The Politics of Ecology

National and State Policies. One of the variables affecting the nature and rate of land-use change is the political variable. Man's

place in the ecosystem is determined by the state of his mind as well as by his technological tools. It is political tools which choose the aims of the polity and so, very often, the technological methods. An understanding of specific changes these bring about, their causes and their likely effects, is required in order for a society to be in dynamic equilibrium.

Public comprehension of the connection between our present environmental deterioration and incremental or piecemeal public policy is a prerequisite for obtaining a coordinated ecological orientation in public affairs. Applied ecology is as much a 'policy science' as defense strategy, national monetary management, or foreign policy. It does not belong to the fields of ecology or sociology alone, but to all disciplines.

There is, first of all, a need for a national policy regarding man and his environment. In early 1970, President Nixon issued statements regarding the necessity for curbing pollution and improving man's environment, but he also signed at the same time a new bill providing for millions of dollars for more superhighways. Such highways will cause increased irreversible uses of prime lands through encouraging more urban sprawl as well as increasing auto pollution in already congested areas. The latter causes citizens to seek areas of fresh air for living and recreation and further increases travel and urban sprawl. Obviously, such policies as the two cited above are to

a greater or less degree in conflict with each other.

An encouraging recent development is the passing of federal legislation entitled the National Environmental Policy Act of 1969² and the subsequent executive order (#11514) issued by President Nixon which represents the President's instructions on implementation of the Act. The National Environmental Policy Act provides for the establishment of the Council on Environmental Quality. Three men, appointed by the President, have the responsibility for re-orienting national policies toward a better environment. They also have the authority to revamp the decision-making procedures of the vast federal bureaucracy which deals with environmental plans and programs--a bureaucracy which tolerated wasteful use of the land and had strongly entrenched influence for decades. It will be a difficult task.

The institutions in existence in the United States favor the single-purpose users and the short-term income producing interests. It will be necessary to identify the factors in these institutions which immunize them against ecological reasoning and then to discover what types of institutions are most congenial to an ecological orientation. Governmental reorganization and control will not be effective without identification efforts first.

The Council has the responsibility to "issue guidelines to federal

² Senator Henry Jackson and Representative John Dingell, sponsors of the bill.

agencies for the preparation of detailed statements on proposals for legislation and other federal actions affecting the environment"

(Tupling, 1970, p. 23). The entire effectiveness of the National Environmental Policy Act for achieving a better quality of American Life may hinge on the content of the Council's guidelines and their ability to obtain performance by the bureaus (Tupling, 1970, p. 23).

State environmental policies, including land policies, will also have to be more clearly defined in the future. Priorities for land-users, based upon ecological data, must be set forth by state legislatures and state governors. As an example, since Oregon is primarily a timber and agricultural state, it should be a state policy that such lands should be conserved and that other uses be located away from the prime biotically productive lands.

Broader Government Powers Needed. So that the same standards can be applied throughout large regional areas in regard to environmental control, broader governmental powers will be needed in the future. Not only will State governments need to become important as regulators and administrators of land uses, but so will regional governments. The river basin is likely to become an important entity, especially in regard to water supplies and the control of water pollution. Larger regions will be important for controlling air pollution, regions based upon climatic factors, i. e., the Columbia Basin, the Mississippi Valley, and the Great Lakes regions. National standards

should be set so that one region does not deviate widely from another in environmental quality or the costs for maintaining it.

Land uses will likely be regulated by existing state governments, a logical development. An important consideration will be to carefully appraise a state's land assets, its expected population growth, and expected demands for specific activities. Then, plans can be made for locating these in suitable areas. Incentives can be found which will encourage such orderly growth.

The State of Washington has recently established a new Department of Ecology which will go into operation July 1, 1970. It will combine air and water pollution control, solid waste management, and water resources functions previously handled in various other agencies. Another law will enable landowners to freeze their holdings for farm and agricultural use, thus qualifying them for a lower tax, hopefully to reduce urban sprawl (Lembke, 1970). State planning for land uses, based upon intrinsic suitability of lands, should also accompany Washington's efforts and, indeed, be accomplished in every state. Piecemeal efforts will not do the job of conserving land.

Citizen's Groups. While it is recognized that broader governmental powers are needed in order that the natural environment and man be managed together as an ecosystem, how will these powers come into being? Legislatures will have to be composed of members who think ecologically rather than represent narrow special-interest groups.

The nation's and the states' over-all, long-run goals and capabilities will have to be considered as each piece of legislation is written and passed from now on.

Active citizen groups interested in sound conservation practices will be necessary to get the legislatures to adopt laws which will enable us to save our biotically productive land from irreversible uses.

Specific actions for citizens were recommended by John Zierold, Peter Wilson, and Alan Sieroty at a February, 1970 meeting of California's Planning and Conservation League: 1) the citizen should stop acting as an individual. People interested in conservation should unite to present their case to law-makers and to pool financial resources for campaign contributions to sympathetic politicians; 2) environmental problems should be patiently explained to legislators, preferably before formal hearings; 3) each environmental cause (such as land preservation) must be directly equated with future votes for the legislators; 4) proposals should call for positive action like new laws to protect shorelines, rather than negative action like stiff fines for polluters; 5) the progress of bills through the legislative machinery must be widely publicized (Time, 1970, p. 52).

An example of the kind of action described above was evident in the recent struggle to save San Francisco Bay from being destroyed by land-fills. Because of an enormous effort on the part of many California citizen groups, good lobbying, and much publicity, strong

economic-interest groups were prevented from stifling legislation to set up a permanent Bay Conservation and Development Commission with complete control over all fill projects in the Bay. Lobbyists cannot accomplish much without citizens' support and publicity. Their job is to secure passage of the bill.

Sometimes, necessary conservation legislation cannot be passed because it is not sent on from a committee to the floor for debate by the entire membership. Committee chairmen and the president of a legislative body, who assigns bills to certain committees, are key persons. If they enjoy seniority (as committee chairmen usually do) they cannot be sidetracked. Many young legislators with an ecological outlook are trying to devise ways to break the seniority pattern in the United States in order to prevent politicians representing special-interest groups from preventing votes on bills.

Conclusions

The land-capability subsystem is shown in Figure 34. It combines the functions of an ecosystem with an approach for determining the 'intrinsic suitability' of respective land areas for land uses.

Information concerning man's physical environment is necessary in order that wise choices can be made in regard to its protection and use.

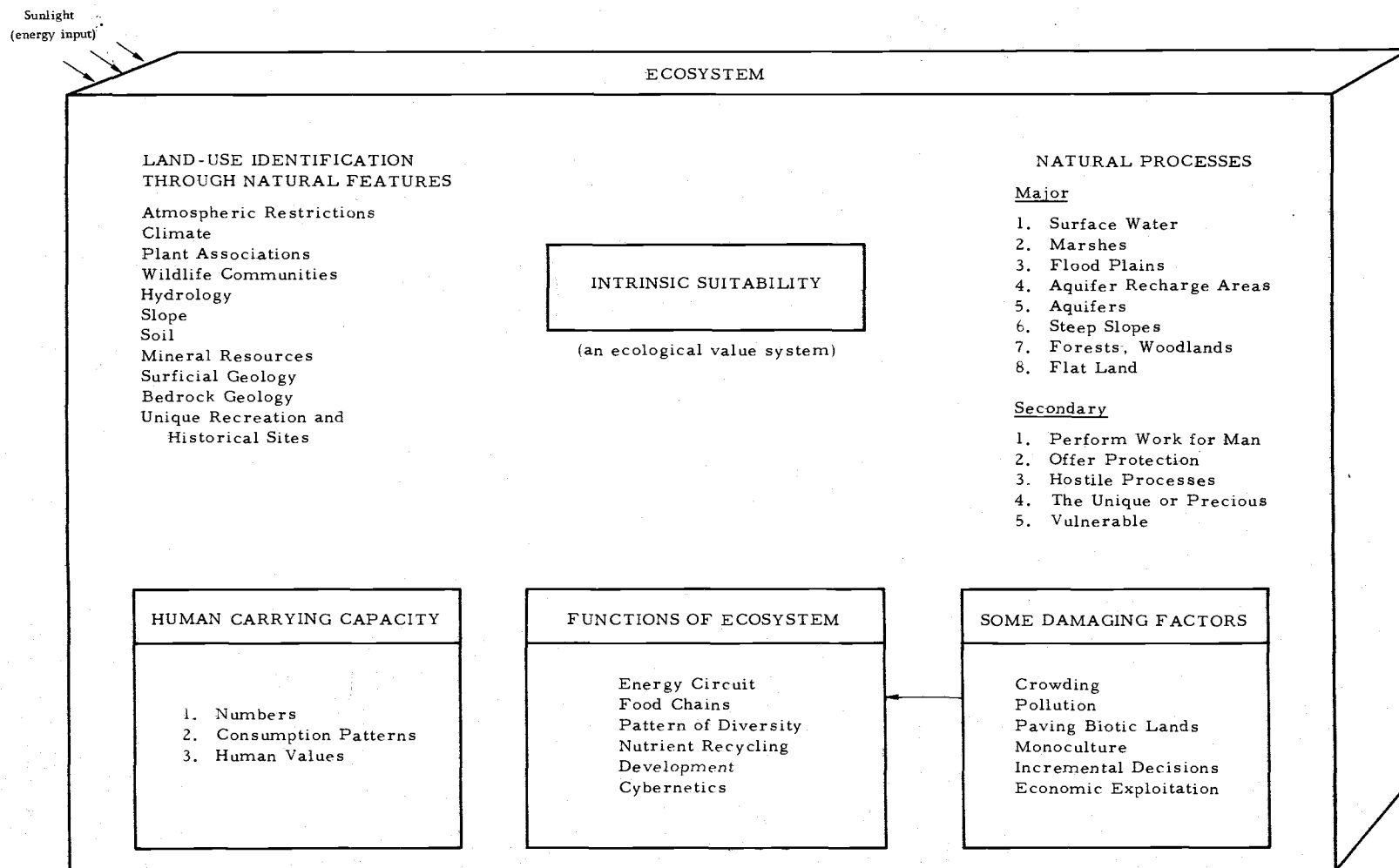


Figure 34. Land-capability Subsystem

Behavioral Variables - Behavioral Subsystem

Introduction

Science and technology have enabled man to reverse to some extent the age-old process of adaptation to environment by assisting him to adapt his physical environment to himself. Scientific consideration of man's social environment and its modifications has only begun. The measurement and/or analysis of the impact of attitudes, customs, and sensuous perceptions on the manipulation of both the physical and social environment is difficult and often inexact. This difficulty, however, calls not for ignoring the behavioral variables in our society but a search for new methods of analysis. General System Theory is perhaps one of the most satisfactory scientific methods for the Social Sciences, for it emphasizes relationships, i. e. , flow of information throughout a system, feedback, primary variables, etc. which are measured whenever possible but which do not have to be measured.

Because human behavior is so complicated and unpredictable, all theories in the Social Sciences contain flaws (Bierstedt, et al., 1964, p. 626). However, a theory may be useful even though it is inadequate. It provides a framework for examination and thinking.

Certain behavioral variables which are connected with man's allocation of the land resource base are included as parts of the total man/land system in this study. They include the following:

1. Attitudes (overt)
 - a. a wasteful use syndrome
 - b. the concept of freedom - individualism versus the group
 - c. detachment - "It is fine for others, but not for me."
 - d. Reservation - clinging to space by a select group.
 - e. Apathy
2. Customs
 - a. Customary space, i. e., backyards in suburbs or front yards in cities.
 - b. Customary economic, political, and personal decision-making.
 - c. Customary educational systems
3. Aesthetics (sensuous perception)
 - a. Beauty
 - b. Tranquillity
 - c. Solitude
 - d. Stimulation

Attitudes

Attitudes are the 'shapers' of a society. They determine the nature of our political institutions, our economic systems, our human relationships, our treatment of the natural environment, etc. In other words, they are basic building blocks in the man/land system.

Attitudes themselves have been little studied in the past, only the institutions which have resulted from them. If institutions are to be consciously changed, it follows that the attitudes behind them have to be changed, too. Otherwise, the change may not be predicated on a sound basis and could turn out to be a mistake or to be merely transitory.

The 'Wasteful Use Syndrome'

Americans comprise perhaps the most wasteful society which has appeared in the history of man. Such a syndrome is based on present affluence and on a history of wasteful practices which were made possible by a relatively small population and a seemingly unlimited supply of natural resources, including land. There is still much land in the United States, but a scarcity of 'prime' land is developing. The wasteful use syndrome is so strongly entrenched as an American attitude, however, that it will be difficult to change. Only in a few places is waste being replaced by conservation. Most prime lands will continue to be covered haphazardly with irreversible uses until the attitude does change (see Figure 35).

The 'frontier mentality' described by many writers condoned waste, i. e., Griffin (1970). Man moved from place to place at a restless pace and exploited the land, often stripping it and leaving it in a desolate state. The individual was free to do with the land what he pleased, with no responsibility for the future occupants or for his neighbors. This lack of a feeling for stewardship differs greatly from that of the age-old oriental concept of productive occupancy, where long ago citizens were confronted with limited space and natural resources. The oriental learned that unlimited exploitation of natural resources by individuals would cause great harm to the group, and thus to the individual.

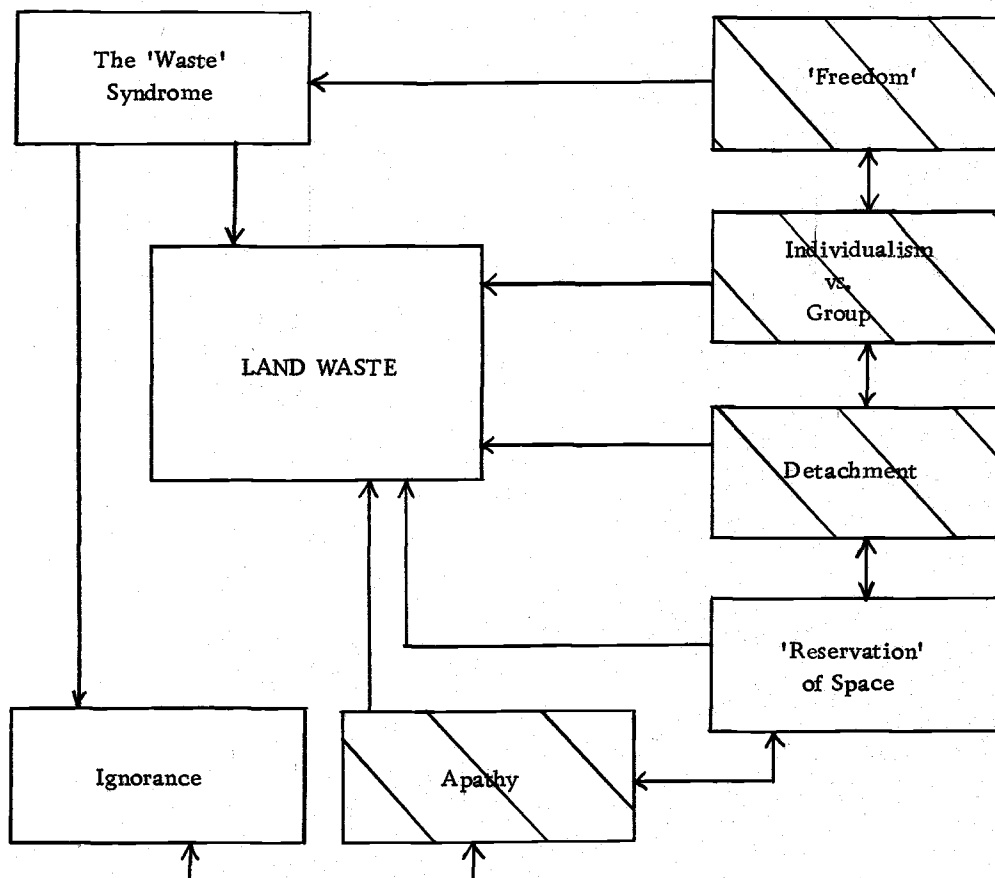


Figure 35. Attitudes and Land Waste

'Freedom' - Individualism Versus the Group

As society becomes increasingly complicated, there is more emphasis on group welfare relative to individual welfare. The biological evolution of animal cells and signals, and the social evolution of human language are indices of the presence and increase of cooperation (Gerard, 1956, p. 157). So is the transition from a loose societal structure of nomads to urban societies.

The growth of individual sacrifice or altruism depends overwhelmingly on the growth of the cerebrum and is an especially important motive of evolution (Gerard, 1956, p. 157). It also follows that as a system becomes more highly integrated the interdependence of each part with the others becomes greater. Without cooperation the organism or system will not survive.

All men have surrendered many of their primitive freedoms, but they have gained in exchange new freedoms made possible by the group and which they certainly prefer to the ones relinquished. Civilized man is no longer free to run around naked in the summer heat, but he has become free to light a fire or turn on a furnace against the winter cold. He is forbidden to kill his fellow when a conflict arises, but he has gained the use of language with which to discuss and resolve differences. Further, the freedoms lost as well as those gained have been accepted practically unconsciously by the members of the group, except in moments of acute transition (Gerard, 1956, p. 158).

It is important to note that the latter half of the 20th century is such a moment. Man is required to be conscious of the evolution of some freedoms and the loss of others. Man must also be aware of his

dualism. He is a complete system within himself, but he is also part of the societal system. Both are evolving, and both need emphasis. The crux of the conscious effort to exist in more than one system is the ability to equate freedom with responsibility and to feel free even while filling a group role.

Freedom in America has meant 'individualism' as it pertains to property. This kind of freedom has its root in the frontier, where man was free to do whatever he wished with his land and natural resources. There has been little attempt in this country to find a sense of freedom that has nothing to do with the mobility and private property rights of our early history, but is concerned with the personality or spirit, i. e. , personal tastes in art, literature, dress, family life, etc. as exemplified by the European individualist or eccentric. Our freedom is apt to infringe upon the welfare of the community or nation because of its preoccupation with private property rights. As an example, Phoenix, Arizona, has no housing code, because it would ostensibly limit 'free enterprise' (Roberts, 1970, p. 8F).

Citizens of Los Angeles fought for the 'historic freedom' to burn trash in their backyards even after smog was a serious problem and the Los Angeles County Air Pollution Control District had ordered no burning (Griffin, 1970, p. 17). Blissfully oblivious of their downstream neighbors, citizens of St. Joseph's, Missouri, recently fought for the right to discharge raw sewage into the Missouri River (Griffin,

1970, p. 17).

The trash-littered streets of America immediately differentiate them from European cities. The preference for private 'good' over public 'good' and the callousness we show toward our cities are more examples of the heritage of the frontier mentality which equated freedom with private property rights.

Americans must learn that we do indeed have a dualistic role, that of individuals and that of members of a society. Each American should try to define himself as an individual who does not detract from the effectiveness of any of the groups to which he belongs, for the more cohesive the groups, the stronger is the individual in the end. Man belongs to his family, his neighborhood, his community, his region, his state, his nation, and the world, and he needs to be aware of the role he fills at each group level. Awareness is of such great importance, that families and schools should emphasize the importance of examining one's roles in society.

There are both short-run and long-run goals for the individual and his groups, and these should be identified and practiced simultaneously. An example of short-run and long-run goals being pursued simultaneously can be found in the practice of land conservation. The long-run goal might be the preservation of biotically-productive land for future generations, who may need it for food, fiber, or timber. The short-range goal could be finding ways in which to make the land

economically productive without reducing its biotic potential, i.e., planting christmas trees, building a golf course, etc. An important factor in land management is the awareness of both goals.

Detachment - "It is Fine for Others but Not for Me."

A feeling of detachment from societal life exists in America in the 20th century, and it had its genesis during frontier times. Each family could 'move on' if life in a community or on a remote farm were not to its liking. They did not have to adjust to a confined space or limited resources as have many other societies.

In a society based on materialism, neighborly love and meaningful social relationships within a community are not regarded as important as the individual family's economic well-being. Hence, a detachment from community responsibility. Americans can intellectualize about the need for cooperation, but they are not by nature cooperative. They can imagine other people in a group action, but seldom will they enter one themselves, especially on the local level. It is on the local community level that a person truly defines himself.

An example appears among farmers whose very livelihood is being threatened by suburban sprawl. Often, individual farmers will refuse to join a group requesting special zoning or tax rates based on agriculture. The farmers who are detached from the group have the feeling that they might be the ones who could sell their land to a real

estate developer for a large profit. It doesn't matter that the entire group might be sacrificed because of their individuality. Here are persons who can accept the group idea for other farmers but not for themselves. Preserving a "way of life" is not so important to them as the chance to make money as individuals.

Another example of detachment is concerned with suburban enclaves in a metropolitan region that cannot see themselves as an integral part of that region with responsibilities for its welfare. It is all right for other urban areas to transform their functions as the region grows, but the one-family dwelling suburb will refuse to co-operate in an overall plan of readjustment.

A serious problem also occurs in the case of large national chain stores, a common phenomenon in the U.S.A., for they most often put national stockholders' interests ahead of community well-being. This is a short-run viewpoint and sometimes boomerangs in the end. But a national company can absorb a local loss here and there.

Another cause of detachment in America is the extreme mobility of its citizens, often through a deliberate attempt by national corporations to move employees around from place to place as they rise in the company's hierarchy of positions. People are uprooted so often that they do not form permanent attachments to a region and are not concerned with preserving a way of life about which they know very little or in conserving the region's resources.

The attitudes of individualism and detachment are so great a part of the American character that it is difficult to imagine their being rapidly changed (Morison, 1957). Until they are changed, however, there is little hope for widespread and adequate land conservation. These attitudes are so important that they are given primacy ratings. They affect many of the variables in the model, especially suburban sprawl, the profit motive, the wasteful use syndrome, political apathy, 'plenty of space' syndrome, and a lack of cooperation (see Figures 35 and 36).

Ignorance is an important contributor to the continued existence of detachment and rugged individualism. Only through education concerned with the dual nature of man and his various roles in society will these attitudes be changed. Man must be made aware of the possibilities of freedom of the spirit while he is also being taught that he has group responsibilities. A strong group can eventually bring him more freedoms.

'Reservation' of Space

The reservation of space or clinging to space by a select group is related to the attitude of favoring individualism rather than the group. In this case, the small group behaves as an individual, because all of the members are very similar in their reasons for reservation. The residents of a large-lot suburb want uniformity in their community,

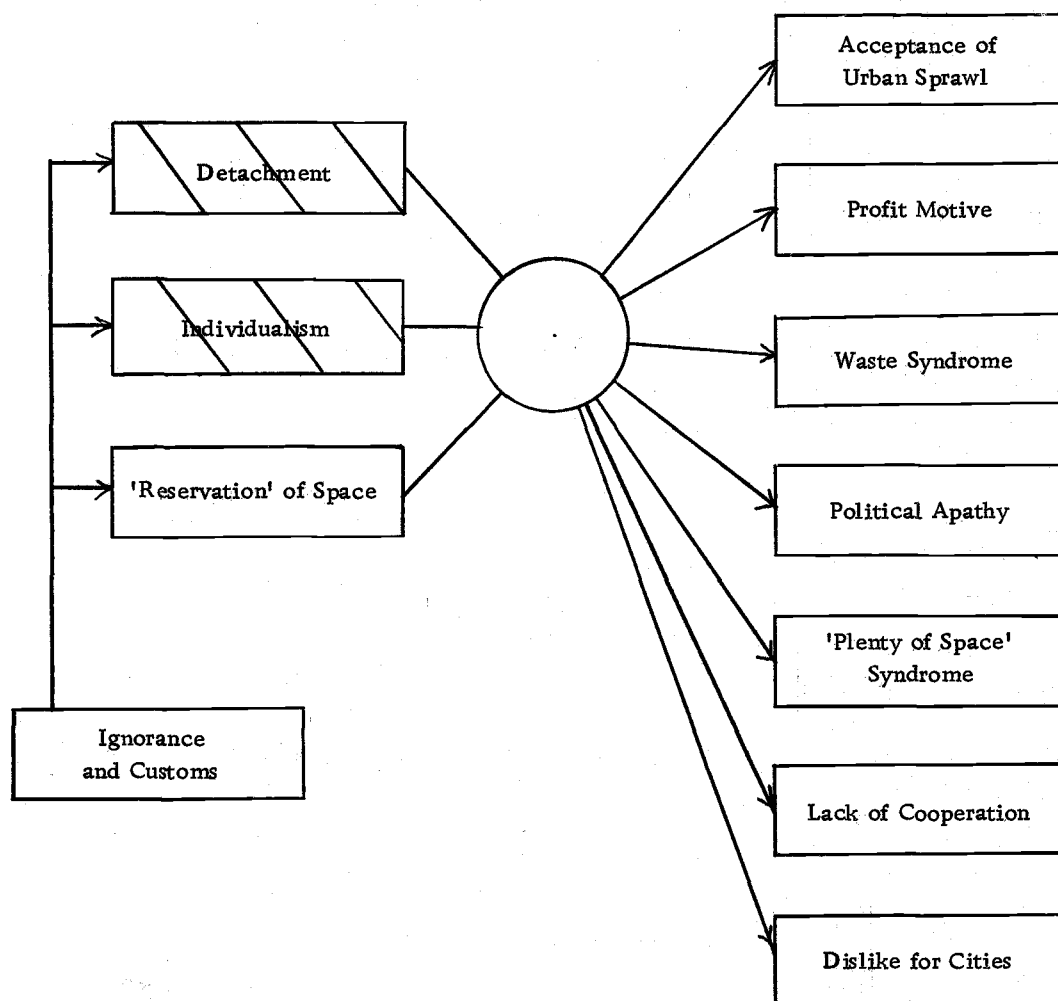


Figure 36. Attitudes and Values

not variety, and they are often successful at maintaining it because they feel so strongly about 'reserving' the uniform enclave which they have established. Such a practice is extremely rigid in that it rejects change and development as inevitable or desirable. It is indeed reservationist rather than conservationist.

The 'reservation' of large-lot suburban space on prime land by select groups will become more difficult and expensive. Not only will money be a prerequisite, but so will time, for such areas will be built farther and farther away from central cities. These enclaves are now known as exurbia rather than suburbia, and examples are Big Sur and the Napa Valley in the Bay Area in California, Bucks County, Pa., and Bridgeport, Connecticut. Commuting to San Francisco and New York is done only two or three times a week rather than every day.

The 'reservation' of space for a select group appears to be related to the dislike which Americans have for cities. This, in turn, is connected with the frontier mentality which favors the individual over the group, which fosters sprawl and waste, and which attaches so much importance to one's property.

Perhaps the time is coming when the large city will no longer be the nucleus of a region, for Americans seem to dislike city life so much. Even the cultural amenities are no longer attracting large audiences, because it is too much trouble to struggle through the traffic to get to the core of the city. Decentralized regions will likely

emerge, and perhaps cities should be limited in size in the future.

The effects of the use of biotically productive lands for decentralization must be carefully examined, however, before such plans are fostered on anything but a small experimental scale.

Apathy (a non-attitude)

Apathy differs from detachment in that it does not involve an awareness of one's viewpoint. It often results from ignorance of a condition. Cities grow in a topsy-turvy way mostly because people don't care enough about their communities to inform themselves of policies or actions which affect land conservation. Zoning laws are seldom read until litigation arises. City council meetings are rarely attended unless some spectacular issue is well publicized in advance. Very few people understand or care about the duties and powers of local governments, let alone their state legislatures' responsibilities and powers.

Relatively few people have first-hand knowledge of a variety of environments. They do not know what they really want and would be willing to pay for. It is impossible for people to 'test-drive' new environments for living, as one does with an automobile before purchasing it. Thus, they are stuck with what they have and without any knowledge of what they would like better. There is little or no effort to change one's environment or to conserve it, perhaps because of

ignorance and apathy.

Another example of apathy occurs where most people are too naive to consult master planners or landform specialists before they purchase a new home. They may find out several years later that they are on a floodplain, an earthquake fault, in a slide area, or that a new freeway has been planned a block away from their home. Irresponsible land developers can operate because people are apathetic.

Conclusions

Attitudes are, indeed, the basic building blocks of the man/land system, for they are the shapers of society. Strong institutions designed for land conservation will not emerge until a number of American attitudes are modified.

Customs

An impediment to the orderly change of an institution is often the customs surrounding it, which had their roots in an earlier era. This is a form of cultural lag, which implies that man's culture--of which customs are an important aspect--does not keep pace with his technology. Especially during an era of rapid technological change such as that of the last 25 years, old customs may be a serious problem (see Figure 37).

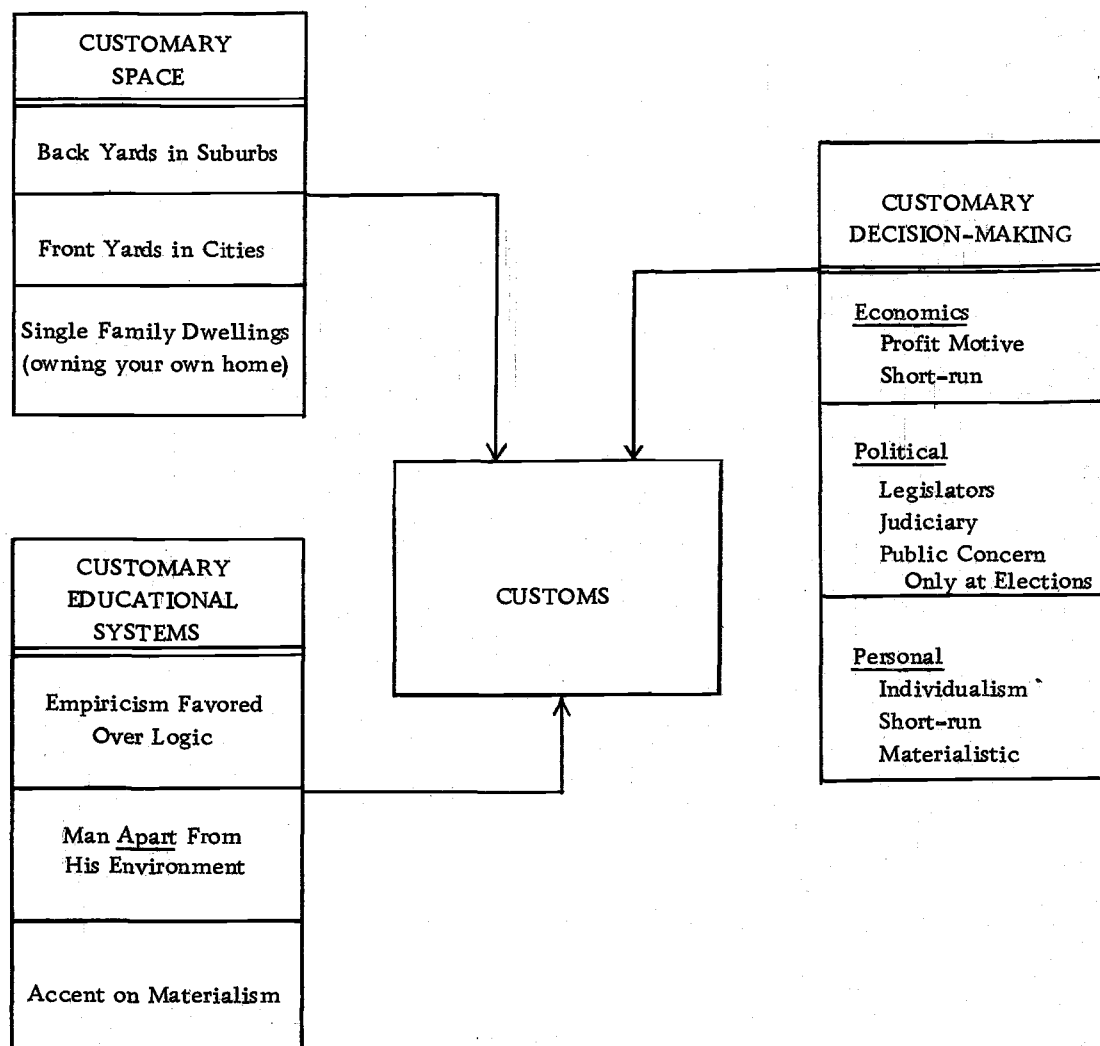


Figure 37. Customs

Customary Space

Backyards in Suburbs. The backyard is an old custom in America which is no longer meaningful. It arose as a place for a family to have a vegetable and flower garden, to keep animals, and to preserve shade trees. City lots were deep so that one had room for all of these activities and a modicum of privacy.

In typical middle-class suburbs, which do not have deep lots, the backyard has neither privacy nor enough room for activities. It resembles a large playpen for young children. The lack of trees in most housing tracts eliminates privacy and natural beauty. Noise from one household to another travels easily through the inside of a block. The customary backyard space is virtually wasted, for it accomplishes very little for a family.

Perhaps such space could be much better utilized in a large common park for the neighborhood community which provides recreational facilities, natural beauty, walking paths, etc. Garden apartments or row houses would use far less space than today's box-like house on a 60' x 100' lot, and more trees and other natural vegetation could be preserved in parks. Fortunately, such innovations are being tried in some suburbs.

Front Yards in Cities. Most American cities have rigid housing codes which require that houses be set back from the street far enough

so that a front yard is mandatory. Since front yards afford no privacy and are often noisy, the space they require is useless. In many European cities houses are built next to the sidewalk so that an inner courtyard affording complete privacy can be built. Kitchens and other utility rooms are built on the street where it is noisy, and bedrooms and living rooms are built away from the street.

For families desiring inner court privacy but who cannot afford the floor space required for a spacious inner court, there could be multiple-family dwellings for three or four families who were related and/or compatible, which were built around an inner court. The square or rectangular box we live in, which has a front yard and a backyard, is not a sacred shape nor a mandatory spatial arrangement. Innovations are in order.

Parking Strips. Another outdated spatial custom is that of requiring parking strips between streets and sidewalks in many communities. This custom dates back to the era of unpaved streets, a time when the pedestrian needed to be protected from splashing mud and water. Paved streets have eliminated this problem, and sidewalks could be built next to the street.

The Single-family Dwelling. The single-family dwelling is America's 'ideal' housing arrangement still, even though it is no longer quiet, private, or attractive. This is a custom left over from frontier days when there was plenty of space, a rural population, and

everyone had a garden. It is now archaic and impractical in many areas, especially in large urbanized regions. Privacy in housing developments is a myth. In addition, these areas are noisy, denuded of trees, and sterile in appearance. The old values desired in a single-family home--quiet, privacy, and natural beauty--are more apt to be found today in a sound-proofed apartment next to a park. Few people in urban areas wish to raise their own vegetables any more. If they do, public lands being held for future biotic production could be divided into plots for citizens' use. Such a scheme is prevalent in European cities.

Customary Decision-making

Economic Decisions. Most economic decisions are based on obtaining the highest profits in a short-run period. This has been the American style--exploitation rather than conservation. The making of profits has, until very recently, entailed little responsibility on the part of the manufacturer toward the welfare of his community or future generations. The result is the severe pollution which now exists in America. The housing developer has been free to pollute the landscape with ugliness and waste, for he was busy making money, and this has always been a valid American goal.

The customary disregard for long-run consequences in American economic life will have to be changed if we are to conserve our land

and preserve a livable environment. The disposal of liquid and solid wastes will have to become part of the manufacturing process--perhaps through recycling of materials or the manufacture of new products from waste matter which are easily disposable.

Land will have to be looked upon as a precious, scarce commodity--a factor of production to be used wisely--rather than as an unlimited resource and/or as an unimportant place for an economic activity. Short-run profits must not be more important than sound economic policies for the long-run which allow for a fair profit.

Political Decisions. In order for America to conserve its prime lands, the customary political actions of its people will have to change. Americans are not normally involved in politics except during biennial national elections, at which time only about 60 percent of the people vote. Elections at local levels draw a much lower percentage of voters. Apathy in political matters is customary, and Americans talk about the Government without realizing that they are the Government. There is a customary lack of involvement in community problems due to the prevalence of attitudes which were listed earlier--individualism, detachment, and apathy.

Such a lack of interest and political involvement on the part of citizens makes it easy for special interest groups to secure privileges that will be detrimental to the community or region in the long-run. These special-interest groups are often over-represented in state

legislatures, on local city councils, or county commissions. They cannot be blamed for their zealousness and selfish interests. The blame rests on the apathetic silent Americans who refuse to become involved in their community's welfare and who even refuse to be fully aware of the issues so that they can occasionally vote intelligently.

A custom of long standing which exists in legislatures and in the United States Congress and which often thwarts change is seniority on committees. The chairman of these committees is the member of the committee belonging to the political party in power who has served in the legislative body for the longest time. Often, this means he is the oldest. He has the power to block legislation through refusal to release a bill from the committee which sponsors it. Perhaps the chairmanships should be rotating positions so that one man does not achieve too much power.

One of the most important political phenomena which is causing a change in our political system is that of the citizens' group. These groups have risen primarily to fight against special-interest groups of industry and government agencies, but they are also working toward encouraging legislation for improving American life or conserving natural resources. An example is the Sierra Club, which aroused enough American public opinion to prevent the Corps of Engineers from building dams on the Colorado River near the Grand Canyon. Another example is that of various citizen groups which were

responsible for persuading Congress to purchase land for a Redwood National Park in California. Some local conservation groups are persuading county commissions and city councils to improve their communities, but as yet very few people are involved.

Until Americans look upon political decision-making as a continuous process of self-education, involvement, and voting, the hazardous development of land will continue, for the special interest groups will win. They are the groups which take the political processes very seriously and which devote much time and effort to using them for their own ends.

Personal Decisions. Personal decision-making has customarily been influenced by the American attitudes favoring freedom, materialism, and a short-run approach. As explained earlier, freedom or individualism in this country is concerned mainly with property rights and mobility, not the personality or spirit. The materialistic, short-run approach toward decision-making regarding natural resources, combined with customary attitudes toward property rights, has led to exploitation of rather than conservation of land.

Americans are being told in 1970 that there is a crisis regarding our natural resources and pollution. There is emerging a widespread movement of persons sounding the alarm. Since Americans act as a large group only in a crisis (such as war), actions in this crisis will probably be taken to correct some of the ills (Rostow, 1958, p. 259-

261). But they may be the wrong ones and may "cover up" for a time the real problems, merely postponing them. Americans are empiricists rather than philosophers. They give sanction to what works rather than what might be best, so they have no long-range goals. When a crisis comes, they are not ready for it. They react in preference to probing deeply to find out the cause of the crisis. This is an extension of their short-run, materialistic attitudes and their aversion to continuous group welfare commitments.

The main weakness of the empiricist approach is that it requires a great deal of time in order that feedback can take place both directly and indirectly for a long-enough period to give a solid indication of the effectiveness or ineffectiveness of an institutional innovation. Sir Geoffrey Vickers feels that we no longer have the time for complete feedback. Many decisions will now have to be made which are based on inductive reasoning rather than empirical evidence gained from experience (Vickers, 1967a, p. 61).

In addition, perhaps it can be said that unless customary personal decision-making in America is based on attitudes other than individualism and materialism, we shall be in a natural resource and pollution crisis for a long time. The solutions must, instead, be based upon new decision-making criteria such as: concern for the community before the individual; long-run effects rather than short-term gains; quality rather than quantity; and a deep understanding of the

relationship between man and his physical environment.

Customary Education Systems

Education in the United States during the 20th century has been influenced mainly by the borrowed empiricism of the German Universities and the personal adjustment theories and pragmatism of John Dewey. These have reinforced the customary American decision-making philosophies described previously, which had their roots in the frontier. The former kind of classical education in the 18th and 19th centuries based on logic, inductive reasoning, and philosophizing gave way in the 20th century to the training of experts for professions and problem solving. Specialization became so prevalent that it is now difficult for men in various fields to communicate with each other. Few people are equipped to interrelate several disciplines or to get at the root of our crises and prescribe long-range solutions. The solving of problems at the 'crisis' stage still goes on.

Empiricism. Great importance is attached to facts--especially to quantitative evidence. This is as it should be in much research, but it is only one aspect. Not enough importance is attached to the crux of the problems to be solved, their interrelationships with other problems, and the consequences of choosing from a variety of solutions. As an example, the rapid building of freeways may have provided temporary convenience for American motorists, but these same

freeways have created urban sprawl, more auto pollution, an irreversible use of prime farm lands, etc. Is this really problem solving? It is a solution which seems to stem from the same old crisis mentality and is a palliative, not a solution. It follows that education should emphasize entire processes and interrelationships, including consequences.

Man and His Environment. For many centuries Western thought has divorced man from his physical environment. Such a state of affairs was based on a Judaic-Christian heritage which taught men that they could and should conquer nature. Europeans have been forced to modify their exploitation of land and waterways because of spatial limitations, but America is only now becoming aware of the need (again, in a crisis) for more conservation measures.

American man behaves as an observer of his environment rather than as a link in the man/earth system, because our customary education removes man from nature, just as our heritage permitting the conquering of nature has dictated that it should. Perhaps it is time for a reinterpretation or revamping of this heritage. It is not valid in a crowded, technological affluent society. There is no longer room for exploitation, pollution, and waste.

Some topics which could be introduced to children in the public schools and then taught again at the college level in a sophisticated fashion which would point out man's place in nature are: man's role

as a parasite; man's ability to use fossil fuels and the consequences; energy flows through the open man/earth system; the importance of diversity in achieving homeostasis; carbohydrate conversions in the food chain; the consequences of monoculture; a rationale for the rotation of crops; reasons for preserving the many species of wildlife; and the importance of the decomposers in the nutrient cycles.

Education and the Economic System. American education is closely related to the country's economic system in that diplomas act as passports to jobs. The primary reason for an education is to achieve more earning power. A college degree should not be required as a 'passport' for many jobs. On-the-job training should be done instead. Education becomes a drudge when it is mandatory for material ends and thus loses its value. Students then wish to accumulate the large number of credits required as easily as possible and get out with the necessary diploma in hand. The 'search for truth' is no longer the primary goal at American universities.

Conclusions. Not until American education is deeply concerned with the study of man within the ecosystem and concerned with those processes of thought which provide insight through inductive reasoning (rather than relying so heavily upon empiricism) will this nation be able to reverse its propensity for inaction except in crises. The country needs a new kind of individualism which is based upon the ability to be a societal member. We must think seriously about the

dilemmas of our society and make long-range plans. Palliatives will no longer suffice, because there is no time anymore to wait for enough feedback to ascertain whether or not they are working.

Aesthetics - Sensuous Perception

Little attention has been paid to the ways in which man perceives his environment. Because perception may differ quite a bit from reality or from man to man, it is important to study the ranges of how people perceive a phenomenon. What is wilderness? What is beautiful? What is quiet? etc. Through interviews with travelers in the Minnesota Canoe Wilderness Area, Lucas (1964) was able to ascertain that people perceived wilderness in many different ways and that the range of definitions based on density of people and their activities was a wide one. What was wilderness for one man was a crowded condition for another.

Studies in perception will be important for planning for the future, for many kinds of environments for living, working, and recreation should be provided so that people can find places which fit their perception of what those places should be. Experience plays an important role in perception, and people will change their ideas from time to time. As an example, the uninitiated camper will perhaps feel that a large public campground is a wilderness for him. As he gains sophistication over the years he may seek more remote areas by car

and may try backpacking. His perception of wilderness will have changed considerably due to experience.

There is such a thing as societal perception as well as individual perception--the ways in which a society regards phenomena affecting the senses, things such as beauty, peace, stimulation, solitude, etc. A norm is established which exists for a time, but it is constantly changing--usually slowly. The 'pace-setters' of a society establish the new criteria for tastes in beauty, life-styles, pasttimes, etc. which are based on changing values. Human values are changed as the conditions for living change, conditions often based upon technological advances in this century. The concepts of time and distance have greatly affected human values in regard to land, for technology has compressed both of them. These, in turn, are related to the aesthetic concepts of beauty, solitude, peace, and stimulation which will be discussed below (see Figure 38).

Beauty

Beauty is subjective. Each man perceives a scene or an object or an experience a little differently. Beauty is also intrinsic, in that certain proportions, shapes, and orderly arrangements are pleasing to the senses. However, an appreciation of such intrinsic beauty does not occur spontaneously; it is learned. Various cultures have their own standards of beauty, and it is within individual societies that

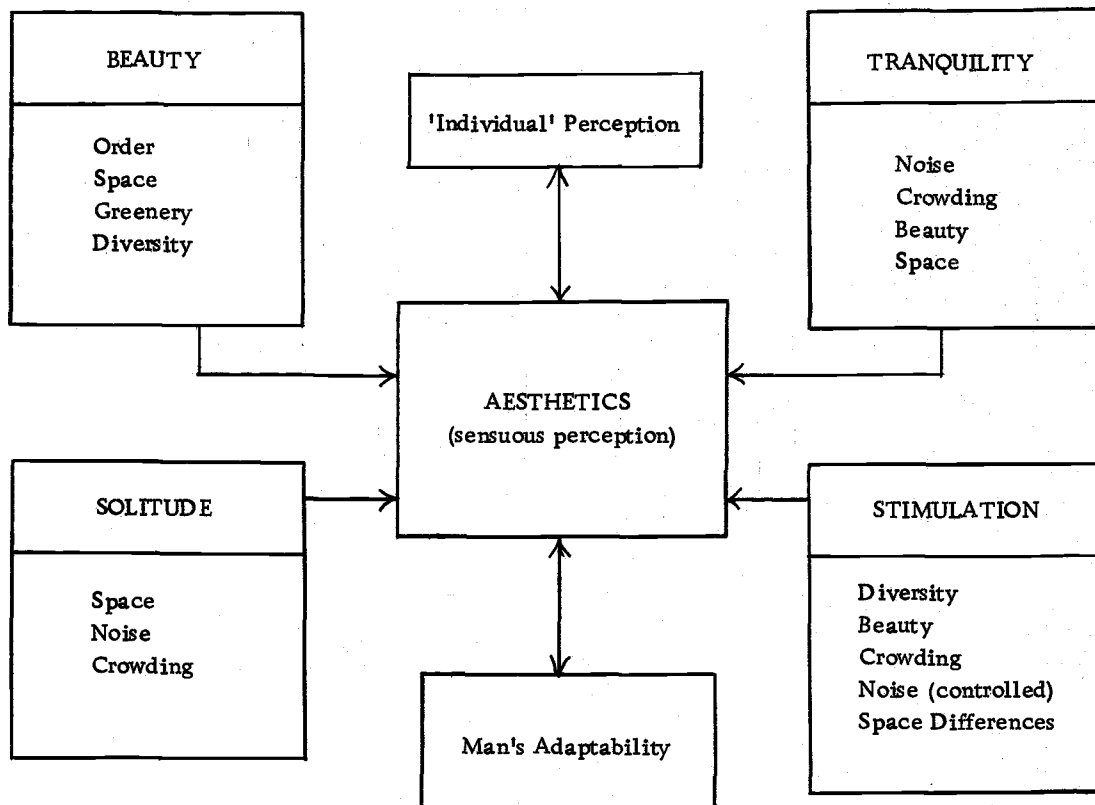


Figure 38. Aesthetics - Sensuous Perception

humans learn these standards.

Universal concepts of beauty also exist, and an appreciation for the beauty in many cultures is a possibility for modern man because of our advanced communications systems. A universal concept is that of aestheticism, a doctrine that says the principles of beauty are basic to other, especially moral, principles. It is a concept which is often related to the principle of order in the universe. Order can denote such things as symmetry and certain spatial arrangements, but it can also be concerned with tidiness, cleanliness, and serenity. The appreciation for order as a kind of beauty seems to be a learned trait. If it were inherent, there would not be such a widespread despoliation of the cities and countryside by people who throw litter, park wrecked cars in their yards, put up with ugly and untidy buildings, and have unkempt yards.

Aesthetic principles of order, form, and cleanliness have not been and are not now important in American society. 'Least cost' has been the governing principle in exploiting natural resources and in building houses, business buildings, highways, etc. In addition to the concept of least cost, with its lack of concern for beauty, there has been the frontier attitude of individualism which favors mobility. One could always 'move on' to a new place if the old one became crowded or populated with uncongenial groups. Now, the moving on occurs toward the suburbs. There still exists among most Americans

an illusion of space in which to continue this trait. There is a lack of concern for the wasting of space in suburban areas and a lack of concern for improving ugly cities so that people won't feel the need to leave them.

Oriental cultures have always felt that nature is beautiful. Trees, rocks, waterfalls, and sand were duplicated in miniature in private gardens so that the correct proportions could be maintained even in a small space. Westerners have felt that nature was fearful and/or needed to be conquered or modified. Wilderness areas, in particular, were not admired until recently. In this era, there is developing a new feeling for the wilderness--a feeling that it is beautiful. It implies a desire for a return to nature and is associated with a wish to preserve this natural state. Such desires are apt to be frustrating in America, for preservation of natural lands is difficult in an era of a rapidly increasing population and increased leisure time. It might be better to beautify our present cities and immediate countryside through restoring order, cleanliness, quiet, form, and greenery so that people would not be so desperate for a return to nature--a nature that was never appreciated very much in America and which will be destroyed quickly if people abuse it.

Because of a heritage which stems from an uncrowded land, many Americans crave a feeling of spaciousness. One of the most important features of greenbelts near cities is aesthetic. They provide

'open space' which people can see on weekends or after work. A continuous large urban area does not satisfy this need, especially for people in the Western United States. There is developing a frantic feeling by many persons in the large metropolitan areas that they are trapped among buildings and highways--that there is too long a drive before one can see 'open space' again. Perhaps cities should not be so large for aesthetic reasons as well as traffic and administrative problems. Open space is beauty to many people (Spilhaus, 1967 and 1969) and (Costikyan, 1970, p. 19-21).

Tranquillity

The concept of tranquillity refers to a state of peace or quiet and/or freedom from civil disturbance. In discussing tranquillity in the context of land-use, it most often means a quiet setting. Again, the problem of perception arises. What is quiet for one person may be noisy for another. It is reasonable to assume, however, that the likelihood of noise increases with crowding. It also increases with the prevalence of machines. The least noisy areas for living are those with few people, few machines, and few birds and dogs. Such areas are scarce near metropolitan areas. Farm areas are noisy, and so are suburbs, due to machinery and animals on the farms and electric lawn mowers, edgers, hedge clippers, motorcycles, autos 'squirreling' corners, loud children in minuscule backyards, and

blasting radios in the suburbs. Cities are noisy because of automobile traffic, airplanes, industry, sirens, etc.

Our society is suffering from noise pollution on a large scale, and this is a factor which adds to the urban sprawl problem. People hope to 'get away' from noise in the city. They move to the suburbs or the country only to find that it is not very quiet, after all, in a suburb or in a mechanized farming region. A forest is undoubtedly the quietest area for living, because trees absorb noise. Unfortunately, many housing developers cut down trees in a subdivision in order to cut building costs and to get more lots per acre.

Many people could live serenely in a small village if noise were controlled. People should be made aware of the debilitating effects of noise pollution, and every effort should be made to insist that engines be made more quiet, that people not be allowed to use electric lawnmowers, saws, and clippers, etc., before 9:00 a.m. on weekends, and that loud horn blowing, squirreling, gunning of engines, be made socially unacceptable practices.

Perhaps the most tranquil place of all in which to live in metropolitan regions is the city apartment with soundproofing and air conditioning. Noise is reduced to a minimum, for it is 'blocked out.' As the population increases and more autos, bigger jet engines, and new gadgets appear, soundproofing in one's house or apartment will be more and more in demand. Indeed, well-built apartments may be

the preferred living places of the future, for one has to go too far away from an urbanized area to find a tranquil forest in which to live.

A recognition that noise is a serious pollutant is essential. Also important is the notion that a state of quiet may contribute to beauty in that it allows a sense of order to prevail wherein members of a family are free to regulate their own noise, not to be at the mercy of unwanted, unpredictable, extraneous noises outside the home.

Solitude

Solitude is the quality of being alone or remote from society. It implies a lack of crowding, with space separating one family from another. In today's urbanized society, however, solitude most often has to be achieved by means other than spatial separation.

Solitude is best perceived in a quiet setting and can be achieved in a soundproofed city apartment as well as in a remote country setting. It cannot be found in a typical suburb--with small backyards, large picture windows, and many electrical gadgets for gardening. Well-built garden apartments in the suburbs would be more quiet than many small individual houses side by side, for noise does not travel as easily through soundproofed multiple-family dwellings as it does across small, open yards.

Shopping malls, wherein no automobiles are allowed, should be set aside in many cities with downtown areas or in suburban shopping

centers. Walking is quiet compared to auto travel and brings a feeling of solitude even though the mall may be fairly crowded.

Stimulation

Stimulation is the act of exciting to activity or growth and is usually caused by an environmental change. Such changes in the city can be brought about by: spatial differences, i. e., a narrow street opening up onto a plaza or high rises mixed with low buildings; beauty, induced by greenery, open space, sculpture, cleanliness, and order; and diversity, provided by heterogeneity in peoples, housing patterns, human activities, spaces, shapes, etc. There should even be places for crowds, for crowding can be momentarily stimulating. As examples, promenading, street dancing, carnivals, and political rallies all provide stimulation. Noise is stimulating only if it is controlled. People need to seek noise, not be surrounded by it all the time, in order to receive a stimulus from it. Continuous noise is a depressant to the human spirit.

Diversity is the main key to stimulation, and it is rarely found in the suburbs. It should be fostered rather than feared and/or shunned and is probably the best reason for trying to preserve city life in America. For stimulation leads to creativity and evolution.

Conclusion

Perhaps one of the main reasons that there is so much pollution of the landscape in America is that human beings are very adaptable to their environment. They have large tolerances for unclean air, ugliness, noise, crowding, etc. Man is not aware of a deteriorating environment until it becomes quite fouled. This point cannot be over-emphasized, and unless he learns about certain standards of beauty, peace, solitude, and stimulation, man may destroy himself. The above-mentioned concepts are difficult to teach without their being experienced in a number of different settings. And who is to set the standards in the first place? A great deal of thought is necessary concerning aesthetics in man's environment and the teaching of the concepts. More pleasing surroundings can alleviate stress and contribute to a richer human existence. Unless our standards of environmental quality and beauty are raised and kept high, our adaptability may, indeed, permit us to ruin our environment.

V. THE GENERAL MODEL

Introduction

The general model of the man/land system is a composite of the subsystem models which are described in Chapter IV. It is a 'linking together' of all of the variables into one large system. The total system, however, becomes much more than a grouping of the subsystems; it is a unique system in itself and differs from each of its components.

The total system is a combination of many types of variables, not all of which are quantifiable. Quantification of those variables and flows which can be measured is desirable, especially the spatial, economic, or ecological factors. The other flows are measured in a qualitative manner--intuition and logic are necessary.

The general system is not to be confused with the structure of its components at a point in time, for the purpose of studying a system is not to describe it but to show how it works. The system involves relationships between its variables; thus, a change in any variable will cause a series of changes in the system. This study deals mainly with a system based upon institutionalism rather than an organism. Institutionalism, which occurs in systems dealing with human beings, is an ongoing, circular, systemic process--not an open-ended chain of events with clear-cut antecedents and consequences. There is much

feedback involved because of human perception, both positive (dis-organizing or structure-elaborating) and negative (stabilizing).

Description of the Model

Figure 39 illustrates the plan for the general model by showing how the subsystems are placed on the large diagram of the model (Figure 40, folded in pocket) and how they are linked together. The whole system is greater than the sum of its parts and is termed the Man/Land system. All subsystems are inter-linked to each other, either directly or indirectly. A person wishing to comprehend the diagrams must try to imagine looking at a region on the earth, i.e., the Willamette Basin, with its imaginary boundaries and envision all at one time the physical environment, spatial limitations, the people and their behavior, the economic allocation of resources, and the political institutions which regulate the allocation of power and values. All are interrelated and together comprise one large system with a capacity for viability or stagnation.

The political and land-capability subsystems are pictured on the large diagram as they should be in order that land waste be minimized, and the behavioral and economic systems are pictured as they exist right now. Thus, the model is not a description of the present state of affairs. Its purpose is to show the flows between the subsystems.

The boxes outlined in a shadow effect on Figure 40 are the

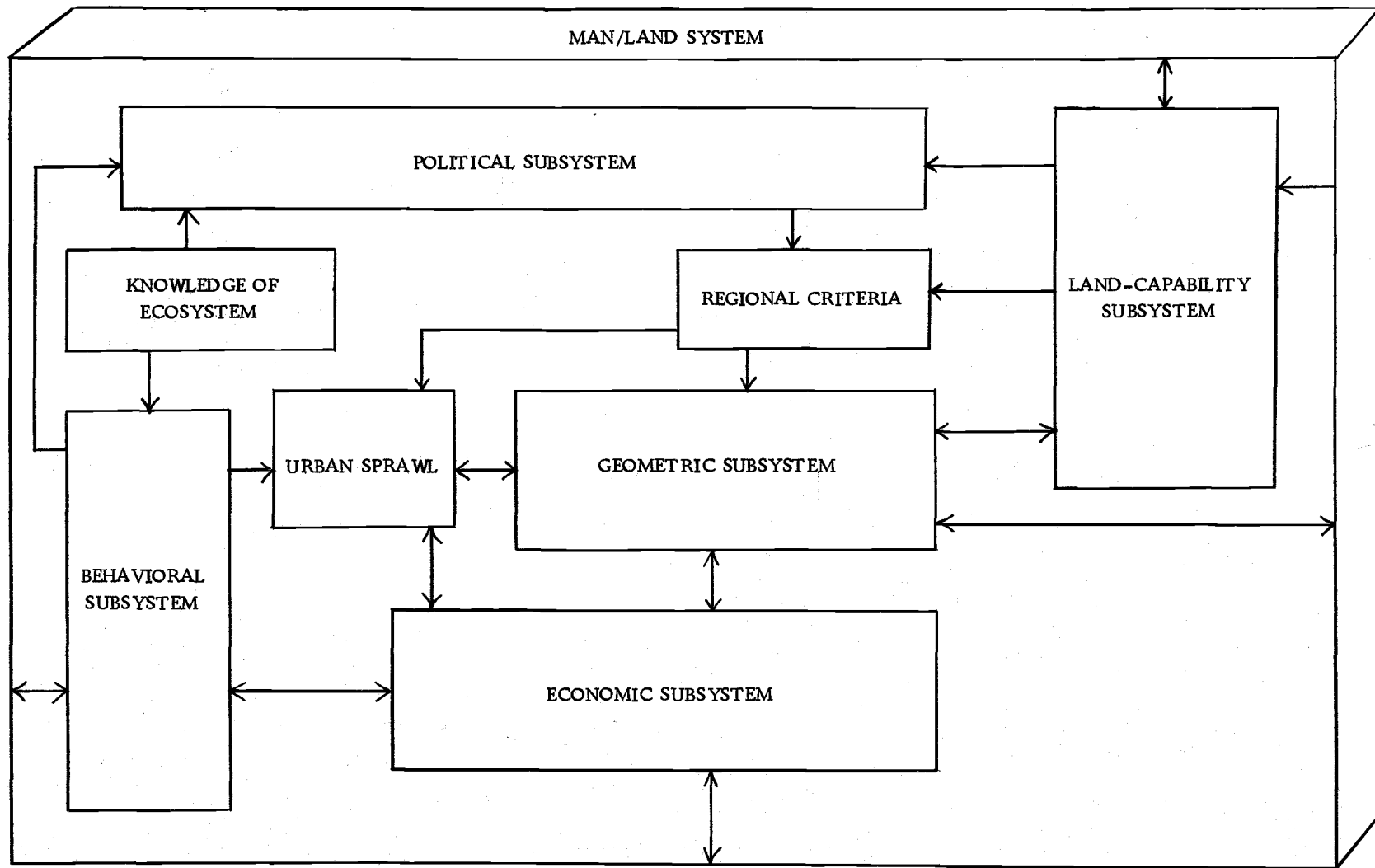


Figure 39. Plan for General System Model

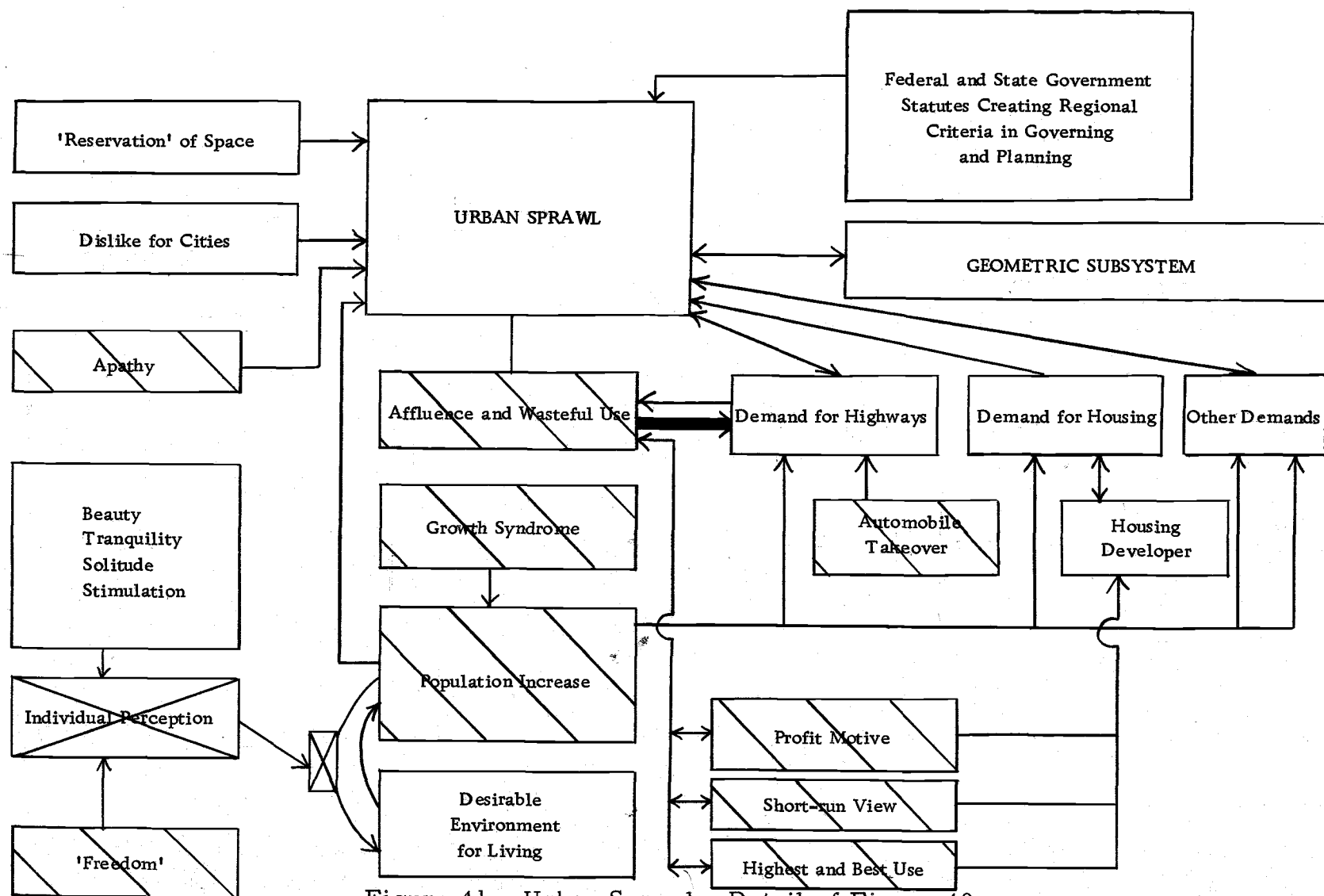
primary tools which are necessary for minimizing the flow of biotically productive land into irreversible uses. The boxes shaded with lines are the primary variables responsible for the present high rate of land waste. Unless the tool variables receive more emphasis than the waste variables, there will be no change in the way in which land is presently allocated for human activities. There will continue to be exploitation and waste.

Analysis of the Model

As shown in Figure 40 and in Figure 41 (a section of the general model), those variables most directly concerned with causing urban sprawl are found in the economic and behavioral subsystems: affluence and wasteful use, a growth syndrome, an increasing population (natural and in-migration), demands for highways and housing, 'freedom' to make a profit at the expense of society and to take the short-run view, automobile takeover, a dislike for cities, and apathy.

The political subsystem has the potential power to regulate the framework within which the economic system may operate so that it will no longer be exploitative. For example, it can set up regional criteria in governing and planning in order to implement the goal to reduce urban sprawl and thus require business to operate within a spatial framework which controls land use.

If attitudes continue to exist, however, which favor the



maintenance of our present exploitative economic system, then the political system will continue to reflect such attitudes and will remain ineffectual in reducing urban sprawl. Criteria for regional governing and planning set up to conserve land and to provide for orderly development in urban areas will not be translated into law by legislators in the form of statutes.

The political system cannot regulate the behavioral system, for it is itself controlled by the behavioral system. Since both the political and economic systems are controlled by the behavioral system, i. e. , attitudes and customs in particular, it can be seen that an extremely complicated set of interactions among variables exists.

The behavioral system is of the utmost importance in the implementation of criteria which can reduce the waste of prime biotically productive land. Attitudes stemming from the American heritage which have promoted materialistic individualism, i. e. , detachment, a short-run viewpoint, a dislike for cities, apathy, a waste syndrome, a crisis mentality, and the favoring of the individual over the group are inimical to a land ethic encompassing the human value of stewardship.

The foregoing attitudes will have to be changed before stewardship--the protection and conservation of land--can replace land exploitation. Changes in attitudes concerning land can be brought about through knowledge of the man/land system. Not only does the man/land

system comprise man's physical environment (land-capability and geometric systems) but also the economic, political, and behavioral systems and the interrelationships between all five subsystems.

Man must think of himself as an organism with institutions operating within nature and must adjust his attitudes to the premise that the land-capability and geometric subsystems will set the limits for his designs upon the land base. They are the governing subsystems and exist in conjunction with each other. Quantitative and qualitative space are the home of man and his social institutions. In order that the home be preserved as a livable habitat, man's attitudes must be relevant to these physical and spatial constraints.

Man's social institutions are set up according to his attitudes and can either be harmful to the spatial subsystems or in harmony with them. Attitudes and customs in keeping with the view that man is part of nature are such as the following: a love for the land, a desire to conserve natural resources, a group ethic in preference to individualistic materialism, a desire for order and beauty everywhere, a belief in individualism of the spirit, an understanding of the benefits of diversity, and an economic system based upon an efficient market allocation which benefits society rather than resource exploitation. The above behavioral variables would help change the existing political and economic systems to systems which, in the long run, would greatly

benefit the individual as well as the group, because there would be far less waste.

A Hierarchy of Subsystems

It can be intuited that there exists a hierarchy of subsystems within the ecosystem--a priority listing--if the goal of man to conserve his biotically productive land is to be achieved (Figure 42 and Table 2). Finite space and land-capability impose a set of natural boundaries upon man and occupy first place in the hierarchy. Knowledge of man's physical and spatial world affects the behavioral subsystem, which occupies the second place in the hierarchy. Attitudes and customs which reflect that man is a part of nature rather than dominant over nature influence the political subsystem, third in the hierarchy. It, in turn, sets the limits within which the economic system can operate, a structure based upon conservation rather than exploitation. The entire system is based upon an ecosystem approach, for although there is a hierarchy of priorities for emphasis in decision making, all of the variables are interrelated.

The foregoing hierarchy is a radical departure from American priorities at the present time. The economic and behavioral systems dominate the man/land system through an exploitation syndrome; the political system often favors local interests and special-interest groups; and the spatial and land-capability systems are too little recognized.

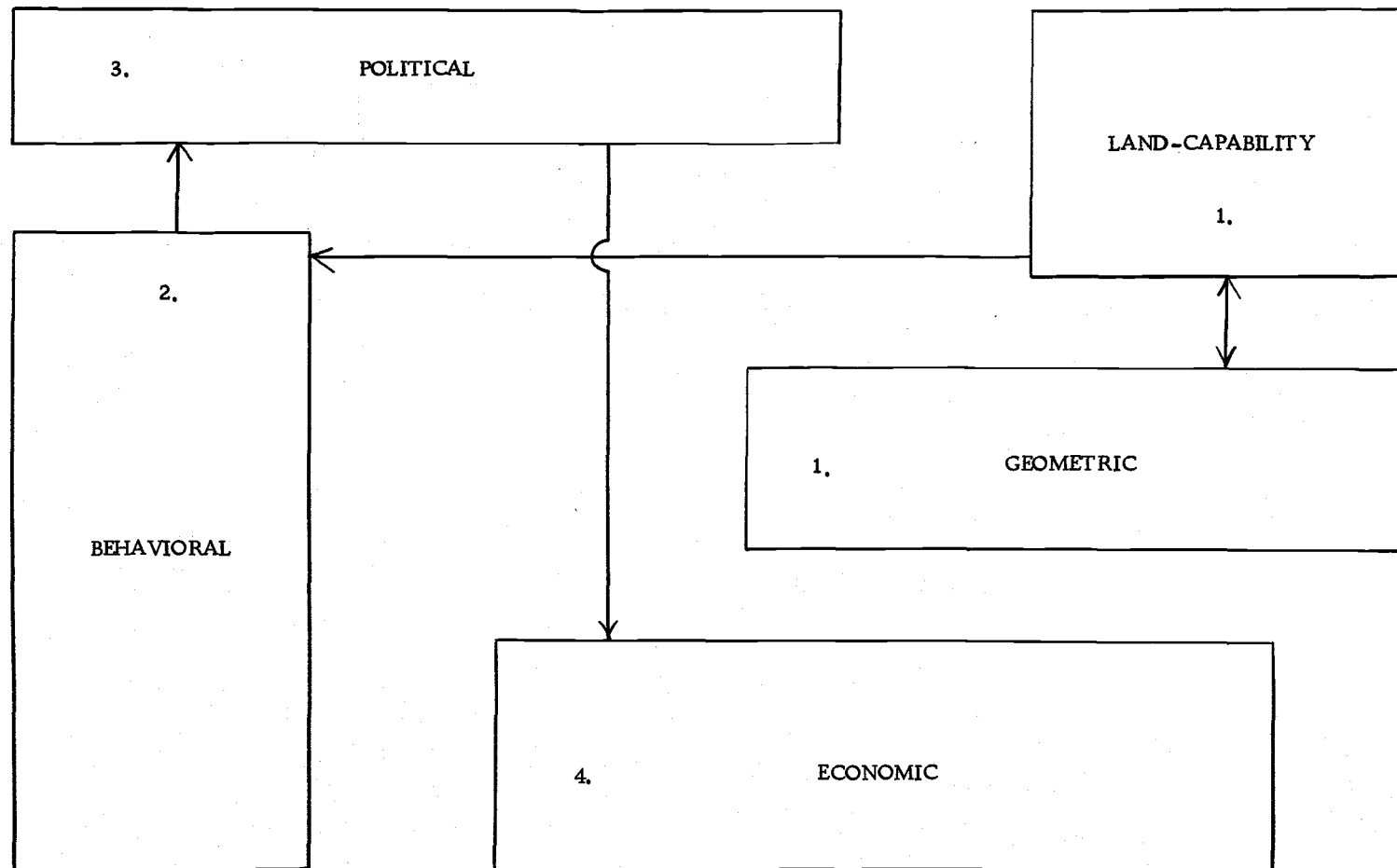


Figure 42. Subsystem Priorities Needed to Minimize Flow of Biotically Productive Land

Table 2. Priorities of Subsystems Within the Man/Land System

1. Finite space and land-capability subsystems.

Impose boundaries for man's activities. Intrinsic suitability and carrying capacity important aspects. Based upon data of the natural features and their natural processes, along with spatial measurements.

2. Behavioral subsystem.

A land ethic based upon knowledge of the ecosystem. A realization that man is part of nature. Attitudes and customs leading toward the protection of and improvement of land rather than exploitation.

3. Political subsystem.

The tools for allocating the power to decide upon land uses. Such tools as statutes and zoning on a regional basis are made possible by the attitudes of persons responsible for inputs and outputs of political systems.

4. Economic subsystem.

A market allocation system that fits into the framework prescribed by above systems.

VI. CONCLUSIONS

The continued existence of the human race on an earth which will nurture rather than injure or destroy it will depend upon the decisions which man makes in the present era regarding his use of the earth's natural resources. Biotically productive land is such a resource; much of it should be protected for future generations by being maintained in a flexible state rather than covered needlessly with irreversible uses.

The procedures for minimizing the flow of biotically productive land into irreversible uses are concerned with the total man/land system. Viable development of this total system on a self-generative basis can occur only when all of the subsystems are in balance with each other and with the entire system.

Because man is a part of this general system, it is possible for him to define goals which he desires and then to seek ways in which to achieve them. The conservation of land is such a goal. A land ethic based upon stewardship is required for the achievement of the goal of protecting the land for future generations--of maintaining it in a flexible state for biotic production. Sir Geoffrey Vickers feels that the best way to respond to the enormous challenges facing man today is to build up in our imaginations a picture of our common situation so lively and so accurate that we can respond to it willingly and effectively (Vickers,

1967, p. 201). With relation to the problem of conserving land, such a goal will entail a need for a great amount of communication, i. e., such activities as formal education, political hearings, articles on land-pollution, and citizen involvement. Above all, there must be a sense of urgency that a new land ethic is necessary--one that calls for the preservation of open space and prime agricultural lands and the conservation of all biotically productive land.

The general model (Figure 40) shows how the man/land system works. It is not merely a description of a state of affairs existing at a certain point in time. Since the system involves relationships between variables, it follows that a change in any variable will cause a series of changes in the system. Study of the model will tell us, for instance, that a number of variables are direct causes of urban sprawl and that, in turn, there are other variables which indirectly affect urban sprawl.

The indirect variables can be of primary importance, however, for they may be the cause of the direct variables. A direct-cause variable often cannot be changed unless the indirect ones are changed first. As an example, the demand for highways will not change until such things as the population increase, the growth syndrome, and automobile takeover diminish or some new form of transportation is widely available (see Figure 41, Chapter V).

Changes in people's attitudes will be necessary before the above

indirect variables become less powerful. Attitudes can change with new knowledge. Therefore, urban sprawl will not be lessened until the entire man/land system is understood by many citizens; they, in turn, will act to curb the sprawl through legislation and education if they feel it is in their interest to put the welfare of the total society ahead of individual selfishness. It can be seen that in order for the man/land system to reach a steady state (a kind of equilibrium) wherein prime land will not be lost, that a great many innovations will be necessary to change the present system.

Both positive and negative feedback are desired in a system. Positive feedback is amplifying and produces changes. Negative feedback is stabilizing. If all feedback were negative in the man/land system, the system would be reduced to a state of homeostasis rather than a steady state with a potential for further human development. If all feedback were positive, then change would occur so rapidly that there could be no steady state.

Since human behavior is unpredictable, it will be impossible to plan a perfect system for land conservation which is based upon logic alone. Innovations should be encouraged which are based both upon logic and intuition. Experiments in new kinds of cities, transportation, recreation sites, and industrial communities should be tried in the effort to conserve land. Some will work; some will not. But the system itself will evolve toward a new stewardship ethic because of

goal seeking and a constant effort toward the attainment of land protection.

An Important Key to Land Conservation -
a Decision-making Hierarchy

The major control for organizing the man/land system is the decision-making structure--those persons with the authority for deciding upon land uses. Decisions are based upon the goals desired and upon the information available to the decision makers. Innovation is limited by the inertia and momentum of past allocative judgments, for the current distribution of resources is the result of an historical process which is difficult to change.

In order that the goal of conserving biotically productive land be attained, a decision-making hierarchy should be established in which the interests of higher levels of governments have priority over those of the local levels. The nation and states traditionally favor policies which will bring benefits to the greatest number of their citizens; these levels of government are usually more democratic than lower levels, wherein vested interest groups and private citizens sometimes exploit resources for their own gain at the expense of society.

At all levels of government the decision-making process must be improved. Since it is in varying degrees a learning process, the more facts that are known about a problem to be solved, the more likely that

some kind of consensus can be achieved among a group of decision makers which is arrived at willingly, not through recrimination. Decisions about the land resource base up to the present time have usually been made on 'feel' or intuition. It has been an art, not a science. Intuition is still necessary, but there should be as much information as possible. Individuals will still make irrational decisions, but the group or society will tend to choose what is rational in the long run (Boulding, 1968, p. 37-40).

The adaptation required of institutions, both public and private, in the next decades will involve not merely learning new responses and skills but the changing of norms and limits. It will involve new criteria of success and failure which will derive from the need to acknowledge a much greater measure of mutual interaction and interdependence, both between individuals and organizations.

The proposed hierarchy of decision-makers is comprised of the Federal Government at the top; the individual states second; metropolitan or regional governments third; and local governments last. Such a hierarchy places a great responsibility upon the federal and state governments to define the prime lands in the country and to establish long-term policies for their protection.

Incremental decision making regarding land uses will continue to exist for some land, i. e. , what to produce for the short-term. The decisions will most likely be based upon economic considerations, for

land is a factor of production. However, the decisions for land use should be contained within the large, long-term framework based upon careful planning as required by the decision-making hierarchy. They will be uses which are ecologically manageable and culturally permissible, flexible uses which will preserve the land's biotic production potential.

The decision-making hierarchy is described as follows:

Federal Government. Policies should be set up by the Federal Government and its agencies which will aim at reducing the flow of land into irreversible uses. The first guidelines set forth by the newly established Council on Environmental Quality will be of enormous importance in setting into motion the trends for years to come. A strong land conservation policy is essential on the federal level if there is to be success at any lower level. All federal agencies should have to conform to the new land ethic.

Prime biotically productive lands of national importance should be identified and protected. It is in the national interest to set aside such lands for present and future needs. The Federal Government has the power to control urbanization through funding incentives, and it could easily do so if there were a strong policy established to stop the urban sprawl which is threatening our best farm lands.

The States. Along with the Federal Government's policies, each state should also identify its prime biotically productive lands and set

up land conservation policies to protect them. Especially if a state has a strong agricultural economic base, for example, Oregon or California, should it not set aside the prime lands? Otherwise, that economic base will eventually disappear, for its land base will have been destroyed. States should assume the planning responsibilities necessary for a balanced land conservation program.

Metropolitan or Regional Areas. The metropolitan level of the decision-making hierarchy is subservient to the federal and state levels and should be responsible for the planning of services and the allocation of land which is not already set aside by federal or state policies. Metropolitan government is a necessary replacement for the many overlapping county and town governments in a large urbanized area. County governments in rural districts can remain as is or be combined into regional governments, i. e. , a large river basin or a region with a specialized economic activity.

Local. (metropolitan districts, villages, small towns). The lowest level of the hierarchy must work within the framework set up by the larger government units. The wishes of a low-level community should be heard by all of the planning agencies in the other government levels and incorporated into plans wherever possible. The interests of the larger groups come first, however, and this concept should be understood and appreciated. If conservation decisions are made which are based upon knowledge of many possible alternatives, and if the

'intrinsic suitability' concept is followed, it is likely that local communities will be amenable to large-area planning.

Recommendations

Diversity is an important key to a viable man/land system. The present American system has become monotonously patterned and over-simplified; there is not enough diversity in the ways in which man uses his land resource base for his homes, transportation, industry, recreation, etc. The present system is stagnating and is comprised mainly of variables with negative feedback--variables that cannot lead to land conservation through changes in our ways of managing our land. In fact, the system is not only stagnating, it is destroying itself. Variables with positive feedback must be introduced.

The concept of diversity implies that there is no one, best method to minimize the flow of biotically productive land into irreversible uses. Many ways to achieve the goal should be tried, for some will succeed and some will fail. Variables which are believed to contain positive feedback potential are especially needed to balance the present stagnating man/land system.

Since the conservation of biotically productive land involves all of the subsystems, there will be the serious problem of a lack of time to read the feedback from land-use decisions; thus, the many decisions must be based upon logic--a study of the interrelationships--

before innovations are implemented on anything but a small, experimental basis. The feedback must be anticipated and alternative courses of action planned for implementation if it is discovered that the feedback deviates too much from that which is desired.

The foregoing course of action is recommended in order to ensure that at least some of the feedback will be positive. The kind of short-run economic decision-making (made on an incremental basis) which prevails in the United States at the present time is causing negative feedback to prevail to such an extent that the land base will disappear unless some innovations are tried which will preserve land.

Under the subsystem headings listed below appear some general recommendations for possible ways to conserve biotically productive land in America. Specific courses of action for each subsystem are found in Appendix 2. Some of them can be tried and the feedback read almost immediately; others, such as those involved with attitudes and education, will require much more time. The most important requirements for finding ways to achieve the goal of land conservation are: to have that goal proclaimed loudly and continually at all levels of government; to provide incentives for citizens to reach the goal; and to expose the electorate to knowledge of the man/land system.

Economic System. The present analysis of ways to conserve land may seem like a severe indictment of the American economic system. It is not an indictment, for our system of market allocation

is basically sound. But the economic system is out of balance with the rest of the ecosystem at the present time; it is the governing subsystem rather than the most subservient in a priority hierarchy. It is a system which is based upon the exploitation of natural resources rather than conservation. More important, it is short-range rather than long-range.

We are, indeed, a materialistic society. The enormous emphasis placed upon 'materialism' causes the behavioral and political systems to be materialistic, too, and to give license to economic values which cost society a great deal. Our technology is ruling us while the humanistic side of man is neglected, and the quality of the physical environment is being deteriorated. There must be a shift in attitudes which will cause Americans to work toward human occupance viability in a continuum, with regard to densities of population, aesthetic considerations, an environment where pollution is controlled, and where the land resource base is conserved. There is a need for allocating land in a way which will provide such a continuing viability. This will involve setting up a land system which is flexible--one that gives priority to reversible uses for biotically productive land rather than to irreversible uses.

It is recommended that our present market allocation system be retained in essence but that it be modified to fit into the above hierarchy of subsystem priorities. The distribution of goods and services based

upon the theory of supply and demand needs to be conducted within an ethic of conservation rather than exploitation. Such a system would be in better balance with the geometric and land-capability subsystems.

The allocation of land as a production input would operate, as now, under economic principles, but there would not be the free reign to do exactly what one wants to do with his land as there is today. Social benefits would take priority over individual benefits. The economic system would be self-adjusting under new political boundaries, and the innovative entrepreneur will continue to exist.

The 'growth syndrome' must be replaced with an idea of viability in a steady state. The rate of economic growth should be correlated closely with population growth in order to provide needed goods and services, but population growth should be discouraged rather than encouraged. Economic growth must be slowed in order that the natural resource base not be consumed. Materialistic man (short-run) needs to be replaced by societal man (long-run) who wishes to conserve rather than exploit.

Political Subsystem. Few citizens understand that political decision making is a continuous process. It involves each participating individual's securing knowledge of the man/land system, for the entire intra-societal environment affects the producers of inputs and outputs. These producers respond to information feedback at all times, not only at elections. Demands and support must be forwarded by the

producers of inputs to be processed into outputs by the producers of outputs. These outputs will allocate the power to control land use, either to governments or individuals, usually in the form of statutes.

It is desirable that a greater understanding of the political process be gained by all citizens in order that special-interest groups can be prevented from securing privileges for themselves at the expense of society. Apathy is a very great danger to society in America. More knowledge of the political process as well as the entire ecosystem might help to get people involved. They should be able to see where in the political process they can make their own wishes felt. There must be a realization that laws cannot be passed until there is a societal consensus that the ideas are good ones and that the costs are worth it.

Geometric Subsystem. The recommendations for the geometric subsystem (quantitative space) are concerned mainly with the more efficient use of presently developed (either wholly or partly) urban and rural/urban space and with means to prevent further rapid urban development of rural space. There is a need for the American society to recognize that the space on the earth's surface is a finite entity, and that 'prime' lands are becoming scarce.

Innovations should be encouraged for new types of dwellings, transportation systems, service centers, and recreation areas which will minimize the amount of land needed for each activity. Better ways

of using presently developed urban space are also necessary so as to make up for the waste in the past.

Land-capability Subsystem. Planning for the development of land will be a constant process, based upon ecological information and the continuing projection of spatial needs by industry, housing, recreation, highways, etc. Hopefully, the present rate of population increase will decline and the economic system now based upon rapid growth will shift toward a system of equilibrium. Until these things occur, plans for a growing population are necessary.

The recommendations for the land-capability subsystem are concerned with methods whereby good decisions can be made about where to put people and activities in the future. The choices for places for man and his activities should be based upon the concept of 'intrinsic suitability.' This concept depends upon knowledge of a region's natural features and natural processes.

There should be an emphasis upon diversity in the natural environment--polyculture rather than monoculture; many species of animals, insects, and plants rather than a few; cities and villages separated by large open spaces for variety, etc. Diversity strengthens systems, and it is equally important in natural and man-made systems.

The Judeo-Christian heritage of man's dominion over nature needs to be replaced by a different interpretation of man's relationship with nature--one which maintains that man is a part of nature rather

than separate from it.

The Behavioral Subsystem. The behavioral system will change or readjust because of new knowledge of the man/land system. Particularly important is an understanding of the limitations placed upon man and his institutions by the land-capability and geometric subsystems. A land ethic based upon stewardship and intrinsic suitability needs to be promulgated if the proper attitudes for implementing land conservation through the political process are to be forthcoming.

Value changes are necessary:

1. Americans need to develop a sense of the finite in order to realize that space must be used more wisely.
2. There needs to be less emphasis on 'growth' and 'materialism,' for these have led to the exploitation of the land resource base.
3. The concept of 'freedom' should be changed from that of a materialistic freedom based upon individual property rights and mobility to a personal freedom of the spirit.
4. A concern for the welfare of the group must prevail over individual selfishness.
5. 'Quality' of life must be emphasized rather than the 'quantity' of goods people try to acquire. Man's place in nature must be understood in order to achieve this value.
6. A 'crisis mentality' must be replaced by a logical appraisal

of our problems and goals. Stop-gap measures no longer suffice.

7. The feeling for a time continuum should be incorporated into American values. A respect for the past and planning for the distant future are overlooked in our society, with its emphasis on short-term economic gain.
8. A recognition that technology can influence normal behavior in a society more than ethics (Gouldner and Peterson, 1962). We must not allow technology to rule us.
9. An appreciation of aesthetic values -- beauty and order.

Summary

To sum up, a viable man/land system which will provide a favorable home for the future development of man will be achieved only if the following concepts are fully understood and implemented:

1. Man is a goal seeker and creates his cultural institutions for the purposes of attaining certain goals. If he is to conserve his biotically productive land, he must recognize this as a goal and then find ways to attain it.
2. Decision making is a complicated process. The more knowledge available, the better able are decision makers to make wise decisions. Knowledge of the man/land system is of the utmost importance in making good decisions concerning land

uses.

3. A decision-making hierarchy must exist so as to provide a framework for planning and governing responsibilities with respect to the conservation of land.
4. The crisis mentality (effective in emergencies) may cover up the crux of the current land problems; it should be avoided in favor of deep study of the entire system and a gradual change of the variables involved.
5. The concept of diversity in an ecosystem is important. It is the means by which systems are kept strong, for although some attempts at changing the system will fail, others will succeed. Growth or evolution comes out of such a process wherever human beings and their institutions are involved. If diversity were minimized, the system would be in danger of becoming too stable or too unstable. Therefore, many ideas for minimizing the flow of biotically productive land into irreversible uses must be tried.
6. The overriding concern is that a new land ethic be established in America--an ethic whereby land is to be protected for future generations rather than exploited. It is best protected by being kept in a biotically productive state, or in a state which is easily reversible back to a biotic one. Land space for irreversible uses must be kept at a minimum.

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APPENDICES

APPENDIX I

Definitions

Systems analysis - consideration of the complex interrelated whole, as opposed to the study of the individual parts separately.

Optimiser - rational man, who lives in a deterministic world with excellent information and high-level decision processes.

Satisficer - irrational man, who chooses a course of action which is 'good enough,' not necessarily optimum. He is molded by individual and group values and his learning processes.

Land resource - physical characteristics of the earth's surface as a foundation for human use.

Biotically productive land - provides for a flow of biotic resources. Includes idle land or recreational areas that can be converted into units providing food, fibers, timber, etc.

Uncertain behavior - occurs in decision making and arises through the imperfectness of the human being, the multiplicity of choices, and through the multiplicity of small causes and counter causes.

Society - an open, adaptive, self-directing system of human beings endowed with the possibility of relatively free transfer and recombination into new patterns of activity.

Externalities - institutional or privately invoked factors hindering or aiding market allocation.

General System Theory - formulation and derivation of universal principles which are valid for 'systems' in general.

Urbanized area - contains at least one city of 50,000 inhabitants (or twin central cities) as well as the closely settled incorporated places and unincorporated areas that surround it (U. S. Department of Commerce/Bureau of the Census, 1960).

General System Theory Definitions

Closed system - possesses clearly defined boundaries across which no import or export of material or energy occurs.

Open system - involves an outside energy supply for maintenance and preservation.

Information - movement toward negative entropy. Order is increased.

Entropy - tendency toward disorder or randomness.

Equilibrium - occurs in an isolated physical system at the stage of maximum entropy.

Homeostasis - maintenance of balance in an open system.

Steady state - import and export of energy and material in equilibrium. Implies growth and change, especially in a system involving human beings.

Isomorphism - a formal correspondence of general principles or even laws among different phenomena.

Reductionism - reducing everything to the constructs and laws of physics.

Perspectivism - finding constructs and possibly laws within individual levels, i. e., the physical, the biological, the social, and the moral universe.

Heteromorphic - a system capable of maintaining its continuity and integrity specifically by changing essential aspects of its structure or organization.

Components - subsystems.

Variables - parts of subsystems.

Environment - the larger system to which a subsystem belongs.

Feedback - information about one stage of a process which is returned to an earlier stage's controlling device.

Cybernetics - scientific analysis and control of animate or inanimate systems, based upon their methods of communication.

Oscillations - fluctuations between conditions or variations in attitudes, policies, or purposes.

Discontinuity - an emergent level of organization with novel features.

Control - an attribute of a system when used as a name for 'connectiveness.'

Mutual causation - when the size of influence in one direction has an effect on the size of influence in the other direction.

Efficient cause and historical cause - analyzing phenomena by relating them to prior phenomena or causes.

Teleology or final cause - an event X is analyzed in terms of its relation to future events or goals.

Primacy - some variables are more significant than others in a process.

Buffer mechanisms - delay the effects of a variable until some later point in a process.

Step function - connected with a variable which has no appreciable effect on others until its value has increased or decreased by some minimal increment.

Equifinality - different initial conditions lead to similar end effects.

Multifinality - similar initial conditions lead to different end effects.

P. P. B. S. - "Planning - Programming - Budgeting - System." A name derived from the concepts of a system in wide use by the government for formulating programs of at least five-years' duration. Stems from General System Theory.

APPENDIX II

SOME SPECIFIC RECOMMENDATIONS TO BE CONSIDERED
FOR POSSIBLE CHANGES IN THE MAN/LAND SYSTEM - LISTED
BY SUBSYSTEMS.

Economic Subsystem

1. Economic theories must not be so concerned with the idea of 'scarcity.' Quality is also important (Brinser, 1966, p. 244).

2. Land prices could be controlled like those of utilities.
Reasonable prices for land to be set. Perhaps land is too much in the public interest to be allowed to remain in private ownership with uncontrolled prices.

3. Air and water pollution costs should be incorporated into the price system (external diseconomies internalized) so as to improve the quality of land.

4. Economic incentives to develop land for flexible uses.
Make it costly to use land for irreversible uses.

5. Sound tax policies to accompany planning. Farm areas should be taxed at a low rate, not at subdivision rates. Perhaps land taxes, rather than improvement taxes should be used in cities in order to force development there first. Land speculation should be discouraged by means of taxation.

6. An economic value system encompassing all biophysical processes and human aspirations (McHarg, 1969, p. 197).

7. The United States Government could help to disperse people through economic enticements to locate in new urban areas, or government contracts could be awarded to those existing urban areas which can best tolerate an increasing population.

8. Apartment living should be made more attractive. There should be many kinds of apartment shapes and sizes and also a variety of recreational activities. There could be rewards for people who live in apartments, i. e. , a lower cost of rent or purchase per room than in houses. Thus, single-family dwellings would be considered a luxury, and people would have to pay more for the privilege of living in them.

9. 'Automobile takeover' must be examined by the American people before we become completely dominated by this machine. Perhaps other forms of transportation should be encouraged to substitute for the automobile in congested areas.

10. "Not-for-profit" community development corporations, such as state land development corporations, that can contract with profit-making businesses to build new communities that meet certain performance standards (Perloff, 1967, p. 800).

11. New construction methods, i. e. , 'modular units,' may make possible construction of high-rise buildings at costs more nearly in

line with present methods used for low buildings.

Political Subsystem

1. Federal policies on land conservation must precede state and local policies.
2. Hierarchical planning and decision making--the higher levels having priority over the lower ones.
3. Long-term planning and constant reappraisal of all the variables involved. Information from data banks will be important.
4. Recognition that suburbs can be 'reservationist' rather than conservationist and a bottleneck to orderly growth.
5. Sound tax policies to accompany planning as land-use regulation devices. High land taxes could force development of city lands. Low taxes could encourage the holding of biotically productive lands.
6. State Land Commissions to preserve agricultural lands by means of land banks. Orderly development could be controlled.
7. State Agricultural Land Commissions should work with all other land development agencies (highways, dams, etc.) to make a case for preserving the best farm lands.
8. State statutes providing priorities for regional interests in matters requiring litigation.
9. Principles of law, such as equal rights and equal

responsibilities, applied to regional matters in preference to local ones.

10. Representatives to watch out for regional interests in law-suits involving only local people.

11. State Land Boards to buy land on the urban fringe and hold it for future development. Land not to be released until the urban lands are fully developed.

12. Government purchases of land use rights for the general welfare, i. e., for recreation, scenery, historical sites.

13. Buy development rights from farmers for urban use.

Where it is possible for governmental units at various levels to purchase the rights to convert farms to urban uses, this can be done to control the rate and manner in which land passes from rural to urban uses. Such a scheme for controlling land use has been seldom tried.

14. Legislation giving agriculture priority over other uses in certain areas. Animal densities not to be limited; large-scale spraying and fertilizing, noisy machinery, etc. allowed. This would protect the most suitable farm lands for modern mechanical agriculture from other non-compatible activities. Long-range planning required at the state level.

15. Rigid government control over freeway building and other large public works projects in order to conserve valuable lands.

16. A reappraisal of the federal right of eminent domain.

17. Statutes and policies to emphasize incentives for conservation rather than more police action.

18. School children should be taught about the practical political matters of hearings, petitions, letters of protest or support to legislators, the roles of committee chairmen and lobbyists, and how bills are brought to the floor for a vote.

Geometric Subsystem

1. Minimum amounts of land to be used for public needs-- power lines, highways, parking, schools, municipal buildings.

2. Non-compatible uses separated. Priority use zoning. Or require industry to be so clean that it does not need to be separated from other activities. Mechanized farm lands separate because of sprays, odors, noise, etc.

3. Multiple-uses for land wherever ecologically and economically feasible.

4. Minimize freeways. They tend to modify the areas through which they pass and require a great deal of space for themselves and for the activities which they generate.

5. Adopt policies that prevent easily reversible land from being opened up for irreversible uses until prior urban areas have been fully developed (a certain population or percent of land area under approved uses).

6. New areas to be planned for maximum carrying capacity but with lots of open spaces between developed clusters and within them.

7. Open spaces for variety. Man needs them in urban areas for his psychological well-being.

8. More attractive and stimulating urban areas in order to limit urban sprawl (the flight to the suburbs).

a. Small parks and open spaces greatly increased.

b. Bicycle and walking paths.

c. Balconies on apartment houses.

d. Sidewalk cafes.

e. Few or no automobiles in cities (jitneys, rapid transit, moving sidewalks, etc.).

f. Fountains, trees, and flowers in profusion.

g. Underground wires.

h. Small signs for shops--no billboards.

9. Long-range planning and education are necessary for the promotion of other types of dwellings than the traditional single-family home on a small plot of land which is already so prevalent.

10. A change in suburban zoning laws that discriminate against multiple dwellings. If the empty spaces in many suburbs could be filled with apartments or other types of multiple-dwellings, the developer would not have to range so widely over the rural landscape.

11. There should be much more experimentation in city living

in an effort to make it more desirable. Perhaps some houses should be built in rows right next to a sidewalk and contain inside courts which would be quiet, because they are away from traffic noise, i. e. , such as in many Latin countries. Apartments could provide sports facilities (pools, saunas, indoor tennis, etc.) on a much larger scale to give their residents a feeling of the outdoors and freedom even though everything is inside.

12. Experimental cities. Spilhaus recommends for an experimental city a density of 100 people per acre in the city proper (6,400 persons per square mile) (Spilhaus, 1967, p. 1139). His group at the University of Minnesota suggests cities of 250,000 persons (2,500 acres) (Spilhaus, 1967, p. 1139). Anything smaller would reduce the range of cultural advantages and services which can and should be offered in an urban area. To preserve the identity, character, cleanliness, and experimental freedom of such a city, it might need 100 times this amount of land as an insulating belt. The ground in the city would be leased, for the city would be set up by a non-profit, quasi-governmental, quasi-private corporation, patterned after the experience of the Communications Satellite Corporation. Spilhaus' group also suggests that industry and residential and commercial activities should be located together, i. e. , intermixed. Industry would have to be clean, quiet, and aesthetically pleasing. Thus, zoning would not be necessary (Spilhaus, 1967, p. 1135).

13. Develop excellent public transportation, i. e. , subways, monorails, jitneys, etc. , in urban areas.

14. Public buildings such as high schools, colleges, athletic stadiums, concert halls, etc. should all be located wherever possible near good public transportation to prevent highway crowding.

15. An alternative to providing miles and miles of urban free-ways is to do nothing at all. Either the economic activity or the people would shift positions when the peak loads became unbearable, i. e. , the spatial distribution of activities would change out of necessity. As it is, we are building freeways fast enough to handle urban traffic, but in the process we are building great concrete structures that are completely taking over the landscape in our urban areas.

16. Rapid transit planning that provides for a grid system for moving people and goods in an area rather than radially from a city center to a few places on the outskirts. It would encourage development everywhere in the city, not just on main arteries and would help to prevent urban sprawl.

Land-capability Subsystem

1. Laws which limit the use of septic tanks except for farmers and very low density housing such as in forests. Developers would not be permitted to go out very far from the edge of a city because they would have to be hooked up to an existing sewer line.

2. Control of water and air pollution through the means of placing the responsibility for the costs of control upon the polluter and getting these costs into the price system (profits = price less costs).

3. The recycling of solid wastes. The recycling costs (mainly transportation) would be part of the original price of a good. Land would not be necessary for waste disposal to such a degree as it is now, and it would not have ugliness imposed upon it by junk automobiles, cans, non-returnable bottles, etc.

4. Require services before development, i. e. , electricity, streets, water, and sewer. Approval of state funds for sewer or water districts, local road construction, etc. should hinge on how well local proposals compare with over-all planning objectives for the state. Pre-servicing could also be encouraged through making loans available for these purposes. The important point is to arrange the services ahead of demand in order to guide urban development.

5. Provide more guidance to utility districts. Replacing unguided utility districts which are created after-the-fact with better regulated and financed ones would apply to the present-day semi-planned or unplanned areas which are growing in a haphazard way. A better solution is the first-mentioned one--pre-servicing, but it involves statewide, long-range planning which takes time to implement.

6. Data banks with many kinds of information on the physical

environment--continually updated.

7. The study of air corridors in regions to be developed so that externalities from air pollution will be minimized.

8. Carrying capacities to be studied in regard to human communities. Physical and psychological factors to be considered.

9. Forests surrounding cities wherever possible (or farmlands) to temperize summer climates, counteract polluted city air, and filter noises and smells of civilization.

Behavioral Subsystem

In order that attitudes, customs, and aesthetic values can be changed, all types of educational institutions should emphasize the following ideas:

1. Logic rather than empiricism. There is not always enough time any more for trial and error based upon feedback.

2. Entire processes and relationships.

3. Man's place in nature and as a link in the ecosystem.

4. Long-term planning and means to achieve goals.

5. Creative individualism--a freedom of the spirit.

6. An emphasis on society's welfare. The individual will reap the benefits of a more stable society.

7. Attitudes which will promote values that promote a healthy, more equitable economic system rather than those which promote

economic gain for privileged interest groups.

8. Teaching youngsters to desire a more livable environment and to appreciate beauty.

9. That a planner must be an educator as well as a practitioner. Ideas, thoughts, and concepts not heretofore part of the public consciousness must be brought to light.